Perinatal Replace Supply Fan & Exhaust Fans
Advertisement for Documented Quote
Notice Number: 19-174168

Monday, July 29, 2019
ADDENDUM 1

QUESTIONS/RESPONSES:

1. Please provide Cut Sheets of the pre Purchased Fans and VFD's
   
   **Response:** See attached fan submittals

2. Please confirm Start Time and Completion times for the Facility
   
   **Response:** 6:00AM to 7:00PM

3. Please confirm the Medical Requirements for the project
   
   **Response:** All on site contractors will need fit testing through the University, which involves paperwork, medical clearance, skillsoft training and a ½ hour appointment for fit testing, a Q fever titer(blood work) and recommendation to get additional blood work in a month after the work is done to determine possible exposure while work was performed. Fees for this are included in the attachment. Allow 4 hours per person for this time.

4. Will Pre and Post Air Balance be required,(Will the Fan CFM's be the basis of Design)?
   
   **Response:** Yes

5. Were the SF VFD's purchased with the SF wall?
   
   **Response:** Yes

6. Do we need to have the fan wall dynamically balanced?
   
   **Response:** Yes

7. Is there a preferred Test & Balance contractor?
   
   **Response:** No
8. When is the official return date for the product?

Response: Anticipate middle of September

There were no further questions.

CLARIFICATIONS:

Owner is purchasing the supply fan wall with VFD’s included. Exhaust fans will be purchased by contractor.

ADDITIONAL INFORMATION:

Attachments: Fan Submittals and EH&S Service Fees

END OF ADDENDUM
SUBMITTAL

PROJECT: UCHSC Perinatal Research Facilities
LOCATION: Aurora, CO
DATE: July 25, 2019
SUBMITTED BY: Robert Stojevich
SO#: 51258

EQUIPMENT: Fan Wall

MANUFACTURER: Nortek Air Systems

NOTES:
- HPF-A100 Size 16, 4 fans
- 1 Row x 4 Cells
- 460/3/60
- Coplanar Insulation – Standard Melamine
- FDB backdraft dampers
- 10 HP TEAO premium efficient direct drive motors
- Shaft grounding kits
- Tie Wall
- Factory authorized start-up
- Electric Panel to include:
  - NEMA 3R Construction with rain hood
  - (2) 20 HP ABB ACH 580 VFDs w/ Bluetooth controlled availability
  - Motor Overload
  - Indicating lights
  - Circuit breaker
  - Through the door disconnect
  - Mounting, wiring from electric panel to fan wall motors by others
Project Name: UCHSC Perinatal Research Facility
Unit Tag: FWT-1

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

<table>
<thead>
<tr>
<th>Weights</th>
<th>Weights</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipping Weight</td>
<td>1,537 lb</td>
<td>Operating Weight</td>
</tr>
</tbody>
</table>

- FANWALL: Supply, 4 Wide x 1 High Array, HPF-A100 Size 16, 105% Wheel, 10 HP 2-Pole Baldor Motors (460/3/60), By Others Electrical System
NOTES:
1. ALL BLANKOFFS PROVIDED BY AND INSTALLED BY OTHERS.
2. ALL MOTOR WIRING BY OTHERS.
3. REP TO SUPPLY VFD / MOOP ELECTRICAL PANEL.
4. HUNTAIR TO PROVIDE FLEXIBLE CONDUIT AND ELECTRICAL RACEWAYS FOR EACH MOTOR.
## Configuration / Quantity

<table>
<thead>
<tr>
<th>Function</th>
<th>Supply Fan</th>
<th>Cell Size</th>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
<th>Overall Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>4</td>
<td></td>
<td>38.00 in</td>
<td>30.00 in</td>
<td>28.00 in</td>
<td>33.96 in</td>
</tr>
<tr>
<td>Array</td>
<td>1 Rows x 4 Cols</td>
<td>Elev. / Temp.</td>
<td>39 ft / 70.0 °F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>Gen II</td>
<td>Mtr. &amp; Wheel Weight</td>
<td>226 lb</td>
<td>Redundant</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Inlet Cone Location</td>
<td>Upstream Removable</td>
<td>Fan Cell Weight</td>
<td>346 lb</td>
<td>Empty</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Stand Height</td>
<td>N/A</td>
<td>Ship Loose Fan (Wheel, Motor and Mounting Base)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Options

- Coplanar Insulation: Standard Melamine
- Extended Coplanar: NO
- Back Draft Dampers: HBD0212
- Inlet Cone Type: A100 Curved Cone
- Discharge Guard: NO
- Cell Material: Aluminum / Steel
- Cell Finish: None
- Insulation Retainer: NO
- Inlet Attenuation: None
- Blankoff Material: 16Ga Galv
- Blankoff Finish: None

## Fan Wheel

<table>
<thead>
<tr>
<th>Wheel Type</th>
<th>HPF-A100</th>
<th>Width</th>
<th>105 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>16</td>
<td>Max RPM</td>
<td>3930</td>
</tr>
<tr>
<td>Balancing Planes</td>
<td>1</td>
<td>Wheel Finish</td>
<td>None</td>
</tr>
</tbody>
</table>

## Motor

- Manufacturer: Baldor
- Model: 07M267W723G6
- HP Each / Total: 10 / 40
- Poles / RPM: 2-Pole / 3500
- Frame / Casing: 215T / TEAO
- Volts / Phase / Hz: 460/3/60
- Winding: FLA Each / Total: 11.2 / 44.8 Amps
- Efficiency: 91.7
- Service Factor: 1.15
- Shaft Grounding: Yes
- Motor HP Safety Factor: 3.0 %

## Variable Frequency Drive

- Furnished by: N/A
- Quantity: 0
- Manufacturer: N/A
- Model No: N/A
- Horsepower: N/A
- Output Amps: N/A
- Maximum Hertz: .00
- Input Line Reactor: NO
- VFD Communication: N/A
- Switching Frequency: N/A
- Voltage: 460/3/60

## Control System

- Redundant VFD: NO
- Bypass Circuit: N/A
- Drive: By Others
- Optimization Control: NO
- Control Method: By Others
- Flow Monitoring: N/A
- Fans to Monitor: N/A
- Display: N/A
- Communication: N/A

## 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. Cone constant = 1671, cone flow differential pressure = 10.79 in.H2O at 5494 CFM per fan.
4. The estimated VFD input watts are based on the motor and VFD efficiency at the selected load and RPM.
5. Fans balanced to a maximum allowable level of 0.022 inches per second peak.
Project Name: UCHSC Perinatal Research Facility
Unit Tag: FWT-1
Quote #: 19-1456

FANWALL 1 (Supply) : FWT1 : Box A

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>21,975</td>
<td>6.58</td>
<td>8.00</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>3,310</td>
<td>56.7</td>
<td>8.84</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>90</td>
<td>82</td>
<td>87</td>
<td>100</td>
<td>89</td>
<td>90</td>
<td>87</td>
<td>85</td>
<td>99</td>
<td>102</td>
</tr>
<tr>
<td>Outlet</td>
<td></td>
<td>98</td>
<td>90</td>
<td>87</td>
<td>94</td>
<td>90</td>
<td>89</td>
<td>81</td>
<td>72</td>
<td>95</td>
<td>101</td>
</tr>
</tbody>
</table>

Notes / Features

1. Fan data accuracy as per AMCA 311 (63Hz +6 dB, remaining bands +3 dB with an additional 3 dB available in any one band).
   Model predictive accuracy is ±6 dB. Fan and modeling accuracy is based on ideal flow patterns and design conditions. Projected fan and system sound levels are provided for comparison purposes only, actual levels may vary.
2. Sound power projections are not valid with VFD motor control carrier frequencies of less than 8KHz.
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
UCHSC Perinatal Research Facility

Electrical Panel
NOTE: ALL VFD CONTROL SHOWN WITH DEFAULT SETTING
SEE MANUAL FOR OPTIONS & CONFIGURATIONS
UCHSC Perinatal Research Facility

Variable Frequency Drives
Submittal Schedule

This schedule includes the products supplied as part of this submittal.

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Tag</th>
<th>Motor Data (^1)</th>
<th>Drive Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>HP   FLA  Volts</td>
<td>Product ID</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td>20   27  460 VAC</td>
<td>ACH580-01-027A-4+J429</td>
</tr>
</tbody>
</table>

**Notes:**
1. AC motor data is per National Electrical Code Table 430.250 for typical motors used in most applications. It is provided as typical data only. DC motor data is per typical industry standards. Actual motor data may vary.
## Submittal Schedule Details for

<table>
<thead>
<tr>
<th>Item</th>
<th>Tag / Equipment ID</th>
<th>Product ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>ACH580-01-027A-4+J429</td>
</tr>
</tbody>
</table>

### Item Description

**Input Voltage:** 480 VAC Three Phase  
**Rated Output Current:** 27A  
**Enclosure:** UL (NEMA) Type 1  
**Nominal Horsepower:** 20 HP  
**Frame Size:** R3  
**Input Disconnecting Means:** None  
**Bypass:** None  
**Input Impedance:** 5% equivalent impedance  
**Short Circuit Current Rating:** 100 kA with fusing  
**Communication Protocols:** Johnson Controls N2, Modbus RTU, BACnet (MS/TP)  
**Other Options:** [+J429]: Bluetooth control panel

### Drive Input Fuse Ratings

<table>
<thead>
<tr>
<th>Fuse Class</th>
<th>Amps (600 V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class T</td>
<td>40</td>
</tr>
</tbody>
</table>

### Wire Size Capacities of Power Terminals

<table>
<thead>
<tr>
<th>Input Wiring</th>
<th>Output Wiring</th>
<th>Ground Wiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>#20 ... #2</td>
<td>#20 ... #2</td>
<td>#24 ... #2</td>
</tr>
<tr>
<td>2.6 lbf-ft</td>
<td>2.6 lbf-ft</td>
<td>1.1 lbf-ft</td>
</tr>
</tbody>
</table>

### Dimensions and Weights

<table>
<thead>
<tr>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>in</td>
<td>in</td>
<td>in</td>
<td>lbs</td>
</tr>
<tr>
<td>(mm)</td>
<td>(mm)</td>
<td>(mm)</td>
<td>(kg)</td>
</tr>
<tr>
<td>19.3</td>
<td>8.0</td>
<td>9.0</td>
<td>26</td>
</tr>
<tr>
<td>(490)</td>
<td>(203)</td>
<td>(229)</td>
<td>(11.8)</td>
</tr>
</tbody>
</table>

### Heat Dissipation & Airflow Requirements

<table>
<thead>
<tr>
<th>Power Losses</th>
<th>Airflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTU/Hr</td>
<td>Watts</td>
</tr>
<tr>
<td>1,466</td>
<td>430</td>
</tr>
</tbody>
</table>
ACH580-01/-31

The ACH580 drive sets new standards in both simplicity and reliability, and ensures smooth, energy-efficient operation of your HVAC systems in normal and mission-critical situations.

**ACH580-01, wall-mounted base drives**
The ACH580-01 wall-mounted drives are available from 1 to 100 HP at 208/240 V, 1 to 350 HP at 480 V, and 2 to 250 HP at 575 V. The ACH580-01 drives are available in UL (NEMA) Type 1 and 12 configurations. In standard installations, the drive is mounted directly onto a wall and uses the provided conduit box. Conduit openings are provided for bottom conduit entry & exit. For mounting in a customer-supplied cabinet, the conduit box may be removed. The drive has a 100 kA SCCR rating when paired with appropriately sized upstream fuses.

**ACH580-31, ultra low harmonic wall-mounted base drives**
The ACH580-31 wall-mounted drives are available from 5 to 150 HP at 480 V. The ACH580-31 are available in UL (NEMA) Type 1 and 12 configurations. In standard installations, the drive is mounted directly onto a wall and uses the provided conduit box. Conduit openings are provided for bottom conduit entry and exit. For mounting in a customer-supplied cabinet, the conduit plate may be removed.

**Features for HVAC**
The ACH580 comes standard with an intuitive control panel used to configure, control, and monitor the drive. An optional Bluetooth control panel allows the drive to be configured via the control panel or the DriveTune app.

A robust HVAC firmware package provides drive, motor, and application protection features. Examples of drive protection features include undervoltage, overvoltage, overcurrent, and ground fault protection. The ACH580 also has a variety of motor protection features including overload and stall protections.

Application specific features, such as accepting four separate start interlocks (safeties), along with broken belt detection, are also included. The drive includes BACnet MS/TP, Modbus RTU, and Johnson N2 as standard. Additional protocols, such as BACnet/IP and LonWorks (coming 2019), are available with optional fieldbus adapters.
## Technical specifications

### Product compliance (complete list on following page)

| ACH580-01/-31 | CE, UL, cUL, and EAC |

### Supply connection

| Input voltage ($U_1$) | 208/240V |
| ACH580-xx-xxxxA-2 | 480V |
| ACH580-xx-xxxxA-4 | 600V |

| Input voltage tolerance | +10% / -15% |
| Phase | 3-phase (1-phase, 240 V) |

| Frequency | 48 to 63 Hz |
| Line Limitations | Max ±3% of nominal phase to phase input voltage |

| Power Factor ($\cos \phi$) at nominal load | ACH580-01: 0.98 |
| ACH580-31: 1.0 |

| Efficiency at rated power | ACH580-01: 98.0% |
| ACH580-31: 96.5% |

| Power Loss | Approximately 2% of rated power |

### Motor connection

| Supported motor control | Scalar and vector |
| Supported motor types | Asynchronous motor, permanent magnet motor (vector), SynRM (vector) |

| Voltage | 3-phase, from 0 to supply voltage |
| Frequency | 0 to 500 Hz |

| Short Term Overload Capacity Variable Torque | 110% for 1 min/10min |
| Peak Overload Capacity Variable Torque | 1.35 for 2 second (2 sec / 10 min) |

| Switching Frequency | 2, 4, 8 or 12 kHz |
| Acceleration/Deceleration Time | 0 to 1800 s |

| Short Circuit Current Rating (SCCR) | 100 ka with fusing |

### Inputs and outputs (drive)

| 2 analog inputs | Selection of Current/Voltage input mode is user programmable. |
| Voltage reference | 0 (2) to 10 V, $R_{in} > 200$ kΩ |
| Current reference | 0 (4) to 20 mA, $R_{in} = 100$ Ω |

| Potentiometer reference value | 10 V ±1% max. 20 mA |
| 2 analog outputs | AO1 is user programmable for current or voltage. AO2 current |

| Voltage reference | 0 to 10 V, $R_{load} > 100$ kΩ |
| Current reference | 0 to 20 mA, $R_{load} < 500$ Ω |

| Applicable potentiometer | 1 kΩ to 10 kΩ |
| Internal auxiliary voltage | 24 V DC ±10%, max. 250 mA |
| Accuracy | +/- 1% full scale range at 25°C (77°F) |
| Output updating time | 2 ms |

| 6 digital inputs | 12 to 24 V DC, 10 to 24 V AC, Connectivity of PTC sensors supported by a single digital input. |
PNP or NPN connection
(5 DIs with NPN connection).
Programmable

<table>
<thead>
<tr>
<th>Input Updating Time</th>
<th>2 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 relay outputs</td>
<td>Maximum switching voltage</td>
</tr>
<tr>
<td></td>
<td>250 V AC/30 V DC.</td>
</tr>
<tr>
<td></td>
<td>Maximum continuous current 2 A rms.</td>
</tr>
<tr>
<td></td>
<td>Programmable, Form C</td>
</tr>
</tbody>
</table>

Adjustable filters on analog inputs and outputs
All control inputs isolated from ground and power

**Operation**

<table>
<thead>
<tr>
<th>Air temperature</th>
<th>0 to -15 °C (32 to 5 °F).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-15 to +50 °C (5 to 122 °F): No frost allowed. Output derated above +40 °C (104 °F)</td>
</tr>
<tr>
<td>Installation site altitude</td>
<td>0 to 4000 m (13123 ft)</td>
</tr>
<tr>
<td></td>
<td>above sea level</td>
</tr>
<tr>
<td></td>
<td>Output derated above 1000 m (3281 ft)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>5 to 95%</td>
</tr>
<tr>
<td></td>
<td>No condensation allowed</td>
</tr>
<tr>
<td></td>
<td>Maximum relative humidity is 60% in the presence of corrosive gasses</td>
</tr>
<tr>
<td>Atmospheric pressure</td>
<td>70 to 106 kPa (10.2 to 15.4 PSI)</td>
</tr>
<tr>
<td></td>
<td>0.7 to 1.05 atmospheres</td>
</tr>
<tr>
<td>Vibration</td>
<td>Risk category IV Certified (IBC 2018)</td>
</tr>
</tbody>
</table>

**Environmental protections**

<table>
<thead>
<tr>
<th>Chemical Gasses</th>
<th>Class 3C2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Particles</td>
<td>Class 3S2</td>
</tr>
<tr>
<td></td>
<td>No conductive dust allowed</td>
</tr>
<tr>
<td>Pollution degree (IEC/EN 61800-5-1)</td>
<td>Pollution degree 2</td>
</tr>
</tbody>
</table>

**Product compliance**

<table>
<thead>
<tr>
<th>Standards and directives</th>
<th>Low Voltage Directive 2006/95/EC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EMC Directive 2004/108/EC</td>
</tr>
<tr>
<td></td>
<td>60721-3-3: 2002</td>
</tr>
<tr>
<td></td>
<td>60721-3-1:1997</td>
</tr>
<tr>
<td></td>
<td>Quality assurance system ISO 9001 and Environmental system ISO 14001</td>
</tr>
<tr>
<td></td>
<td>CE, UL, cUL, and EAC approvals</td>
</tr>
<tr>
<td></td>
<td>Galvanic isolation according to PELV</td>
</tr>
<tr>
<td></td>
<td>RoHS2 (Restriction of Hazardous Substances)</td>
</tr>
<tr>
<td></td>
<td>EN 61800-5-1: 2007; IEC/EN 61000-3-12;</td>
</tr>
<tr>
<td></td>
<td>(1st environment restricted distribution); Safe torque off (EN 61800-5-2)</td>
</tr>
<tr>
<td></td>
<td>BACnet Testing Laboratory (BTL)</td>
</tr>
<tr>
<td></td>
<td>Seismic (IBC, OSHPD)</td>
</tr>
<tr>
<td></td>
<td>Plenum (ACH580-01 only)</td>
</tr>
<tr>
<td></td>
<td>EMC (according to EN61800-3)</td>
</tr>
</tbody>
</table>

ACH580-01 and ACH580-31 class C2
(1st environment restricted distribution)
### Storage (in Protective Shipping Package)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Temperature</strong></td>
<td>-40 to +70 °C (-40 to +158 °F)</td>
</tr>
<tr>
<td><strong>Relative Humidity</strong></td>
<td>Less than 95%</td>
</tr>
<tr>
<td></td>
<td>No condensation allowed</td>
</tr>
<tr>
<td></td>
<td>Maximum relative humidity is 60% in the presence of corrosive gasses</td>
</tr>
<tr>
<td><strong>Chemical Gasses</strong></td>
<td>Class 1C2</td>
</tr>
<tr>
<td><strong>Solid Particles</strong></td>
<td>Class 1S2</td>
</tr>
<tr>
<td></td>
<td>Contact ABB regarding Class 1S3</td>
</tr>
<tr>
<td><strong>Atmospheric pressure</strong></td>
<td>70 to 106 kPa</td>
</tr>
<tr>
<td></td>
<td>0.7 to 1.05 atmospheres</td>
</tr>
<tr>
<td><strong>Vibration (ISTA)</strong></td>
<td>R1…R4 In accordance with ISTA 1A</td>
</tr>
<tr>
<td></td>
<td>R5…R9 In accordance with ISTA 3E</td>
</tr>
</tbody>
</table>

### Transportation (in Protective Shipping Package)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Temperature</strong></td>
<td>-40° to 70°C (-40° to 158°F)</td>
</tr>
<tr>
<td><strong>Relative Humidity</strong></td>
<td>Less than 95%</td>
</tr>
<tr>
<td></td>
<td>No condensation allowed</td>
</tr>
<tr>
<td></td>
<td>Maximum relative humidity is 60% in the presence of corrosive gasses</td>
</tr>
<tr>
<td><strong>Atmospheric Pressure</strong></td>
<td>60 to 106 kPa</td>
</tr>
<tr>
<td></td>
<td>0.6 to 1.05 atmospheres</td>
</tr>
<tr>
<td></td>
<td>R1: 76 cm (30 in)</td>
</tr>
<tr>
<td></td>
<td>R2: 61 cm (24 in)</td>
</tr>
<tr>
<td></td>
<td>R3: 46 cm (18 in)</td>
</tr>
<tr>
<td></td>
<td>R4: 31 cm (12 in)</td>
</tr>
<tr>
<td></td>
<td>R5: 25 cm (10 in)</td>
</tr>
<tr>
<td><strong>Chemical Gasses</strong></td>
<td>Class 2C2</td>
</tr>
<tr>
<td><strong>Solid Particles</strong></td>
<td>Class 2S2</td>
</tr>
<tr>
<td><strong>Shock/ Drop (ISTA)</strong></td>
<td>R1…R4 In accordance with ISTA 1A</td>
</tr>
<tr>
<td></td>
<td>R5…R9 In accordance with ISTA 3E</td>
</tr>
<tr>
<td><strong>Vibration (ISTA)</strong></td>
<td>R1…R4 In accordance with ISTA 1A</td>
</tr>
<tr>
<td></td>
<td>R5…R9 In accordance with ISTA 3E</td>
</tr>
</tbody>
</table>
Feature overview

Communication
Protocols as standard (EIA-485): BACnet MS/TP, Modbus RTU, Johnson Controls N2

Application functions
Start interlock
Delayed start
Run permissive (damper monitoring)
Override operation mode
Real-time clock (scheduling)
PID controllers for motor and process
Motor flying start
Motor preheating
Energy optimizer and calculators
Timer
2 or 3 wire start/stop
Ramp to stop
2 independent adjustable accel/decel ramp

Protection functions
Overvoltage controller
Undervoltage controller
Motor earth-leakage monitoring
Motor short-circuit protection
Motor overtemperature protection
Output and input switch supervision
Motor overload protection (UL508C)
Phase-loss detection (both motor and supply)
Under load supervision (belt loss detection)
Overload supervision
Stall protection
Loss of reference
Panel loss
Ground fault
External events
Overcurrent
Current limit regulator
Transient/Surge protection (MOV and choke)

Panel functions
First start assistant
Primary settings for HVAC applications
Hand-Off-Auto operation mode
HVAC quick set-up
Includes Day, Date and Time
Operator Panel Parameter Backup (read/write)
Full Graphic and Multilingual Display for Operator Control
Parameter Set-Up and Operating Data Display:
- Output Frequency (Hz)
- Speed (RPM)
- Motor Current
- Calculated % Motor Torque
- Calculated Motor Power (kW)
- DC Bus Voltage
- Output Voltage
- Heatsink Temperature
- Elapsed Time Meter (resettable)

Motor control features
Scalar (V/Hz) and vector modes of motor control
V/Hz shapes
- Linear
- Squared
Energy optimization
IR compensation
Slip compensation
Three (3) Critical Frequency Lockout Bands

PID control
One (1) Process PID
Four (4) Integral Independent Programmable PID
Setpoint Controllers (Process and External)
External Selection between Two (2) Sets of Process
PID Controller Parameters
PID Sleep/Wake-Up
Control panel features

The ACH580 Assistant Control Panel features:
- Intuitive to operate
- Primary Setting menu to ease drive commissioning
- Real-time clock
- Diagnostic and maintenance functions
- Full-graphic display, including chart, graph, and meter options
- 21 editable home views
- USB interface for PC and tool connection as standard
- Parameters are alpha-numeric
- North American version supports 14 languages as standard
- Dedicated “Help” key
- 4 user sets
- Parameters are stored in control panel memory for later transfer to other drives or for backup of a particular system
- Back-up and restore parameters and/or motor data
- Automatic back-up 2 hours after parameter change
- Modified parameter display
- Creates unique short menu
- Shows parameters that differ from the default
- Bluetooth connectivity for use with mobile device (requires +J429 option)
Cable connections

The following illustrations show the ACH580-01 and ACH580-31 cable connection points for the base drive. The illustrations indicate the location of input and output power connections as well as equipment and motor grounding connection points.

ACH580 drives are configured for wiring access from the bottom only. At least three separate metallic conduits are required, one for input power, one for output power to the motor and one for control signals.
Control connections

Default control connections

1. Panel port (PC tools, control panel)
2. ABB drive customizer port for programming the drive without mains
3. Analog Inputs (2 × AI)
4. Analog outputs (2 × AO)
5. 24 V DC output
6. Digital inputs (6 × DI)
7. Safe torque off (STO)
8. Embedded fieldbus
9. Communication options (fieldbuses)
10. Analog and digital I/O extensions
11. Relay outputs (5 × RO)
12. Mains connection

### Control connections table

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Meaning</th>
<th>Default Macro connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>Reference voltage and analog inputs and outputs</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SCR</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A1ND</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>+10 V</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2ND</td>
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<tr>
<td>7</td>
<td>A01</td>
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<td>8</td>
<td>A02</td>
<td></td>
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<td>9</td>
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### X2 & X3

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<tr>
<td>10</td>
<td>+24 V</td>
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<tr>
<td>11</td>
<td>DGND</td>
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</tr>
<tr>
<td>12</td>
<td>DCOM</td>
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</tr>
<tr>
<td>13</td>
<td>DI1</td>
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</tr>
<tr>
<td>14</td>
<td>DIZ</td>
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<td>15</td>
<td>DI8</td>
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<tr>
<td>16</td>
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<td>17</td>
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<td>ROIC</td>
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<td>21</td>
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<td>22</td>
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<td>23</td>
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<tr>
<td>24</td>
<td>RO2B</td>
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<td>25</td>
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<td>26</td>
<td>RO3A</td>
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<td>27</td>
<td>RO3B</td>
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### X6

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<th>Meaning</th>
<th>Default Macro connections</th>
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<tbody>
<tr>
<td>29</td>
<td>E+</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>A-</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>DGND</td>
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<td>TBSM</td>
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<td>BIAS</td>
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<tr>
<td>34</td>
<td>OUT1</td>
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<tr>
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<td>OUT2</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>SGNDC</td>
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<tr>
<td>37</td>
<td>INS</td>
<td></td>
</tr>
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<td>38</td>
<td>ENS</td>
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### X10

<table>
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<th>Meaning</th>
<th>Default Macro connections</th>
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</thead>
<tbody>
<tr>
<td>40</td>
<td>24 V AC/DC</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>24 V AC/DC</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- Connected with jumpers at the factory.
- Only frames R8-R11 have terminals 40 and 41 for external 24 V AC/DC input.
Engineering Data Summary

Fuses

Drive input fuses are recommended to disconnect the drive from power in the event that a component fails in the drive’s power circuitry. Recommended drive input fuse specifications are listed in the Submittal Schedule Details and in the Fuse Ratings Table. Fuse rating information is provided for customer reference.

<table>
<thead>
<tr>
<th>Item</th>
<th>Catalog Number</th>
<th>Drive Input Fuse Ratings</th>
<th>Bussmann Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACH580-01-027A-4+J429</td>
<td>40</td>
<td>Class T</td>
</tr>
</tbody>
</table>

Terminal Sizes / Cable Connection Requirements

Power and motor cable terminal sizes and connection requirements are shown in the Submittal Schedule Details and in the Terminal Sizes / Cable Connection Requirements Table. The information provided below is for connections to input power and motor cables. These connections may be made to an input circuit breaker or disconnect switch, a motor terminal block, overload relay, and/or directly to bus bars and ground lugs. The table also lists torque that should be applied when tightening terminals and spacing requirements where multiple mounting holes are provided in the bus bar.

<table>
<thead>
<tr>
<th>Item</th>
<th>Catalog Number</th>
<th>Input Wiring</th>
<th>Output Wiring</th>
<th>Ground Wiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACH580-01-027A-4+J429</td>
<td>#20 ... #2  2.6 lbf-ft</td>
<td>#20 ... #2  2.6 lbf-ft</td>
<td>#24 ... #2  1.1 lbf-ft</td>
</tr>
</tbody>
</table>

Heat Dissipation Requirements

The cooling air entering the drive must be clean and free from corrosive materials. The Submittal Schedule Details and the Heat Dissipation Requirements table below give the heat dissipated into the hot air exhausted from the drives. If the drives are installed in a confined space, the heat must be removed from the area by ventilation or air conditioning equipment.

<table>
<thead>
<tr>
<th>Item</th>
<th>Catalog Number</th>
<th>Watts</th>
<th>BTU/Hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACH580-01-027A-4+J429</td>
<td>430</td>
<td>1,466</td>
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</tbody>
</table>

Dimensions and Weights

Dimensions and weights of the drives provided are given in the Submittal Schedule Details and in the Dimensions and Weights Table. The table also lists the applicable dimension drawings that include additional detail. Dimension drawings may be provided in the back of this submittal.

<table>
<thead>
<tr>
<th>Item</th>
<th>Catalog Number</th>
<th>Height mm (in)</th>
<th>Width mm (in)</th>
<th>Depth mm (in)</th>
<th>Weight kg (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACH580-01-027A-4+J429</td>
<td>490 (19.3)</td>
<td>203 (8.0)</td>
<td>229 (9.0)</td>
<td>11.8 (26)</td>
</tr>
</tbody>
</table>

Product short Circuit Current Rating

Short circuit ratings shown below are as show on the device rating label.

<table>
<thead>
<tr>
<th>Item</th>
<th>Catalog Number</th>
<th>Short Circuit Current Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACH580-01-027A-4+J429</td>
<td>100 kA with fusing</td>
</tr>
<tr>
<td>Item</td>
<td>Part Number</td>
<td>Customer Designation</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>1</td>
<td>ACH580-01-027A-4+J429</td>
<td></td>
</tr>
</tbody>
</table>
UCHSC Perinatal Research Facility

Tie Wall
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INTRODUCTION

This booklet is a general guide for the assembly of the SEMCO’s Acoustical Panel Enclosures. Carefully read and understand these instructions and any additional instructions on the panel layout drawings before you begin assembling the enclosure. Should you have any questions concerning the assembly procedure, please contact your SEMCO representative.

BEFORE ASSEMBLY

• Special instructions and/or details on the panel layout drawings take precedence over the assembly instructions. Self-drilling #14 x 3/4” Hex Head Tek screws are included for the panel trim supplied. (Pan Head screws will require pilot holes.)
• Butyl rubber sealant is supplied for panel and trim installation but is not required for trim pieces that are joined to the perforated panel skin unless otherwise noted (refer to Step #4.) - Sikaflex is supplied for door installation (refer to Figure 4.)
• Sealants are to be applied in accordance with manufacturer’s instructions.
• Store sealants in accordance with manufacturer’s instructions. If the sealant is exposed to certain weather conditions or is too old, enclosure may leak after unit is completely erected.

GENERAL NOTES

Check shipment when it arrives against the bill of materials (included with drawings.) Notify SEMCO within seven days of receipt of panels in case of shortages or damages. SEMCO Duct & Acoustical Products Inc. will not be liable for any shortages or damages claimed beyond seven days. **NOTE:** Having panels on edge with male edge down usually facilitates selection and accessibility. If enclosure is not to be assembled immediately or if panels are exposed to the weather, take appropriate measures to keep panels dry and allow air circulation between panels. Maintain a clean work area to avoid debris and dust from collecting on panels, curbs and sealant.

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**STEP 1: BASE CHANNEL**

1.1 Using the plan view on the panel layout drawings, chalk a line, using the outside dimensions of the enclosure, directly on the curb (or finished structural floor.)

1.2 Base channels are supplied in 10 ft. lengths with 9/16” holes punched on 24” centers. Cut the base channel to lengths required by the casing outline.

Straight joints are to be butted end-to-end and corner joints are to be lapped. (Figure 1)
STEP 1: BASE CHANNEL, CONTINUED

1.3 Sweep curb to remove all dust and debris prior to applying sealant. Apply two ½” continuous beads of butyl sealant directly on curb approximately ½”-1” on either side of the base channel centerline. (Figure 2) Do not apply more sealant at one time than will be covered by the base channel within 15 minutes.

1.4 Place the base channel on sealant keeping the outside edge aligned with the chalk line. Secure base channel to curb with ramset, concrete anchor, expansion studs or other suitable fasteners with 2,000 lbs. shear and pullout (these fasteners are not supplied by SEMCO Duct & Acoustical Products Inc.)

FIGURE 2.
STEP 2: WALL PANEL INSTALLATION

2.1 Using the panel layout drawings follow the wall panel sequence indicated. Beginning with wall #1, mark the dimensioned panel joint for each panel on the base channel for the entire perimeter of the casing. (Figure 2) Take into account the exposed 1” male edge allowance where indicated on drawings. This step will provide a reference point for the location of each panel and will serve to detect and correct any growth in the wall length.

2.2 Apply a 1/2” high by ½” wide continuous bead of butyl sealant to the outer flange of the base channel for a distance slightly greater than the panel to be installed. Do not apply sealant too far in advance to avoid premature curing or collection of debris.

2.3 All panels are individually piece-marked as indicated on the panel layout drawings and are labeled with these mark numbers on each panel. Install the first panel, keeping the panel joint aligned with the mark on the base channel. Make certain that the male (>) and female (=) edges are properly oriented as indicated on the panel layout drawings.

2.4 Plumb the panel and install a Tek screw through the base channel at the centerline of the panel, inside and outside (Figure 3.) Apply sealant generously the entire length of the exterior flange of the female channel; make certain that the sealant ties into the sealant in the base channel. Continue sealant across the female channel where it meets the base channel and 1 ½” up the interior flange of the female channel. (Figure 2)

2.5 Install the next panel in sequence by placing the female edge near the next joint mark on the base channel. With the panel tilted about 12” above the base, slip the male edge into the female edge of the previously installed panel and lower male edge into place. (Figure 3) Keep in mind that the panels must be installed with the male edge inserted into the female edge.

---

FIGURE 3.
STEP 2: WALL PANEL INSTALLATION, CONTINUED

Adjust the position of the panel horizontally so that the panel is centered between the joint line marks on the base channel. If necessary, carefully drive the panel into position by driving against a timber placed in the female channel of the panel. Take extreme care not to damage the roll-formed edges.

2.6 Install a Tek screw on the inside of the panel joint 3" below the top to maintain plumb; however, no additional screws are required in vertical joints for structural rigidity.

2.7 Continue installing panels as described following the sequence shown on the panel layout drawings. As each panel is installed, the joint line mark previously placed on the base channel will verify the location of each panel point.

2.8 Door frame installation must coincide with the panel installation. It is impossible to put them in at a later date. Doors must be installed to open against air pressure to ensure an airtight seal. Caulk the exterior perimeter of the door frame with silicone sealant. (Figure 4)

2.9 IMPORTANT: After installation of all wall panels is complete, Tek screw both sides of base channel through each panel joint and at 12" on center between joints.

FIGURE 4.
**STEP 3: ROOF PANEL INSTALLATION**

3.1 Review the roof plan on the panel layout drawings and locate roof panels. If structural reinforcement is required, it must be installed prior to the roof panels.

3.2 Install inside trim at the joint where the roof and walls meet. The upper edge of the trim must be level and flush with the highest point of the wall panels. (Figure 5) Fasten the trim to the assembled wall panels with Tek screws through every panel joint and at 12” on center between joints.

3.3 Mark roof panel joints (as dimensioned on the panel layout drawings) on the inside trim before installing roof panels. (Figure 5) Take into account the 1” male edge allowance where indicated on the drawing.

3.4 Install the first roof panel keeping the joint aligned with the mark on the inside trim. Square the panel with the walls and fasten both ends of the roof panel through the inside trim near the centerline of the panel with Tek screws. Make certain that the male (<) and female (>) edges are properly oriented as shown on the panel layout drawings. Keep in mind that the panels must be installed with the male edge inserted into the female edge.

3.5 Apply sealant generously to the exterior flange in the female channel on the previously installed roof panel and install next panel. Again, it is important to maintain proper alignment with the joint line marks on the inside trim.

3.6 After installation of all roof panels is complete, Tek screw inside trim through roof panel joints, internal channels, and at 12” on center.

**FIGURE 5.**
STEP 4: TRIM INSTALLATION

4.1 All trim is supplied in 10 ft. lengths to be field cut to length as necessary. Trim is to be secured to panels with selfdrilling Tek screws through each panel joint, internal stiffener and at 12" on center.

4.2 Install inside trim where interior wall panels meet exterior wall panel. (Figure 6) Sealant is not required for trim pieces that are joined to interior, perforated panel skin. (Figure 6)

4.3 Apply butyl sealant to both legs of outside trim and install vertical outside trim where preformed corner panels are not used. Attach the trim such that it runs from the top of the roof panels to the curb overlapping the base channel. Field notch kicks at trim overlapping the base channel. (Figure 7)

Attach vertical inside trim along interior corners where preformed corner panels are not used.

FIGURE 6.
STEP 4: TRIM INSTALLATION, CONTINUED

4.4 Apply butyl sealant to both legs of horizontal outside trim and fasten to roof and wall panels providing a tight seal. (Step #4.1) Field notch kicks at trim overlap and miter as required. (Figure 7)

4.5 Where splices are necessary, overlap trim by 6” and coat the overlap with butyl sealant. Install Tek screws at center of overlap and 1” beyond. (Figure 8)
STEP 4: TRIM INSTALLATION, CONTINUED

4.6 Cap channel is supplied for trimming all exposed panel edges and framing all rectangular openings in the enclosure. Field cut and install cap channel to form a false miter. (Figure 9) Apply butyl sealant along panel exterior edge and fasten cap channel to panels with Tek screws at 12” on center.

4.7 Special trim applications not pictured in this booklet may be required on a particular enclosure and will be detailed on the final panel layout drawings.

FIGURE 9.
**STRUCTURAL STEEL**

4.8 Structural steel must be field welded and secured in place as necessary. All structural steel is to be secured to panels through tongue and groove panel joints and internal panel stiffeners with a fastener rated at a minimum of 1,000 lbs. shear and pullout. In positive pressure areas, steel will require additional through bolts through tongue and groove panel joints to prevent uplift of panels at operating pressures. (Figure 10)

**SEMCO DUCT & ACOUSTICAL PRODUCTS INC. DOES NOT PROVIDE ANY FASTENERS FOR SECURING STRUCTURAL STEEL.**

4.9 On enclosures where SEMCO is supplying structural steel, that steel will be supplied in standard 10’ and 20’ lengths to be field cut as necessary.

4.10 Refer to panel layout drawings for further details for structural steel reinforcement.

**FIGURE 10.**

APPLICATION: ROOF SUPPORT WITH PANEL BREAK POSITIVE PRESSURE AREA
**A. Inaccessible Trim**

- Typical Inaccessible Trim
- Sealant (Typical)
- 1 1/2" x 1 1/2" inside trim
- Minimum required clearance. See plan, roof and wall views for specific application.

**B. Panel to Structure**

- Typical
- Sealant - apply on exterior side of panels (Typ.)
- Cap channel - attach to structure prior to installing panel.

**C. Panel to Structure**

- Clearance required. See plan, roof and wall views for specific application.
- Sealant (Typ.)
- 90° bend trim both sides of panel. Trim legs are generally 1 1/2" longer than clearance requirement. (i.e. with 1" R.C., trim legs would measure 1 1/2" x 2 1/2"

**D. Panel to Joiner**

- #14 x 3/4" Tek screw
- 3" on center (Typ.)
- Butt strap both sides of panel
- Sealant (Typ.)
E. Angle Panel Trim

F. Intermediate Panel Trim

G. Panel Support at Structure

H. Roof Break at Interior Wall
I. Roof Panel Support

J. Roof Panel Support with Break

K. Wall Panel Support Corner Brace

L. Wall Panel Support Knee Brace
**M. Wall Clip**

- **Typical**
  - Outside Trim
  - Sealing (Typ.)

- Structural Steel Roof Reinforcement
  - See Plan for Size
  - Steel Angle
  - See Plan for Size and Length

- 3/8" Through Bolt (by Others)
  - Through All Panel Joints and Internal Channels
  - Fasten at a Minimum of 3 Panel Joints

**N. Removable Panel**

- **Typical**
  - Gasket
  - Cap Channel

- Removable Panel

**O. Removable Section**

- Cap Channel
  - Typical All Around Opening

- Removable Panel Trim

**Fastener Schedule**

- **A.** #14 x 3/4" Tek Screw 12" on Center & Through Panel Joints (Where Applicable)
- **B.** #14 x 3/4" Tek Screw Through Panel Joints & Internal Stiffeners (Where Not Applicable, Tek Screw @ 12" on Center)
- **C.** 1000# Shear and Pullout 12" on Center (by Others)
- **D.** 2500# Shear and Pullout 4 per Base Plate (by Others)
- **E.** Positive Pressure Areas - Use 3/8" Through Bolts (by Others) Through Panel Joints and 1000# Shear & Pullout (by Others) Through Internal Stiffeners
  - Negative Pressure Areas - Use 1000# Shear & Pullout (by Others) Through Panel Joints and Internal Stiffeners
- **F.** #14 x 1 1/2" Pan Head Screws 12" on Center
Model: USF-424-AF
Centrifugal Utility Fan - Airfoil Wheel

Operating Performance

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<thead>
<tr>
<th>Static Pressure (in. wg)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>Brake Power (hp)</td>
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<td>6</td>
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<table>
<thead>
<tr>
<th>Volume (CFM) x 1,000</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
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<tr>
<td>Operating Bhp point</td>
<td></td>
<td></td>
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<td>Operating point at Total External SP</td>
<td></td>
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<tr>
<td>Fan curve</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>System curve</td>
<td></td>
<td></td>
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<tr>
<td>Brake horsepower curve</td>
<td></td>
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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>
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<tbody>
<tr>
<td>Inlet</td>
<td>91</td>
<td>88</td>
<td>97</td>
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<td>84</td>
<td>83</td>
<td>79</td>
<td>75</td>
<td>92</td>
<td>81</td>
<td>36</td>
</tr>
<tr>
<td>Outlet</td>
<td>108</td>
<td>100</td>
<td>99</td>
<td>92</td>
<td>89</td>
<td>86</td>
<td>81</td>
<td>76</td>
<td>96</td>
<td>84</td>
<td>52</td>
</tr>
</tbody>
</table>

*LwA - based on tables 156 or 148 of National Electrical Code 2002. Actual motor LwA 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. dB(A) levels are not licensed by AMCA International.

Sones - calculated using AMCA 301 at 5 ft
Model: USF-424-AF
Centrifugal Utility Fan - Airfoil Wheel

Standard Construction Features:
HOUSING: Unit support angles with pre-punched mounting holes - Adjustable motor plate - Corrosion resistant fasteners - Steel components are phosphatized and coated. 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
Discharge Position - TH
Bearings - L(10) Life of 80k Hours
UL/cUL-705 - Power Ventilators
Polished Steel Shaft
Inlet Connection - Slip Fit
Outlet Connection - Slip Fit
Weatherhood - Steel
Coating - Permaterior, Concrete Gray-RAL 7023, Fan and Attached Accessories
Unit Warranty: 1 Yr (Standard)
Model: USF-424-AF

Centrifugal Utility Fan - Airfoil Wheel

INLET

OUTLET

CONNECTIONS

Ø 30.86 INLET OD

26.03 OD

Ø 0.44856 in

4 Holes

4.47

170 lbs

132 lbs

15.17

15.17

40.20

145 lbs

10.83

FAN FOOTPRINT

WEATHERHOOD

SHAFT DIA 1.94

KEYWAY

0.5 X 0.28

12.88 (To Slip Fit Inlet)

3.25 (To Slip Fit Inlet)

Ø 30.86 Slip Fit O.D.

END VIEW

SIDE VIEW

*SIDE VIEW IS VIEWED FROM DRIVE SIDE
*FANS ARE SUBJECT TO ±0.125 INCH TOLERANCE
*DUE TO CONTINUOUS IMPROVEMENTS DIMENSIONS MAY CHANGE

Notes: All dimensions shown are in units of in.
USF-424-AF  Min/Max Fan Curve

Performance

<table>
<thead>
<tr>
<th>Requested Volume (CFM)</th>
<th>Actual Volume (CFM)</th>
<th>External SP (in. wg)</th>
<th>Total SP (in. wg)</th>
<th>Fan RPM</th>
<th>Operating Power (hp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,100</td>
<td>10,100</td>
<td>3.5</td>
<td>3.5</td>
<td>1775</td>
<td>8.48</td>
</tr>
</tbody>
</table>

Graphical representation showing the performance characteristics of the USF-424-AF fan, including static pressure, brake horsepower, and volume (CFM) x 1,000. The graph includes various points and curves such as the operating Bhp point, operating point at Total External SP, construction limit, motor/system limit, fan curve, min FRPM, system curve, and brake horsepower curve.
Warranty - 1 Yr (Standard)

WARRANTY AND LIABILITY: SELLER warrants to Buyer that products manufactured are free from defects in material and workmanship for a period of 1 Yr (Standard) from the date of shipment. SELLER's obligations and liabilities under this warranty are limited to furnishing FOB factory or warehouse at SELLER's designated shipping point, freight allowed to Buyer's city, (or point of export for shipments outside the conterminous United States) replacement equipment (or at the option of SELLER parts therefore) for all Seller's products not conforming to this warranty and which have been returned to the manufacturer. No liability whatever shall attach to SELLER until said products have been paid for and such liability shall be strictly limited to the purchase price of the equipment shown to be defective. SELLER may make further warranty protection available on an optional extra-cost basis and which must be authorized and in writing.

Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by SELLER prove defective during this period, they should be returned to the nearest authorized motor service station. SELLER will not be responsible for any removal or installation costs.

Electrical components, excluding motors, are warranted only to the extent warranted by the original manufacturer. To the extent that SELLER is entitled to pass through a warranty of the original equipment manufacturer of the electrical goods sold, SELLER will pass through such warranties to Buyer.

ANY MISUSE, NEGLIGENCE, FAILURE TO FOLLOW INSTRUCTIONS OR MANUALS OF INSTALLATION OF MAINTENANCE REPAIR, SERVICE, RELOCATION OR ALTERATION TO OR OF, OR OTHER TAMPERING WITH, THE PRODUCTS PERFORMED BY ANY PERSON OR ENTITY OTHER THAN SELLER WITHOUT SELLER'S PRIOR WRITTEN APPROVAL OR ANY USE OF REPLACEMENT PARTS NOT SUPPLIED BY SELLER, SHALL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED PRODUCTS.

THE WARRANTY AND LIABILITY SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESSED OR IMPLIED, IN LAW OR IN FACT, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE. SELLER PROVIDES NO INDEPENDENT WARRANTY FOR THIRD PARTY PRODUCTS OR COMPONENTS SOLD TOGETHER OR INCORPORATED WITH SELLER'S PRODUCT(S).
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.
Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if seismic activity is present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.

2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.

3. Motor must be securely and adequately grounded.

4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.

5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.

6. Verify that the power source is compatible with the equipment.

7. Never open access doors to a duct while the fan is running.
Receiving
Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your local representative. Any physical damage to the unit after acceptance is not the responsibility of manufacturer.

Unpacking
Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling
Fans are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. Location of brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce the ability of the fan to resist corrosion. Fans should never be lifted by the shaft, fan housing, motor, belt guard, windband or accessories.

Storage
- Rotate fan wheel monthly and purge bearings once every three months.
- Energize fan motor once every three months.
- Store belts flat to keep them from warping and stretching.
- Store unit in a location which does not have vibration.
- After storage period, purge grease before putting fan into service.

If storage of fan is in a humid, dusty or corrosive atmosphere, rotate the fan and purge the bearings once a month, improper storage which results in damage to the fan will void the warranty.

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

**DANGER**
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

**CAUTION**
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.

**CAUTION**
Precaution should be taken in explosive atmospheres.

**DANGER**
Pour écarter les risques d’incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l’installation ou l’entretien.

**ATTENTION**
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.

**ATTENTION**
Faire preuve de précaution dans les atmosphères explosives.

**INDOOR** - The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F (-1° to 43°C), wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to remove any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ inches (89 mm) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

**OUTDOOR** - Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so it is above water and snow levels and has enough blocking to prevent it from settling into soft ground.
Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

**Inspection and Maintenance During Storage**

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant in motor and bearings. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

**Removing from Storage**

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

Prior to assembly and installation of the unit and system components, inspect the fan assembly to make sure it is in working order.

1. Check all fasteners, set screws on the fan, wheel, bearings, drive, motor base and accessories for tightness.
2. Rotate the fan wheel by hand and assure no parts are rubbing. Access to the wheel is obtained through a bolted panel located on the side of the fan housing.
General Information

To ensure a successful installation, the instructions in this manual should be read and adhered to. Failure to comply with proper installation procedures may void the warranty.

Unit and System Identification Tags

Each fan has a permanently affixed manufacturer’s engraved metal nameplate containing the model number and individual serial number.

The tag shown is an example of an identification nameplate on the fan. The information provides general details about the fan, as well as containing specific information unique to the unit. When contacting your local manufacturer’s representative with future needs or questions, have the information on this label available. Tags are mounted in an area which is clearly visible, usually on the side of the fan cabinet.

Pre-Installation Information

Before installation, it is important to be certain the mounting surface will bear the operating weight of the unit. For proper unit operation, it is also important that it be operated in a completely level position.

For further details on safety practices involving industrial and commercial fans, please refer to AMCA Publication 410.

Electrical Disconnects

All fan motors should have disconnects located in close visual proximity to turn off electrical service. Service disconnects shall be locked-out when maintenance is being performed.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Models USFD and USF-100-BT, and USF-100-FC will include an integrated electrical disconnect.</td>
</tr>
</tbody>
</table>

Moving Parts

All moving parts must have guards to protect personnel. Refer to local codes for requirements as to the number, type and design. Fully secure fan wheel before performing any maintenance. The fan wheel may start “free wheeling” even if all electrical power has been disconnected. Before the initial start-up or any restart, check the following items to make sure that they are installed and secure.

- Do not spin fan wheel faster than the maximum cataloged fan RPM.
- Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.

Guards – Motor Cover, Weatherhood, Shaft, Belt, Inlet or Outlet Guard

Do not operate fans without proper protective devices in place. Failure to do so may result in serious bodily injury and property damage. Check local codes to ensure compliance for all protective devices.

Access Doors

Before opening access doors, ensure the fan wheel has stopped moving and that the wheel has been secured from being able to rotate. Do not operate fan without access door in its fully closed position.

Air Pressure and Suction

In addition to the usual hazards associated with rotating machinery, fans also create a dangerous suction at the inlet. Special caution needs to be used when moving around a fan, whether it is in operation or not. Before start-up, make sure the inlet area is clear of personnel and loose objects.
Fans - Rigging and Lifting

**IMPORTANT**

Fans should never be lifted by the shaft, motor, motor cover or accessories.

1. Before lifting, be sure that all shipping materials have been removed from the unit.
2. Use standard lifting and rigging practices.
3. ALL lifting brackets on each unit must be utilized at the same time.
4. Fan to be kept level during lifting and installation.
5. Spreader bars must span the unit to prevent damage to the unit by the lifting cables.
6. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7. Never lift unit in windy conditions.
8. Preparation of roof opening should be completed prior to lifting unit to the roof.

Fans are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. Location of brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of fan to resist corrosion.

See coating repair section of this manual for details regarding touch-up of damaged surfaces.

**IMPORTANT**

Spreader bars are recommended to prevent damage to the unit. Failure to use spreader bars may result in damage which becomes the installer’s responsibility.

**NOTE**

- Certain images are shown with higher lifting points on the unit. These are tie-off points to balance the load while lifting.
- Motor covers on certain size units and arrangements need to be removed prior to rigging and lifting as shown in diagram.

**Sizes 7 thru 24**

USFD-100 and USF-300 Arrangement 10
Without Isolation Base

**Sizes 27 thru 49**

USF-300 Arrangement 10
Without Isolation Base
Sizes 7 thru 30

USF-400 and CSW Class 0, I, II, Arrangement 10
Without Isolation Base

CSW Arrangement 1
W or Z Motor Position
Isolation Base

CSW Arrangement 4
Without Isolation Base

CSW Arrangement 1
X/Y Motor Position
Isolation Base
Optional Height Savings Bracket
For illustration purposes, some lifting location images with isolation bases are shown with optional height savings brackets. Lift unit using the corner hole located in the isolation base; with and without the height savings bracket.
Sizes 33 thru 73

CSW Arrangement 1
X/Y Motor Position
Isolation Base

CSW Arrangement 1
W or Z Motor Position
Isolation Base

CSW Arrangement 1
No Motor
Without Isolation Base

CSW Arrangement 8
Isolation Base

NOTE
Lift unit from fan lifting points, not from isolation base.
Installation

Move the fan to the desired location. Check and tighten fasteners throughout the unit and then fasten securely through mounting holes provided in the base angles. The unit must be set level (shimming may be necessary). Flexible duct connections and vibration isolators should be used where noise is a factor.

The motor voltage and ampere rating must be checked for compatibility with the electrical supply prior to final electrical connection. Supply wiring to the fan must be properly fused, and conform to local and national electrical codes.

Discharge Positions

**USFD-100 and USF-100**

- CW UB
- CW TH
- CW DH

*Except USFD-100-BI

**USF-300 and USF-400**

- CW BH
- CW BAU
- CW UB
- CW TH
- CCW BH
- CCW BAU
- CCW UB
- CCW TH

**CSW**

- CW BH
- CW BAU
- CW UB
- CW TH
- CCW BH
- CCW BAU
- CCW UB
- CCW TH
- CCW DH

The discharge is factory set as specified by customer order, however, certain sizes can be rotated to other discharge positions in the field if necessary. If rotating the fan housing, accommodations may need to be made for the fan to drain properly. The USFD-100, USF-100 and USF-300, all sizes, have field rotatable housings. For the USF-400 and CSW, rotatable housings are standard on sizes 30 and less, arrangements 1, 9 and 10, and Class 0, I and II. Class III and IV are not field rotatable. Removal of the housing bolts allows the discharge to be rotated to the clockwise positions shown above. For downblast (DB) discharge position, a portion of the frame angle must be removed.

Fan rotation is always specified from the drive side of the housing.

Installations with inlet or discharge configurations that deviate from this manual may result in reduced fan performance. Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel yielding large system losses and increased sound levels. Free discharge or turbulent flow in the discharge ductwork will also result in system effect losses. Refer to the following diagrams for the most efficient installation conditions.

**Ducted Inlet Installations**

**Inlet Duct Turns** - Installation of a duct turn or elbow too close to the fan inlet reduces fan performance because air is loaded unevenly into the fan wheel. To achieve full fan performance, there should be at least three fan wheel diameters between the turn or elbow and the fan inlet.

**Inlet Spin** - Inlet spin is a frequent cause of reduced fan performance. The change in fan performance is a function of the intensity of spin and not easily defined. The best solution is proper duct design and airflow patterns. Turning vanes reduce the effects of inlet spin.
Ducted Outlet Installations

Discharge Duct Turns - Duct turns located near the fan discharge should always be in the direction of the fan rotation.

Fan performance is reduced when duct turns are made immediately off the fan discharge. To achieve cataloged fan performance there should be at least three equivalent duct diameters of straight ductwork between the fan discharge and any duct turns.

Non-Ducted Installations

Inlet Clearance - Installation of a fan with an open inlet too close to a wall or bulkhead will cause reduced fan performance. It is desirable to have a minimum of three-fourths of a wheel diameter between the fan inlet and the wall.

Free Discharge - Free or abrupt discharge into a plenum results in a reduction in fan performance. The effect of discharge static regain is not realized.

Fan Drainage Piping and Trap Detail (by others)

Fans may have been supplied with an optional drain. Drains are located at the underside of the scroll housing. The drain may need to be connected to a drainage system to ensure proper disposal of any water or condensate that may occur.

- Drain connections with a plug are 1.0 inch (25.4 mm) MNPT.
- Installed piping to have a downward angle to allow for drainage.
- Fill traps to recommended level before start-up.

Note: A conservative method of trap design is to set

\[ N = \text{total static pressure} \]

Positive Pressure Trap

Connect this end to fan drain.

\[ N = \text{Negative fan pressure (inches W.C.)} \]
\[ H = N - 0.5 \text{ inches minimum} \]

Check local codes for proper disposal of drain water which has been in contact with the exhaust air.

Fans used for grease exhaust need to be equipped with a separate grease collector.

<table>
<thead>
<tr>
<th>Drain Options</th>
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<tbody>
<tr>
<td>USFD-100</td>
</tr>
<tr>
<td>USF-100</td>
</tr>
<tr>
<td>USF-300</td>
</tr>
<tr>
<td>USF-400</td>
</tr>
<tr>
<td>CSW</td>
</tr>
</tbody>
</table>

*1.0 inch (25.4 mm) non-threaded drain hole
Bases (Foundation and Isolation)
Critical to every fan installation is a strong, level foundation. A reinforced poured concrete pad with a steel base or inertia base provides an excellent foundation. Bases must be sturdy enough, with welded construction, to prevent flexing and vibration.

To eliminate vibration and noise from being transferred to the building, vibration isolators should be used. The fan is mounted directly on the isolation base and must be supported for the entire length of the fan base angle. (Refer to the Centrifugal Fan Isolation Base Assembly Instructions if the base was supplied by manufacturer). Isolators are installed between the isolation base and the foundation.

After the fan, isolation base, and isolators are installed, the entire assembly must be leveled. Position the level on the isolation base, not the fan shaft, for proper leveling. Additionally, the motor and fan shafts must be level and parallel relative to each other for proper alignment.

**Typical Fan on Isolation Base**

**IMPORTANT**

When installing a fan, ensure the proper protective devices are used to protect personnel from moving parts and other hazards. A complete line of protective accessories are available from the manufacturer including: inlet guards, outlet guards, belt guards, shaft guards, protective cages and electrical disconnects.

**Electrical Disconnects**

All fan motors should have disconnects located in close visual proximity to turn off electrical service. Service disconnects shall be locked out when maintenance is being performed.

**Moving Parts**

All moving parts must have guards to protect personnel. Refer to local codes for requirements as to the number, type and design. Fully secure fan wheel before performing any maintenance. The fan wheel may start “free wheeling” even if all electrical power has been disconnected. Before the initial start-up or any restart, check the guards (belt, shaft, inlet and outlet) and check the access doors to ensure that they are installed and secure.

Installation of UL/cUL 762 Listed Fans for Restaurant Exhaust

The UL/cUL 762 listing for restaurant exhaust is available on the USF-300 and 400 and CSW.

UL/cUL 762 fans are listed for a maximum operating temperature of 400°F (204°C) and includes an access door and 1 inch (25.4 mm) drain connection. An outlet guard is strongly recommended when the fan discharge is accessible. An upblast discharge is recommended. The fan discharge must be a minimum of 40 inches (1016 mm) above the roof line and the exhaust duct must be fully welded to a distance of 18 inches (457 mm) above the roof surface.

**This drawing is for dimensional information only. See the latest edition of NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations for detailed installation instructions, materials, duct connections and clearances.**

**Electrical Connections**

Before electrical connections are made, the supply voltage, phase and ampere capacity must be checked for compatibility with the fan motor. In addition, the supply wiring must be properly fused and conform to local and national electrical codes. If the unit is supplied with a safety disconnect switch, ensure proper wiring to the fan motor. Be sure the disconnect is switched to the “OFF” position before connecting supply wires. If no disconnect is supplied, ensure the supply wire is not live before connection. Supply wires are then connected to the optional safety disconnect switch (if supplied) or motor.
**V-Belt Drives**

**V-Belt Drive Installation**

1. Remove the protective coating from the end of the fan shaft using mineral spirits or another similar solvent. Check to ensure that the shaft is free of nicks and burrs.

2. Slide sheaves on shafts. Do not drive sheaves on as this may result in bearing damage.

3. Align fan and motor sheaves with a straight edge or string and tighten.

4. Place belts over sheaves. Do not pry or force belts, as this could result in damage to the cords in the belts.

5. Adjust the tension until the belts appear snug. Run the unit for a few minutes and allow the belts to “set” properly.

6. With the fan off and disconnect locked out, adjust the belt tension by moving the motor pivot plate. When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.

**Alignment of Pulleys and Belts**

Check pulleys and belts for proper alignment to avoid unnecessary belt wear, noise, vibration and power loss. Motor and drive shafts must be parallel and pulleys in line as shown in Figure 1.

![Aligning Sheaves with a Straight Edge](image)

**Figure 1**

The adjustable motor pulley is set at the factory for the fan RPM specified by the customer. Fan RPM can be increased by closing or decreased by opening the adjustable motor pulley. Multigroove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in fan speed represents a substantial increase in load on the motor.

To avoid motor overheating and possible burnout, motor load amperes should always be checked and compared to nameplate rating when fan speed is increased.

---

**Field Coating Touch-Up Procedure for Scratched Areas**

Standard coating and color is RAL 7023 Concrete Grey. The procedure outlines the correct method for repairing minor scratches in the coating.

**TOUCH-UP PAINT REPAIR KIT CONTENTS**

- One pint of Kem Kromik® primer
  - including a technical data sheet
- One pint of industrial enamel
  - including a technical data sheet
- Four disposable foam brushes
- One sheet sandpaper
- Repair procedure details

1. Scuff affected area to be repaired using medium sandpaper (provided) or medium Scotch Brite™ pad. Feather the edges.

2. Clean affected area to be touched up using an alkaline based cleaner and rinse.

3. Apply Kem Kromik® primer using 1 inch foam brush (provided). Follow technical data sheet instructions.

4. Allow primer to dry a minimum of 2-1/2 hours before top coating.

5. Apply topcoat with industrial enamel using 1 inch foam brush (provided). Follow technical data sheets instructions. Allow painted units to air-dry and cure before putting into service. See Technical Data sheets (included with kit) for detailed drying and cure schedules at different temperatures.

---

**NOTE**

While the manufacturer provides heavy-duty, quality products for marine environments, routine paint touch-ups may be required in coastal regions where salt or marine air could damage the coating. The severe environment will accelerate the damage from any scratches or chips and it is recommended that those be repaired immediately.

To order additional coating repair kits please reference part number HAZ2597 PNT FIELD REPAIR KIT, RAL 7023 CONCRETE GREY. Please contact factory with your fan’s serial number for colors other than our standard.
Wheels must rotate freely and not rub on the inlet cone. Models USFD and USF-BI (backward-inclined) and CSW wheels overlap the inlet cone. There is a gap between the inlet cone and wheel on models USFD and USF-FC (forward-curved). Refer to the tables for the proper dimension.

**Radial Gap and Alignment**

Efficient fan performance can be maintained by having the correct radial gap, overlap and wheel alignment. These items should be checked after the fan has been in operation for 24 hours and before start-up when the unit has been disassembled.

**Radial Gap:** Adjust inlet cone position such that the radial gap between the wheel cone and inlet cone is evenly distributed around the wheel. Radial gap is adjusted by loosening the inlet cone/ring bolts and centering the cone/ring on the wheel. If additional adjustment is required to maintain a constant radial gap, loosening the bearing bolts and centering the wheel is acceptable as a secondary option.

**Overlap:** Overlap is adjusted by loosening the wheel hub from the shaft and moving the wheel to the desired position along the shaft.

The transition between the inlet cone and wheel should be as shown; there is a smooth feel to the profile when moving from one component to the other.

**Method for Centering Wheel:** On belt drive units, centering can be accomplished by (a) loosening the inlet cone bolts to move the inlet cone or by (b) loosening the bearings in order to move the shaft. Wheel and inlet cone overlap can be adjusted by loosening the wheel hub set screws and moving the wheel to the desired position. Tighten all fasteners and set screws securely and realign drive pulleys after adjustment.
Wheel Rotation
Rotation direction of the wheel is critical. Incorrect rotation will result in reduced air performance, increased motor loading and possible motor burnout.

Check wheel rotation by momentarily energizing the unit and noting if rotation is in the same direction as the airflow at the outlet and conforms to the rotation decal affixed to the unit.

Wheels as viewed from the drive side:

Backward Inclined

Forward Curved

Vibration
On start-up and during operation, the unit should operate smoothly with minimal vibration. It is possible that a higher degree of vibration may be experienced. Excessive vibration if left unchecked, can cause a multitude of problems, including structural and/or component failure. The most common sources of vibration are listed.

Many of these conditions can be discovered by careful observation. Refer to the troubleshooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified technician using vibration analysis equipment should be consulted. If the problem is wheel unbalance, in-place balancing can be done through the access panel located on the side of each fan’s tubular housing. Any correction weights added to the wheel should be welded to either the wheel back (single-plane balance) or to the wheel back and wheel cone (two-plane balance).

Unit Start-Up

WARNING
Disconnect and secure to the OFF position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

DANGER
Pour écarter les risques de blessure grave ou de mort, débrancher et verrouiller l’alimentation électrique en position « Arrêt » avant tout contrôle ou entretien.

Visual Inspection of Equipment
The equipment type and arrangement should be verified as ordered at once when it arrives at the jobsite. When a discrepancy is found, the local representative must be notified immediately so that corrective action may be investigated. Verify electrical conformance to specifications. Unauthorized alterations and unauthorized backcharges will not be recognized by manufacturer.

After the unit has been assembled, installed and all utilities have been hooked up, the unit is ready for operation.

Check
Before starting the unit, check the following:

1. Confirm that building supply voltage matches the voltage for which the unit is wired.
2. Check all piping and wiring penetrations made by contractors for water tightness. All penetrations must be made watertight to prevent water damage to the unit and building.
3. Rotate the fan wheel manually to be sure that it is free to operate. Remove any dirt or debris that may have accumulated during installation.
4. Check the fan bearing set screws for tightness.
5. Check alignment of sheaves and V-belts. See Belt Drive Maintenance section.
6. Inspect all fasteners to ensure that none have loosened during shipment.
7. Check flex coupling for proper alignment and connect between motor shaft and fan shaft (direct drive).
8. Check all guarding to ensure that it is securely attached and not interfering with rotating parts.
9. Check all electrical connections for proper attachment.
10. Check housing and ductwork, if accessible, for obstructions and foreign material that may damage the fan wheel.
11. Fill drainage piping trap.
Additional Steps for Initial Start-Up

1. Check for proper wheel rotation by momentarily energizing the fan. Access to view the wheel can be gained through the blower housing access panel.

One of the most frequently encountered problems are motors that are wired to rotate the wheel in the wrong direction. This is especially true with 3-phase installations where the motor will run in either direction, depending on how it has been wired. To reverse rotation of a 3-phase motor, interchange any two of the three electrical leads. Single phase motors can be reversed by changing internal connections as described on the motor label or wiring diagram.

2. Fans with multi-speed motors should be checked on low speed during initial start-up.

3. Check for unusual noise, vibration or overheating of bearings. Refer to the “Troubleshooting” section of this manual if a problem develops.

4. Grease may be forced out of the bearing seals during initial start-up. This is a normal self-purging feature for the type of bearing used on this product.

NOTE
Model USF and CSW units should be operated only when attached to the system for which they were designed. Without proper system static pressure, the motor could be overloaded.

Model USFD-100-BI - Three-phase

This unit ships with the variable frequency drive (VFD) preprogrammed based on selected performance. No additional programming is required.

1. To operate, turn disconnect on and allow VFD to power up.

2. Once VFD display is shown, press LO/RE button which will switch control from remote to local.

3. If necessary, use vertical arrows to scroll through display screens to find frequency reference F.

4. Frequency should be programmed from factory. To balance system (by adjusting frequency), press Enter and use vertical arrows and Reset button until desired frequency is achieved. Press Enter to set frequency.

5. Press Run to start fan.

6. If additional adjustment is required, press Stop and repeat steps 3-4.

Routine Maintenance and Operation

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before taking any corrective action, make certain unit is not capable of operation during repairs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AVERTISSEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avant d’entreprendre toute action corrective, s’assurer que l’appareil ne pourra pas fonctionner durant les réparations.</td>
</tr>
</tbody>
</table>

Once the unit has been put into operation, a routine maintenance schedule should be set up to accomplish the following:

1. Lubrication of bearings and motor.

2. Wheel, housing, bolts and set screws on the entire fan should be checked for tightness.

3. Any dirt accumulation on the wheel or in the housing should be removed to prevent unbalance and possible damage.

4. Inspect fan impeller and housing looking for fatigue, corrosion, or wear.

Fan Operation

All fans should be run every thirty (30) days, or at least “bumped” every thirty days. It is preferred that each fan is run as this causes all electrical and mechanical components to get up to temperature, displacing any formed condensation, redistributes load on bearings, and redistributes grease in the bearings (motor and shaft bearings).

<table>
<thead>
<tr>
<th>IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult manufacturer to determine if the unit can operate safely at the new condition.</td>
</tr>
</tbody>
</table>

Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling. Never wash down motor with high pressure spray.

Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the manufacturer’s recommendations. When motor temperature does not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time.

Direct drive systems have extended grease lines to lubricate the motor without removal of any guarding.
Belt Drive Maintenance

V-belt drives must be checked on a regular basis for wear, tension, alignment and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage and overheated sheaves. Either excessively loose or tight belts may cause fan vibration.

When replacing V-belts on multiple groove drives, all belts should be changed to provide uniform drive loading. Use a set of matched belts whenever possible. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, ensure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

The proper tension for operating a V-belt drive is the lowest tension at which the belts will not slip at peak load conditions. Belts are adjusted by raising or lowering the motor pivot plate. For initial tensioning, the proper belt deflection halfway between sheave centers is 1/64-inch for each inch of belt span.

For more information about measuring belt tension, refer to Product Application Guide, FA/127-11, Measuring Belt Tension, found online at greenheck.com in the library section.

Check belt tension two times during the first 24 hours of operation and periodically thereafter.

USF-100 Belt Adjustment

Belts on the USF-100 are adjusted from the exterior of the fan. The end cover must be removed so that the belt(s) can be inspected and checked for proper tension.

1. Loosen, but DO NOT remove the four corner bolts on the adjustment plate.
2. Loosen, then adjust L-bolts on adjustment plate to tighten or loosen belt(s) as needed.
3. Tighten L-adjustment bolts and the four corner bolts to lock motor in place after proper tension is reached.

**NOTE**

Loosen the corner bolts as minimal as possible to allow the plate to move, but so the plate has minimal movement when bolts are re-tightened.

Wheel and Fastener Maintenance

Wheels require very little attention when exhausting clean air, however, air heavily laden with grease or dirt will tend to accumulate on the wheel causing unbalance. Wheels exhausting dirty or grease-laden air require frequent cleaning to assure smooth and safe operation.

All fasteners, including set screws in the bearing collars, should be checked for tightness each time maintenance checks are performed.

A proper maintenance program will help preserve the performance and reliability designed into the fan.
Bearing Lubrication Schedule
Shaft bearings are the most critical moving part of a fan. Therefore, special attention should be given to keeping the bearings clean and well lubricated. Proper lubrication provides for reduction in friction and wear, transmission and dissipation of heat, extended bearing life, and prevention of rust.

In order for a lubricant to fulfill these tasks, the proper grease applied at regular intervals is required. See the recommended bearing lubrication schedule below.

If unusual conditions exist (temperatures below 32°F or above 200°F), moisture or contaminants - more frequent lubrication is required.

<table>
<thead>
<tr>
<th>Recommended Bearing Lubrication Schedule</th>
<th>Relubrication Schedule in Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Grease</td>
</tr>
<tr>
<td>Fan RPM</td>
<td>Bearing Bore (Inches)</td>
</tr>
<tr>
<td></td>
<td>1/2 - 1</td>
</tr>
<tr>
<td>To 250</td>
<td>12</td>
</tr>
<tr>
<td>500</td>
<td>12</td>
</tr>
<tr>
<td>750</td>
<td>12</td>
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<tr>
<td>1000</td>
<td>12</td>
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<tr>
<td>1250</td>
<td>12</td>
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<td>1500</td>
<td>12</td>
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<tr>
<td>4000</td>
<td>12</td>
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<tr>
<td>5000</td>
<td>12</td>
</tr>
</tbody>
</table>

Number of Shots: 4 8 8 10 16

- Lubrication interval is based on 12 hour per day operation and maximum 160°F housing temperature. For 24 hour per day operation, the interval should be cut in half.
- Lubricant should be added with the shaft rotating and until clean grease is seen purging from the bearing. The lubrication interval may be modified based on the condition of the purged grease. If bearing is not visible to observe purged grease, lubricate with number of shots indicated in chart for bore size.
- For conditions including high temperatures, moisture, dirt or excessive vibration, consult the factory for a specific lubrication interval for your application.
- Lubricant should be a high quality lithium complex grease conforming to NLGI Grade 2. Factory recommends Mobilux EP-2.
- The use of synthetic lubricants will increase lubrication intervals by approximately 3 times.

In addition to lubricating the bearings at specified intervals, set screws in the bearing collars should be checked for tightness. A bearing collar which has loosened will cause premature failure of the fan shaft. Fasteners attaching the bearings to the drive frame should also be checked.

Variable Frequency Drive Operation
For operation with a variable frequency drive (VFD) always check motor amps when adjusting the operating frequency. Motor may be sized for the original selected operating speed under 60 Hz. Bypassing the VFD or increasing the speed from this original selection, even if less than 60 Hz, may cause motor to overload or fail. Consult factory with fan serial number before increasing the upper limiting frequency.

Always check the fan RPM when adjusting the operating frequency. Do not exceed maximum class fan RPM of the wheel.

NOTE
It is the responsibility of the installing body to perform coast-down tests and identify any resonant frequencies after the equipment is fully installed. These resonant frequencies are to be removed from the operating range of the fan by using the “skip frequency” function in the VFD programming. Failure to remove resonant frequencies from the operating range will decrease the operating life of the fan and void the warranty.

Model USFD-100-BI – Variable Speed Drives
The USFD-100-BI comes equipped with a factory integrated speed controller. Single-phase models will use a Vari-Green® Motor and Potentiometer dial to adjust motor rpm, To change the speed, simply turn the dial. Three-phase models will offer a mounted, wired and programmed VFD and premium induction motor. Changing speeds on a 3-phase model involves pressing the up and down arrows located on the VFD interface (see section under Unit Start-Up).

Both single- and three-phase versions feature a built-in electrical disconnect and the option for external control through 0-10 VDC signal.

For additional information on the USFD-100 variable speed controls:
Bearing Replacement

For Arrangements 1, 3, 8, 9 or 10
The intent of this procedure is to allow a field service technician to replace bearings with the fan remaining in place in its intended application. All work can be conducted accessing the bearings by either removing a shaft guard, a weatherhood or working under a weatherhood. This is dependent on the size of the unit. This procedure assumes the power source has been locked out prior to removing guards and covers, belts and pulleys have been loosened and removed properly, and extended lubrication lines have been disconnected at the bearing. In some cases, it may be necessary to remove the fan inlet cone and wheel if the bearings cannot be removed due to corrosion or damage. See Radial Gap, Overlap and Wheel Alignment on pages 14 and 15 to the realign wheel upon installation.

Bearing Removal
This procedure assumes proper safety measures have been taken.
- Read and follow all instructions carefully.
- Disconnect and lockout power before installation and maintenance.
- Driven sheaves and belts have already been removed.
- **Arrangement 8 fans** will need the coupler removed, the motor feet marked, and slid back far enough for bearing removal. For reinstallation of coupler, follow the coupler manufacturers’ installation procedures.
- **Arrangement 3 fans** will need the inlet ducting removed to access the non-drive bearing for removal.
- Shaft black coating can be removed with a solvent similar to a brake/carburetor cleaner.
1. Scribe a line around the shaft by both bearings and around the bearing base to the bearing support or write down the measurement from the end of the shaft to the bearings. This will help in repositioning the new bearing and wheel cone overlap.
2. Follow the bearing manufacturers’ procedures for removal and installation.
3. Before removing the bearing bolts, make sure the shaft is supported slightly. Remember to consider the wheel weight on the shaft. (Arrangement 3 may need the wheel to be suspended through an access door on top of the fan.)
4. Remove both bearings from the shaft and clean/remove any burrs using an emery cloth or file.
5. Clean mounting surface of any dirt or grease.

Bearing Installation
1. Before installing, read bearing manufacturers’ procedures. Before putting the new bearings on the shaft, you may need to break what is called swivel torque on the bearings (depending on style of bearing). This is done by holding the bearing housing securely and being able to move the inner bearing race around freely.
2. Apply light film of oil on shaft, then gently slide the new bearings onto the shaft.

**Do not hammer bearing onto shaft!**
3. Align bearings on shaft with the previous scribe marks that are on the shaft and lock bearing to shaft.
4. Put bolts into mounting surface and bearings. Do not tighten.
5. Remove blocks if shaft is supported. (For Arrangement 3, release the weight of the wheel onto the bearing).
6. Set bearings on support with the scribed marks locating the bearings. Make sure bearings are square and level with the shaft.
7. Tighten bolts and torque bearing bolts, bearing set screws/locking collars as per bearing manufacturers’ procedures.
8. Rotate shaft by hand to help allow the bearings to help set in. At this time, listen for any unusual noises such as wheel rubbing on cone and any bearing noise.
9. Connect extended lube lines in new bearings if needed.
10. Reinstall the drive sheaves and belts. Check the belt alignment.
11. Make sure to reinstall all guards and follow proper safety measures before starting up the fan.
Parts List

Each fan bears a manufacturer’s nameplate with model number and serial number embossed. This information will assist the local manufacturer’s representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

**CAUTION**

A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing Mark for the fans approved usage.

**CAUTION**

La présence d’un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l’appareil est antidéflagrant. Pour connaître les emplois autorisés de l’appareil, voir son marquage de conformité UL.

• **USFD-100**

![USFD-100 Diagram]

• **USF-100**

![USF-100 Diagram]
• USF-300

*Optional Accessories
Image shows Arrangement 9. Other arrangements will have variations in motor mounting positions.
# Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Excessive Noise</strong></td>
<td>Wheel Rubbing Inlet</td>
<td>Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.</td>
</tr>
<tr>
<td></td>
<td>V-Belt Drive</td>
<td>Tighten sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see procedure). Replace worn belts or sheaves.</td>
</tr>
<tr>
<td></td>
<td>Bearings</td>
<td>Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.</td>
</tr>
<tr>
<td></td>
<td>Wheel Unbalance</td>
<td>Clean all dirt off wheel. Check wheel balance.</td>
</tr>
<tr>
<td><strong>Low CFM</strong></td>
<td>Fan</td>
<td>Check wheel for correct rotation.</td>
</tr>
<tr>
<td></td>
<td>Duct System</td>
<td>Higher pressure than design. Filters need replacement.</td>
</tr>
<tr>
<td><strong>High CFM</strong></td>
<td>Fan</td>
<td>Decrease fan speed.</td>
</tr>
<tr>
<td><strong>Static Pressure Wrong</strong></td>
<td>Duct system has more or less restriction than anticipated</td>
<td>Remove obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.*</td>
</tr>
<tr>
<td><strong>High Motor Amp Draw</strong></td>
<td>Fan</td>
<td>Check rotation of wheel. Reduce fan speed.</td>
</tr>
<tr>
<td></td>
<td>Duct System</td>
<td>Resize ductwork. Check proper operation of isolation and bypass dampers. Check filters and access doors.</td>
</tr>
<tr>
<td><strong>Fan Doesn’t Operate</strong></td>
<td>Electrical Supply</td>
<td>Check fuses/circuit breakers. Check for switches turned off or disconnected. Check for correct supply voltage.</td>
</tr>
<tr>
<td></td>
<td>Drive</td>
<td>Check for broken belts. Tighten loose pulleys.</td>
</tr>
<tr>
<td></td>
<td>Motor</td>
<td>Assure motor is correct horsepower and not tripping overload protector.</td>
</tr>
<tr>
<td><strong>Overheated Bearing</strong></td>
<td>Lubrication</td>
<td>Check for excessive or insufficient grease in the bearing.</td>
</tr>
<tr>
<td></td>
<td>Mechanical</td>
<td>Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.</td>
</tr>
<tr>
<td><strong>Excessive Vibration</strong></td>
<td>Belts</td>
<td>Adjust tightness of belts. Replacement belts should be a matched set.</td>
</tr>
<tr>
<td></td>
<td>System Unbalance</td>
<td>Check alignment of shaft, motor and pulleys. Adjustable pitch pulleys with motors over 15 hp are especially prone to unbalance. Check wheel balance, rebalance if necessary.</td>
</tr>
</tbody>
</table>

* Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in motor failure. Do not exceed the maximum cataloged rpm of the fan.
## Maintenance Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>AM/PM</th>
<th>Notes</th>
<th>Date</th>
<th>Time</th>
<th>AM/PM</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

## Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Programming Sure-Aire™

Greenheck’s Sure-Aire™ Differential Pressure Controller provides either a 2-10 Vdc or 4-20 mA electrical output signal. The output signal is linearly proportional to the pressure range of differential pressure controller. The ranges for Greenheck’s Sure-Aire controllers are listed in the table.

<table>
<thead>
<tr>
<th>Greenheck Part Number</th>
<th>Controller ΔP Range (inches W.C.)</th>
<th>$P_{\text{max}}$ (inches W.C.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>384799</td>
<td>0-8.30</td>
<td>8.30</td>
</tr>
<tr>
<td>384800</td>
<td>0-22.14</td>
<td>22.14</td>
</tr>
<tr>
<td>384801</td>
<td>0-41.52</td>
<td>41.52</td>
</tr>
<tr>
<td>384802</td>
<td>0-83.04</td>
<td>83.04</td>
</tr>
<tr>
<td>384803</td>
<td>0-138.40</td>
<td>138.40</td>
</tr>
</tbody>
</table>

Calculating Flow from Differential Pressure

The volumetric flow through the fan (cfm) can be calculated from the equation:

$$\text{CFM} = K \sqrt{\frac{\Delta P}{\rho}}$$

where $K$ is the K-factor for the specific fan model and size, $\Delta P$ is the measured differential pressure across the inlet cone (inches W.C.), and $\rho$ is the air density (lb/ft³). K-factors for Greenheck models are found on the back of this document.

Calculating Flow from Voltage Signal

If using a 2-10 Vdc output signal from a differential pressure controller, this equation can be used to calculate the flow:

$$\text{CFM} = K \sqrt{\frac{(V - 2) P_{\text{max}}}{8\rho}}$$

where $V$ is the output voltage of a 2-10 Vdc transmitter and $P_{\text{max}}$ is the maximum pressure range of the controller being used (inches W.C.).

Calculating Flow from Current Signal

If using a 4-20 mA output signal from a differential pressure controller, this equation can be used to calculate the flow:

$$\text{CFM} = K \sqrt{\frac{(mA - 4) P_{\text{max}}}{16\rho}}$$

where mA is the output current of a 4-20 mA transmitter and $P_{\text{max}}$ is the maximum pressure range of the controller being used (inches W.C.).

Density Corrections

Air density, $\rho$, is affected by elevation and temperature. The Greenheck Sure-Aire Differential Pressure Controllers allow the user to input the elevation for the application. This elevation input automatically updates the density used for the flow calculation.

The Remote Temperature Sensor will adjust the air density value in the controller based on the sensor measurement when Temperature Compensation is set to ‘Yes’. This density compensation will affect the flow rate displayed on the controller. If Temperature Compensation is set to ‘No’, the air density value will be a function of standard air (70°F/21°C).

The density being used by the Sure-Aire controller can be viewed on the main menu by scrolling up or down through the settings.
### K-Factors

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### Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck’s Sure-Aire™ Flow Monitoring Systems catalogs provides additional information describing the equipment, fan performance, available accessories, and specification data. AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.
**Occupational Health Program**

*Prices effective August 1, 2018*

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