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Date: 11/9/2023
Return Request: 11/19/2023
Project: UCA Snow – Fine Arts Center
Supplier: Airetech
Manufacturer: Nortek
Submittal: Central Station AHUs
Submittal Number: 23 73 13-01
Drawing # and Installation: Mechanical Drawings

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Notes:

*This submittal is preliminary. 11/9/2023

CSUSA PROJECT NO.
23-2020
chowell@comfortar.com

Project Name: Snow Fine Arts HVAC Upgrades

Reviewer Name:	Dakota Ellis
Date:	11/10/2023
Submittal #:	25
Company Name:	Wagner General Contractors, Inc.

Status: Reviewed

This review is only for general conformance of the project and general compilance. Contractor is responsible for all dimensions and fabrication to be confirmed and correlated at the job site.

INSTALLATION, OPERATION & MAINTENANCE

EQUIPMENT: ABB Variable Frequency Drive

TAGS: VFD for AH-6

PROJECT: UCA Snow Fine Arts

LOCATION: Conway, AR

ENGINEER:

CONTRACTOR:

DATE: 7/17/2024

SUBMITTED BY: Forrest Moseley
forrest@airetechcorp.com

ABB DRIVES FOR HVAC

ACH580-01 drives

Installation, Operation and Maintenance Manual (I, O & M)

ACH580-01 HVAC Drives (1...350 HP, 0.75...250 kW)
ACH580-BCR/BDR (1...350 HP, 0.75...250 kW)
ACH580-PCR/PDR (1...350 HP, 0.75...250 kW)
ACH580-VCR/VDR (1...60 HP, 0.75...45 kW)

Safety instructions

These are the safety instructions which you must obey when you install and operate the drive and do maintenance on the drive. If you ignore the safety instructions, injury, death or damage can occur.

Use of warnings and notes in this manual

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger. Notes draw attention to a particular condition or fact, or give information on a subject.

The manual uses these warning symbols:

Electricity warning tells about hazards from electricity which can cause injury or death, or damage to the equipment.
General warning tells about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.
Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the equipment.

General safety in installation, start-up and maintenance

These instructions are for all personnel that install the drive and do maintenance work on it.

WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- Use safety shoes with a metal toe cap to avoid foot injury. Wear protective gloves and long sleeves. Some parts have sharp edges.
- Handle the drive carefully.
  - Frames R5…R9: Lift the drive with a lifting device. Use the lifting eyes of the drive.
  - Frames R5…R9: Do not tip the drive over. The drive is heavy and its center of gravity is high. An overturning drive can cause physical injury.

- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, remain hot for a while after disconnection of the electrical supply.
- Keep the drive in its package or protect it otherwise from dust and burr from drilling and grinding until you install it.
- Vacuum clean the area below the drive before the start-up to prevent the drive cooling fan from drawing the dust inside the drive.
- Do not cover the air inlet and outlet when the drive runs.
- Make sure that there is sufficient cooling. See the *ACH580 Hardware Manual (3AXD50000044839)* for more information.

- Before you connect voltage to the drive, make sure that the drive covers are on. Keep the covers on during the operation.
- Before you adjust the drive operation limits, make sure that the motor and all driven equipment can operate throughout the set operation limits.
- Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break. If these functions are activated, the installation must be clearly marked as defined in IEC/EN 61800-5-1, sub-clause 6.5.3, for example, “THIS MACHINE STARTS AUTOMATICALLY”.
- The maximum number of drive power-ups is five in ten minutes. Too frequent power-ups can damage the charging circuit of the DC capacitors.
- If you have connected safety circuits to the drive (for example, emergency stop and Safe torque off), validate them at the start up. For the validation of the Safe torque off, see *ACH580 HVAC control program firmware manual (3AXD50000027537 [English])*. For the validation of other safety circuits, see the instructions provided with them.

Note:

- If you select an external source for start command and it is on, and the start command is level-triggered, the drive will start immediately after fault reset. See parameters 20.02 Ext1 start trigger type and 20.07 Ext2 start trigger type in *ACH580 HVAC control program firmware manual (3AXD50000027537 [English])*.
- When the control location is not set to Local (text Hand is not shown on the top row of the panel and parameter 19.19 Off mode disable has value Off button disabled), the stop key on the control panel will not stop the drive.
- Frames R1…R5: Do not attempt to repair a malfunctioning drive; contact your local representative for replacement or repair by authorized persons.
- Frames R6…R9: Can be repaired by authorized persons.

Electrical safety in installation, start-up and maintenance

Precautions before electrical work

These warnings are for all personnel who do work on the drive, motor cable or motor.

WARNING! Frames R1 … R9: Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do electrical installation or maintenance work. Go through these steps before you begin any installation or maintenance work.

1. Clearly identify the work location.
2. Disconnect all possible voltage sources. Lock and tag.
   - Open the main disconnector at the power supply of the drive.
   - Make sure that reconnection is not possible.
   - Disconnect any external power sources from the control circuits.
   - After you disconnect the drive, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
3. Protect any other energized parts in the work location against contact.
4. Take special precautions when close to bare conductors.
5. Measure that the installation is de-energized.
   - Use a multimeter with an impedance of at least 1 Mohm.

- Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding terminal (PE) is close to 0 V.

  Frames R1…R3: Measure the voltage between the drive UDC+ terminal and grounding terminal (PE) with one multimeter. As there is no UDC- terminal, measure the voltage between the drive T1/U terminal and grounding terminal (PE) with another multimeter. Make sure that the voltage difference between the multimeters is close to 0 V.

  Frames R4…R9: Measure the voltage between the drive DC terminals (UDC+ and UDC-) and the grounding terminal (PE) and make sure that it is close to 0 V.

6. Install temporary grounding as required by the local regulations.
7. Ask for a permit to work from the person in control of the electrical installation work.

If the drive does not operate according to these steps, refer to the *ACH580 Hardware Manual (3AXD50000044839)*.

Additional instructions and notes

WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- If the drive will be connected on an IT system (ungrounded or high-resistance-grounded [over 30 ohms]), make sure neither the EMC filter nor the ground-to-phase varistor are connected (metal screws should not be installed). Connections with metal screws in these systems can cause danger or damage. See section *Drive compatibility for various electrical power systems* on page *16*.
  Note: For other systems, connecting the internal EMC filter will reduce the conducted emission.
- If the drive will be connected on a corner-grounded TN system, make sure the EMC filter is not connected (metal screws should not be installed). Connections with metal screws in these systems can cause danger or damage. See section *Drive compatibility for various electrical power systems* on page *16*.
  Note: For other systems, connecting the internal EMC filter (using metal screws) will reduce the conducted emission.
- Use all ELV (extra low voltage) circuits connected to the drive only within a zone of equipotential bonding, that is, within a zone where all simultaneously accessible conductive parts are electrically connected to prevent hazardous voltages appearing between them. You can accomplish this by a proper factory grounding, that is, make sure that all simultaneously accessible conductive parts are grounded to the protective earth (PE) bus of the building.
- Do not do insulation or voltage withstand tests on the drive or drive modules.

Note:

- The motor cable terminals of the drive are at a dangerous voltage when the input power is on, regardless of whether the motor is running or not.
- The DC and brake resistor terminals (UDC+, UDC-, R+ and R-) are at a dangerous voltage.
- External wiring can supply dangerous voltages to the terminals of relay outputs (RO1, RO2 and RO3).
- The Safe torque off function does not remove the voltage from the main and auxiliary circuits. The function is not effective against deliberate sabotage or misuse.

WARNING! Use a grounding wrist band when you handle the printed circuit boards. Do not touch the boards unnecessarily. The boards contain components sensitive to electrostatic discharge.

Grounding

These instructions are for all personnel who are responsible for the electrical installation, including the grounding of the drive.

WARNING! Obey these instructions. If you ignore them, injury or death, or equipment malfunction can occur, and electromagnetic interference can increase.

- If you are not a qualified electrical professional, do not do grounding work.
- Always ground the drive, the motor and adjoining equipment to the protective earth (PE) bus of the power supply. This is necessary for the personnel safety. Proper grounding also reduces electromagnetic emission and interference.
- In a multiple-drive installation, connect each drive separately to the protective earth (PE) bus of the power supply.
- Make sure that the conductivity of the protective earth (PE) conductors is sufficient. See section *Power cable terminal and lead-through data* on page *21*. Obey the local regulations.
- Connect the power cable shields to the protective earth (PE) terminals of the drive.
- Standard IEC/EN & UL 61800-5-1 (section 4.3.5.5.2.) requires that as the normal touch current of the drive is higher than 3.5 mA AC or 10 mA DC, you must use a fixed protective earth (PE) connection. In addition,
  - install a second protective earth conductor of the same cross-sectional area as the original protective earthing conductor,

  or
  - install a protective earth conductor with a cross-section of at least 7 AWG (10 mm^2) Cu,

  or
  - install a device which automatically disconnects the supply if the protective earth conductor breaks.

Additional instructions for Safety Functions

WARNING! Bypass configurations (ACH580-VxR & ACH580-BxR) do not support Safe Torque Off (STO) functionality in bypass mode.

Additional instructions for permanent magnet motor drives

Safety in installation, start-up and maintenance

These are additional warnings concerning permanent magnet motor drives. The other safety instructions in this chapter are also valid.

WARNING! Obey these instructions. If you ignore them, injury or death and damage to the equipment can occur.

- Do not work on a drive when a rotating permanent magnet motor is connected to it. A rotating permanent magnet motor energizes the drive including its power terminals.

Before installation, start-up and maintenance work on the drive:

- Stop the motor.
- Disconnect the motor from the drive with a safety switch or by other means.
- If you cannot disconnect the motor, make sure that the motor cannot rotate during work. Make sure that no other system, like hydraulic crawling drives, can rotate the motor directly or through any mechanical connection like felt, nip, rope, etc.
- Measure that the installation is de-energized.
  - Use a multimeter with an impedance of at least 1 Mohm.
  - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive DC terminals (UDC+, UDC-) and the grounding (PE) terminal is close to 0 V.

- Install temporary grounding to the drive output terminals (T1/U, T2/V, T3/W). Connect the output terminals together as well as to the PE.

Start-up and operation:

- Make sure the motor is not run over the rated speed with dynamic/positive displacement loads.

General safety in operation

These instructions are for all personnel that operate the drive.

⚠ **WARNING!** Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- Do not control the motor with the line side disconnect at the drive power supply; instead, use the control panel start and stop keys or commands through the I/O terminals of the drive.
- Give a stop command to the drive before you reset a fault. If you have an external source for the start command and the start is on, the drive will start immediately after the fault reset, unless you configure the drive for pulse start. See the *ACH580 HVAC control program firmware manual (3AXD50000027537 [English])*.
- Before you activate automatic fault reset functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault.

Note: When the drive is not in the Hand mode, the Off key on the control panel will not stop the drive.

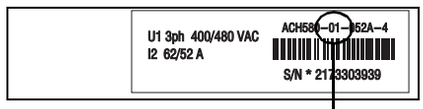
Cybersecurity disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

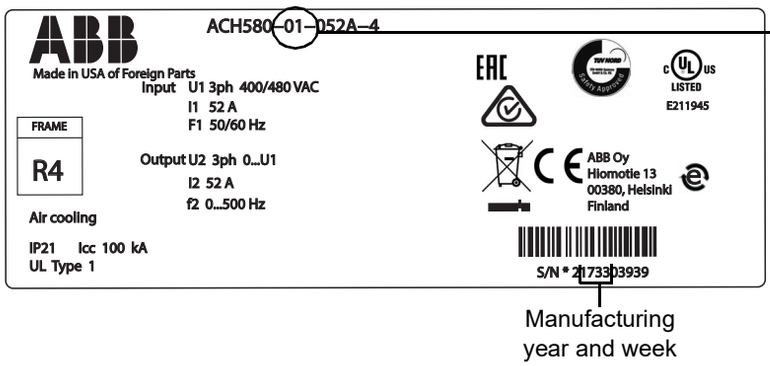
Contents

This manual is the Installation, Operation and Maintenance Manual for the ACH580 Drives. Complete technical details are available in the *ACH580 Hardware manual,* publication number *3AXD50000044839.* Complete programming information is available in the *ACH580 HVAC control program firmware manual,* publication number *3AXD50000027537.*

1. To determine the type of your drive, refer to its construction code on either:
   - Serial number label attached on upper part of the top mounting plate between the mounting holes.



   - Type code label attached to the base frame – on the side of the enclosure.



2. According to the construction code, proceed to your drive's installation, operation, diagnostics and maintenance information:
   - 01 (Wall-Mounted Single Drives) – Below.
   - VCR, VDR, BCR, BDR (E-Clipse Bypass) – page *91*.
   - PCR, PDR (Packaged Drives with Disconnect) – page *137*.

ACH580-01 Installation

Installation

Study these installation instructions carefully before proceeding. **Failure to observe the warnings and instructions may cause a malfunction or personal hazard.**

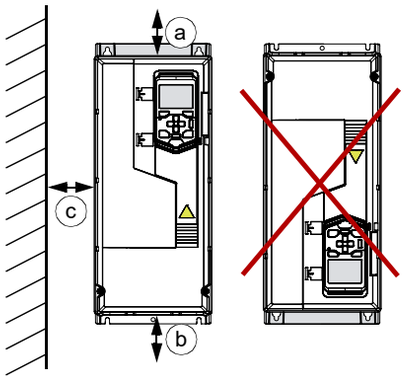
WARNING! Before you begin read *Safety instructions* on page *2*.

1. Check free space requirements

The drive must be installed on the wall. There are two alternative ways to install it.

Note: Do not install upside down.

Vertically alone



Frame size	Vertical installation - Free space					
	Above (a)[1]		Below (b)[2]		Beside (c)[3]	
	mm	in	mm	in	mm	in
R1	200	7.87	150	5.91	150	5.91
R2	200	7.87	150	5.91	150	5.91
R3	200	7.87	200	7.87	150	5.91
R4	53	2.09	200	7.87	150	5.91
R5	100	3.94	200	7.87	150	5.91
R6	155	6.10	300	11.81	150	5.91
R7	155	6.10	300	11.81	150	5.91
R8	155	6.10	300	11.81	150	5.91
R9	200	7.87	300	11.81	150	5.91

3AXD00000586715.xls K

1) Free space above is measured from the frame, not from the hood used in UL (NEMA) Type 12 frames.

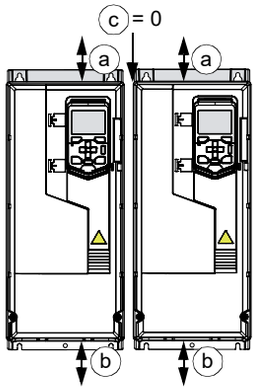
Note: The height of the hood for frames R4 and R9 exceeds the requirement of free space above for these frames.

Frame size	R4	R9
Hood height (in)	2.83	9.06
Hood height (mm)	72	230

2) Free space below is measured from the frame, not from the cable box used in frames R1…R2 and R5…R9.

3) Free space between the drive and other objects, e.g. wall.

Vertically side by side



Frame size	Vertical installation side by side - Free space					
	Above (a)		Below (b)[1)]		Between (c)	
	mm	in.	mm	in.	mm	in.
R1	200	7.87	200	7.87	0	0
R2	200	7.87	200	7.87	0	0
R3	200	7.87	200	7.87	0	0
R4	200	7.87	200	7.87	0	0
R5	200	7.87	200	7.87	0	0
R6	200	7.87	300	11.81	0	0
R7	200	7.87	300	11.81	0	0
R8	200	7.87	300	11.81	0	0
R9	200	7.87	300	11.81	0	0

1) Free space above is measured from the frame, not from the hood used in UL (NEMA) Type 12 frames.

Note: The height of the hood for frames R4 and R9 exceeds the requirement of free space above for these frames.

2) Free space below is always measured from the drive frame, not from the cable box.

2. Prepare for installation

Lifting R1…R4

Lift the drive only by the chassis.

Lifting R5…R8

1. Use a pallet truck to move the transport package/enclosure to the installation site.

WARNING! Frames R5…R9: Lift the drive with a lifting device. Use the lifting eyes of the drive. **The drive is heavy and its center of gravity is high. An overturning drive can cause physical injury.**

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2. Use a hoist to lift the drive. (Do not place drive in final position until mounting site is prepared.)

Unpack the drive

1. Unpack the drive.
2. Check for any damage and notify the shipper immediately if damaged components are found.
3. Check the contents against the order and the shipping label to verify that all parts have been received.

Tools required

To install the ACH580 you need the following:

- Screwdrivers as appropriate for the mounting hardware used, including a T20 Torx driver for drive cover removal
- Wire stripper
- Tape measure and/or provided mounting template
- Drill
- Frame sizes R5…R9: pallet truck and hoist
- Frame sizes R5…R9: The appropriate crimping tool for power cable lugs.
- Mounting hardware: screws or nuts and bolts. The type, length and quantity of hardware depends on the mounting surface and the frame size:

Frame size	Mounting hardware		Qty
	Metric	Standard	
R1...R2	M5	#10	4
R3	M6	1/4 in.	4
R5	M6	1/4 in.	6
R6…R9	M8	5/16 in.	4

WARNING! Before installing the ACH580, ensure the input power supply to the drive is off.

WARNING! Metal shavings or debris in the enclosure can damage electrical equipment and create a hazardous condition. Where parts, such as conduit plates require cutting or drilling, first remove the part. If that is not practical, cover nearby electrical components to protect them from all shavings or debris.

Flange Mounting

Frame size	Kit
R1	3AXD50000105311
R2	3AXD50000105328
R3	3AXD50000105335
R4	3AXD50000031460
R5	3AXD50000031461
R6	3AXD50000018852
R7	3AXD50000018853
R8	3AXD50000018854
R9	3AXD50000018855

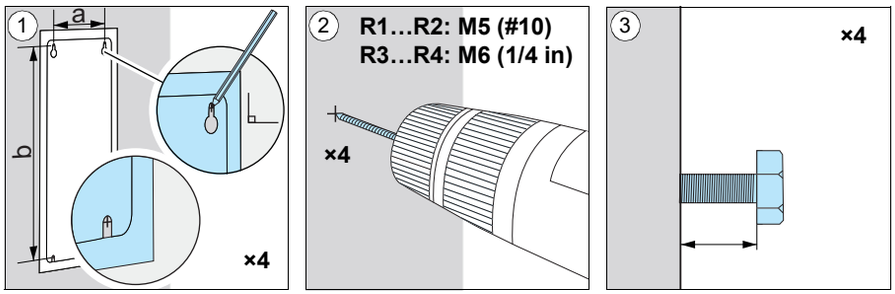
Further information is in *Supplement: Flange mounting kit installation*, 3AXD50000201877.

3. Install the drive

Installing the drive vertically, frames R1…R4

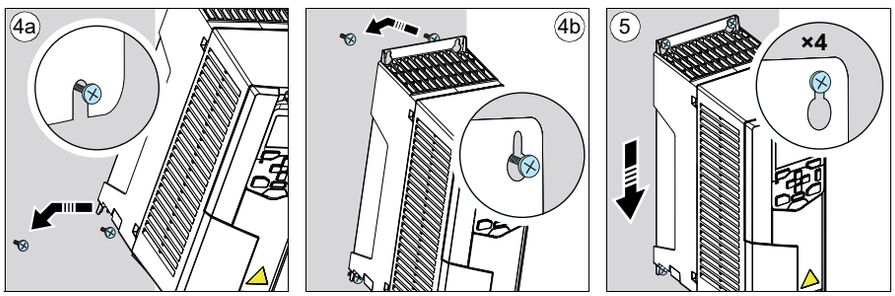
The figures show frame R3 as an example.

1. Mark the hole locations using the mounting template included in the package. Do not leave the mounting template under the drive. The drive dimensions and hole locations are also shown in the drawings in the *ACH580 Hardware manual,* publication number *3AXD50000044839.*
2. Drill the mounting holes.
3. Insert anchors or plugs into the holes and start the bolts into the anchors or plugs. Use long enough bolts to make them carry the weight of the drive.



	R1		R2		R3		R4	
	in.	mm	in.	mm	in.	mm	in.	mm
a	3.86	98	3.86	98	6.30	160	6.30	160
b	12.48	317	16.42	417	18.62	473	24.37	619
Weight IP21 (UL (NEMA) Type 1)	lb	kg	lb	kg	lb	kg	lb	kg
	10.1	4.6	14.6	6.6	26.0	11.8	41.9	19.0
Weight IP55 (UL (NEMA) Type 12)	lb	kg	lb	kg	lb	kg	lb	kg
	10.6	4.8	15.0	6.8	28.7	13.0	44.1	20.0

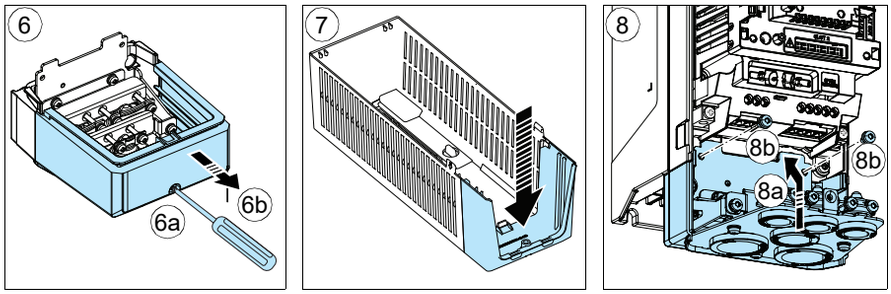
4. Position the drive onto the bolts on the wall.
5. Tighten the bolts in the wall securely.



Install the cable box, frames R1…R2

6. Remove the screw (6a) and lift the cover off (6b) from the separate cable box.
7. Attach the cable box cover to the front cover.

8. Install the cable box to the frame. Position the cable box (8a) and tighten the screws (8b).

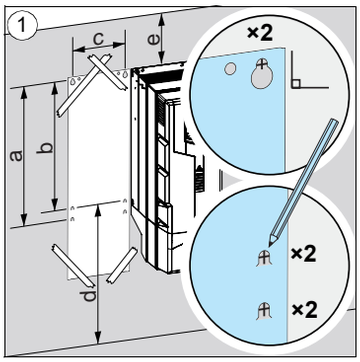


Note: Install the hood to UL (NEMA) Type 12 drives after you have installed the drive electrically and reinstalled covers.

Installing the drive vertically, frame R5

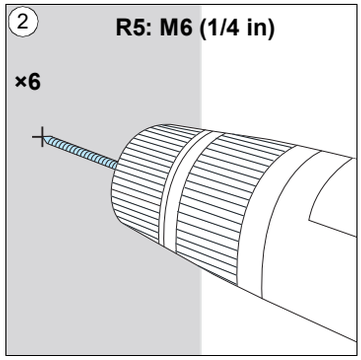
1. Mark the hole locations using the mounting template included in the package. Do not leave the mounting template under the drive. The drive dimensions and hole locations are also shown in the drawings in the *ACH580 Hardware manual,* publication number *3AXD50000044839*.
2. Drill the mounting holes.
3. Insert anchors or plugs into the holes. Start the two upper bolts and the two lowest bolts into the anchors or plugs.

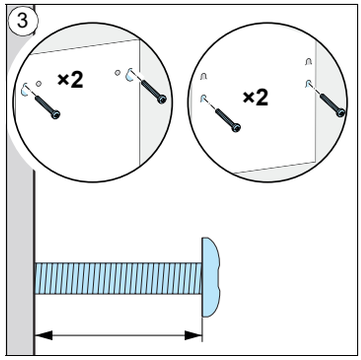
   Use long enough bolts to make them carry the weight of the drive.



	R5 IP21 (UL (NEMA)		R5 IP55 (UL (NEMA)	
	in.	mm	in.	mm
a	24.09	612	24.09	612
b	22.87	581	22.87	581
c	6.30	160	6.30	160
d >	7.87	200	7.87	200
e >	3.94	100	3.94	100

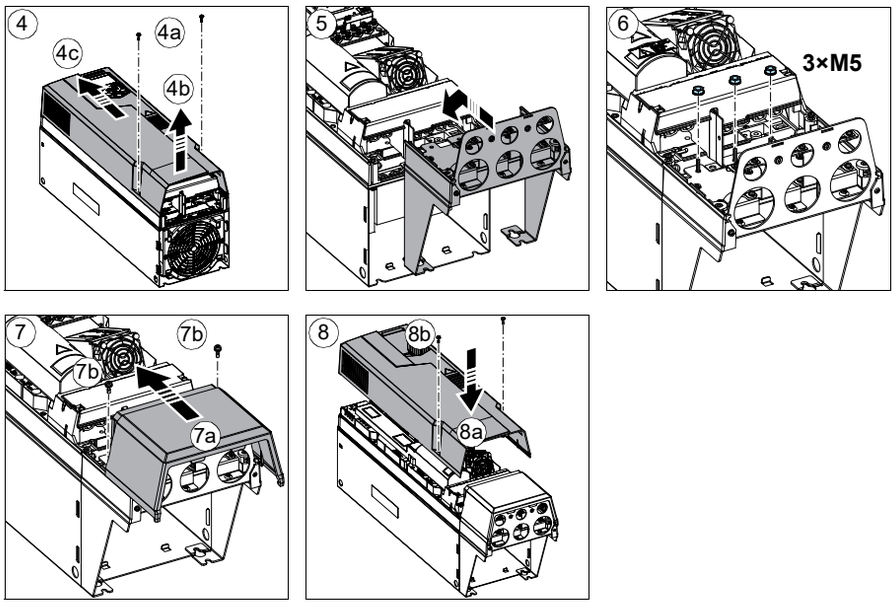
⚠	R5 IP21 (UL (NEMA)		R5 IP55 (UL (NEMA)	
	lb	kg	lb	kg
	62.4	28.3	64.0	29.0





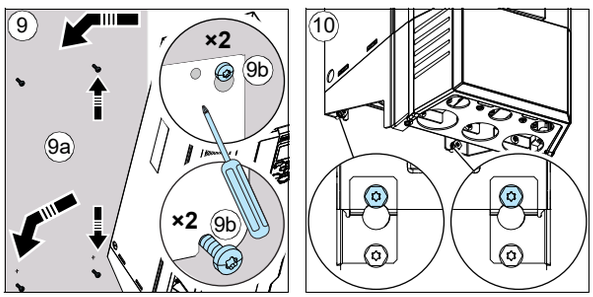
IP21 (UL (NEMA) Type 1)

4. Remove the front cover: Remove the fastening screws (4a) with a T20 Torx screwdriver and lift the cover from the bottom upwards (4b) and then to the top side (4c).
5. Attach the cable box to the drive frame.
6. Tighten the box nuts.
7. Slide the box cover from the bottom (7a) and tighten the retaining screws (7b).
8. Put the tabs at the top of the front cover in their counterparts on the housing and then press at the bottom (8a) and tighten the retaining screws (8b).



IP21 (UL (NEMA) Type 1), IP55 (UL (NEMA) Type 12)

9. Position the drive onto the four bolts on the wall. Lift the drive with another person or with a lifting device as it is heavy. Tighten the bolts in the wall securely.
10. Tighten the two remaining bolts securely.



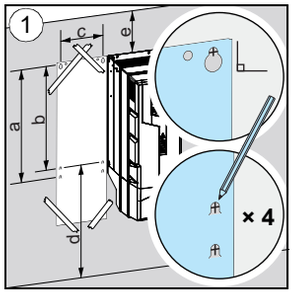
Note: Install the hood on UL (NEMA) Type 12 drives after you have installed the drive electrically and reinstalled covers.

Installing the drive vertically, frames R6…R9

1. Mark the hole locations for the six mounting holes using the mounting template included in the package. Do not leave the mounting template under the drive.

   The drive dimensions and hole locations are also shown in the drawings in the *ACH580 Hardware manual,* publication number *3AXD50000044839.*

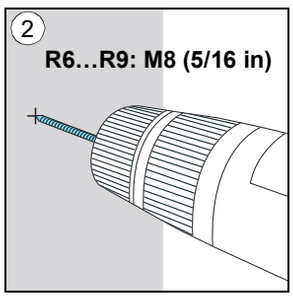
Note: You can use only two bolts instead of four to attach the lower part of the drive.

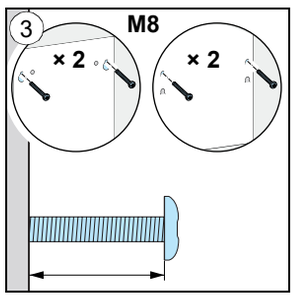


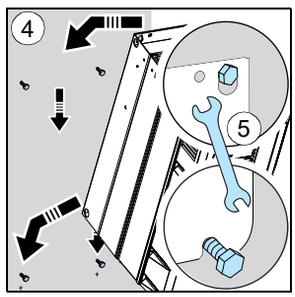
	R6		R7		R8		R9	
	in.	mm	in.	mm	in.	mm.	in.	mm
a	22.5	571	24.5	623	27.6	701	28.3	718
b	20.9	531	23.0	583	25.9	658	25.9	658
c	8.4	213	9.7	245	10.4	263	13.6	345
d	11.8	300	11.8	300	11.8	300	11.8	300
e	6.1	155	6.1	155	6.1	155	7.9	200
IP21, UL (NEMA) Type 1	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**
⚠	93.5	42.4	119.1	54.0	152.2	69.0	213.9	97.0
IP55, UL (NEMA) Type 12	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**
⚠	94.8	43.0	123.5	56.0	169.8	77.0	227.1	103.0

2. Drill the mounting holes.
3. Insert anchors or plugs into the holes and start the bolts into the anchors or plugs.

   Use a sufficient number of bolts that are long enough to make them carry the weight of the drive.
4. Position the drive onto the bolts on the wall. Lift the drive with a lifting device with another person as it is heavy.
5. Tighten the top two bolts in the wall securely.

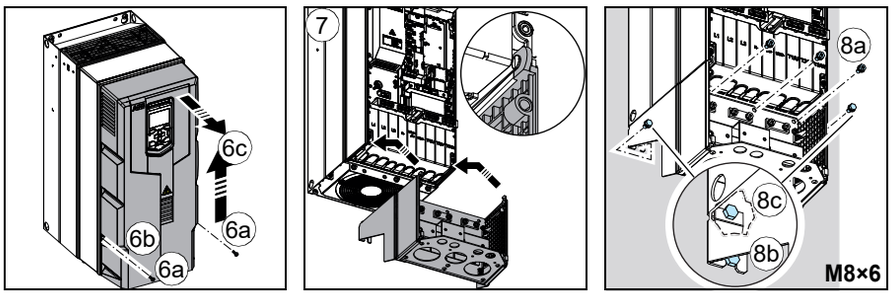






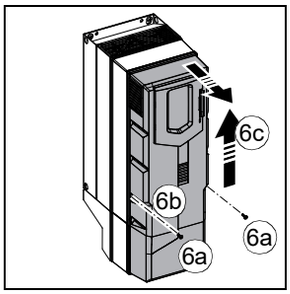
IP21 (UL (NEMA) Type 1)

6. Remove the front cover: Remove the fastening screws (a), with a T20 Torx screwdriver, move the cover to the top side (b) and then up (c).
7. Attach the cable box to the drive frame.
8. Tighten the box bolts: three at the top (8a) and two at the bottom (8b). Also tighten the bottom bolts started in step 3 (8c).



IP55 (UL (NEMA) Type 12)

9. Remove the front cover: Remove the fastening screws (a), with a T20 Torx screwdriver, move the cover to the top side (b) and then up (c).



Note: Install the hood on UL (NEMA) Type 12 drives after you have installed the drive electrically and reinstalled covers.

Installing the drive vertically side by side

Install the drive following the steps in the appropriate section *Installing the drive vertically, frames R1…R4* (page *11*), or *Installing the drive vertically, frame R5* (page *12*) or *Installing the drive vertically, frames R6…R9* (page *14*).

4. Install wiring

WARNING! Ensure the motor is compatible for use with the ACH580. The ACH580 must be installed by a competent person. If in doubt, contact your local ABB sales or service office.

WARNING! If the drive will be connected on an IT (ungrounded) system, make sure neither the EMC filter nor the ground-to-phase varistor are connected. If the drive will be connected on a corner-grounded TN system, make sure you have not connected the EMC filter. See *Drive compatibility for various electrical power systems* on page *16*.

Checking the insulation of the assembly

WARNING! Do not make any voltage tolerance or insulation resistance tests on any part of the drive as testing can damage the drive. The drive has been tested at the factory.

1. Check the insulation of the input cable according to local regulations before connection to the drive. Minimum cable temperature rating of 167 °F (75 °C) must be used.
2. With the motor cable connected to the motor, but NOT to the drive output terminals T1/U, T2/V and T3/W, measure the insulation resistance between the phase conductors and between each phase conductor and the Protective Earth (PE) conductor, using a measuring voltage of 1000 V DC. The insulation resistance must exceed 100 Mohm at 25 °C.

Ground connections

For personnel safety, proper operation and to reduce electromagnetic emission/pick-up, the drive and the motor must be grounded at the installation site.

- Conductors must be adequately sized as required by safety regulations.
- Power cable shields must be connected to the drive PE terminal in order to meet safety regulations.
- Power cable shields are suitable for use as equipment grounding conductors only when the shield conductors are adequately sized as required by safety regulations.
- In multiple drive installations, do not connect drive terminals in series.

Drive compatibility for various electrical power systems

When the drive is installed on the electrical power system, configure the EMC and VAR screws to provide the proper electromagnetic compatibility (EMC) and minimize disturbances on that network. Identify the electrical power system prior to installation. See *Identifying different types of electrical power systems:*.

WARNING! Do not install the drive with the EMC filter(s) or VAR circuit enabled to an electrical power system that the filter is not rated for or unknown. This can cause danger and/or damage the drive.

NOTE: When the internal EMC filter(s) is disconnected, the EMC protection of the drive is considerably reduced.

Identifying different types of electrical power systems:

The power network can be determined with a RMS multimeter. Once identified, the EMC and VAR *screws* may be properly configured for that power system.

Table: Power system identification

U_{L-L}	U_{L1-G}	U_{L2-G}	U_{L3-G}	Electrical power system type	Figure
X	0.58x	0.58x	0.58x	**TN System** (Symmetrically grounded wye)	A
X	1.0x	1.0x	0	**Corner-grounded Delta System** (non-symmetrical)	B
X	0.866x	0.5x	0.5x	**Midpoint-grounded Delta System** (non-symmetrical)	C
X	Varying level versus time	Varying level versus time	Varying level versus time	**IT System** (ungrounded or high-resistance-grounded [>30 ohms]) non-symmetrical	D
X	Varying level versus time	Varying level versus time	Varying level versus time	**TT System** (the protective earth connection for the customer is provided by a local earth electrode, and there is another independently installed at the generator.	E

1. Input voltage line to line (UL-L)
2. Input voltage line 1 to ground (UL1-G)
3. Input voltage line 2 to ground (UL2-G)
4. Input voltage line 3 to ground (UL3-G)

T - Terra (ground)

N - Neutral

C - Combined

S - Separate

I - Isolated

TN-S = Tera Neutral - Separate

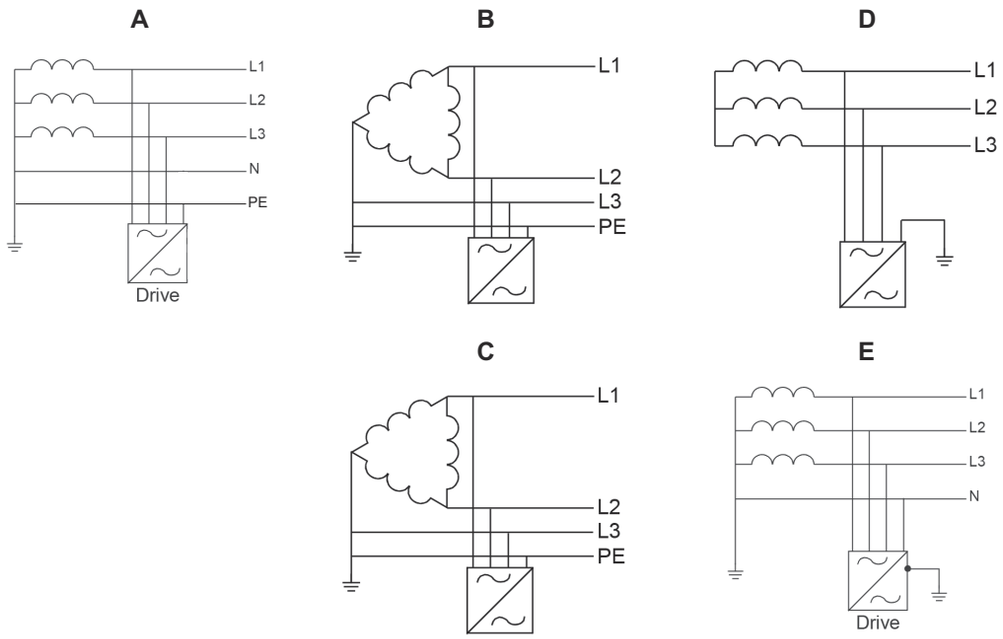
Earth and Neutral have separate conductors (3 wire single phase L, N, E).

IT = Isolated Neutral

Earth is either ungrounded or high-resistive (>30 ohms) non-symmetrical earth path.

TT = Tera Tera

Earth at source and Earth a Destination (no earth conductor between source and consumer, the soil is used as the earth return path.



Default EMC and VAR screws material

The following tables show the default material based on the drive frame and manufactured location. (North America or except North America). See section for data nameplate.

ACH580-01

Frame	Default screw material (North America)		
	EMC (DC)	EMC (AC)	VAR
R1...R3	Nylon	N/A	Metal
R4...R5	Nylon	Nylon	Metal
R6...R9*	Nylon	Nylon	Metal

Frame	Default screw material (except North America)		
	EMC (DC)	EMC (AC)	VAR
R1...R3	Nylon	N/A	Metal
R4...R5	Nylon	Metal	Metal
R6...R9*	Nylon	Metal	Metal

Note: *The R7 has no EMC (DC) screw for 600V.

EMC/VAR screw type selection for various electrical power networks

The following describes the purpose of the EMC filter and the varistor (VAR) and how to configure based on the electrical power systems the drive will be connected.

WARNING! Disconnect EMC filter and VAR circuits when power network is unknown.

EMC Filter

The EMC filter(s) in the drive reduces the electromagnetic noise produced by the drive. Electromagnetic noise could interfere with or affect other electrical products. The EMC filter(s) needs to be configured prior to installing the drive on the electrical power system to provide the proper EMC protection.

Varistor

The varistor (VAR) is a Metal Oxide Varistor (MOV), which is used to protect the sensitive electronics in the drive caused by transient overvoltage conditions. The ground-to-phase varistor needs to be configured prior to installing the drive on the electrical power system to provide proper protection.

Replacement parts kits and torque values shown below.

Screw kit, Hardware R1-R4, R6-R9 part number: 3AXD50000561261

Qty	Description	Location	Bit size	Torque
1	Screw, M4x12, COMBI, Torx, T20 Steel	EMC/VAR	T20	1.5 Nm
1	Screw, M4x12, PZ1, Nylon	EMC/VAR	PZ1	Hand tighten

Screw kit, Hardware R5 part number: 3AXD50000561278

Qty	Description	Location	Bit size	Torque
1	Screw, M5x16, COMBI, Torx, T20 Steel	EMC (AC)/VAR	T20	3.0 Nm
1	Screw, M6x16, PZ1, Nylon	EMC (AC)/VAR	PZ1	Hand Tighten
1	Screw, M5x35, COMBI, Torx, T20 Steel	EMC (DC)	T20	3.0 Nm
1	Screw, M6x35, PZ1, Nylon	EMC (DC)	PZ1	Hand Tighten

ACH580-01 North America

		TN system or Corner-grounded Delta system	TN system	Corner-grounded delta (B) and Mid-point-grounded delta (C)	IT system	TT system
Frame	Connection	Default Figures A and B	Figure A	Figures B and C	Figure D	Figure E
R1...R3	EMC (DC)	Nylon	**Metal** [2]	Nylon [1]	Nylon [1]	Nylon [1]
	VAR	Metal	Metal	Metal	Nylon [1]	Nylon [1]
R4 [3]	EMC (DC)	Nylon	**Metal** [2]	Nylon [1]	Nylon [1]	Nylon [1]
	EMC (AC)	Nylon	**Metal** [2]	Nylon [1]	Nylon [1]	Nylon [1]
	VAR	Metal	Metal	Metal	Nylon [1]	Nylon [1]
R5 [3]	EMC (DC)	Nylon	**Metal** [2]	Nylon [1]	Nylon [1]	Nylon [1]
	EMC (AC)	Nylon	**Metal** [2]	**Metal** [2]	Nylon [1]	Nylon [1]
	VAR	Metal	Metal	Metal	Nylon [1]	Nylon [1]
R6...R9	EMC (DC)	Nylon	**Metal** [2]	Nylon [1]	Nylon [1]	Nylon [1]
	EMC (AC)	Nylon	**Metal** [2]	**Metal** [2]	Nylon [1]	Nylon [1]
	VAR	Metal	Metal	Metal	Nylon [1]	Nylon [1]

Bold represents change from default material.

1) Metal screw must be not used.

2) Optional, for greater noise filtering.

3) Frames R4 and R5 are evaluated for use on corner-grounded delta networks by UL standards. R4 and R5 frames may not be used on IEC installations with corner grounded networks.

ACH580-01 except North America

		TN system	IT system	TT system
Frame	Connection	Default Figures A	Figure D	Figure E
R1...R3	EMC (DC)	Metal	Nylon 1)	Nylon
	VAR	Metal	Nylon	Nylon
R4 3)	EMC (DC)	Metal	Nylon 1)	Nylon
	EMC (AC)	Metal	Nylon	Nylon
	VAR	Metal	Nylon	Nylon
R5 3)	EMC (DC)	Metal	Nylon 1)	Nylon
	EMC (AC)	Metal	Nylon	Nylon
	VAR	Metal	Nylon	Nylon
R6...R9	EMC (DC)	Metal	Nylon 1)	Nylon
	EMC (AC)	Metal	Nylon	Nylon
	VAR	Metal	Nylon	Nylon

Bold represents change greater from default material.

1) Optional, for greater noise filtering.

3) Frames R4 and R5 are evaluated for use on corner-grounded delta networks by UL standards. R4 and R5 frames may not be used on IEC installations with corner grounded networks.

Power cable terminal and lead-through data

Input, motor, resistor and DC cable lead-throughs, maximum wire sizes (per phase) and terminal screw sizes.

Frame size	Cable lead-throughs			L1, L2, L3, T1/U, T2/V, T3/W terminals[1]				Grounding terminals[1]	
	Per cable type	Max cable dia.		Min wire size (solid/stranded)		Max wire size (solid/stranded)		Max wire size	
	pcs	in.	mm	AWG	mm^2	AWG	mm^2	AWG	mm^2
R1	1	1.18	30	14	2.1	10	6/4	6/6	16/16
R2	1	1.18	30	14	2.1	6	16/16	6/6	16/16
R3	1	1.18	30	14	2.1	2	35/25	2/2	35/35
R4	1	1.77	45	14	2.1	1	50	2/2	35/35
R5	1	1.77	45	14	2.1	2/10	70	[2]	[2]
R6	1	1.77	45	4	25	300 MCM	150	[2]	[2]
R7	1	2.13	54	3/0	95	500 MCM	240	[2]	[2]
R8	2	1.77	45	2×1/0	2×50	2×300 MCM	2×150	[2]	[2]
R9	2	2.13	54	2×3/0	2×95	2×500 MCM	2×240	[2]	[2]

1) Screwdrivers: R1 - Slot 4 mm and PH1; R2 - 4.5 mm and PH2; R3, R4 - PH2

2) Either cable lug (R5) or clamp (R6…R9) is used for grounding.

Frame size	Cable lead-throughs			R+, R-, UDC+ and UDC- terminals[1]						
	Per cable type	Max cable dia.		Min wire size (solid/stranded)		Max wire size (solid/stranded)		Hardware	Torque	
	pcs	in.	mm	AWG	mm^2	AWG	mm^2	M…	lb-ft	N·m
R1	1	0.906	23	14	2.1	10	6/4	[1]	0.4	1.2…1.5
R2	1	0.906	23	14	2.1	6	16/16	[1]	1.1	1.2…1.5
R3	1	0.906	23	14	2.1	2	35/25	[1]	3.3	2.5…4.5
R4	1	1.54	39	14	2.1	1	50	[1]	3.0	4.0
R5	1	1.54	39	14	2.1	2/10	70	M5	4.1	5.6
R6	1	1.77	45	4	25	300 MCM	150	M8	22.1	30
R7	1	2.13	54	3/0	95	500 MCM	240	M10	29.5	30
R8	2	1.77	45	2×1/0	2×50	2×300 MCM	2×150	M10	29.5	40
R9	2	2.13	54	2×3/0	2×95	2×500 MCM	2×240	M12	51.6	70

1) Screwdrivers: R1 - Slot 4 mm and PH1; R2 - 4.5 mm and PH2; R3, R4 - PH2

Note: Minimum wire size does not necessarily have enough current capability for full load. Make sure the installation complies with local laws and regulations.

Maximum recommended motor cable length

Operational functionality and motor cable length

The drive is designed to operate with optimum performance with the following maximum motor cable lengths.

Note: Conducted and radiated emissions of these motor cable lengths do not comply with EMC requirements.

Frame size	Maximum motor cable length, 4 kHz[1, 2]			
	Scalar control		Vector control	
	m	ft	m	ft
Standard drive, without external options				
R1	100	330	100	330
R2	200	660	200	660
R3	300	990	300	990
R4	300	990	300	990
R5	300	990	300	990
R6	300	990	300	990
R7	300	990	300	990
R8	300	990	300	990
R9	300	990	300	990

1) In multimotor systems, the calculated sum of all motor cable lengths must not exceed the maximum motor cable length given in the table.

2) Longer motor cables cause a motor voltage decrease which limits the available motor power. The decrease depends on the motor cable length and characteristics. Contact ABB for more information.

Control cable terminal and lead-through data

Imperial control cable lead-throughs, wire sizes and tightening torques (*T*) are given below.

Frame size	Cable lead-throughs		Control cable entries and terminal sizes			
	Holes	Max cable size	+24V, DCOM, DGND, EXT. 24V terminals		DI, AI/O, AGND, RO, STO terminals	
			Wire size	*T*	Wire size	*T*
	pcs	in.	AWG	lb·ft	AWG	lb·ft
R1	3	0.67	24…14	0.4	26…14	0.4
R2	3	0.67	24…14	0.4	26…14	0.4
R3	3	0.67	24…14	0.4	26…14	0.4
R4	4	0.67	24…14	0.4	26…14	0.4
R5	3	0.67	24…14	0.4	26…14	0.4
R6	4	0.67	26…14	0.4	26…14	0.4
R7	4	0.67	26…14	0.4	26…14	0.4
R8	4	0.67	26…14	0.4	26…14	0.4
R9	4	0.67	26…14	0.4	26…14	0.4

Metric control cable lead-throughs, wire sizes and tightening torques (*T*) are given below.

Frame size	Cable lead-throughs		Control cable entries and terminal sizes			
	Holes	Max cable size	+24V, DCOM, DGND, EXT. 24V terminals		DI, AI/O, AGND, RO, STO terminals	
			Wire size	*T*	Wire size	*T*
	pcs	mm	mm^2	N·m	mm^2	N·m
R1	3	17	0.2…2.5	0.5…0.6	0.14…1.5	0.5…0.6
R2	3	17	0.2…2.5	0.5…0.6	0.14…1.5	0.5…0.6
R3	3	17	0.2…2.5	0.5…0.6	0.14…1.5	0.5…0.6
R4	4	17	0.2…2.5	0.5…0.6	0.14…1.5	0.5…0.6
R5	3	17	0.2…2.5	0.5…0.6	0.14…1.5	0.5…0.6
R6	4	17	0.14…2.5	0.5…0.6	0.14…2.5	0.5…0.6
R7	4	17	0.14…2.5	0.5…0.6	0.14…2.5	0.5…0.6
R8	4	17	0.14…2.5	0.5…0.6	0.14…2.5	0.5…0.6
R9	4	17	0.14…2.5	0.5…0.6	0.14…2.5	0.5…0.6

UL (NEC) ratings at U_N = 208 V

Type	Output ratings	Heat dissipation	Air flow	Frame size
	A	W	ft^3/min	
ACH580-01-04A6-2	4.6	45	25	R1
ACH580-01-06A6-2	6.6	55	25	R1
ACH580-01-07A5-2	7.5	66	25	R1
ACH580-01-011A-2	10.6	84	25	R1
ACH580-01-017A-2	16.7	133	25	R1
ACH580-01-024A-2	24.2	174	59	R2
ACH580-01-031A-2	30.8	228	59	R2
ACH580-01-046A-2	46.2	322	105	R3
ACH580-01-059A-2	59.4	430	105	R3
ACH580-01-075A-2	74.8	525	170	R4
ACH580-01-088A-2	88	619	82	R5
ACH580-01-114A-2	114	835	82	R5
ACH580-01-143A-2	143	1035	256	R6
ACH580-01-169A-2	169	1251	265	R7
ACH580-01-211A-2	211	1521	265	R7
ACH580-01-273A-2	273	2061	324	R8

UL (NEC) ratings at U_N = 460 V

Type	Output ratings	Heat dissipation	Air flow	Frame size
	A	W	ft^3/min	
ACH580-01-02A1-4	2.1	45	25	R1
ACH580-01-03A0-4	3	55	25	R1
ACH580-01-03A5-4	3.5	66	25	R1
ACH580-01-04A8-4	4.8	84	25	R1
ACH580-01-07A6-4	7.6	133	25	R1
ACH580-01-012A-4	12	174	25	R1
ACH580-01-014A-4	14	228	59	R2
ACH580-01-023A-4	23	322	59	R2
ACH580-01-027A-4	27	430	105	R3
ACH580-01-034A-4	34	525	105	R3
ACH580-01-044A-4	44	619	105	R3
ACH580-01-052A-4	52	835	79	R4
ACH580-01-065A-4	65	1024	79	R4
ACH580-01-077A-4	77	1024	79	R4
ACH580-01-096A-4	96	1510	82	R5
ACH580-01-124A-4	124	1476	256	R6
ACH580-01-156A-4	156	1976	265	R7

Type	Output ratings	Heat dissipation	Air flow	Frame size
	A	W	ft^3/min	
ACH580-01-180A-4	180	2346	265	R7
ACH580-01-240A-4	240	3336	324	R8
ACH580-01-302A-4	302	4836	677	R9
ACH580-01-361A-4	361	6036	677	R9
ACH580-01-414A-4	414	6036	677	R9

UL (NEC) ratings at U_N = 575 V

Type	Output ratings	Heat dissipation	Air flow	Frame size
	A	W	ft^3/min	
ACH580-01-02A7-6	2.7	66	59	R2
ACH580-01-03A9-6	3.9	84	59	R2
ACH580-01-06A1-6	6.1	133	59	R2
ACH580-01-09A0-6	9	174	59	R2
ACH580-01-011A-6	11	228	59	R2
ACH580-01-017A-6	17	322	59	R2
ACH580-01-022A-6	22	430	105	R3
ACH580-01-027A-6	27	525	105	R3
ACH580-01-032A-6	32	619	105	R3
ACH580-01-041A-6	41	835	82	R5
ACH580-01-052A-6	52	1024	82	R5
ACH580-01-062A-6	62	1240	82	R5
ACH580-01-077A-6	77	1510	82	R5
ACH580-01-099A-6	99	2061	265	R7
ACH580-01-125A-6	125	2466	265	R7
ACH580-01-144A-6	144	3006	324	R8
ACH580-01-192A-6	156	4086	677	R9
ACH580-01-242A-6	242	4896	677	R9
ACH580-01-271A-6	271	4896	677	R9

Definitions

U_N Output voltage of the drive.

I Continuous rms output current, allowing 110% overload for 1 minute every 10 minutes.

P Typical motor power

Fuses

Note: The UL listed fuses in the table are the required branch circuit protection. Fuses are to be provided as part of the installation.

- Fuses are not included in the purchased drive and must be provided by others.
- Fuses with higher current rating than specified must not be used.
- Fuses with lower current rating than specified may be used if they are of the same class and voltage rating. It is the user's responsibility to verify that lower current rated fuses are compliant with local regulations and appropriate for the application.
- Drive fuses must be used to maintain the drive UL listing. Additional protection can be used. Refer to local codes and regulations.

208...240 volt, fuse requirements

ACH580-01-	Input current A	UL			
		Maximum current	Voltage rating	Bussmann type 1	UL class
3-phase UN = 208 V					
04A6-2	4.6	15	600	KTK-R-15 or JJS-15	CC or T
06A6-2	6.6	15	600	KTK-R-15 or JJS-15	CC or T
07A5-2	7.5	15	600	KTK-R-15 or JJS-15	CC or T
10A6-2	10.6	15	600	KTK-R-15 or JJS-15	CC or T
017A-2	16.7	30	600	KTK-R-30 or JJS-30	CC or T
024A-2	24.2	40	600	JJS-40	T
031A-2	30.8	40	600	JJS-40	T
046A-2	46.2	80	600	JJS-80	T
059A-2	59.4	80	600	JJS-80	T
075A-2	74.8	100	600	JJS-100	T
088A-2	88	150	600	JJS-150	T
114A-2	114	150	600	JJS-150	T
144A-2	143	200	600	JJS-200	T
169A-2	169	250	600	JJS-250	T
211A-2	211	300	600	JJS-300	T
273A-2	273	400	600	JJS-400	T

1) ABB does not require Bussmann brand fuses. Fuses which meet the appropriate UL class type, current rating, and are rated at 600V, 200 kA may be used.

380…480 volt, fuse requirements

ACH580-01-	Input current A	UL			
		Maximum current	Voltage rating	Bussmann type 1	UL class
3-phase UN = 460 V					
02A1-4	2.1	15	600	JJS-15	T
03A0-4	3.0	15	600	JJS-15	T
03A5-4	3.5	15	600	JJS-15	T
04A8-4	4.8	15	600	JJS-15	T
07A6-4	7.6	15	600	JJS-15	T
012A-4	12.0	15	600	JJS-15	T
014A-4	14.0	30	600	JJS-30	T
023A-4	23.0	30	600	JJS-30	T
027A-4	27.0	40	600	JJS-40	T
034A-4	34.0	60	600	JJS-60	T
044A-4	44.0	60	600	JJS-60	T
052A-4	52.0	80	600	JJS-80	T
065A-4	62.0	100	600	JJS-100	T
077A-4	77.0	100	600	JJS-100	T
096A-4	100	150	600	JJS-150	T
124A-4	124	200	600	JJS-200	T
156A-4	156	225	600	JJS-225	T
180A-4	180	300	600	JJS-300	T
240A-4	240	350	600	JJS-350	T
302A-4	302	500	600	JJS-500	T
361A-4	361	500	600	JJS-500	T
414A-4	414	600	600	JJS-500	T

1) ABB does not require Bussmann brand fuses. Fuses which meet the appropriate UL class type, current rating, and are rated at 600V, 200 kA may be used.

500…600 volt, fuse requirements

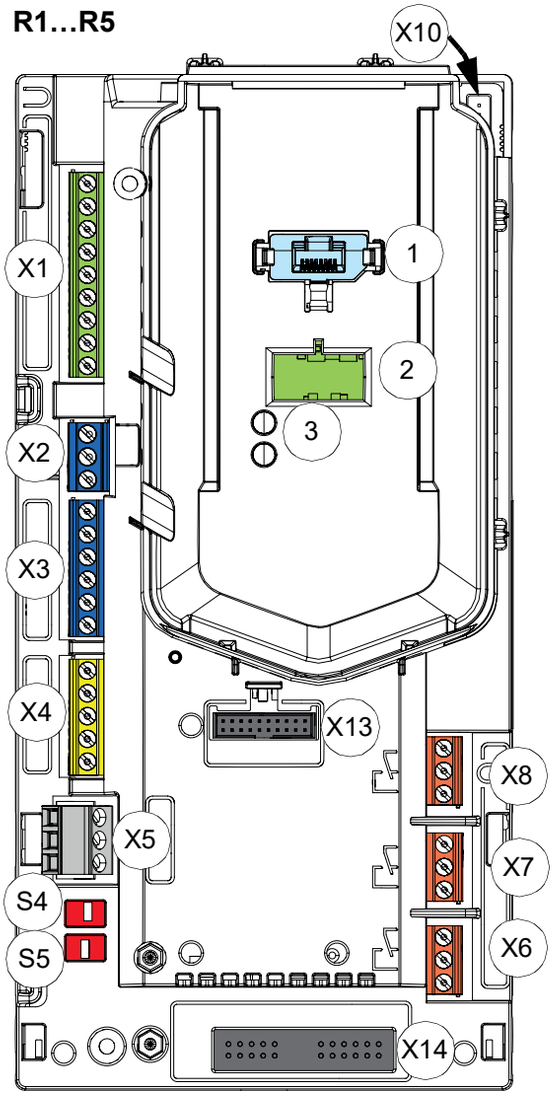
ACH580-01-	Input current A	UL			
		Maximum current	Voltage rating	Bussmann type 1	UL class
3-phase UN = 460 V					
02A7-6	2.7	15	600	KTK-R-15 or JJS-15	Class CC or T
03A9-6	3.9	15	600	KTK-R-15 or JJS-15	Class CC or T
06A1-6	6.1	15	600	KTK-R-15 or JJS-15	Class CC or T
09A0-6	9	15	600	KTK-R-15 or JJS-15	Class CC or T
011A-6	11	15	600	KTK-R-15 or JJS-15	Class CC or T
017A-6	17	30	600	KTK-R-30 or JJS-30	Class CC or T
022A-6	22	40	600	JJS-40	T
027A-6	27	40	600	JJS-40	T
032A-6	32	40	600	JJS-40	T
041A-6	41	100	600	JJS-100	T
052A-6	52	100	600	JJS-100	T
062A-6	62	100	600	JJS-100	T
077A-6	77	100	600	JJS-100	T
099A-6	99	150	600	JJS-150	T
125A-6	125	200	600	JJS-200	T
144A-6	144	250	600	JJS-250	T
180A-6	180	300	600	JJS-300	T
242A-6	242	400	600	JJS-400	T
271A-6	271	400	600	JJS-400	T

1) ABB does not require Bussmann brand fuses. Fuses which meet the appropriate UL class type, current rating, and are rated at 600V, 200 kA may be used.

External control connection terminals, frames R1…R5

The layout of the external control connection terminals of the R1 frame is shown below. Layout of the external control connection terminals is identical in frames R1…R5 but the location of the control board with the terminals is different in frames R3…R5.

R1…R5

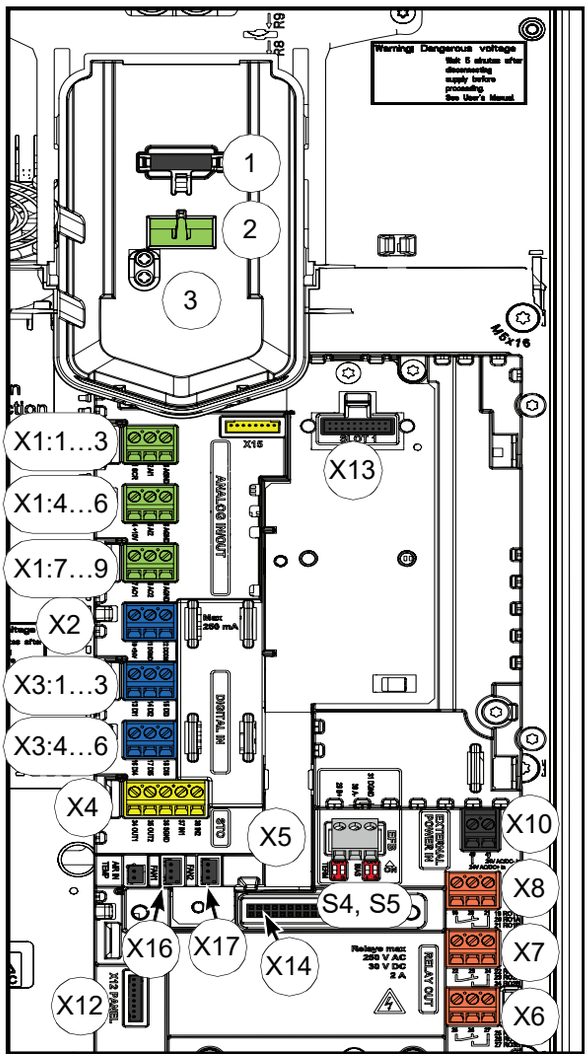


	Description
X1	Analog inputs and outputs
X2	Aux. voltage output
X3	Programmable digital inputs
X4	Safe torque off connection
X5	Embedded fieldbus
X6	Relay output 3
X7	Relay output 2
X8	Relay output 1
X10	Auxiliary fan connection (IP55)
X13	Option slot 1 (fieldbus adapter modules)
X14	Option slot 2 (I/O extension modules)
S4, S5	Termination switch (S4), bias resistor switch (S5), see section *Switches* on page *43*
1	Panel port (control panel connection)
2	Cold configuration connection. This connector is used with the CCA-01 configuration adapter.
3	Power OK and Fault LEDs

External control connection terminals, frames R6…R9

The layout of the external control connection terminals of frames R6…R9 is shown below.

R6…R9



	Description
X1	Analog inputs and outputs
X2	Aux. voltage output
X3	Digital inputs
X4	Safe torque off connection
X5	Connection to embedded EIA-485 fieldbus adapter module
X6	Relay output 3
X7	Relay output 2
X8	Relay output 1
X10	External +24 V AC/DC input connection
X12	Panel connection
X13	Option slot 1 (fieldbus adapter modules)
X14	Option slot 2 (I/O extension modules)
X16	Auxiliary fan 1 connection
X17	Auxiliary fan 2 connection
S4, S5	Termination switch (S4), bias resistor switch (S5), see section *Switches* on page *43*
1	Panel port (control panel connection)
2	Cold configuration connection. This connector is used with the CCA-01 configuration adapter.
3	Power OK and Fault LEDs

WARNING! If installing modules, the +24 V AC cable to the control board ground when the control board is powered using an external 24 V AC supply.

Wiring R1…R2

Note: These are instructions for conduit wiring. For cable wiring, see the *ACH580 Hardware manual,* publication number *3AXD50000044839.*

Note: In US deliveries, options are already installed at the factory. If installing on site, option slot 1 modules (fieldbus adapter) may be installed by mounting the module on the control board and tightening the mounting screw, which is also the grounding screw. Option slot 2 modules (I/O extension) should not be installed until after the power cables. Refer to Warning and step 8 below.

WARNING! If installing modules, obey the instructions in *Safety instructions* on page *2*. If you ignore them, injury or death, or damage to the equipment can occur.

Option slot 2 in frames R1…R5 is at U_{DC} potential. You must disconnect power supplies before installing or removing an I/O extension module.

---

1. Install thin-wall conduit clamps for IP21/UL (NEMA) Type 1 or liquid-tight conduit connectors for IP55/UL (NEMA) Type 12 (not supplied). Type 12 has a Pressfit gasket.
2. Connect conduit runs for input power, motor and control cables to the conduit box. Ensure grommets (pointing down) are inserted into all unused holes.
3. Route the input power and motor wiring through separate conduits.
4. Strip wires.
5. Connect the motor and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
6. Connect the input power and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
7. *If brake resistor is used* — Connect the resistor and ground wires. Tighten the screws to torques shown in the Power wiring torque table.
8. Install option slot 2 modules (I/O extension), if necessary, at this point.
   A *Frame R1 only:* Install the option mounting.
   B Put the module carefully into its position on the control board and tighten the mounting screw.
   C Tighten the grounding screw, which is necessary for proper operation and for fulfilling EMC requirements.

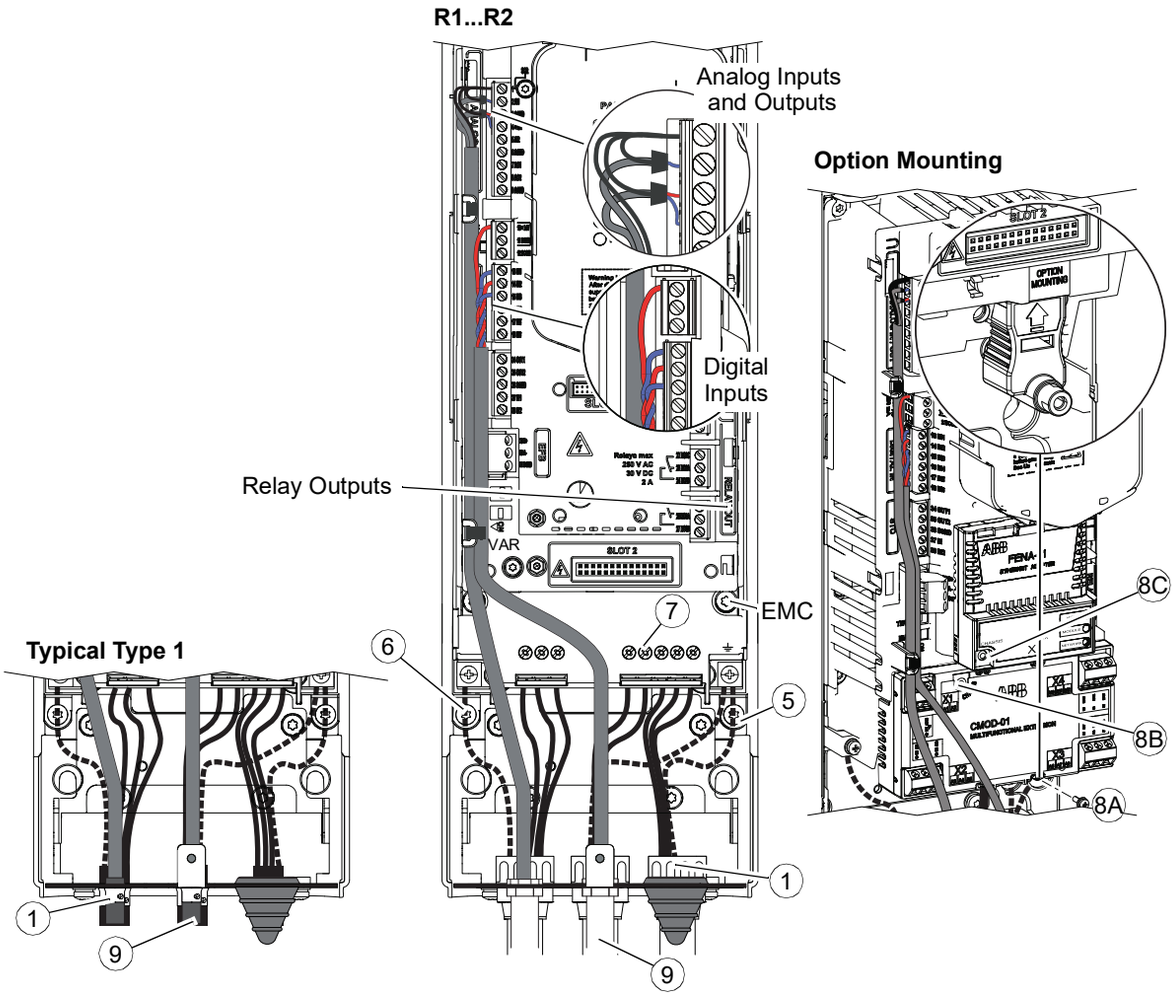
Note: Frame R1 — The module in option slot 2 covers the power terminals. Do not install a module in option slot 2 before you have installed the power cables.

---

9. Route the control cables through the conduit (not the same conduit as either input power or motor wiring).
10. Strip the control cable sheathing and twist the copper screen into a pig-tail.
11. Refer to pages *41*, *42* and *43*. Connect the ground screen pig-tail for digital and analog I/O cables. (Ground only at drive end.)

12. Connect the ground screen pig-tail for Embedded fieldbus, EFB (EIA-485) cables at X5. (Ground only at drive end.)
13. Strip and connect the individual control wires to the drive terminals. Tighten the screws to 0.4 lb-ft (0.5…0.6 Nm).

WARNING! To avoid danger or damage to the drive on IT systems and corner grounded TN systems, see section *Drive compatibility for various electrical power systems* on page *16*.



Power wiring torque table

Frame size	R1		R2	
	lb-ft	Nm	lb-ft	Nm
T1/U, T2/V, T3/W	0.7	1.0	1.1	1.5
L1, L2, L3	0.7	1.0	1.1	1.5
R+, R-	0.7	1.0	1.1	1.5
PE Ground	1.1	1.5	1.1	1.5

Wiring R3

Note: These are instructions for conduit wiring. For cable wiring, see the *ACH580 Hardware manual,* publication number *3AXD50000044839.*

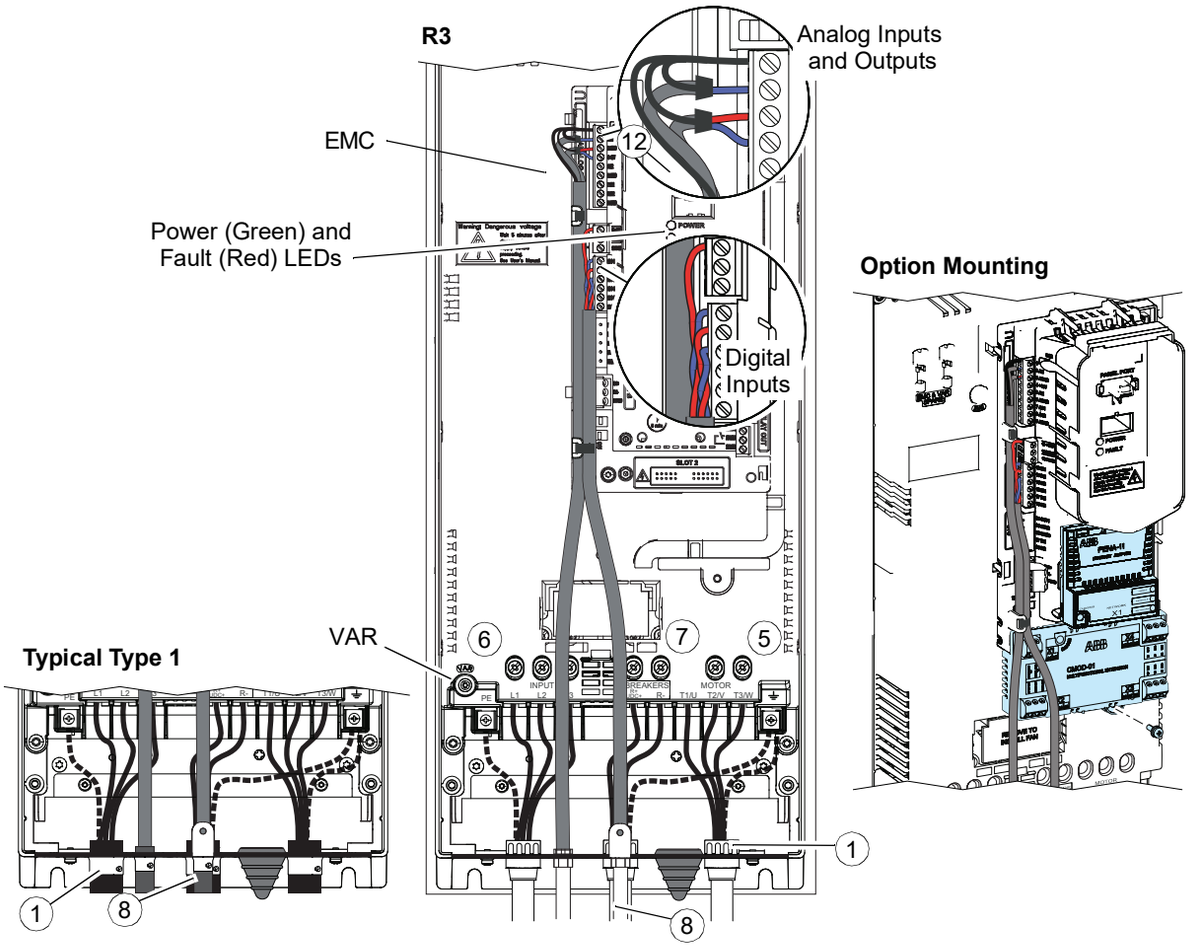
Note: In US deliveries, options are already installed at the factory. If installing on site, option slot 1 modules (fieldbus adapter) may be installed by mounting the module on the control board and tightening the mounting screw, which is also the grounding screw. Option slot 2 modules (I/O extension) may be installed by mounting the module on the control board and tightening both the mounting screw and the grounding screw. Refer to Warning.

WARNING! If installing modules, obey the instructions in *Safety instructions* on page *2*. If you ignore them, injury or death, or damage to the equipment can occur.

Option slot 2 in frames R1…R5 is at U_{DC} potential. You must disconnect power supplies before installing or removing an I/O extension module.

1. Install thin-wall conduit clamps for IP21/UL (NEMA) Type 1 or liquid-tight conduit connectors for IP55/UL (NEMA) Type 12 (not supplied). Type 12 has a Pressfit gasket.
2. Connect conduit runs for input power, motor and control cables to the conduit box. Ensure grommets (pointing down) are inserted into all unused holes.
3. Route the input power and motor wiring through separate conduits.
4. Strip wires.
5. Connect the motor and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
6. Connect the input power and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
7. *If brake resistor is used* — Connect the resistor and ground wires. Tighten the screws to torques shown in the Power wiring torque table.
8. Route the control cables through the conduit (not the same conduit as either input power or motor wiring).
9. Strip the control cable sheathing and twist the copper screen into a pig-tail.
10. Refer to pages *41*, *42* and *43*. Connect the ground screen pig-tail for digital and analog I/O cables. (Ground only at drive end.)
11. Connect the ground screen pig-tail for Embedded fieldbus, EFB (EIA-485) cables at X5. (Ground only at drive end.)
12. Strip and connect the individual control wires to the drive terminals. Tighten the screws to 0.4 lb-ft (0.5…0.6 Nm).

WARNING! To avoid danger or damage to the drive on IT systems and corner grounded TN systems, see section *Drive compatibility for various electrical power systems* on page *16*.



Power wiring torque table

Frame size	R3	
	lb-ft	Nm
T1/U, T2/V, T3/W	2.6	3.5
L1, L2, L3	2.6	3.5
R+, R-	2.6	3.5
PE Ground	1.1	1.5

Wiring R4

Note: These are instructions for conduit wiring. For cable wiring, see the *ACH580 Hardware manual,* publication number *3AXD50000044839.*

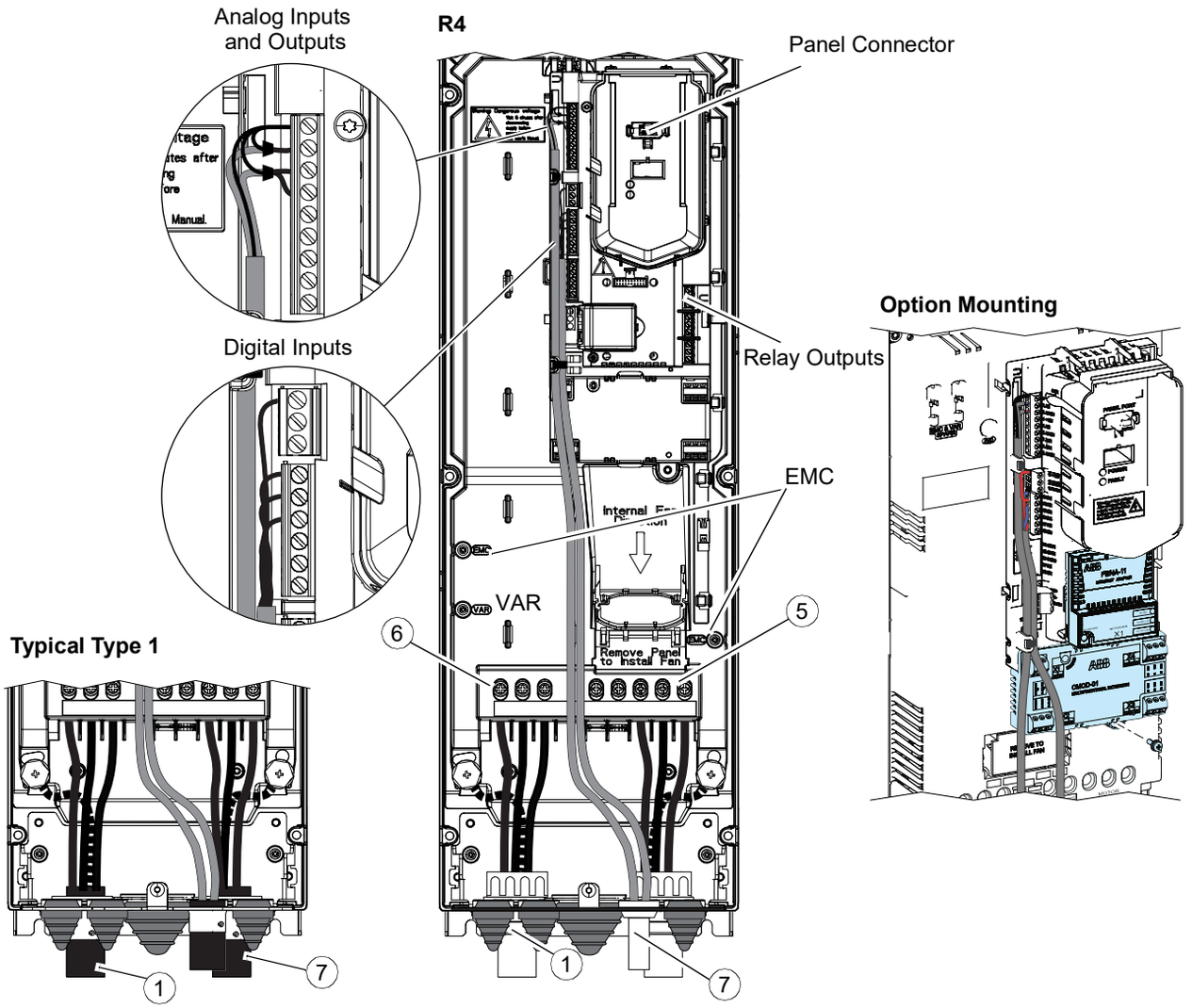
Note: In US deliveries, options are already installed at the factory. If installing on site, option slot 1 modules (fieldbus adapter) may be installed by mounting the module on the control board and tightening the mounting screw, which is also the grounding screw. Option slot 2 modules (I/O extension) may be installed by mounting the module on the control board and tightening both the mounting screw and the grounding screw. Refer to Warning.

WARNING! If installing modules, obey the instructions in *Safety instructions* on page *2*. If you ignore them, injury or death, or damage to the equipment can occur.

Option slot 2 in frames R1…R5 is at U_{DC} potential. You must disconnect power supplies before installing or removing an I/O extension module.

1. Install thin-wall conduit clamps for IP21/UL (NEMA) Type 1 or liquid-tight conduit connectors for IP55/UL (NEMA) Type 12 (not supplied). Type 12 has a Pressfit gasket.
2. Connect conduit runs for input power, motor and control cables to the conduit box. Ensure grommets (pointed down) are inserted into all unused holes.
3. Route the input power and motor wiring through separate conduits.
4. Strip wires.
5. Connect the motor and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
6. Connect the input power and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
7. Route the control cables through the conduit (not the same conduit as either input power or motor wiring).
8. Strip the control cable sheathing and twist the copper screen into a pig-tail.
9. Refer to pages *41*, *42* and *43*. Connect the ground screen pig-tail for digital and analog I/O cables. (Ground only at drive end.)
10. Connect the ground screen pig-tail for Embedded fieldbus, EFB (EIA-485) cables at X5. (Ground only at drive end.)
11. Strip and connect the individual control wires to the drive terminals. Tighten the screws to 0.4 lb-ft (0.5…0.6 Nm).

WARNING! To avoid danger or damage to the drive on IT systems and corner grounded TN systems, see section *Drive compatibility for various electrical power systems* on page *16*.



Note: UDC+ and UDC- terminals are used for external brake chopper units.

Power wiring torque table

Frame size	R4	
	lb-ft	Nm
T1/U, T2/V, T3/W	3.0	4.0
L1, L2, L3	3.0	4.0
UDC+ and UDC-	3.0	4.0
PE Ground	2.1	2.9

Wiring R5

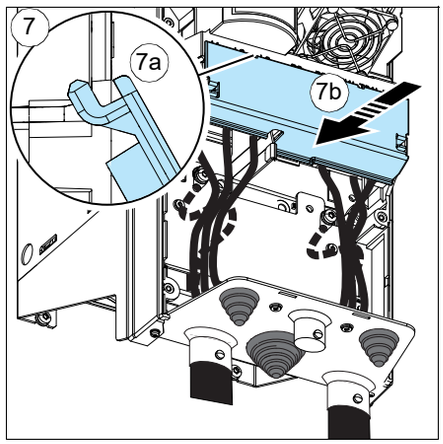
Note: These are instructions for conduit wiring. For cable wiring, see the *ACH580 Hardware manual,* publication number *3AXD50000044839*.

Note: In US deliveries, options are already installed at the factory. If installing on site, option slot 1 modules (fieldbus adapter) may be installed by mounting the module on the control board and tightening the mounting screw, which is also the grounding screw. Option slot 2 modules (I/O extension) may be installed by mounting the module on the control board and tightening both the mounting screw and the grounding screw. Refer to Warning.

WARNING! If installing modules, obey the instructions in *Safety instructions* on page *2*. If you ignore them, injury or death, or damage to the equipment can occur.

Option slot 2 in frames R1…R5 is at U_{DC} potential. You must disconnect power supplies before installing or removing an I/O extension module.

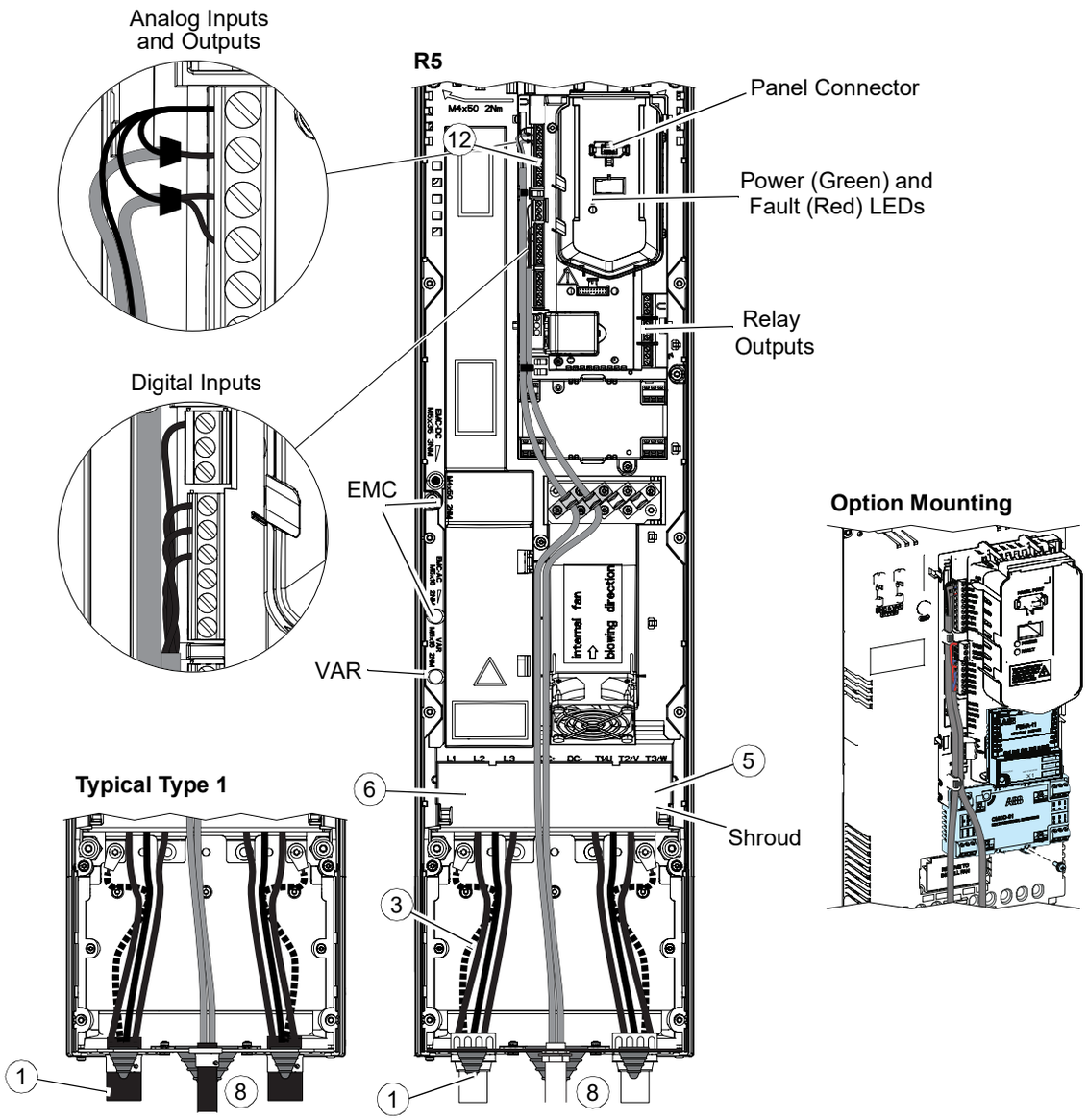
1. Install thin-wall conduit clamps for IP21/UL (NEMA) Type 1 or liquid-tight conduit connectors for IP55/UL (NEMA) Type 12 (not supplied). Type 12 has a Pressfit gasket.
2. Connect conduit runs for input power, motor and control cables to the conduit box. Ensure grommets (pointing down) are inserted into all unused holes.
3. Route the input power and motor wiring through separate conduits.
4. Strip wires.
5. Connect the motor and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
6. Connect the input power and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
7. Reinstall the shroud on the power terminals by putting the tabs at the top of the shroud in their counterparts on the drive frame and then pressing the shroud in place.
8. Route the control cables through the conduit (not the same conduit as either input power or motor wiring).
9. Strip the control cable sheathing and twist the copper screen into a pig-tail.
10. Refer to pages *41*, *42* and *43*. Connect the ground screen pig-tail for digital and analog I/O cables. (Ground only at drive end.)



11. Connect the ground screen pig-tail for Embedded fieldbus, EFB (EIA-485) cables at X5. (Ground only at drive end.)

12. Strip and connect the individual control wires to the drive terminals. Tighten the screws to 0.4 lb-ft (0.5…0.6 Nm).

WARNING! To avoid danger or damage to the drive on IT systems and corner grounded TN systems, see section *Drive compatibility for various electrical power systems* on page *16*.



Note: UDC+ and UDC- terminals are used for external brake chopper units.

Power wiring torque table

Frame size	R5	
	lb-ft	Nm
T1/U, T2/V, T3/W	4.1	5.6

Frame size	R5	
	lb-ft	Nm
L1, L2, L3	4.1	5.6
UDC+ and UDC-	4.1	5.6
PE Ground	1.6	2.2

Wiring R6…R9

Note: These are instructions for conduit wiring. For cable wiring, see the *ACH580 Hardware manual,* publication number *3AXD50000044839.*

Note: In US deliveries, options are already installed at the factory. If installing on site, see the appropriate option module manual for specific installation and wiring.

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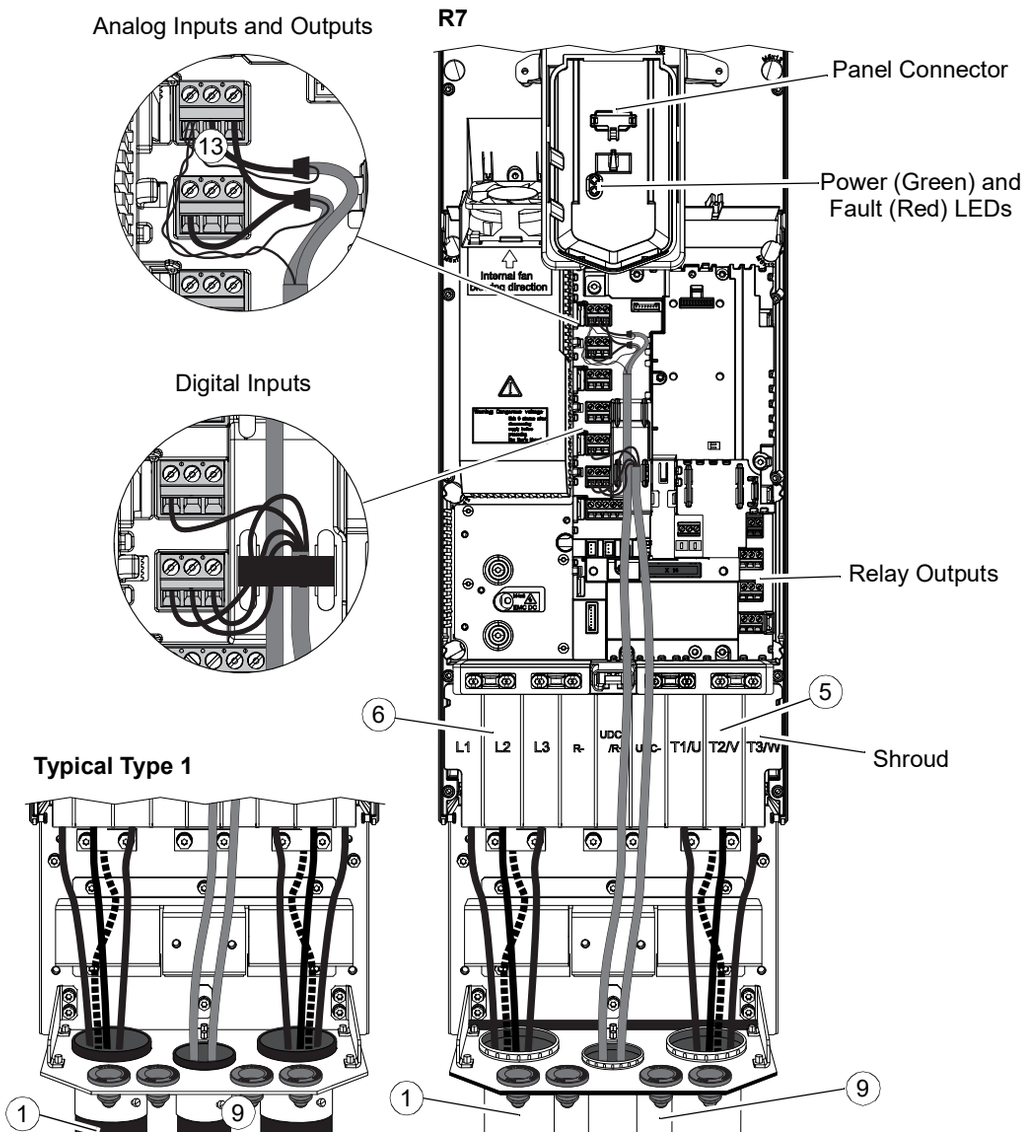
1. Install thin-wall conduit clamps for IP21/UL (NEMA) Type 1 or liquid-tight conduit connectors for IP55/UL (NEMA) Type 12 (not supplied). Type 12 has a Pressfit gasket.
2. Connect conduit runs for input power, motor and control cables to the conduit box. Ensure grommets (pointing down) are inserted into all unused holes.
3. Route the input power and motor wiring through separate conduits.
4. Strip wires.
5. Connect the motor and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.

Note: *Frames R8…R9* — If you connect only one conductor to the connector, we recommend that you put it under the upper pressure plate.

---

6. Connect the input power and ground wires to the drive terminal. Tighten the screws to torques shown in the Power wiring torque table.
7. *Frames R8…R9* — If parallel cables are used, install the parallel power cables.
8. Reinstall the shroud on the power terminals and the conduit box side plates.
9. Route the control cables through the conduit (not the same conduit as either input power or motor wiring).
10. Strip the control cable sheathing and twist the copper screen into a pig-tail.
11. Refer to pages *41*, *42* and *43*. Connect the ground screen pig-tail for digital and analog I/O cables. (Ground only at drive end.)
12. Connect the ground screen pig-tail for Embedded fieldbus, EFB (EIA-485) cables at X5. (Ground only at drive end.)
13. Strip and connect the individual control wires to the drive terminals. Tighten the screws to 0.4 lb-ft (0.5…0.6 Nm).

WARNING! To avoid danger or damage to the drive on IT systems and corner grounded TN systems, see section *Drive compatibility for various electrical power systems* on page *16*.

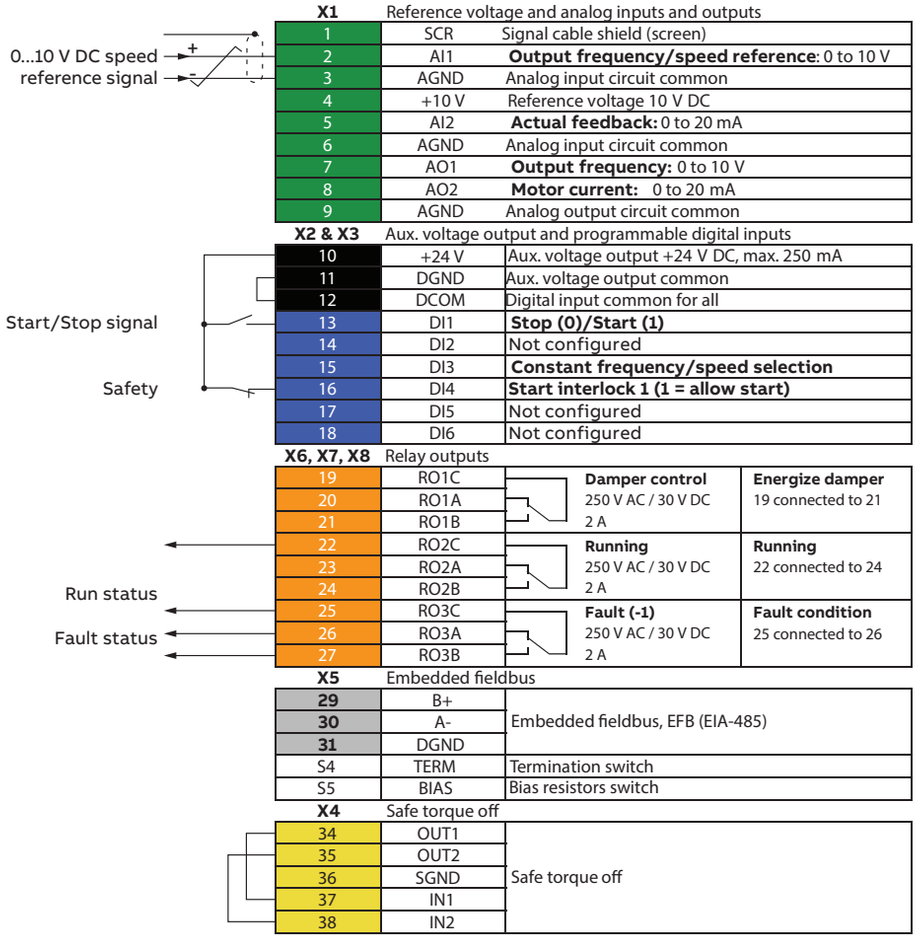


Note: UDC+ and UDC- terminals are used for external brake chopper units.

Power wiring torque table

Frame size	R6		R7		R8		R9	
	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm
T1/U, T2/V, T3/W	22.1	30	29.5	40	29.6	40	51.6	70
L1, L2, L3	22.1	30	29.5	40	29.6	40	51.6	70
UDC+ and UDC-	22.1	30	29.5	30	29.5	40	51.6	70
PE Ground	7.2	9.8	7.2	9.8	7.2	9.8	7.2	9.8

Default control connections for the HVAC default



Notes:

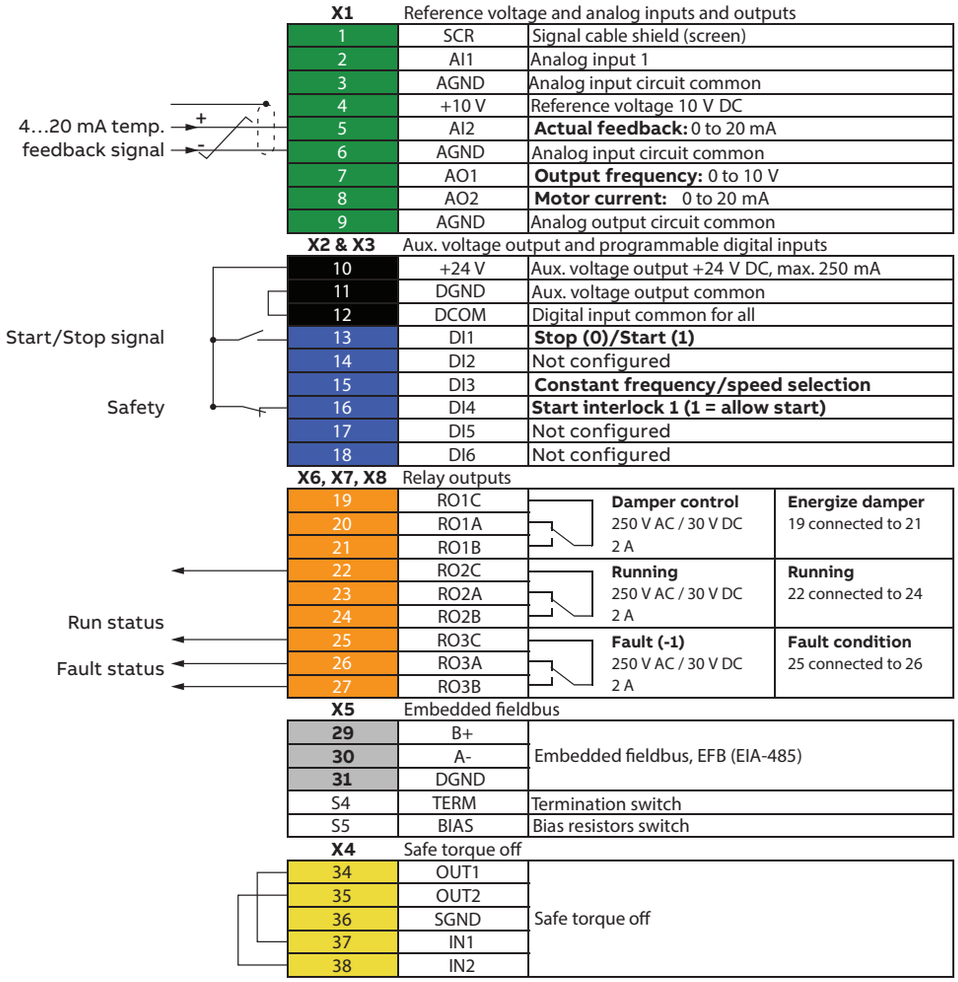
1) Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.
2) Connected with jumpers at the factory.
3) Only frames R6…R11 have terminals 40 and 41 for external 24 V AC/DC input.

Terminal sizes:

1. R1…R5: 24…14 AWG (0.2…2.5 mm^2): Terminals +24V, DGND, DCOM, B+, A-, DGND, Ext. 24V
2. 26…16 AWG (0.14…1.5 mm^2): Terminals DI, AI, AO, AGND, RO, STO
3. R6…R9: 26...14 AWG (0.14…2.5 mm^2) (all terminals)
4. Tightening torques: 0.4 lb-ft (0.5…0.6 Nm

HVAC default direct I/O control	
Input Signals	*Output signals*
• Analog frequency/speed reference (AI1)	• Analog output AO1: Output frequency
• Start/stop selection (DI1)	• Analog output AO2: Motor current
• Constant speed/frequency selection (DI3)	• Relay output 1: Damper control
• Start interlock 1 (DI4)	• Relay output 2: Running
	• Relay output 3: Fault (-1)

Default control connections for the PID control, single motor



1) Connected with jumpers at the factory.
2) Only frames R6…R9 have terminals 40 and 41 for external 24 V AC/DC input.

Terminal sizes:

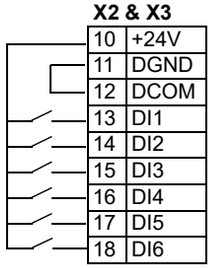
1. R1…R5: 24…14 AWG (0.2…2.5 mm^2): Terminals +24V, DGND, DCOM, B+, A-, DGND, Ext. 24V
2. 26…16 AWG (0.14…1.5 mm^2): Terminals DI, AI, AO, AGND, RO, STO
3. R6…R9: 26...14 AWG (0.14…2.5 mm^2) (all terminals)
4. Tightening torques: 0.4 lb-ft (0.5…0.6 Nm

PID control, single motor	
Input signals	*Output signals*
• Setpoint selected from: control panel setpoint/constant setpoint /analog input (AI1)	• Analog output AO1: Output frequency
• PID feedback (AI2)	• Analog output AO2: Motor current
• Start/stop selection (DI1)	• Relay output 1: Damper control
• Constant speed/frequency selection (DI3)	• Relay output 2: Running
• Start interlock 1 (DI4)	• Relay output 3: Fault (-1)

You can wire the digital input terminals for internal or external power supply in either a PNP or NPN configuration.

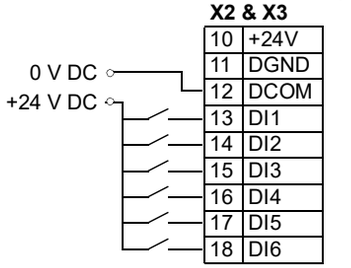
Internal +24 V power supply

PNP connection (source)



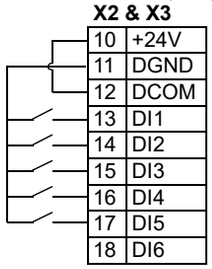
External +24 V power supply

PNP connection (source)



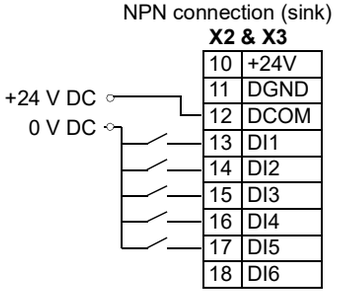
Internal +24 V power supply

NPN connection (sink)



External +24 V power supply

NPN connection (sink)



Note: DI6 is not supported in the NPN configuration.

WARNING! Do not connect the +24 V AC cable to the control board ground when the control board is powered using an external 24 V AC supply.

Communications

Terminals 29...31 provide Embedded fieldbus, EFB (EIA-485) connections used to control or monitor the drive from a fieldbus controller.

Switches

Switch	Description	Position	
S4 (TERM)	EFB link termination. Must be set to the terminated (ON) position when the drive is the first or last unit on the link.	ON TERM	Bus not terminated (**default**)
		ON TERM	Bus terminated
S5 (BIAS)	Switches on the biasing voltages to the bus. One (and only one) device, preferably at the end of the bus must have the bias on.	ON BIAS	Bias off (**default**)
		ON BIAS	Bias on

5. Check installation

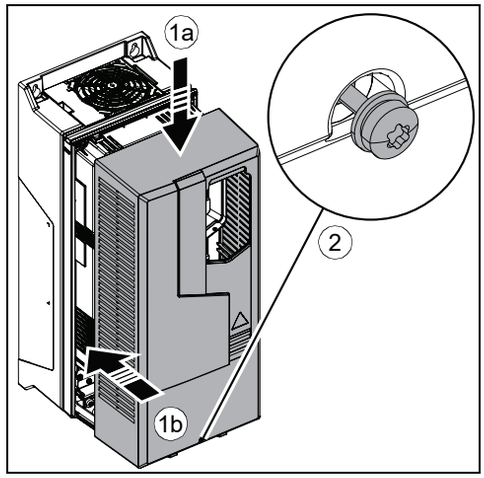
Before applying power, perform the following checks.

☑	**Check that …**
☐	The ambient operating conditions meet the specification.
☐	If the drive will be connected to a corner-grounded TN system: The internal EMC filter is disconnected. (No metal screws.)
☐	If the drive will be connected to an IT (ungrounded) system: The internal EMC filter and the ground-to-phase varistor is disconnected. (No metal screws.)
☐	If the drive has not been powered (either in storage or unused) over one year: The electrolytic DC capacitors in the DC link of the drive have been reformed.
☐	There is an adequately sized protective earth (ground) conductor between the drive and the switchboard.
☐	There is an adequately sized protective earth (ground) conductor between the motor and the drive.
☐	All protective earth (ground) conductors have been connected to the appropriate terminals and the terminals have been tightened.
☐	The supply voltage matches the nominal input voltage of the drive. Check the type designation label.
☐	The input power cable has been connected to appropriate terminals, and the terminals have been properly tightened.
☐	Appropriate supply fuses and disconnector have been installed.
☐	The motor cable has been connected to appropriate terminals and the terminals have been tightened.
☐	The brake resistor cable (if present) has been connected to appropriate terminals, and the terminals have been tightened.
☐	The motor cable (and brake resistor cable, if present) have been properly wired through conduits.
☐	The control cables (if any) have been connected to the control board.
☐	There are no tools, foreign objects or dust from drilling inside the drive.
☐	Drive and motor connection box covers are in place.
☐	The motor and the driven equipment are ready for start-up.

6. Re-install cover(s)

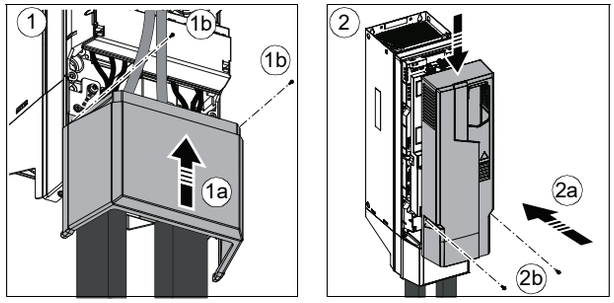
Frames R1...R4

1. Reinstall the cover: Put the tabs on the cover top in their counterparts on the housing (1a) and then press the cover (1b)
2. Tighten the retaining screw at the bottom with a screwdriver.



Frame R5 cover installations

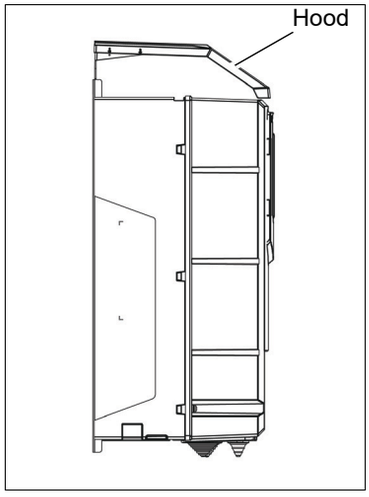
1. Slide the conduit box upwards (1a) and tighten the retaining screws (1b).
2. Install the cover, press it at the bottom (2a) and tighten the retaining screws (2b).



7. Install hood, if applicable

IP 55/UL (NEMA) Type 12, Frame R1...R9

Install the hood by following the instructions provided with the hood kit.



8. Before Start-up

Prepare for start-up by reviewing the following information. The First start assistant walks you through the initial start-up procedure.

Motor data

The motor data on the ratings plate may differ from the defaults in the ACH580. The drive provides more precise control and better thermal protection if you enter the rating plate data.

Before start-up, gather the following from the motor ratings plate:

- Nominal motor current
- Nominal speed
- Voltage
- Nominal frequency
- Nominal power

Default configurations

After initial start-up, you will need to complete the commissioning. This will determine how the drive is controlled, let you make use of default configurations, and allow you to change specific parameters. See *2. Complete commissioning on page 52.*

The ACH580 can be controlled by two default configurations.

HVAC default direct I/O control – Used for typical I/O controlled BMS applications.

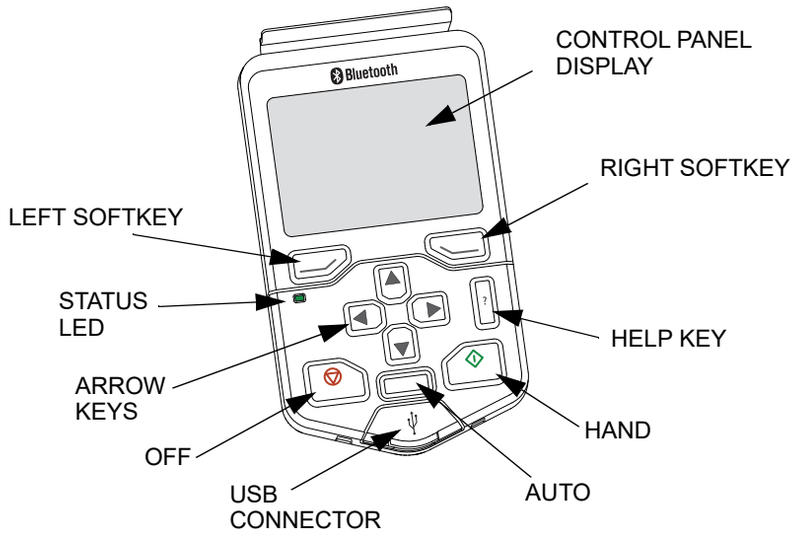
- In the Auto mode, this configuration uses a direct speed reference connected to analog input 1 (AI1).
- In the Hand/Off mode, the speed reference and start command are given through the control panel (operator keypad).
- See the *Default control connections for the HVAC default on page 41.*

PID control, single motor – Offers quick setup of PID control for keeping flow or pressure constant, requiring feedback from the process given by a feedback signal connected to analog input 2 (AI2).

- You can set a constant setpoint, or, in the Auto mode, you can specify the setpoint to come from analog input 1 (AI1) or from the control panel.
- In the Hand/Off mode, the speed reference and start command come from the control panel.
- In the Hand mode, the speed reference is the direct speed reference and a PID setpoint value.
- See the *Default control connections for the PID control, single motor on page 42.*

Operation

The ACH580 HVAC control panel features:



Control panel features

Left softkey

The left softkey ( ) is usually used for exiting and canceling. Its function in a given situation is shown by the softkey selection in the bottom left corner of the display.

Holding down exits each view in turn until you are back in the Home view. This function does not work in special screens.

Right softkey

The right softkey ( ) is usually used for selecting, accepting and confirming. The function of the right softkey in a given situation is shown by the softkey selection in the bottom right corner of the display.

The arrow keys

The up and down arrow keys (and) are used to highlight selections in menus and selection lists, to scroll up and down on text pages, and to adjust values when, for example, setting the time, entering a passcode or changing a parameter value.

The left and right arrow keys (and) are used to move the cursor left and right in parameter editing and to move forward and backward in assistants. In menus, and function the same way as and , respectively.

Help

The help key ( ) opens a help page. The help page is context-sensitive, in other words, the content of the page is relevant to the menu or view in question.

Hand, Off and Auto

The ACH580 can be in local or external control. The local control has two modes: Hand and Off.

Hand key ( ):

- In local control / Off mode: Starts the drive. The drive will switch to the Hand mode.
- In external control: Switches the drive to local control / Hand mode, keeping it running.

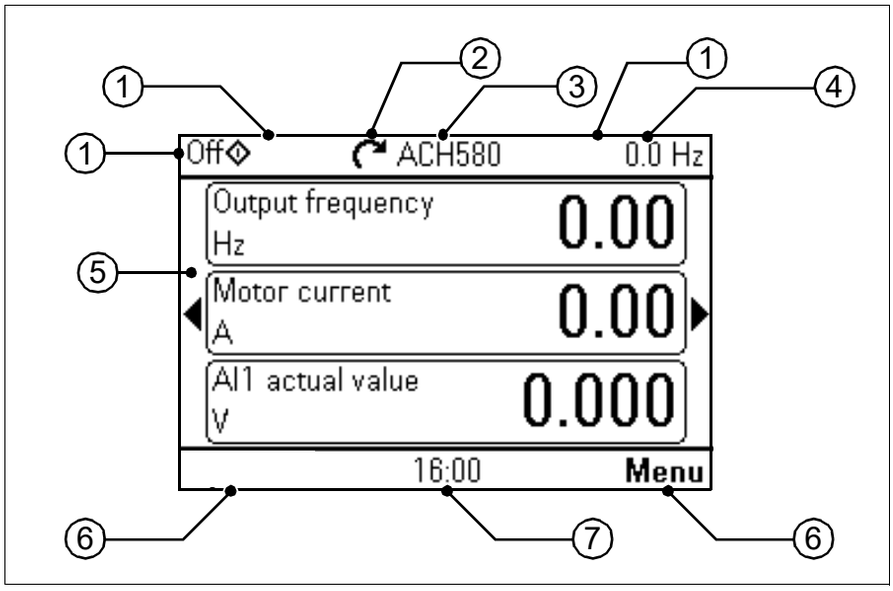
Off key ( ):

- Stops the drive and switches to the Off mode.

Auto key (Auto):

- In local control: The drive will switch to external control.

Control panel display



1. Control location and related icons
2. Status icon
3. Drive name
4. Reference value
5. Content area
6. Softkey selections
7. Clock

Note: Complete programming information is available in the *ACH580 HVAC control program firmware manual*, publication number 3AXD50000027537.

For initial start-up, follow steps 1 through 4 below.

WARNING! Do not start up the drive unless you are a qualified electrical professional.

Read and obey the instructions in chapter Safety instructions at the beginning of the manual. Ignoring the instructions can cause physical injury or death, or damage to the equipment.

WARNING! Verify there is no active start command on drive terminal DI1 on power up, as this is default run command.

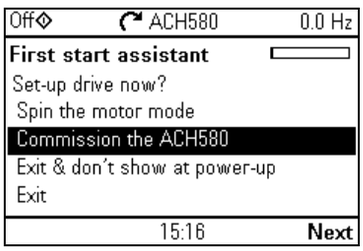
Check that the starting of the motor does not cause any danger.

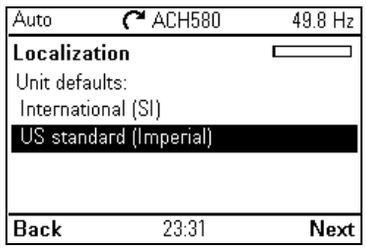
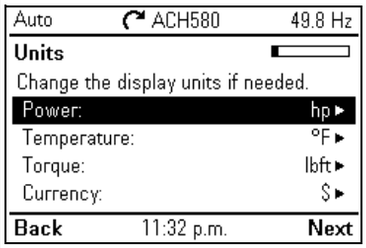
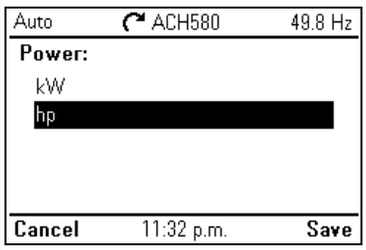
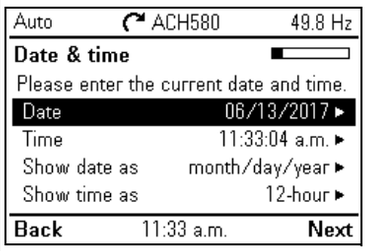
De-couple the driven machine if

- there is a risk of damage in case of an incorrect direction of rotation, or
- a **Normal** ID run is required during the drive start-up, when the load torque is higher than 20% or the machinery is not able to withstand the nominal torque transient during the ID run.

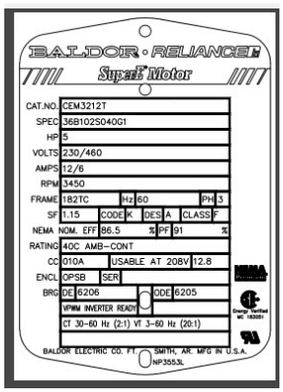
Note: For additional E-Clipse bypass primary settings information please go to page *113*.

1. Make *First start assistant*-guided settings: Language, motor nominal values, and date and time

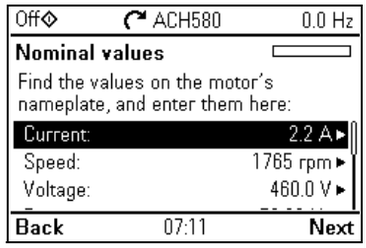
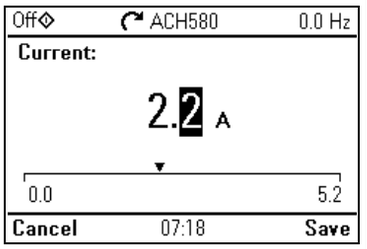
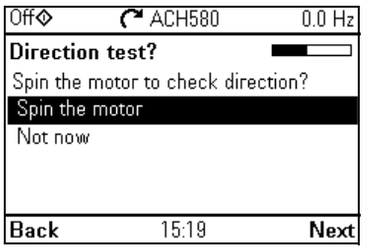
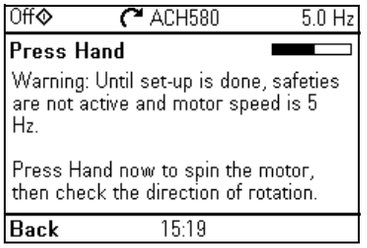
1	Have the motor name plate data at hand. Power up the drive.	
2	The First start assistant guides you through the first start-up. The assistant begins automatically. Wait until the control panel enters the view shown on the right. English is pre-loaded. To change the control panel, select the language you want to use by highlighting it and pressing (**OK**). **Note:** After you have selected the language, it takes a few minutes to download the language file to the control panel.	
3	Select **Commission the ACH580** and press (**Next**).	

4	Select the localization you want to use and press (**Next**).	
5	Change the units shown on the panel if needed. Go to the edit view of a selected row by pressing . Scroll the view with and . Go to the next view by pressing (**Next**).	
6	To select a value in an edit view: Use and to select the value. Press (**Save**) to accept the new setting, or press (**Cancel**) to go back to the previous view without making changes.	
7	Set the date and time as well as date and time display formats. Go to the edit view of a selected row by pressing . Scroll the view with and . Go to the next view by pressing (**Next**).	

Note: Enter the following values exactly as shown on the motor nameplate.



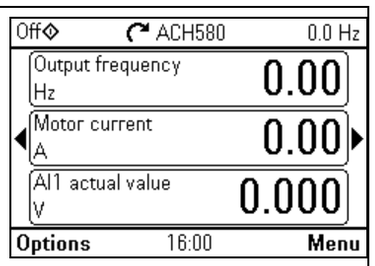
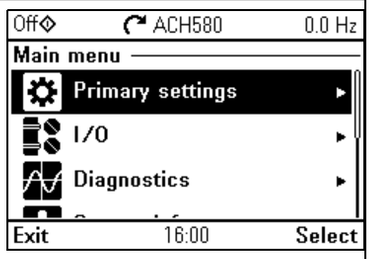
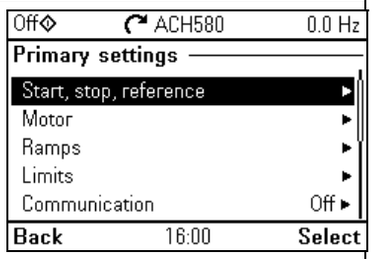
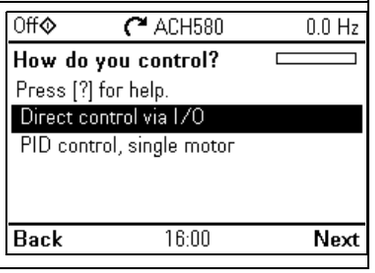
Example of a nameplate of an induction (asynchronous) motor.

8	Check that the motor data is correct. Values are predefined on the basis of the drive size but you should verify that they correspond to the motor. Start with the motor type. Go to the edit view of a selected row by pressing ▶. Scroll the view with ▲ and ▼. Motor nominal cos Φ and nominal torque are optional. Press (**Next**) to continue.	
9	To change a value in an edit view: Use ◀ and ▶ to move the cursor left and right. Use ▲ and ▼ to change the value. Press (**Save**) to accept the new setting, or press (**Cancel**) to go back to the previous view without making changes.	
10	This step is optional, and requires rotating the motor. Do not do this if it could cause any risk, or if the mechanical setup does not allow it. To do the direction test, select **Spin the motor** and press (**Next**).	
11	Press the Hand key (Hand) on the panel to start the drive.	
12	Check the direction of the motor. If it is forward, select **Yes, motor is spinning forward** and press (**Next**) to continue. If the direction is not forward, select **No, fix direction** and press (**Next**) to continue.	
13	The first start is now complete and the drive is ready for use. Press (**Done**) to enter the Home view.	

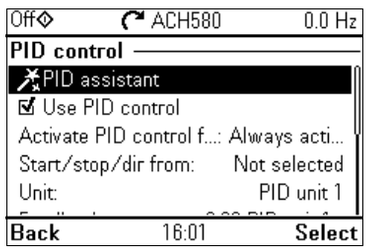
2. Complete commissioning

Default configurations — HVAC and PID Control

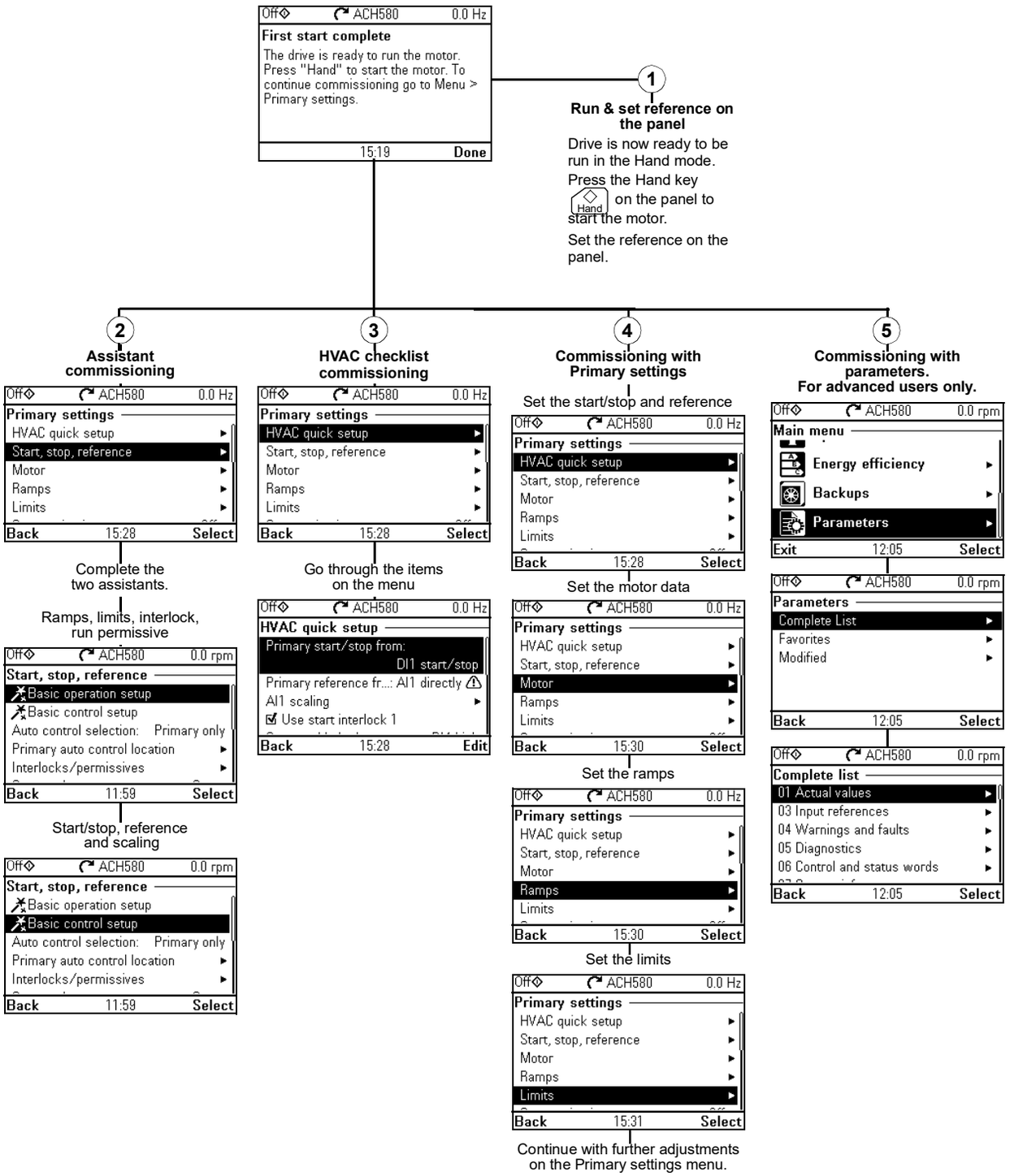
For more information on Default configurations, see pages *41*, *42* and *46*.

1	Press the Hand key to start the motor. The Home view is shown on the panel. Select **Menu** (press on the soft key under “Menu”).	
2	From the Main menu, select **Primary settings**.	
3	Select **Start, stop, reference** and **How do you control?**	
4	The default configurations are shown on the panel. For HVAC, press **Direct control via I/O**. For PID Control, press **PID control, single motor**.	

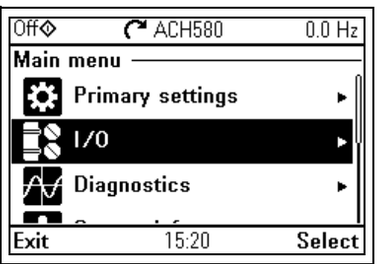
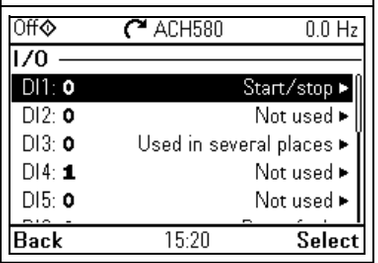
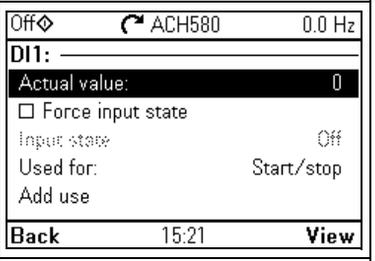
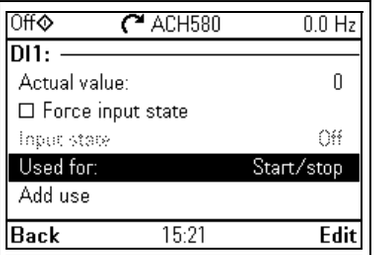
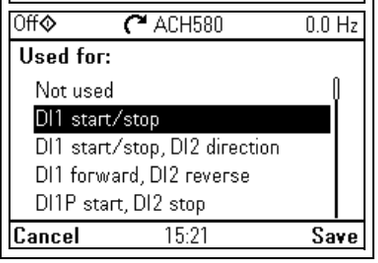
Note: You can adjust Process PI(D) in the PID control submenu of the Primary Settings menu after you have commissioned the drive to use PID control.



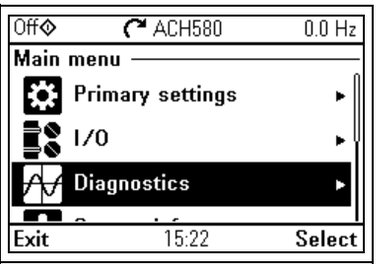
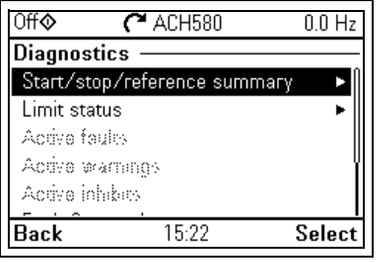
Other ways to complete commissioning



3. Make additional settings in the Primary settings menu – I/O menu

1	After the additional adjustments, make sure that the actual I/O wiring matches the I/O use in the control program. In the **Main** menu, select a **I/O** and press (**Select**) to enter the **I/O** menu.	
2	Select the connection you want to check and press (**Select**) (or).	
3	To view the details of a parameter that cannot be adjusted via the **I/O** menu, press (**View**).	
4	To adjust the value of a parameter, press (**Edit**), adjust the value using , , and keys and press (**Save**). Note that the actual wiring must match the new value. Go back to the **Main** menu by pressing (**Back**) repeatedly.	 

4. Check setup with the Diagnostics menu

1	After making the additional adjustments and checking the I/O connections, use the **Diagnostics** menu to make sure that the setup is functioning correctly. In the **Main** menu, select **Diagnostics** and press (**Select**) (or ▶).	
2	Select the diagnostics item you want to view and press (**Select**). Return to the **Diagnostics** menu by pressing (**Back**).	

How to control the drive through the I/O interface

Instructions below are for operating the drive through the digital and analog inputs when:

- the motor start-up is performed, and
- the default parameter settings of the HVAC default configurations are in use.

Preliminary settings

If you need to change the direction of rotation, check that limits allow reverse direction. Check parameter group *30 Limits* and make sure that the minimum limit has a negative value and the maximum limit has a positive value.

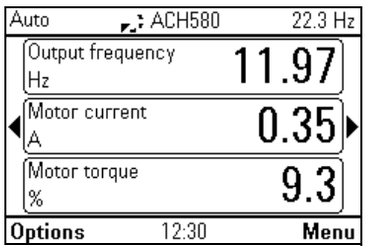
Note: Default settings only allow forward direction.

---

1. Make sure that the control connections are wired according to the connection diagram given for the HVAC default. See section *Default control connections for the HVAC default on page 41*.
2. Make sure that the drive is in external control. To switch to external control, press key Auto. In external control, the panel display shows text **Auto** at the top left.

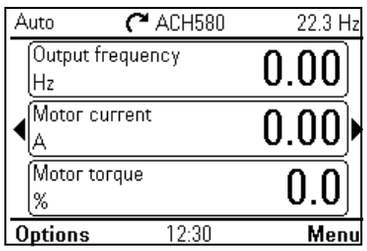
Starting and controlling the speed of the motor

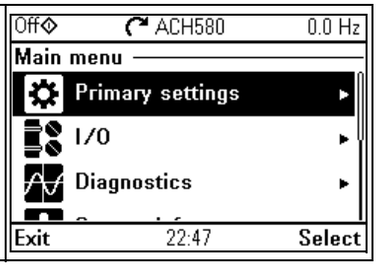
1. Start by switching digital input DI1 on. The arrow starts rotating. It is dotted until the setpoint is reached.
2. Regulate the drive output frequency (motor speed) by adjusting voltage of analog input AI1.

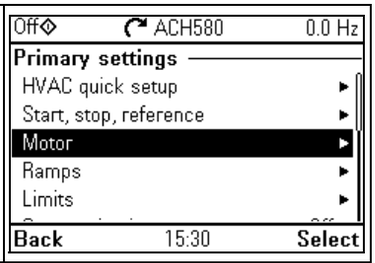
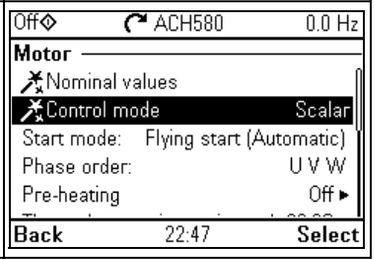
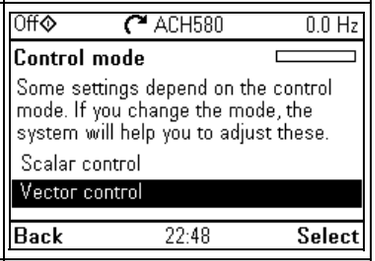
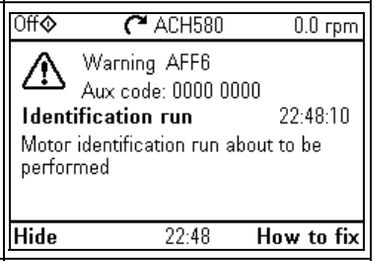
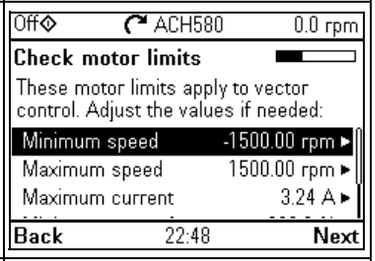
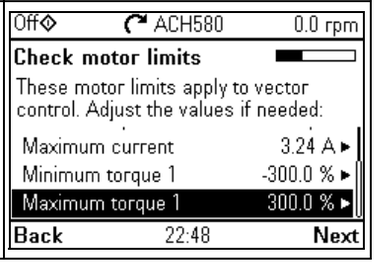


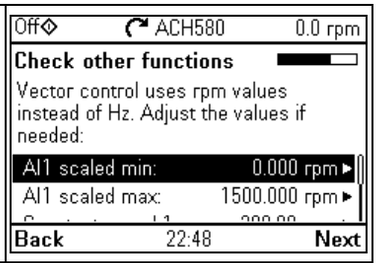
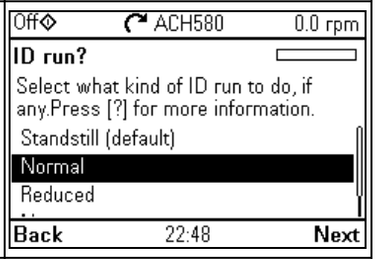
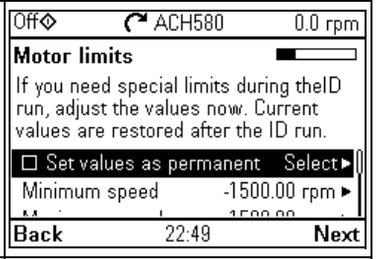
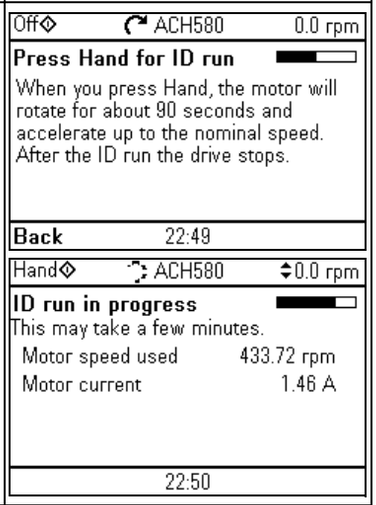
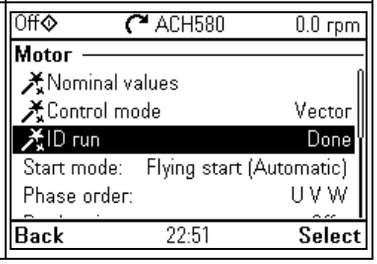
Stopping the motor

1. Switch digital input DI1 off. The arrow stops rotating.



1	Go to the **Main** menu by pressing (**Menu**) in the Home view. Select **Primary settings** and press (**Select**) (or ▶).	

2	Select **Motor** and press (**Select**) (or ▶).	
3	If the control modes is scalar, select **Control mode** and press (**Select**) (or ▶) and continue to the next step.	
4	Select **Vector control** and press (**Select**) (or ▶).	
5	Warning message **Identification run** is shown for a moment.	
6	Check the motor speed limits. The following must be true: Minimum speed ≤ 0 rpm Maximum speed = motor rated speed.	
7	Check the motor current as well as torque limits. The following must be true: Maximum current > I_{HD} Maximum torque > 50%.	

8	Check AI1 scaling, see parameters *12.19 AI1 scaled at AI1 min* and *12.20 AI1 scaled at AI1 max*.	
9	Select the type of ID run you want to do and press (**Select**) (or).	
10	Check the motor limits shown on the panel. If you need other limits during the ID run you can enter them here. The originals limits will be restored after the ID run, unless you select **Set values as permanent**.	
11	Press the Hand key ( ) to start the ID run. In general, it is recommended not to press any control panel keys during the ID run. However, you can stop the ID run at any time by pressing the Off key ( ). During the ID run a progress view is shown. After the ID run is completed, text **ID run done** is shown. The LED stops blinking. If the ID run fails, fault *FF61 ID run* is shown.	
12	After the ID run is completed, text **Done** is shown on row **ID run**.	

Diagnostics

Warning Messages

Note: The list also contains events that only appear in the Event log.

Code (hex)	Warning / Aux. code	Cause	What to do
64FF	Fault reset	A fault has been reset from the panel, Drive composer PC tool, fieldbus or I/O.	Event. Informative only.
A2B1	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this warning may also be caused by an earth fault or supply phase loss.	Check motor load. Check acceleration times in parameter group *23 Speed reference ramp* (speed control) or *28 Frequency reference chain* (frequency control). Also check parameters *46.01 Speed scaling*, *46.02 Frequency scaling* and *46.03 Torque scaling*. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See *Checking the insulation of the assembly on page 16*. Check there are no contactors opening and closing in motor cable. Check that the start-up data in parameter group *99 Motor data* corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable.
A2B3	Earth leakage	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See *Checking the insulation of the assembly on page 16*. If an earth fault is found, fix or change the motor cable and/or motor. If no earth fault can be detected, contact your local ABB representative.

Code (hex)	Warning / Aux. code	Cause	What to do
A2B4	Short circuit	Short-circuit in motor cable(s) or motor.	Check motor and motor cable for cabling errors. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See *Checking the insulation of the assembly on page 16*. Check there are no power factor correction capacitors or surge absorbers in motor cable.
A2BA	IGBT overload	Excessive IGBT junction to case temperature. This warning protects the IGBT(s) and can be activated by a short circuit in the motor cable.	Check motor cable. Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A3A1	DC link overvoltage	Intermediate circuit DC voltage too high (when the drive is stopped).	Check the supply voltage setting (parameter *95.01 Supply voltage*). Note that the wrong setting of the parameter may cause the motor to rush uncontrollably, or may overload the brake chopper or resistor. Check the supply voltage. If the problem persists, contact your local ABB representative.
A3A2	DC link undervoltage	Intermediate circuit DC voltage too low (when the drive is stopped).	
A3AA	DC not charged	The voltage of the intermediate DC circuit has not yet risen to operating level.	
A490	Incorrect temperature sensor setup	Temperature cannot be supervised due to incorrect adapter setup.	Check the settings of temperature source parameters *35.11* and *35.21*.
A491	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded warning limit.	Check the value of parameter *35.02 Measured temperature 1*. Check the cooling of the motor (or other equipment whose temperature is being measured). Check the value of *35.13 Temperature 1 warning limit*.
A492	External temperature 2 (Editable message text)	Measured temperature 2 has exceeded warning limit.	Check the value of parameter *35.03 Measured temperature 2*. Check the cooling of the motor (or other equipment whose temperature is being measured). Check the value of *35.23 Temperature 2 warning limit*.
A4A0	Control board temperature	Control board temperature is too high.	Check the auxiliary code. See actions for each code below.

Code (hex)	Warning / Aux. code	Cause	What to do
	(none)	Temperature above warning limit	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up.
	1	Thermistor broken	Contact an ABB service representative for control board replacement.
A4A1	IGBT overtemperature	Estimated drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A4A9	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F (IP21 frames R4…R9) or if it exceeds 50 °C /122 °F (IP21 frames R1...R9), ensure that load current does not exceed derated load capacity of drive. For all P55 frames, check the derating temperatures. See chapter *Technical data*, section *Derating* in the *Hardware manual* of the drive. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
A4B0	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A4B1	Excess temperature difference	High temperature difference between the IGBTs of different phases.	Check the motor cabling. Check cooling of drive module(s).
A4F6	IGBT temperature	Drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A581	Fan	Cooling fan feedback missing.	Check the auxiliary code to identify the fan. Code **0** denotes main fan 1. Other codes (format XYZ): “X” specifies state code (**1:** ID run, **2:** normal). “Y” = 0, “Z” specifies the index of the fan (**1:** Main fan 1, **2:** Main fan 2, **3:** Main fan 3). Check fan operation and connection. Replace fan if faulty.

Code (hex)	Warning / Aux. code	Cause	What to do
A582	Auxiliary fan missing	An auxiliary cooling fan (IP55 internal fan) is stuck or disconnected.	Check the auxiliary code. Check the auxiliary fan and connection. Replace faulty fan. Make sure the front cover of the drive is in place and tightened. If the commissioning of the drive requires that the cover is off, this warning will be generated even if the corresponding fault is defeated. See fault *5081 Auxiliary fan broken on page 73*.
A5A0	Safe torque off Programmable warning: *31.22 STO indication run/stop*	Safe torque off function is active, ie safety circuit signal(s) connected to connector STO is lost.	Check safety circuit connections. For more information, chapter *The Safe torque off function* in the *Hardware manual* of the drive and description of parameter *31.22 STO indication run/stop* in the Firmware manual. Check the value of parameter *95.04 Control board supply*.
A5EA	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Contact your local ABB representative.
A5EB	PU board powerfail	Power unit power supply failure.	Contact your local ABB representative.
A5ED	Measurement circuit ADC	Measurement circuit fault.	Contact your local ABB representative.
A5EE	Measurement circuit DFF	Measurement circuit fault.	Contact your local ABB representative.
A5EF	PU state feedback	State feedback from output phases does not match control signals.	Contact your local ABB representative.
A5F0	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system.
A682	Flash erase speed exceeded	The flash memory (in the memory unit) has been erased too frequently, compromising the lifetime of the memory.	Avoid forcing unnecessary parameter saves by parameter *96.07* or cyclic parameter writes (such as user logger triggering through parameters). Check the auxiliary code (format XYYY YZZZ). “X” specifies the source of warning (**1:** generic flash erase supervision). “ZZZ” specifies the flash subsector number that generated the warning.
A6A4	Motor nominal value	The motor parameters are set incorrectly.	Check the auxiliary code. See actions for each code below.
		The drive is not dimensioned correctly.	

Code (hex)	Warning / Aux. code	Cause	What to do
	0001	Slip frequency is too small.	Check the settings of the motor configuration parameters in groups 98 and 99. Check that the drive is sized correctly for the motor.
	0002	Synchronous and nominal speeds differ too much.	
	0003	Nominal speed is higher than synchronous speed with 1 pole pair.	
	0004	Nominal current is outside limits	
	0005	Nominal voltage is outside limits.	
	0006	Nominal power is higher than apparent power.	
	0007	Nominal power not consistent with nominal speed and torque.	
A6A5	No motor data	Parameters in group 99 have not been set.	Check that all the required parameters in group 99 have been set. **Note:** It is normal for this warning to appear during the start-up and continue until the motor data is entered.
A6A6	Voltage category unselected	The voltage category has not been defined.	Set voltage category in parameter *95.01 Supply voltage*.
A6A7	System time not set	System time is not set. Timed functions cannot be used and fault log dates are not correct.	Set the system time manually or connect the panel to the drive to synchronize the clock. If basic panel is used, synchronize the clock through the EFB or a fieldbus module. Set parameter *34.10 Timed functions enable* to *Not selected* to disable the timed functions if they are not used.
A6B0	User lock is open	The user lock is open, ie. user lock configuration parameters *96.100…96.102* are visible.	Close the user lock by entering an invalid pass code in parameter *96.02 Pass code*. See section *User lock* in the Firmware manual.
A6B1	User pass code not confirmed	A new user pass code has been entered in parameter *96.100* but not confirmed in *96.101*.	Confirm the new pass code by entering the same code in *96.101*. To cancel, close the user lock without confirming the new code. See section *User lock* in the Firmware manual
A6D1	FBA A parameter conflict	The drive does not have a functionality requested by a PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups *50 Fieldbus adapter (FBA)*.

Code (hex)	Warning / Aux. code	Cause	What to do
A6E5	AI parametrization	The current/voltage hardware setting of an analog input does not correspond to parameter settings.	Check the event log for an auxiliary code. The code identifies the analog input whose settings are in conflict. Adjust either the hardware setting (on the drive control unit) or parameter *12.15*/*12.25*. **Note:** Control board reboot (either by cycling the power or through parameter *96.08 Control board boot*) is required to validate any changes in the hardware settings.
A6E6	ULC configuration	User load curve configuration error.	Check the auxiliary code (format XXXX ZZZZ). “ZZZZ” indicates the problem (see actions for each code below).
	0000	Speed points inconsistent.	Check that each speed point (parameters *37.11*…*37.15*) has a higher value than the previous point.
	0001	Frequency points inconsistent.	Check that each frequency point (*37.20*…*37.16*) has a higher value than the previous point.
	0002	Underload point above overload point.	Check that each overload point (*37.31*…*37.35*) has a higher value than the corresponding underload point (*37.21*…*37.25*).
	0003	Overload point below underload point.	
A780	Motor stall Programmable warning: *31.24 Stall function*	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
A792	Brake resistor wiring	Brake resistor short circuit or brake chopper control fault. For drive frames R6 or larger.	Check brake chopper and brake resistor connection. Ensure brake resistor is not damaged.
A793	BR excess temperature	Brake resistor temperature has exceeded warning limit defined by parameter *43.12 Brake resistor warning limit*.	Stop drive. Let resistor cool down. Check resistor overload protection function settings (parameter group *43 Brake chopper*). Check warning limit setting, parameter *43.12 Brake resistor warning limit*. Check that the resistor has been dimensioned correctly. Check that braking cycle meets allowed limits.
A794	BR data	Brake resistor data has not been given.	One or more of the resistor data settings (parameters *43.08*…*43.10*) is incorrect. The parameter is specified by the auxiliary code.
	0000 0001	Resistance value too low.	Check value of *43.10*.
	0000 0002	Thermal time constant not given.	Check value of *43.08*.

Code (hex)	Warning / Aux. code	Cause	What to do
	0000 0003	Maximum continuous power not given.	Check value of *43.09*.
A79C	BC IGBT excess temperature	Brake chopper IGBT temperature has exceeded internal warning limit.	Let chopper cool down. Check for excessive ambient temperature. Check for cooling fan failure. Check for obstructions in the air flow. Check the dimensioning and cooling of the cabinet. Check resistor overload protection function settings (parameters *43.06*…*43.10*). Check minimum allowed resistor value for the chopper being used. Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.
A7AB	Extension I/O configuration failure	Installed CMOD module is not the same as configured.	Check that the installed module (shown by parameter *15.02 Detected extension module*) is the same as selected by parameter *15.01 Extension module type*.
A7C1	FBA A communication Programmable warning: *50.02 FBA A comm loss func*	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups *50 Fieldbus adapter (FBA)*, *51 FBA A settings*, *52 FBA A data in* and *53 FBA A data out*. Check cable connections. Check if communication master is able to communicate.
A7CE	EFB comm loss Programmable warning: *58.14 Communication loss action*	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
A7EE	Panel loss Programmable warning: *49.05 Communication loss action*	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Check mounting platform if being used. Disconnect and reconnect the control panel.
A88F	Cooling fan	Maintenance timer limit exceeded.	Consider changing the cooling fan. Parameter *05.04 Fan on-time counter* shows the running time of the cooling fan.

Code (hex)	Warning / Aux. code	Cause	What to do
A8A0	AI supervision Programmable warning: *12.03 AI supervision function*	An analog signal is outside the limits specified for the analog input.	Check signal level at the analog input. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group *12 Standard AI*.
A8A1	RO life warning	The relay has changed states more than the recommended number of times.	Change the control board or stop using the relay output.
	0001	Relay output 1	Change the control board or stop using relay output 1.
	0002	Relay output 2	Change the control board or stop using relay output 2.
	0003	Relay output 3	Change the control board or stop using relay output 3.
A8A2	RO toggle warning	The relay output is changing states faster than recommended, eg. if a fast changing frequency signal is connected to it. The relay lifetime will be exceeded shortly.	Replace the signal connected to the relay output source with a less frequently changing signal.
	0001	Relay output 1	Select a different signal with parameter *10.24 RO1 source*.
	0002	Relay output 2	Select a different signal with parameter *10.27 RO2 source*.
	0003	Relay output 3	Select a different signal with parameter *10.30 RO3 source*.
A8B0	ABB Signal supervision 1 (Editable message text) Programmable warning: *32.06 Supervision 1 action*	Warning generated by the signal supervision function 1.	Check the source of the warning (parameter *32.07 Supervision 1 signal*).
A8B1	ABB Signal supervision 2 (Editable message text) Programmable warning: *32.16 Supervision 2 action*	Warning generated by the signal supervision function 2.	Check the source of the warning (parameter *32.17 Supervision 2 signal*).
A8B2	ABB Signal supervision 3 (Editable message text) Programmable warning: *32.26 Supervision 3 action*	Warning generated by the signal supervision function 3.	Check the source of the warning (parameter *32.27 Supervision 3 signal*).
A8B3	ABB Signal supervision 4 (Editable message text) Programmable warning: *32.36 Supervision 4 action*	Warning generated by the signal supervision function 4.	Check the source of the warning (parameter *32.37 Supervision 4 signal*).
A8B4	ABB Signal supervision 5 (Editable message text) Programmable warning: *32.46 Supervision 5 action*	Warning generated by the signal supervision function 5.	Check the source of the warning (parameter *32.47 Supervision 5 signal*).

Code (hex)	Warning / Aux. code	Cause	What to do
A8B5	ABB Signal supervision 6 (Editable message text) Programmable warning: *32.56 Supervision 6 action*	Warning generated by the signal supervision function 6.	Check the source of the warning (parameter *32.57 Supervision 6 signal*).
A8BE	ULC overload warning Programmable fault: *37.03 ULC overload actions*	Selected signal has exceeded the user overload curve.	Check for any operating conditions increasing the monitored signal (for example, the loading of the motor if the torque or current is being monitored). Check the definition of the load curve (parameter group *37 User load curve*).
A8BF	ULC underload warning Programmable fault: *37.04 ULC underload actions*	Selected signal has fallen below the user underload curve.	Check for any operating conditions decreasing the monitored signal (for example, loss of load if the torque or current is being monitored). Check the definition of the load curve (parameter group *37 User load curve*).
A981	External warning 1 (Editable message text) Programmable warning: *31.01 External event 1 source* *31.02 External event 1 type*	Fault in external device 1.	Check the external device. Check setting of parameter *31.01 External event 1 source*.
A982	External warning 2 (Editable message text) Programmable warning: *31.03 External event 2 source* *31.04 External event 2 type*	Fault in external device 2.	Check the external device. Check setting of parameter *31.03 External event 2 source*.
A983	External warning 3 (Editable message text) Programmable warning: *31.05 External event 3 source* *31.06 External event 3 type*	Fault in external device 3.	Check the external device. Check setting of parameter *31.05 External event 3 source*.
A984	External warning 4 (Editable message text) Programmable warning: *31.07 External event 4 source* *31.08 External event 4 type*	Fault in external device 4.	Check the external device. Check setting of parameter *31.07 External event 4 source*.

Code (hex)	Warning / Aux. code	Cause	What to do
A985	External warning 5 (Editable message text) Programmable warning: *31.09 External event 5 source* *31.10 External event 5 type*	Fault in external device 5.	Check the external device. Check setting of parameter *31.09 External event 5 source*.
AF80	INU-LSU comm loss Programmable warning: *60.79 INU-LSU comm loss function*	DDCS (fiber optic) communication between converters (for example, the inverter unit and the supply unit) is lost. Note that the inverter unit will continue operating based on the status information that was last received from the other converter.	Check status of other converter (parameters *06.36* and *06.39*). Check settings of parameter group *60 DDCS communication*. Check the corresponding settings in the control program of the other converter. Check cable connections. If necessary, replace cables.
AF85	Line side unit warning	The supply unit (or other converter) has generated a warning.	The auxiliary code specifies the original warning code in the supply unit control program. See chapter *Fault tracing* in the *ACH580 HVAC control program firmware manual,* publication number *3AXD50000027537.*
AF88	Season configuration warning	You have configured a season which starts before the previous season.	Configure the seasons with increasing start dates, see parameters *34.60 Season 1 start date…34.63 Season 4 start date*.
AF8C	Process PID sleep mode	The drive is entering sleep mode.	Informative warning. See section *Sleep and boost functions for process PID control*, and parameters *40.43…40.48* in the Firmware manual
AFAA	Autoreset	A fault is about to be autoreset.	Informative warning. See the settings in parameter group *31 Fault functions*.
AFE1	Emergency stop (off2)	Drive has received an emergency stop (mode selection off2) command.	Check that it is safe to continue operation. Then return emergency stop push button to normal position. Restart drive. If the emergency stop was unintentional, check the source selected by parameter *21.05 Emergency stop source*.
AFE2	Emergency stop (off1 or off3)	Drive has received an emergency stop (mode selection off1 or off3) command.	
AFE9	Start delay	The start delay is active and the drive will start the motor after a predefined delay.	Informative warning. See parameter *21.22 Start delay*.
AFED	Run permissive	Run permissive is keeping the drive from running the motor.	Check the setting of (and source selected by) parameter *20.40 Run permissive*.
AFEE	Start interlock 1	Start interlock 1 is keeping the drive from starting.	Check the signal source selected for parameter *20.41 Start interlock 1*.

Code (hex)	Warning / Aux. code	Cause	What to do
AFEF	Start interlock 2	Start interlock 2 is keeping the drive from starting.	Check the signal source selected for parameter *20.42 Start interlock 2*.
AFF0	Start interlock 3	Start interlock 3 is keeping the drive from starting.	Check the signal source selected for parameter *20.43 Start interlock 3*.
AFF1	Start interlock 4	Start interlock 4 is keeping the drive from starting.	Check the signal source selected for parameter *20.44 Start interlock 4*.
AFF5	Override new start required	The Safe torque off function was active and has been reset while in Override.	A new start signal is required to start the drive again.
AFF6	Identification run	Motor ID run will occur at next start.	Informative warning.
AFF8	Motor heating active	Pre-heating is being performed	Informative warning. Motor pre-heating is active. Current specified by parameter *21.16 Pre-heating current* is being passed through the motor.
AFFE	Override active	Drive is in override mode.	Informative warning.
B5A0	STO event Programmable event: *31.22 STO indication run/ stop*	Safe torque off function is active, ie. safety circuit signal(s) connected to connector STO is lost.	Informative warning. Check safety circuit connections. For more information, see chapter *The Safe torque off function* in the *Hardware manual* of the drive and parameter *31.22 STO indication run/ stop*.
D501	No more available PFC motors	No more PFC motors can be started because they can be interlocked or in the Hand mode.	Check that there are no interlocked PFC motors, see parameters: *76.81…76.84*. If all motors are in use, the PFC system is not adequately dimensioned to handle the demand.
D502	All motors interlocked	All the motors in the PFC system are interlocked.	Check that there are no interlocked PFC motors, see parameters *76.81…76.84.*
D503	VSD controlled PFC motor interlocked	The motor connected to the drive is interlocked (unavailable).	Motor connected to the drive is interlocked and thus cannot be started. Remove the corresponding interlock to start the drive controlled PFC motor. See parameters *76.81…76.84*.

Fault messages

Code (hex)	Fault / Aux. code	Cause	What to do
1080	Backup/Restore timeout	Panel or PC tool has failed to communicate with the drive when backup was being made or restored.	Request backup or restore again.
1081	Rating ID fault	Drive software has not been able to read the rating ID of the drive.	Reset the fault to make the drive try to reread the rating ID. If the fault reappears, cycle the power to the drive. You may have to be repeat this. If the fault persists, contact your local ABB representative.
2310	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this fault may also be caused by an earth fault or supply phase loss.	Check motor load. Check acceleration times in parameter group *23 Speed reference ramp* (speed control) or *28 Frequency reference chain* (frequency control). Also check parameters *46.01 Speed scaling, 46.02 Frequency scaling* and *46.03 Torque scaling*. Check motor and motor cable (including phasing and delta/star connection). Check there are no contactors opening and closing in motor cable. Check that the start-up data in parameter group 99 corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See *Checking the insulation of the assembly on page 16*.
2330	Earth leakage Programmable fault: *31.20 Earth fault*	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. Try running the motor in scalar control mode if allowed. (See parameter *99.04 Motor control mode*.) If no earth fault can be detected, contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
2340	Short circuit	Short-circuit in motor cable(s) or motor	Check motor and motor cable for cabling errors. Check there are no power factor correction capacitors or surge absorbers in motor cable. Cycle the power to the drive.
2381	IGBT overload	Excessive IGBT junction to case temperature. This fault protects the IGBT(s) and can be activated by a short circuit in the motor cable.	Check motor cable. Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
3130	Input phase loss Programmable fault: *31.21 Supply phase loss*	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse.	Check input power line fuses. Check for loose power cable connections. Check for input power supply imbalance.
3181	Wiring or earth fault Programmable fault: *31.23 Wiring or earth fault*	Incorrect input power and motor cable connection (ie. input power cable is connected to drive motor connection).	Check input power connections.
3210	DC link overvoltage	Excessive intermediate circuit DC voltage.	Check that overvoltage control is on (parameter *30.30 Overvoltage control*). Check that the supply voltage matches the nominal input voltage of the drive. Check the supply line for static or transient overvoltage. Check brake chopper and resistor (if present). Check deceleration time. Use coast-to-stop function (if applicable). Retrofit drive with brake chopper and brake resistor. Check that the brake resistor is dimensioned properly and the resistance is between acceptable range for the drive.
3220	DC link undervoltage	Intermediate circuit DC voltage is not sufficient because of a missing supply phase, blown fuse or fault in the rectifier bridge.	Check supply cabling, fuses and switchgear.
3381	Output phase loss Programmable fault: *31.19 Motor phase loss*	Motor circuit fault due to missing motor connection (all three phases are not connected).	Connect motor cable.

Code (hex)	Fault / Aux. code	Cause	What to do
4110	Control board temperature	Control board temperature is too high.	Check proper cooling of the drive. Check the auxiliary cooling fan.
4210	IGBT overtemperature	Estimated drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4290	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F (IP21 frames R4...R9) or if it exceeds 50 °C /122 °F (IP21 frames R1...R9), ensure that load current does not exceed derated load capacity of drive. For all P55 frames, check the derating temperatures. See chapter *Technical data*, section *Derating* in the *Hardware manual* of the drive. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
42F1	IGBT temperature	Drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4310	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4380	Excess temperature difference	High temperature difference between the IGBTs of different phases.	Check the motor cabling. Check cooling of drive module(s).
4981	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded fault limit.	Check the value of parameter *35.02 Measured temperature 1*. Check the cooling of the motor (or other equipment whose temperature is being measured).
4982	External temperature 2 (Editable message text)	Measured temperature 2 has exceeded fault limit.	Check the value of parameter *35.03 Measured temperature 2*. Check the cooling of the motor (or other equipment whose temperature is being measured).
5080	Fan	Cooling fan feedback missing.	See *A581 Fan* (page *61*).

Code (hex)	Fault / Aux. code	Cause	What to do
5081	Auxiliary fan broken	An auxiliary cooling fan (connected to the fan connectors on the control unit) is stuck or disconnected.	Check the auxiliary code. Check auxiliary fan(s) and connection(s). Replace fan if faulty. Make sure the front cover of the drive is in place and tightened. If the commissioning of the drive requires th the cover is off, activate parameter *31.36 Aux fan fault bybass* within 2 min from control unit reboot to temporarily suppress the fault. Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power.
	0001	Auxiliary fan 1 broken.	
	0002	Auxiliary fan 2 broken.	
5090	STO hardware failure	STO hardware diagnostics has detected hardware failure.	Contact your local ABB representative for hardware replacement.
5091	Safe torque off Programmable fault: *31.22 STO indication run/stop*	Safe torque off function is active, ie. safety circuit signal(s) connected to connector STO is broken during start or run.	Check safety circuit connections. For more information, see chapter *The Safe torque off function* in the *Hardware manual* of the drive and parameter *31.22 STO indication run/stop*. Check the value of parameter *95.04 Control board supply*.
5092	PU logic error	Power unit memory has cleared.	Contact your local ABB representative.
5093	Rating ID mismatch	The hardware of the drive does not match the information stored in the memory. This may occur eg. after a firmware update.	Cycle the power to the drive. You may have to be repeat this.
5094	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Contact your local ABB representative.
5098	I/O communication loss	Internal standard I/O communication failure.	Try resetting the fault or reboot the drive.
50A0	Fan	Cooling fan stuck or disconnected.	Check fan operation and connection. Replace fan if faulty.
5682	Power unit lost	Connection between the drive control unit and the power unit is lost.	Check the connection between the control unit and the power unit.
5691	Measurement circuit ADC	Measurement circuit fault.	Contact your local ABB representative.
5692	PU board powerfail	Power unit power supply failure.	Contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
5693	Measurement circuit DFF	Measurement circuit fault.	Contact your local ABB representative.
5696	PU state feedback	State feedback from output phases does not match control signals.	Contact your local ABB representative.
5697	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system
5698	Unknown PU fault	The power unit logic has generated a fault which is not known by the software.	Check the logic and software compatibility.
6181	FPGA version incompatible	Firmware and FPGA versions are incompatible.	Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power. If the problem persists, contact your local ABB representative.
6306	FBA A mapping file	Fieldbus adapter A mapping file read error.	Contact your local ABB representative.
6481	Task overload	Internal fault.	Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power. If the problem persists, contact your local ABB representative.
6487	Stack overflow	Internal fault.	Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power. If the problem persists, contact your local ABB representative.
64A1	Internal file load	File read error.	Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power. If the problem persists, contact your local ABB representative
64A4	Rating ID fault	Rating ID load error.	Contact your local ABB representative.
64A6	Adaptive program	Error running the adaptive program.	Check the auxiliary code (format XXYY ZZZZ). “XX” specifies the number of the state (00=base program) and “YY” specifies the number of the function block (0000=generic error). “ZZZZ” indicates the problem.
	000A	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	000C	Required block input missing	Check the inputs of the block.
	000E	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	0011	Program too large.	Remove blocks until the error stops.
	0012	Program is empty.	Correct the program and download it to the drive.

Code (hex)	Fault / Aux. code	Cause	What to do
	001C	A non-existing parameter or block is used in the program.	Edit the program to correct the parameter reference, or to use an existing block.
	001D	Parameter type invalid for selected pin.	Edit the program to correct the parameter reference.
	001E	Output to parameter failed because the parameter was write-protected.	Check the parameter reference in the program. Check for other sources affecting the target parameter.
	0023	Program file incompatible with current firmware version.	Adapt the program to current block library and firmware version.
	0024		
	Other	–	Contact your local ABB representative, quoting the auxiliary code.
64B1	Internal SSW fault	Internal fault.	Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power. If the problem persists, contact your local ABB representative.
64B2	User set fault	Loading of user parameter set failed because • requested set does not exist • set is not compatible with control program • drive was switched off during loading.	Ensure that a valid user parameter set exists. Reload if uncertain.
64E1	Kernel overload	Operating system error.	Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power. If the problem persists, contact your local ABB representative.
64B1	Fault reset	A fault has been reset. The cause of the fault no longer exists and the fault reset has been requested and completed.	Informative fault.
6581	Parameter system	Parameter load or save failed.	Try forcing a save using parameter *96.07 Parameter save manually*. Retry.
6591	Backup/Restore timeout	During backup creating or restoring operation a panel or PC-tool has failed to communicate with the drive as part this operation.	Check panel or PC-tool communication and if it is still in backup or restore state.

Code (hex)	Fault / Aux. code	Cause	What to do
65A1	FBA A parameter conflict	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups *50 Fieldbus adapter (FBA)* and *51 FBA A settings*.
6681	EFB comm loss Programmable fault: *58.14 Communication loss action*	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
6682	EFB config file	Embedded fieldbus (EFB) configuration file could not be read.	Contact your local ABB representative.
6683	EFB invalid parameterization	Embedded fieldbus (EFB) parameter settings inconsistent or not compatible with selected protocol.	Check the settings in parameter group *58 Embedded fieldbus*.
6684	EFB load fault	Embedded fieldbus (EFB) protocol firmware could not be loaded.	Contact your local ABB representative.
		Version mismatch between EFB protocol firmware and drive firmware.	
6685	EFB fault 2	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6686	EFB fault 3	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6882	Text 32-bit table overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.
6885	Text file overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.
7081	Control panel loss Programmable fault: *49.05 Communication loss action*	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Disconnect and reconnect the control panel.
7085	Incompatible option module	Fieldbus option module not supported.	Replace the module with a supported type.
7100	Excitation current	Excitation current feedback low or missing	
7121	Motor stall Programmable fault: *31.24 Stall function*	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.

Code (hex)	Fault / Aux. code	Cause	What to do
7181	Brake resistor	Brake resistor broken or not connected.	Check that a brake resistor has been connected. Check the condition of the brake resistor. Check the dimensioning of the brake resistor.
7183	BR excess temperature	Brake resistor temperature has exceeded fault limit defined by parameter *43.11 Brake resistor fault limit*.	Stop drive. Let resistor cool down. Check resistor overload protection function settings (parameter group *43 Brake chopper*). Check fault limit setting, parameter *43.11 Brake resistor fault limit*. Check that braking cycle meets allowed limits.
7184	Brake resistor wiring	Brake resistor short circuit or brake chopper control fault.	Check brake chopper and brake resistor connection. Ensure brake resistor is not damaged.
7191	BC short circuit	Short circuit in brake chopper IGBT.	Ensure brake resistor is connected and not damaged. Check the electrical specifications of the brake resistor against chapter *Resistor braking* in the *Hardware manual* of the drive. Replace brake chopper (if replaceable).
7192	BC IGBT excess temperature	Brake chopper IGBT temperature has exceeded internal fault limit.	Let chopper cool down. Check for excessive ambient temperature. Check for cooling fan failure. Check for obstructions in the air flow. Check resistor overload protection function settings (parameter group *43 Brake chopper*). Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.
7310	Overspeed	Motor is turning faster than highest allowed speed due to incorrectly set minimum/maximum speed, insufficient braking torque or changes in load when using torque reference.	Check minimum/maximum speed settings, parameters *30.11 Minimum speed* and *30.12 Maximum speed*. Check adequacy of motor braking torque. Check applicability of torque control. Check need for brake chopper and resistor(s).
73F0	Overfrequency	Maximum allowed output frequency exceeded.	Contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
73B0	Emergency ramp failed	Emergency stop did not finish within expected time.	Check the settings of parameters *31.32 Emergency ramp supervision* and *31.33 Emergency ramp supervision delay*. Check the predefined ramp times (*23.11…23.15* for mode Off1, *23.23* for mode Off3).
7510	FBA A communication Programmable fault: *50.02 FBA A comm loss func*	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups *50 Fieldbus adapter (FBA)*, *51 FBA A settings*, *52 FBA A data in* and *53 FBA A data out*. Check cable connections. Check if communication master is able to communicate.
7580	INU-LSU comm loss Programmable fault: *60.79 INU-LSU comm loss function*	DDCS communication between the inverter unit and the supply unit is lost.	Check status of the supply unit (parameter group *06 Control and status words*). Check settings of parameter group *60 DDCS communication*. Check the corresponding settings in the control program of the supply unit. Check cable connections. If necessary, replace cables.
7583	Line side unit faulted	The supply unit connected to the inverter unit has generated a fault.	The auxiliary code specifies the original fault code in the supply unit control program. See chapter *Fault tracing* in the *ACH580 HVAC control program firmware manual*, publication number *3AXD50000027537*.
7584	LSU charge failed	The supply unit was not ready (ie. the main contactor/breaker could not be closed) within expected time.	Check settings of parameter *94.10 LSU max charging time*. Check that parameter *60.71 INU-LSU communication port* is set to *DDCS via BC*. Check that the supply unit is enabled, allowed to start, and can be controlled by the inverter unit (eg. not in local control mode).
8001	ULC underload fault	User load curve: Signal has been too long under the underload curve.	See parameter *37.04 ULC underload actions*.
8002	ULC overload fault	User load curve: Signal has been too long over the overload curve.	See parameter *37.03 ULC overload actions*.

Code (hex)	Fault / Aux. code	Cause	What to do
80A0	AI supervision Programmable fault: *12.03 AI supervision function*	An analog signal is outside the limits specified for the analog input.	Check signal level at the analog input. Check the auxiliary code. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group *12 Standard AI*.
	0001	AI1LessMIN	
	0002	AI1GreaterMAX	
	0003	AI2LessMIN.	
	0004	AI2GreaterMAX	
80B0	Signal supervision 1 (Editable message text) Programmable fault: *32.06 Supervision 1 action*	Fault generated by the signal supervision function 1.	Check the source of the fault (parameter *32.07 Supervision 1 signal*).
80B1	Signal supervision 2 (Editable message text) Programmable fault: *32.16 Supervision 2 action*	Fault generated by the signal supervision function 2.	Check the source of the fault (parameter *32.17 Supervision 2 signal*).
80B2	Signal supervision 3 (Editable message text) Programmable fault: *32.26 Supervision 3 action*	Fault generated by the signal supervision function 3.	Check the source of the fault (parameter *32.27 Supervision 3 signal*).
80B3	Signal supervision 4 (Editable message text) Programmable fault: *32.36 Supervision 4 action*	Fault generated by the signal supervision function 4.	Check the source of the fault (parameter *32.37 Supervision 4 signal*).
80B4	Signal supervision 5 (Editable message text) Programmable fault: *32.46 Supervision 5 action*	Fault generated by the signal supervision function 5.	Check the source of the fault (parameter *32.47 Supervision 5 signal*).
80B5	Signal supervision 6 (Editable message text) Programmable fault: *32.56 Supervision 6 action*	Fault generated by the signal supervision function 6.	Check the source of the fault (parameter *32.57 Supervision 6 signal*).
9081	External fault 1 (Editable message text) Programmable fault: *31.01 External event 1 source* *31.02 External event 1 type*	Fault in external device 1.	Check the external device. Check setting of parameter *31.01 External event 1 source*.
9082	External fault 2 (Editable message text) Programmable fault: *31.03 External event 2 source* *31.04 External event 2 type*	Fault in external device 2.	Check the external device. Check setting of parameter *31.03 External event 2 source*.

Code (hex)	Fault / Aux. code	Cause	What to do
9083	External fault 3 (Editable message text) Programmable fault: *31.05 External event 3 source* *31.06 External event 3 type*	Fault in external device 3.	Check the external device. Check setting of parameter *31.05 External event 3 source*.
9084	External fault 4 (Editable message text) Programmable fault: *31.07 External event 4 source* *31.08 External event 4 type*	Fault in external device 4.	Check the external device. Check setting of parameter *31.07 External event 4 source*.
9085	External fault 5 (Editable message text) Programmable fault: *31.09 External event 5 source* *31.10 External event 5 type*	Fault in external device 5.	Check the external device. Check setting of parameter *31.09 External event 5 source*.
FA81	Safe torque off 1	Safe torque off function is active, ie. STO circuit 1 is broken.	Check safety circuit connections. For more information, see chapter *The Safe torque off function* in the *Hardware manual* of the drive and parameter *31.22 STO indication run/stop*. Check the value of parameter *95.04 Control board supply*.
FA82	Safe torque off 2	Safe torque off function is active, ie. STO circuit 2 is broken.	
FF61	ID run	Motor ID run was not completed successfully.	Check the nominal motor values in parameter group *99 Motor data*. Check that no external control system is connected to the drive. Cycle the power to the drive (and its control unit, if powered separately). Check that no operation limits prevent the completion of the ID run. Restore parameters to default settings and try again. Check that the motor shaft is not locked. Check the auxiliary code. The second number of the code indicates the problem (see actions for each code below).
	0001	Maximum current limit too low.	Check settings of parameters *99.06 Motor nominal current* and *30.17 Maximum current*. Make sure that *30.17 > 99.06*. Check that the drive is dimensioned correctly according to the motor.

Code (hex)	Fault / Aux. code	Cause	What to do
	0002	Maximum speed limit or calculated field weakening point too low.	Check settings of parameters *30.11 Minimum speed* *30.12 Maximum speed* *99.07 Motor nominal voltage* *99.08 Motor nominal frequency* *99.09 Motor nominal speed*. Make sure that *30.12* > (0.55 × *99.09*) > (0.50 × synchronous speed) *30.11* ≤ 0, and supply voltage ≥ (0.66 × *99.07*).
	0003	Maximum torque limit too low.	Check settings of parameter *99.12 Motor nominal torque*, and the torque limits in group *30 Limits*. Make sure that the maximum torque limit in force is greater than 100%.
	0004	Current measurement calibration did not finish within reasonable time	Contact your local ABB representative.
	0005…0008	Internal error.	Contact your local ABB representative.
	0009	(Asynchronous motors only) Acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000A	(Asynchronous motors only) Deceleration did not finish within reasonable time.	Contact your local ABB representative.
	000B	(Asynchronous motors only) Speed dropped to zero during ID run.	Contact your local ABB representative.
	000C	(Permanent magnet motors only) First acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000D	(Permanent magnet motors only) Second acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000E…0010	Internal error.	Contact your local ABB representative.
	0011	(Synchronous reluctance motors only) Pulse test error.	Contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
	0012	Motor too large for advanced standstill ID run.	Check that the motor and drive sizes are compatible. Contact your local ABB representative.
	0013	(Asynchronous motors only) Motor data error.	Check that the motor nominal value settings in the drive are the same as in the motor nameplate. Contact your local ABB representative.
FF63	STO diagnostics failure.	SW internal malfunction.	Reboot the control unit (using parameter *96.08 Control board boot*) or by cycling power.
FF81	FB A force trip	A fault trip command has been received through fieldbus adapter A.	Check the fault information provided by the PLC.
FF8E	EFB force trip	A fault trip command has been received through the embedded fieldbus interface.	Check the fault information provided by the PLC.

Maintenance

WARNING! Read *Safety instructions* on page *2* before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death.

Maintenance schedule

Recommended maintenance intervals and component replacements are based on specified operational and environmental conditions. ABB recommends annual drive inspections to ensure the highest reliability and optimum performance.

Note: Long term operation near the maximum specified ratings or environmental conditions may require shorter maintenance intervals for certain components. Consult your local ABB Service for maintenance recommendations at: *www.abb.com/searchchannels*

Description of symbols

Action	Description
I	**Inspection** (visual inspection and maintenance action if needed)
P	**Performance** of on/off-site work (commissioning, tests, measurements or other work)
R	**Replacement**

Recommended annual actions by the user

Action	Description
P	Quality of supply voltage
I	Spare parts
P	Capacitor reforming for spare drives and spare capacitors (page *90*)
I	Tightness of terminals
I	Dustiness, corrosion or temperature
P	Heat sink cleaning (page *84*)

Recommended maintenance actions by the user

Component Replacement	Years from start-up							Instruction
	3	6	9	12	15	18	21	
Cooling								
Fans, IP21 (UL (NEMA) Type 1) frames R1 to R9								
Main cooling fans R1...R5		**R**		**R**				R1…R4: page *85*, R5…R8: page *85*, R9: page *86*
Main cooling fans R6...R9			**R**			**R**		
Auxiliary cooling fan for circuit boards			**R**			**R**		R5…R9: page *86*
Fans, IP55 (UL (NEMA) Type 12) frames R1 to R9								
Main cooling fans R1...R5		**R**		**R**		**R**		R1…R4: page *85*, R5…R8: page *85*, R9: page *86*
Main cooling fans R6...R9			**R**			**R**		
Auxiliary cooling fan for circuit boards R1...R2		**R**		**R**		**R**		R1…R2: page *87*, R3: page *88*, R4: page *89*, R5…R9: page *86*
Auxiliary cooling fan for circuit boards R3...R9			**R**			**R**		
Second auxiliary cooling fan			**R**			**R**		R8 and R9: page *89*
Aging								
Control panel battery			**R**			**R**		page *90*

Heatsink

The heatsink fins accumulate dust from the cooling air. Since a dusty heatsink is less efficient at cooling the drive, overtemperature faults become more likely. In a “normal” environment (not dusty, not clean) check the heatsink annually, in a dusty environment check more often.

Clean the heatsink as follows (when necessary):

1. Remove power from drive. Wait 5 minutes and measure to confirm.
2. Remove the cooling fan(s) (see section *Main cooling fan replacement* below).
3. Blow clean, dry, oil-free condensed air (not humid) from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust.

Note: If there is a risk of the dust entering adjoining equipment, perform the cleaning in another room.

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4. Replace the cooling fan(s).
5. Restore power.

Main cooling fan replacement

Main cooling fans are speed-controlled, and the speed of the fan matches the cooling needs. When the drive is stopped, the main fan is kept running at a low speed to cool the control board. Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Frame Size R1...R3

To replace the fan:

WARNING! Obey the *Safety instructions* on page 2. Ignoring the instructions can cause physical injury or death, or damage to the equipment.

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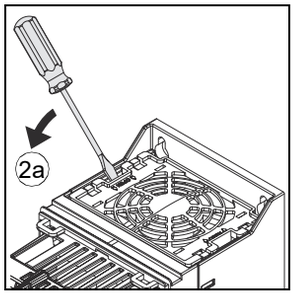
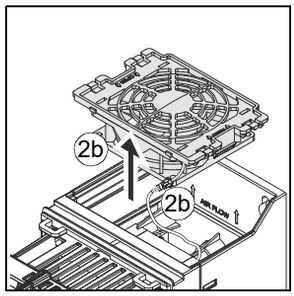
1. Stop the drive and disconnect it from the power line. Wait for 5 minutes and then make sure by measuring that there is no voltage. See section *Precautions before electrical work* on page 3 before you start the work.
2. Pry the fan assembly off the drive frame with a screwdriver (2a) and pull out of the fan assembly (2b) until you can unplug the fan power supply wires from the fan assembly (2c).
3. Install the fan assembly in reverse order.

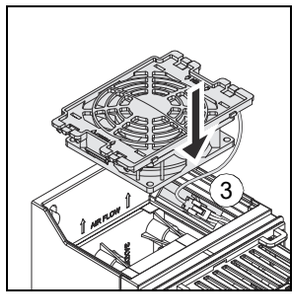
   R1…R2: Put the connector and extra length of wires in the groove so that the wires do not get caught in the revolving fan.

   R3: Put the extra length of wires under the fan assembly so that the wires do not get caught in the revolving fan.
4. Restore power.

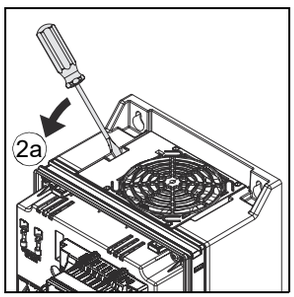
R1...R2

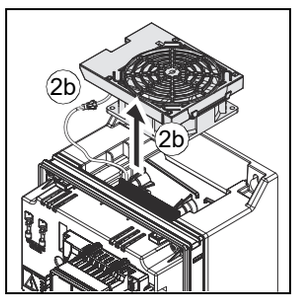


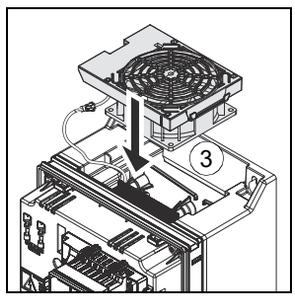




R3

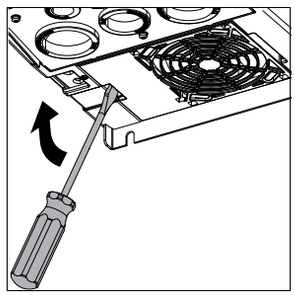






Frame Size R4

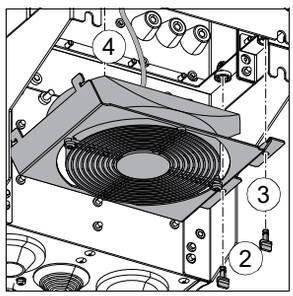
To replace the fan:



1. Remove power from drive.
2. Pry the fan assembly off the drive frame with a screwdriver and pull it out.
3. Disconnect the fan cable.
4. Install the fan in reverse order.
5. Restore power.

Frame Sizes R5…R8

To replace the fan:

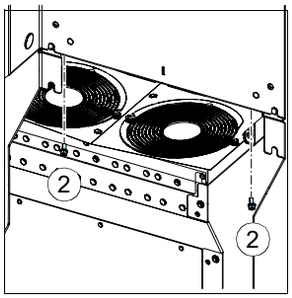


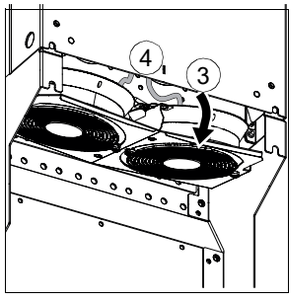
1. Remove power from drive.
2. Remove the 2 screws attaching the fan mounting plate at the bottom of the drive.
3. Pull the mounting plate down from the side edge.
4. Disconnect the fan cable.
5. Lift the mounting plate off.
6. Remove the fan from the mounting plate.
7. Install the fan in reverse order.
8. Restore power.

Frame Size R9

To replace the fans:

1. Remove power from drive.
2. Remove the 2 screws attaching the fan mounting plate.
3. Turn the mounting plate downwards.
4. Disconnect the fan cables
5. Remove the mounting plate.
6. Remove the fans by removing the 2 mounting screws.
7. Install the fan in reverse order.
8. Restore power.





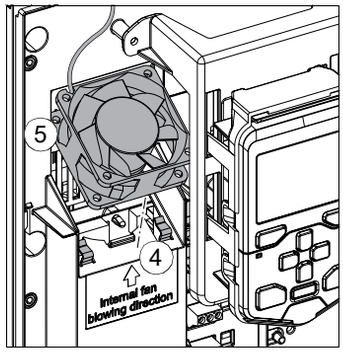
Auxiliary cooling fan replacement

Auxiliary cooling fans are not speed-controlled and run all the time that the control board is powered. Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

IP21/UL (NEMA) Type 1 and IP55/UL (NEMA) Type 12 Frame Sizes R5…R9

To replace the fan:

1. Remove power from drive.
2. Remove the front cover.
3. Disconnect the fan cable.
4. Release the retaining clips.
5. Lift the fan off.
6. Install the fan in reverse order.



Note: Make sure that the arrow on the fan points up.

7. Restore power.

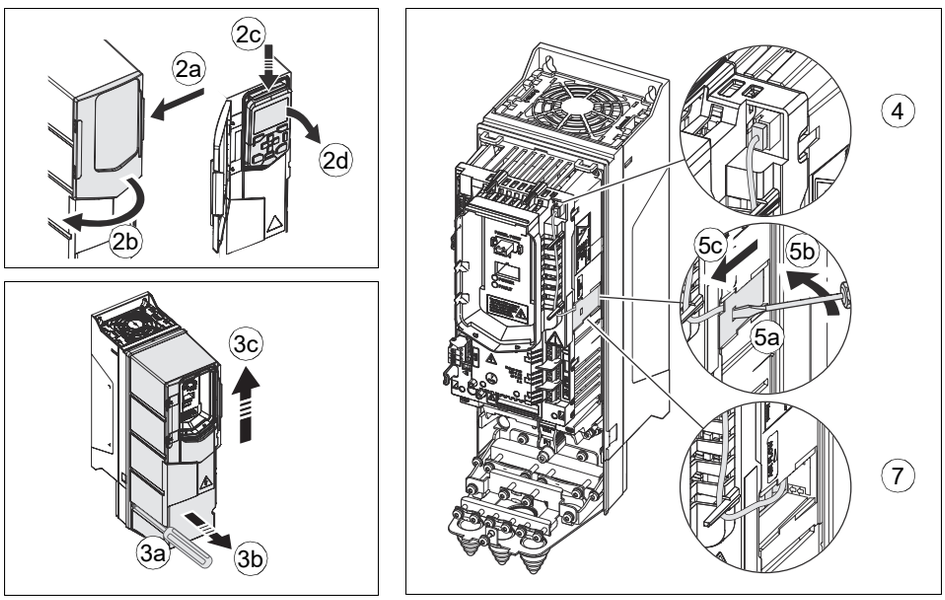
IP55/UL (NEMA) Type 12 Frame Sizes R1…R2

To replace the fan:

WARNING! Obey the *Safety instructions* on page 2. Ignoring the instructions can cause physical injury or death, or damage to the equipment.

1. Stop the drive and disconnect it from the power line. Wait for 5 minutes and then make sure by measuring that there is no voltage. See section *Precautions before electrical work* on page 3 before you start the work.
2. Remove the control panel: Press the retaining clip of the IP55 panel cover (2a) and open the cover (2b). Press the retaining clip of the control panel at the top (2c) and pull it forward from the top edge (2d).
3. Remove the front cover: Loosen the retaining screws with a screwdriver (3a) and lift the cover from the bottom outwards (3b) and then up (3c).
4. Unplug the fan power supply wires from the drive.
5. Remove the fingerguard: Insert a screwdriver into the hole of the fingerguard (5a), bend the front edge of the fingerguard a little away from the drive frame with the screwdriver (5b) and pull the fingerguard out of the groove (5c).
6. Pull off the fan.
7. Install the new fan assembly in reverse order. Route the wires round the pins.

Note: Make sure that the arrow on the fan points to the same direction as the arrow on the drive frame.



8. Restore power.

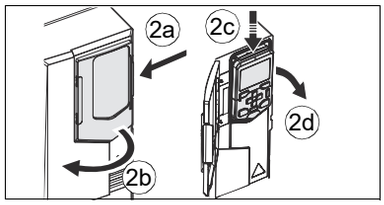
IP55/UL (NEMA) Type 12 Frame Size R3

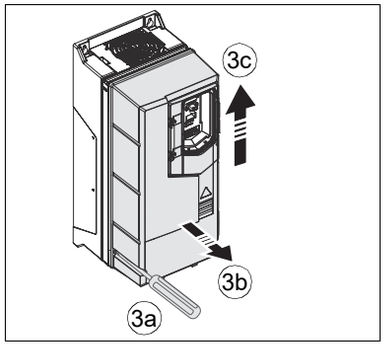
To replace the fan:

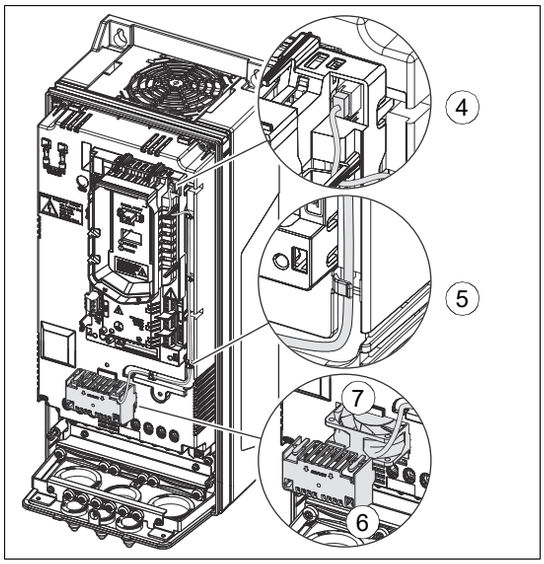
WARNING! Obey the *Safety instructions* on page *2*. Ignoring the instructions can cause physical injury or death, or damage to the equipment.

1. Stop the drive and disconnect it from the power line. Wait for 5 minutes and then make sure by measuring that there is no voltage. See section *Precautions before electrical work* on page *3* before you start the work.
2. Remove the control panel: Press the retaining clip of the IP55 panel cover (2a) and open the cover (2b). Press the retaining clip of the control panel at the top (2c) and pull it forward from the top edge (2d).
3. Remove the front cover: Loosen the retaining screws with a screwdriver (3a) and lift the cover from the bottom outwards (3b) and then up (3c).
4. Unplug the fan power supply wires from the drive.
5. Detach the fan cable from the holders.
6. Pull off the plastic housing.
7. Pull off the fan.
8. Install the new fan and housing in reverse order.

Note: Make sure that the arrow on the fan points to the same direction as the arrow on the plastic housing (down).





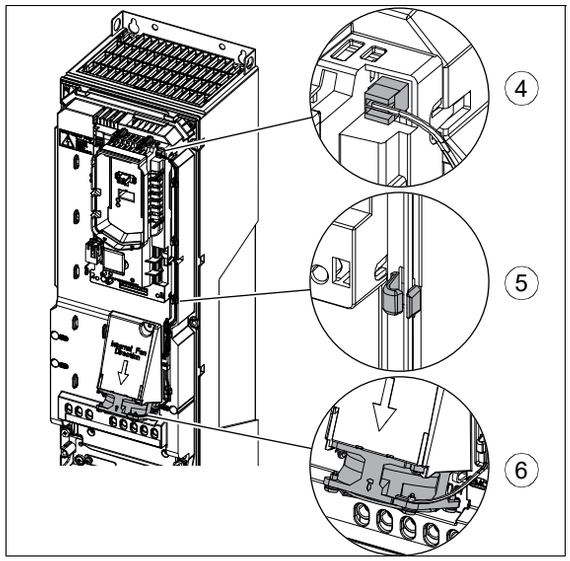


9. Restore power.

IP55/UL (NEMA) Type 12 Frame Size R4

To replace the fan:

1. Remove power from drive.
2. Remove the control panel: Press the retaining clip at the top and pull it forward.
3. Remove the front cover: Loosen the retaining screws at the bottom left and pull the cover outwards from the bottom and then up.
4. Unplug the fan cable from the drive.
5. Detach the fan cable from the clips.
6. Pull off the fan.
7. Install the fan in reverse order.



Note: Make sure that the arrow on the fan points up.

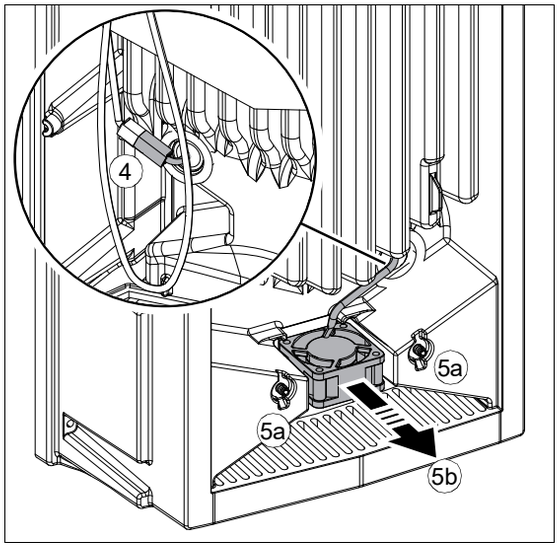
8. Restore power.

Second auxiliary cooling fan replacement

IP55/UL (NEMA) Type 12 Frame Sizes R8…R9

To replace the fan:

1. Remove power from drive.
2. Remove the front cover: Loosen the 14 retaining screws and pull the cover outwards from the bottom and then up.
3. Remove the lower cover panel from the cover.
4. Unplug the fan cable from the connector on the other side.
5. Remove the retaining screws (5a) and pull off the fan (5b).
6. Install the fan in reverse order.



Note: Make sure that the arrow on the fan points up.

7. Restore power.

Capacitors

The drive intermediate DC circuit employs several electrolytic capacitors. Their lifespan depends on the operating time of the drive, loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

Capacitor failure is usually followed by damage to the drive and an input cable fuse failure, or a fault trip. Contact the manufacturer if capacitor failure is suspected. Replacements are available from the manufacturer. Do not use other than specified spare parts.

Reforming the capacitors

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for a year or more. See label on page 7 for how to find out the manufacturing date from the serial number.

For information on reforming the capacitors, see *Converter module capacitor reforming instructions (3BFE64059629 [English])*, available on the Internet (go to http://www.abb.com and enter the document code in the Search field).

Control panel

Cleaning

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Battery

A battery is used in all control panels to keep the clock operating in memory during power interruptions.

The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

Note: The battery is NOT required for any control panel or drive function, except the real-time clock.

INSTALLATION, OPERATION & MAINTENANCE

EQUIPMENT: Nortek - Temtrol Air Handling Units

TAGS: RTU-1, RTU-2 and AH-6

PROJECT: UCA Snow Fine Arts

LOCATION: Conway, AR

ENGINEER:

CONTRACTOR:

DATE: 7/17/2024

SUBMITTED BY: Forrest Moseley
forrest@airetechcorp.com

NORTEK™
AIR SOLUTIONS

ITF (Indoor/Outdoor)

Air Handling Units

Installation, Operation, and Maintenance Guide

GENERAL DESCRIPTION

The Nortek Air Solutions ITF Series is designed for either indoor or outdoor installation. The unit may come equipped with a heating section which can be electrical resistance, hot water coil, glycol coil, or steam coil.

Units equipped with direct fired burners (optional) used for make-up air applications only. For units equipped with a Heatco DF Module, the burns are compliant with ANSI Standard Z83.4. Refer to the unit drawings in the submittal for the specific unit configuration for this installation.

The unit may be provided with various cooling options to meet a particular building's requirements. Among them are evaporative, chilled water, and direct expansion. The unit will also be supplied with either throwaway filters or washable filters and may include a variety of damper options.

Refer to the drawings in the submittal for the specific unit configuration for this installation.

Safety Considerations

Installing and servicing air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install or service air conditioning equipment.

Untrained personnel can perform basic maintenance, such as cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on air conditioning equipment, observe precautions in literature and on tags and labels attached to unit.

Follow all safety codes. Wear safety glasses and work gloves.

WARNING

Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch.

If your unit has permanent magnet motors, high voltage can be generated whenever the motor is rotating, even if power is off. **ALWAYS MAKE SURE MOTORS CANNOT ROTATE DURING SERVICING.**

Turn off accessory heater power if applicable. Electrical shock can cause personal injury or death.

CAUTION: Before proceeding, make sure all electrical service to unit is locked in "Off" position.

FOR YOUR SAFETY

If you smell gas:

1. Open windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

Improper installation, adjustment, alteration service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

Direct gas-fired heater modules are not designed for use in hazardous atmospheres containing, flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne substances containing silicone.

SAFETY

Only trained and qualified service personnel should install or service burner equipment. Factors which can influence the safe operation of the burner are interlocked into the flame safeguard relay and the AHU heater enable command. This will prevent burner start up and cause a shut down if an unsafe condition has been met. If a failure or malfunction of this heater creates a hazard to other fuel burning equipment in the building, the unit is interlocked to open inlet air dampers or other such devices.

The following criteria must be met for safe operation of the burner:

1. The heater inlet shall be located in accordance with the applicable building code provisions for ventilation air.
2. Field constructed intake accessories should be properly designed to minimize the entry of snow and rain.
3. All air to the heater must be ducted directly from the outdoors. Recirculation of room air is only permitted at least 40” downstream of the burner.
4. Bleeds and vents that require venting shall be vented to the out-of-doors.
5. If in doubt regarding the application, consult Nortek Air Solutions service team.

MODEL IDENTIFICATION CODE

ITF - R DH RE 100

- **ITF** — Integrated Frame Construction
- **R** — (blank) = Indoor Unit; R = Rooftop/Outdoor Unit
- **DH** — **Unit Style**
  - BD = Blow Through Double Deck
  - BH = Blow Through Horizontal
  - BV = Blow Through Vertical
  - BZ = Blow Through Multi-Zone
  - CF = Cabinet Fan
  - CS = Coil Section
  - DH = Draw Through Horizontal
  - DV = Draw Through Vertical
- **RE** — **Return Fan**
  - (blank) = No Return Fan or Economizer
  - E = Economizer Only
  - RE = Return Fan & Economizer
- **100** — Square footage of the coil.

STORAGE

INSTRUCTIONS FOR LONG-TERM AND SHORT-TERM STORAGE

Instructions on the temporary outdoor storage of Nortek air handling units (AHUs) in excess of 10 days for up to 30 days. For any unit stored in excess of 30 days, please refer to the component maintenance recommendations in the maintenance section.

All units will be shipped with shrink wrap to protect the units from weather, road dirt, etc. during transit from the factory to the first destination. When received:

Visible damage should be noted on the signed and dated bill of lading with a request that the carrier inspect the damage within 72 hours of notification.

Shrink wrap is to be kept in place to maintain a protective covering for both indoor units and outdoor units. The entire unit must be protected from the elements to ensure no impact to unit casing or warranty.

AHUs must be placed on a level surface. When conducting proper inspections, a temporary cut to the shrink wrap must be made. After inspection, the temporary cut must be resealed to ensure no humidity gets trapped within the unit. The openings on the units must be fully covered. For modular units, the customer is responsible to ensure the shrink wrap's integrity has not been compromised. In the event of damage, cuts or tears to the shrink wrap, it is the responsibility of the customer to ensure it is sealed or tarped to protect the equipment from the elements. Any concealed damage reported after 15 days will compromise a claim settlement. Inspection requests may be done by telephone or in person but should be confirmed in writing.

Verify that all shipped loose items are present. Note any missing items. Within 5 business days or it will be agreed all parts where received.

During storage, care must be taken to protect the AHUs from dust, rain, rodents, construction vehicles and most importantly; condensation.

The stored AHUs must not be used to house other equipment onsite.

Drains must be opened to prevent standing water inside the unit. The drain openings must be covered with a type of screen or guard that prevents entry of rodents, animals and insects.

Store the units on a firm, flat surface to prevent distortion. Block the units off the ground to protect components from water or ground moisture.

The following actions are required during storage to prevent damage to the units:

- Every week (depending upon amount of moisture present)
- Open access doors to all AHU sections to allow for air and moisture out of the unit.
- If moisture is present, wipe internal surfaces and replace desiccant bags in each section.
- Open electrical panels to allow for air and moisture out of the panel.
- Check drain openings for secure fit of screen(s)/ guard(s) preventing animal intrusion.
- If possible, Nortek recommends that if units are to be stored, they should be stored in a climate-controlled environment.
- Every Month additional checks and maintenance is required dependent on product line.

QUESTIONS?

Please call the following number with questions:

Service Line North America (844) 899-6611

INSTALLATION CODES / PRECAUTIONS

INSTALLATION CODES

All unit installation shall conform to all applicable local codes and ordinances, or in the absence of local codes must be in accordance with the National Fuel Gas Code ANSI Z223.1 (NFPA 54) in the US and Can/CGA-B149.1 Natural Gas and Propane Installation Code in Canada. For air handlers to be installed in an airplane hangar, refer to ANSI/NFPA 409. For air handlers to be installed in a service garage, refer to ANSI/NFPA 88B. For air handlers to be installed in parking structures, refer to ANSE/NFPA 88A. All air handler installations above altitudes of 2,000 ft. shall conform to all applicable local codes and ordinances, or in the absence of local codes must be in accordance with CGA 2.17 Gas-Fired Appliances for Use at High Altitudes. Refer to the submittal for the air handler's design altitude.

An electrical disconnect switch having adequate ampacity (See air handler marking for voltage and ampacity), if not provided as part of the unit, shall be installed in accordance with Article 430 of the National Electric Code, ANSI/NFPA 70. All electrical equipment must be grounded and wired be in accordance with NFPA 70 in the US and the Canadian Electric Code (CSA C22.1) in Canada. For any field installed wiring and control wiring, see electrical drawings provided with the air handler.

If the low-temperature control system is not an integral part of the heater, it is recommended that a low-temperature limit control be installed in areas where freeze-up protection is needed in the event of a burner shutdown.

If any original wire as supplied with the appliance must be replaced, it must be replaced with wiring material have a temperature rating of at least 90°C (194°F).

Electrical characteristics are shown on the unit rating plate.

The unit shall be carefully installed in accordance with the standards of the National Fire Protection Association (National Electrical Code).

Authorities having jurisdiction should be consulted before installations are made to verify local codes and installation procedures.

INSTALLATION PRECAUTIONS

1. The services of qualified field service personnel are mandatory for safe and proper installation of this equipment.
2. Air volumes and external static pressures that do not coincide with those listed on the rating plate will adversely affect the performance of the unit. Please consult the factory if either of these values change.
3. The following clearances from combustible materials are to be maintained: Top - 6", control side - 48", opposite controls - 6", bottom - 0". If roof curb is provided by others, it must be at least 4" high and constructed from non-combustible material.
4. This unit is designed for installation on a level surface.
5. Do not locate the supply inlet opening within 10' of any exhaust discharge point or within 24" of any obstruction.

ATTENTION INSTALLERS

WARNING: Equipment must be mounted on a flat level surface wether it be a pad, rail, or curb. All must be level before equipment can be mounted.

!WARNING

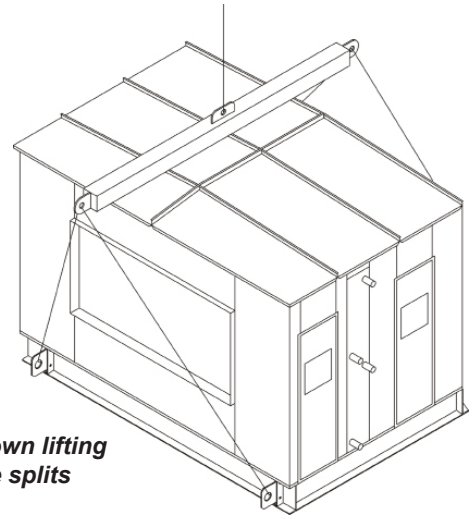
Nortek Air Solutions does not recommend field installation of ultraviolet lights in its air handling equipment for the intended purpose of improving indoor air quality. High intensity C-band ultraviolet light is known to severely damage polymer (plastic) materials and poses a personal safety risk to anyone exposed to the light without proper personal protective equipment (can cause damage to eyes and skin). Polymer materials commonly found in HVAC equipment that may be susceptible include insulation on electrical wiring, fan belts, thermal insulation, various fasteners and bushings. Degradation of these materials can result in serious damage to the equipment.

Nortek Air Solutions accepts no responsibility for the performance or operation of our air handling equipment in which ultraviolet devices were installed outside of the Ventrol factory.

Receiving

Under no circumstances should the trucks moving the units on low loader or flat beds be strapped over the roof of the equipment, as this will cause damage to the roof and sides. The lifting points of each unit are the place to attach securing devices only.

WARNING: If a fork lift is used to lift the unit then fork extensions are required to ensure that the bars reach all the way through to avoid damaging equipment underneath when forks are tilted up, and the forklift tower does not contact the equipment causing damage to the sides or tubing extended from the sides of the unit.



Unit shown lifting from the splits

Uncrating

The unit may be shipped in sections. The quantity of sections will depend upon the configuration of the unit. Upon receipt of the unit, verify that the electrical ratings on the unit nameplates agree with the electrical sources available.

Remove the crate(s) from the unit taking care to keep track of control accessories and installation hardware. Check the entire unit for any damage that may have occurred during transit. If damage is found, immediately file a claim with the transport company. All units are inspected at the factory and fully operation tested prior to shipment.

WARNING: Use all lifting points provided. Spreader bars are mandatory to prevent contact and damage to the unit by lifting hooks, straps, cables or chains. Tension on each lifting line must be adjusted before lifting unit for proper load distribution. Consult the mechanical or structural engineer before moving the unit across the roof deck.

WARNING: Openings in the roof hazard, shipping bag must be removed before standing on roof to locate the openings to prevent falling.

Rigging the Equipment

Safety must be primary consideration when preparing for lifting of equipment. All safety precautions based on standard lifting procedures must be followed. Decide which section of the equipment that would be most advantageous to set first unless otherwise noted by the factory. You may need to consult the rigger in this decision. Items to be considered would be the reach of the pick, configuration of the building and obstructions on the roof. It is important that an experienced and reliable rigger be selected to handle unloading and final placement of the equipment. Weight of the unit or of its individual sections is the key consideration. Weight and size of each section is noted on manufacturer supplied submittal drawings. This will determine the size of the crane needed to execute the lift. The rigger should have spreader bars capable of spanning both the width and length of the equipment. The rigging should employ some method that allows self-leveling of the load. All cables, straps, chains, etc. shall be certified and confirmed to safely lift each section. An imbalance or unleveled lift will damage piping and components installed in the equipment and will not allow proper alignment of the sections as they are lowered into position.

Nortek Air Solutions takes no responsibility for the design of the rigging and spreading apparatus. It is critical that the proper spreader bars and hosting straps be used when rigging the unit. Your rigger must be advised that the unit contains delicate components and that it is to be handled in an upright position. Care must be exercised to avoid twisting the structure. The unit must be rigged to assure a level lift. This will insure each piece will fit together with the least amount of effort.

Rigging a Single Piece Unit

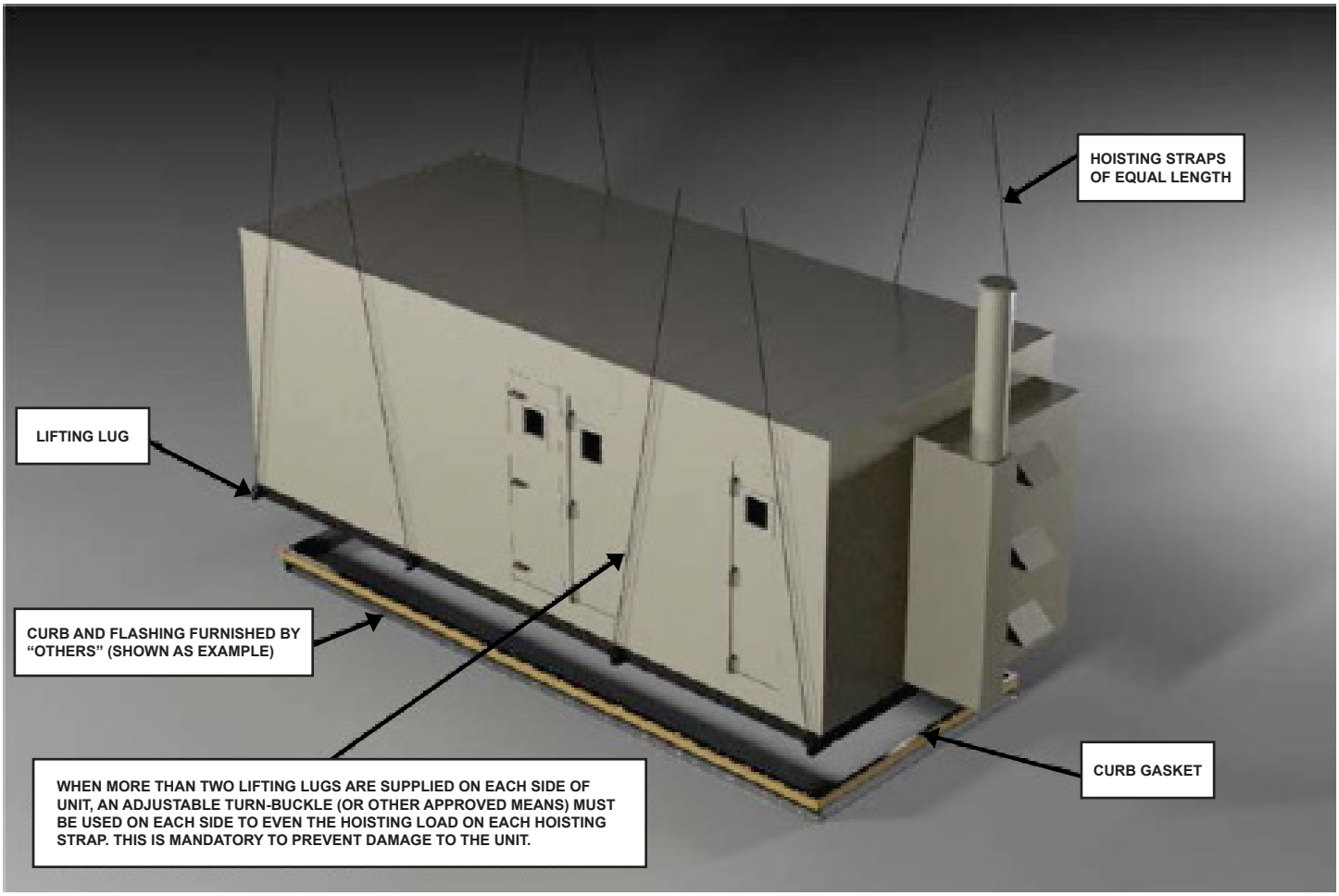
Note: Use all of the lifting points provided on the equipment.

Nortek Air Solutions will not be responsible for damages incurred from not using all of the lifting points.

If the equipment is to set on a curb, install the curb gasket to the curb only. DO NOT apply curb gasket to the units base frame.

Note: All lifting lugs supplied must be used for each lift!

Remove bag surrounding unit section before connecting to any lifting lugs. Also remove all of the sheet metal covers marked “Remove—For Shipping Purpose only” that may interfere with the installation. When the unit is lifted, check the bottom for truck supports. These supports will be 2” x 2” tubing screwed to the bottom of the unit to provide support to units whose width exceeds that of the trailer that it was shipped on. Remove these as the unit is lifted as they may interfere with the installation.

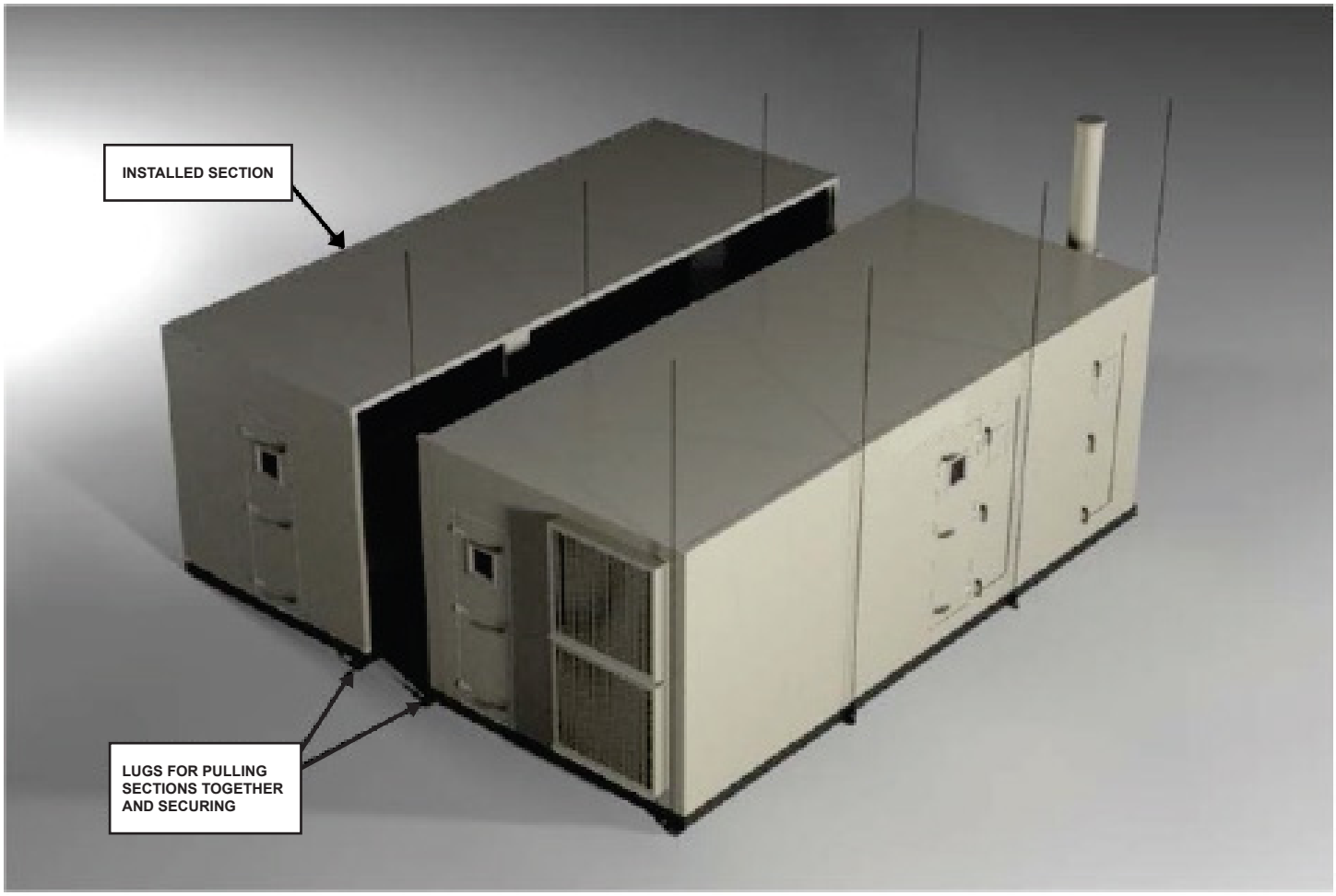


Note: Illustration above is an example only, other configurations and methods may be used by the rigger at their discretion. Spreader bars not shown as that setup is the responsibility of the rigger.

Rigging a Multiple Section Unit

Note: Use all of the lifting points provided on the equipment.

Remove bag surrounding unit section before connecting to any lifting lugs. Also remove all of the sheet metal covers marked “Remove—For Shipping Purpose only” that may interfere with the installation. When the unit is lifted, check the bottom for truck supports. These supports will be 2” x 2” tubing screwed to the bottom of the unit to provide support to units whose width exceeds that of the trailer that it was shipped on. Remove these as the unit is lifted as they may interfere with the installation.

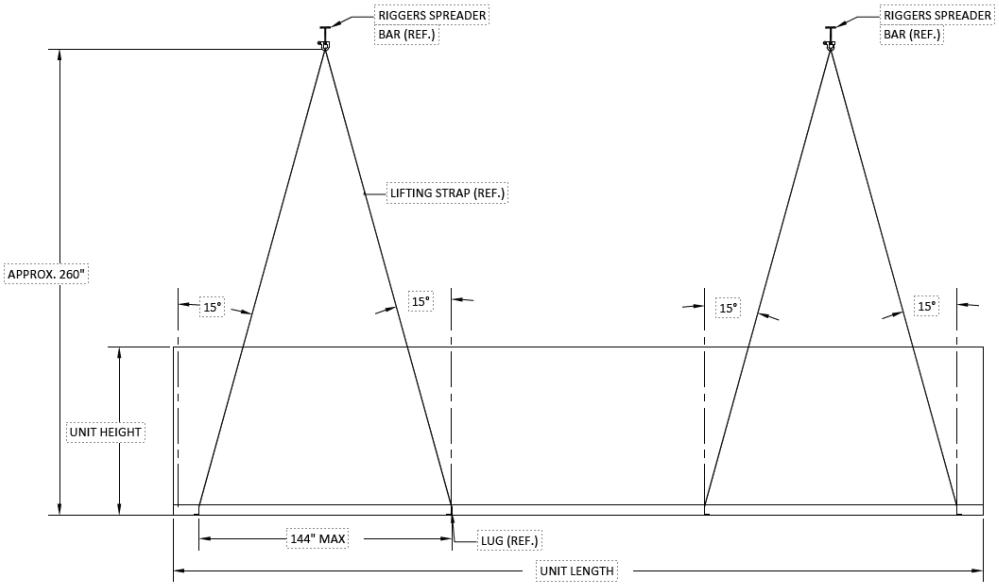


Note: Illustration above is an example only, other configurations and methods may be used by the rigger at their discretion. Spreader bars not shown as that setup is the responsibility of the rigger.

Rigging a Multiple Section Unit

If the equipment is to set on a curb, install the curb gasket to the curb only. Do not apply curb gasket to the unit's base frame. Apply the demount gasket to the equipment along the perimeter of the demount plane. Do not double gasket the sectional abutment. Apply the gasket to the face of only one of the mating sections. Be sure that gasket is applied to the perimeter of the cabinet and also around the separate air passages, which may exist on some units (i.e. units with heat reclaim, exhaust air, heat wheels, multi-zone units, Etc.) Demount gasket is 3/8" x 1" and is also supplied with the equipment (if required). Select the first section to be set and prepare for lifting. Rig into place being careful to place it square and in line of the curb or support base. Once the first section is in place, secure it to the supporting structure. When the second and continuing sections are set, they will be drawn to the previous installed section. That is why it is necessary to secure the first section before proceeding. It is critical that each section is rigged as level as possible.

ANGLE FROM VERTICAL	REDUCTION IN LUG CAPACITY
0°	0%
15°	4%
20°	6%
25°	10%
30°	14%



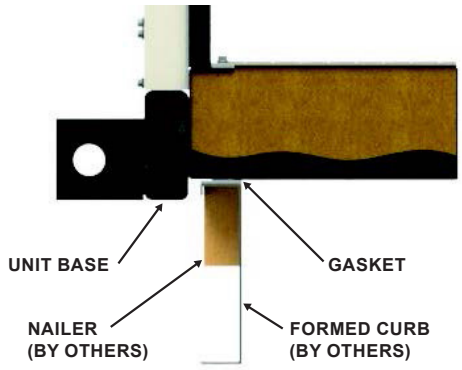
Installation Curb, Structural Steel, Slab

Pre-Lift Considerations

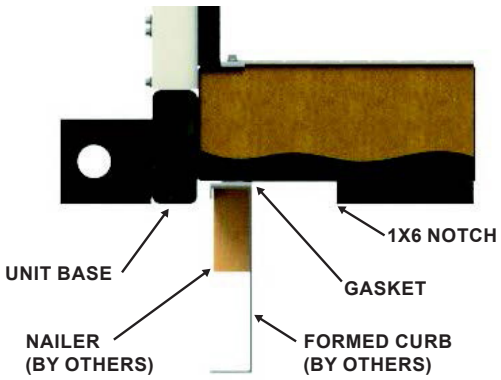
Curbs may be formed metal, structural steel or formed concrete. Illustrations are examples only, there are too many designs to show so actual curbs may vary. Curbs are the responsibility of the job representative or contractor unless otherwise noted. It is important the curb be installed level and square and that it is checked for proper length and width. The structural steel, concrete pad or formed curb to be used should be level and of an even plane. Uneven surfaces at the point of mating sections will cause considerable alignment problems. It would be beneficial to shoot the grade with a transit prior to the lift. This will determine the high or low points of the installation and thus the points to be shimmed as well as the amount of shimming material needed.

The curb is to have a gasket that is mounted between the curb and the unit (if required for sealing). Curb gasket is shipped with the completed unit and is noted on the unit packing list. It is necessary to check the unit packing list for location of the section of the unit in which the curb gasket is located. It is necessary to install the curb gasket before setting the unit on the curb. This is necessary for an air seal between the unit and the curb and also serves as dampening. However, this should not be used as a vibration isolator where the prevention of noise and vibration transmission into the building is critical.

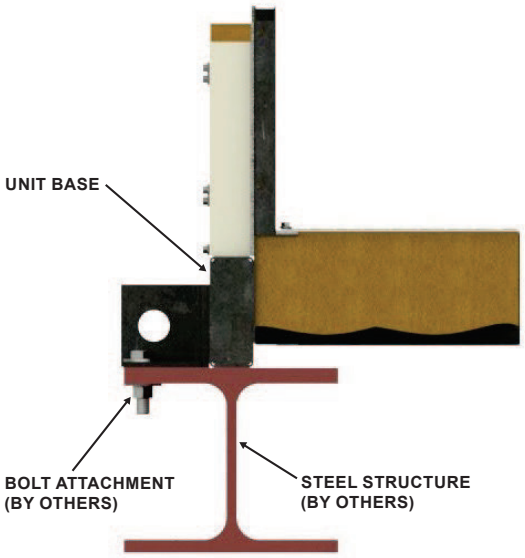
Note: See section under receiving instructions when receiving curbs and inspection for freight damage and filing of freight damage claims. Any freight damage is the responsibility of the receiving contractor and/ or his authorized receiving agent and the delivering carrier.



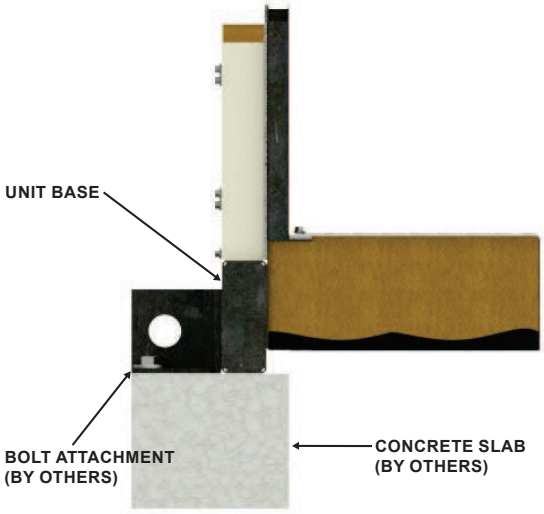
Standard (non-demounted)



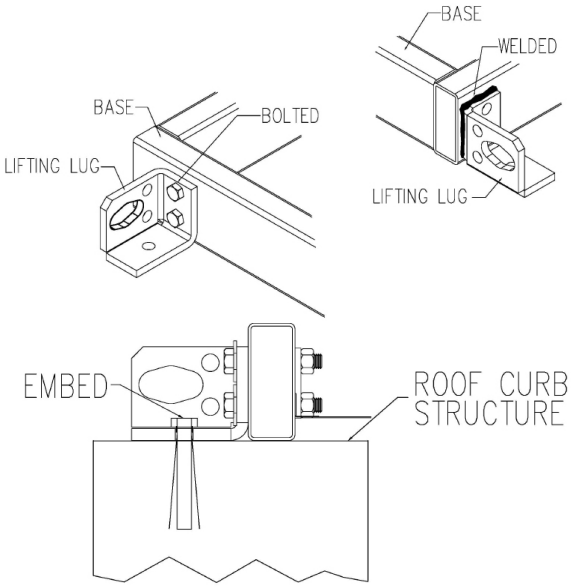
Standard with Curb Notches at Demount



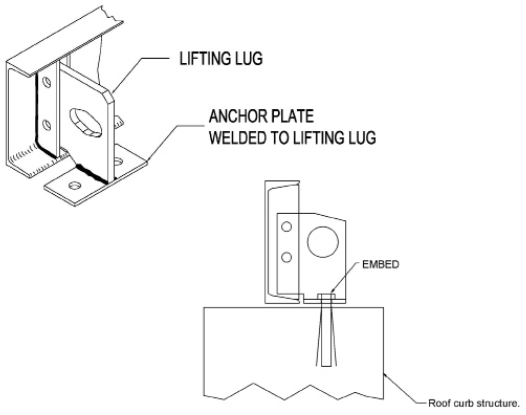
Typical Unit Base to Curb Installation on Structural Steel



Typical Unit Base to Curb Installation on Concrete Curb



UNIT ANCHORING TO CURB TUBE BASE

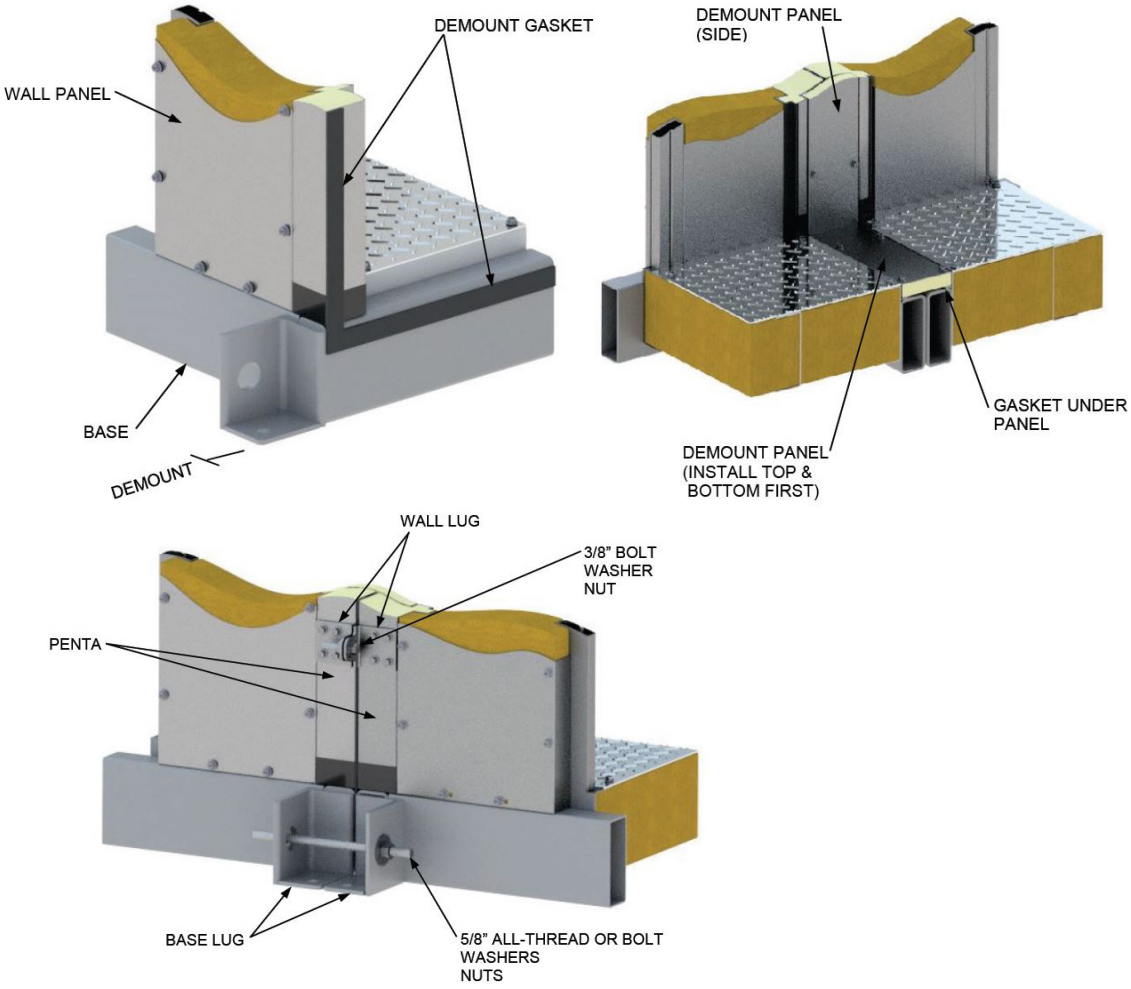


UNIT ANCHORING TO CURB CHANNEL BASE

Assembly of the Sections

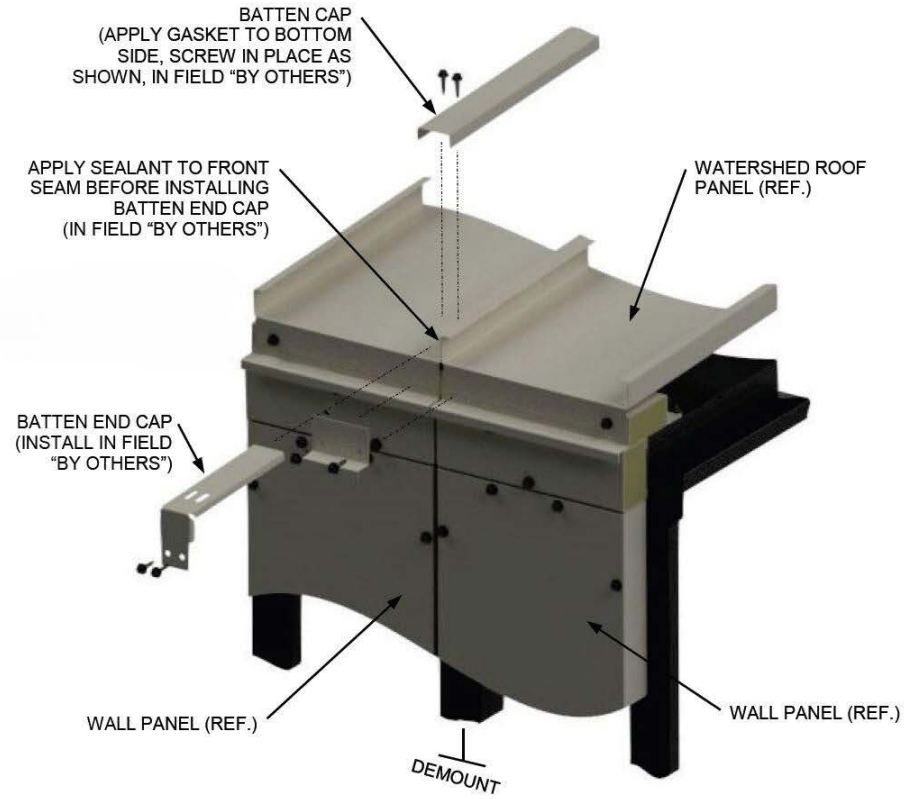
Apply the 1”x3/8” gasket material (if required) to the frame. Apply the gasket to only one section of the two mating sections. Set the equipment as close as possible to the adjacent section and the remove the bolt-on lifting lugs if so equipped. There are demount lugs welded to the base frame of the unit. These connection points are welded at the mating line of each section. The equipment is supplied with5/8” all-thread or nuts and washers. Slide the all-thread or bolt with washer through the opening in the angles and install the washers and nuts. Do not draw the sections together at this time. Make sure that all of the bolt points around the upper perimeter of the frame are aligned. The crane should be used to get the sections as close together as possible and at least every other bolt are to be installed and tightened before unhooking from the crane. Some sections may be heavier than others thus causing them to set down further. This can be overcome with the crane lifting slightly up on the heavier section until the Demount bolts are installed. Shimming material may be required to be installed between the base frame and the supporting member (curb) in order to level mating sections. At this time, draw the sections tightly together using the demount bolts and the 5/8” all-thread. When the crane is unhooked, the two sections will settle together. The sections can then be drawn together utilizing a chain type come-along if necessary. Do not bring up the next section until these two sections are tightly together. Continue to bring up each section and follow above directions until all sections are secured together.

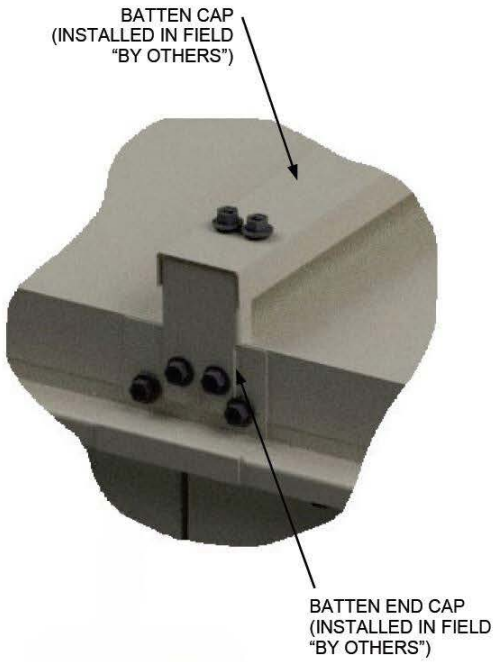
To bolt the demounts sections together from the inside, locate the 1/2” bolts provided in the pipe connections along the walls and roof (also possibly along the floor). Some misalignment between these pipes is possible due to curb slightly being unlevel or unit slightly out of square due to shipping or lifting. Use a pick pry bar to help align if needed or if still connected to crane, can slightly move to align together.

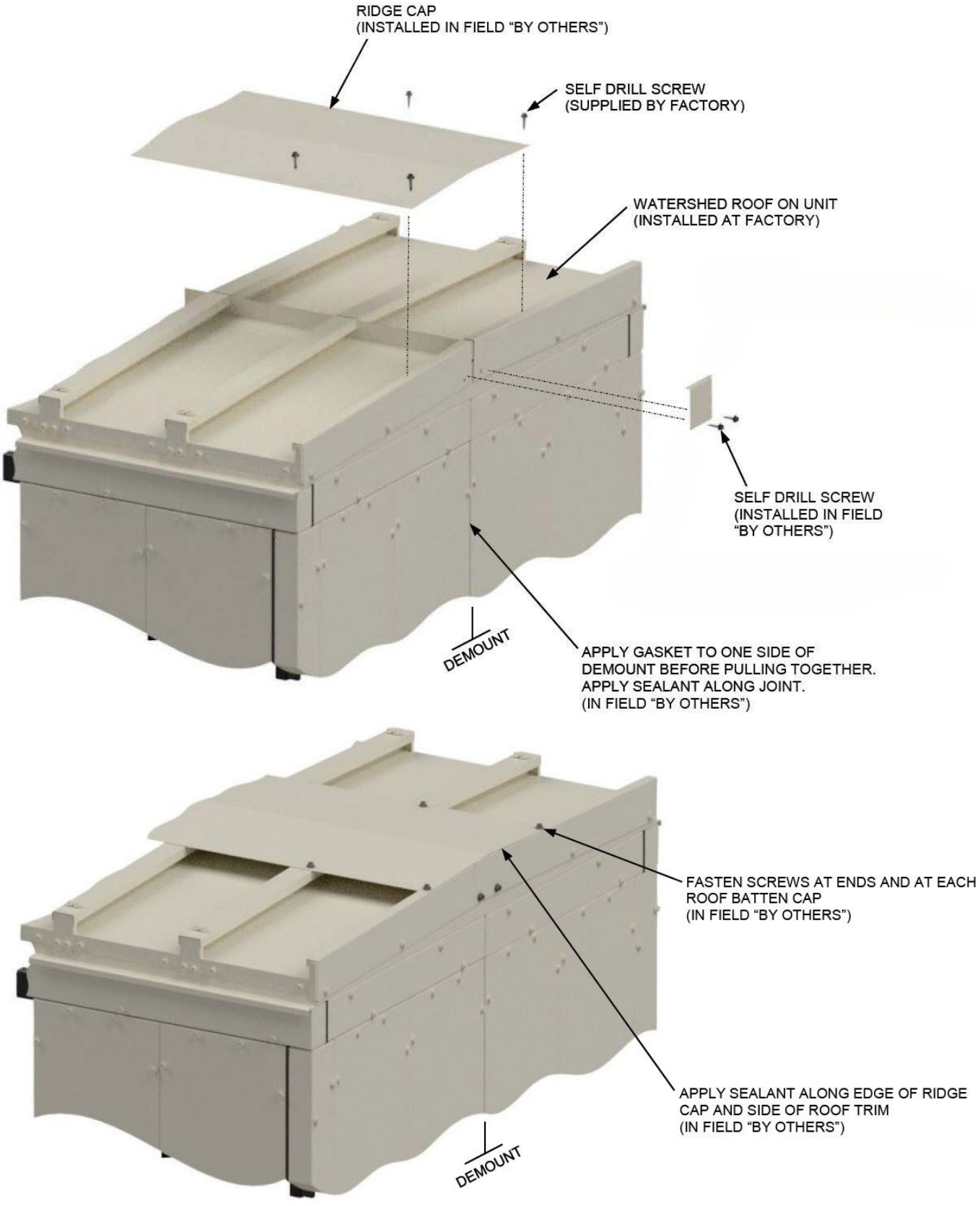


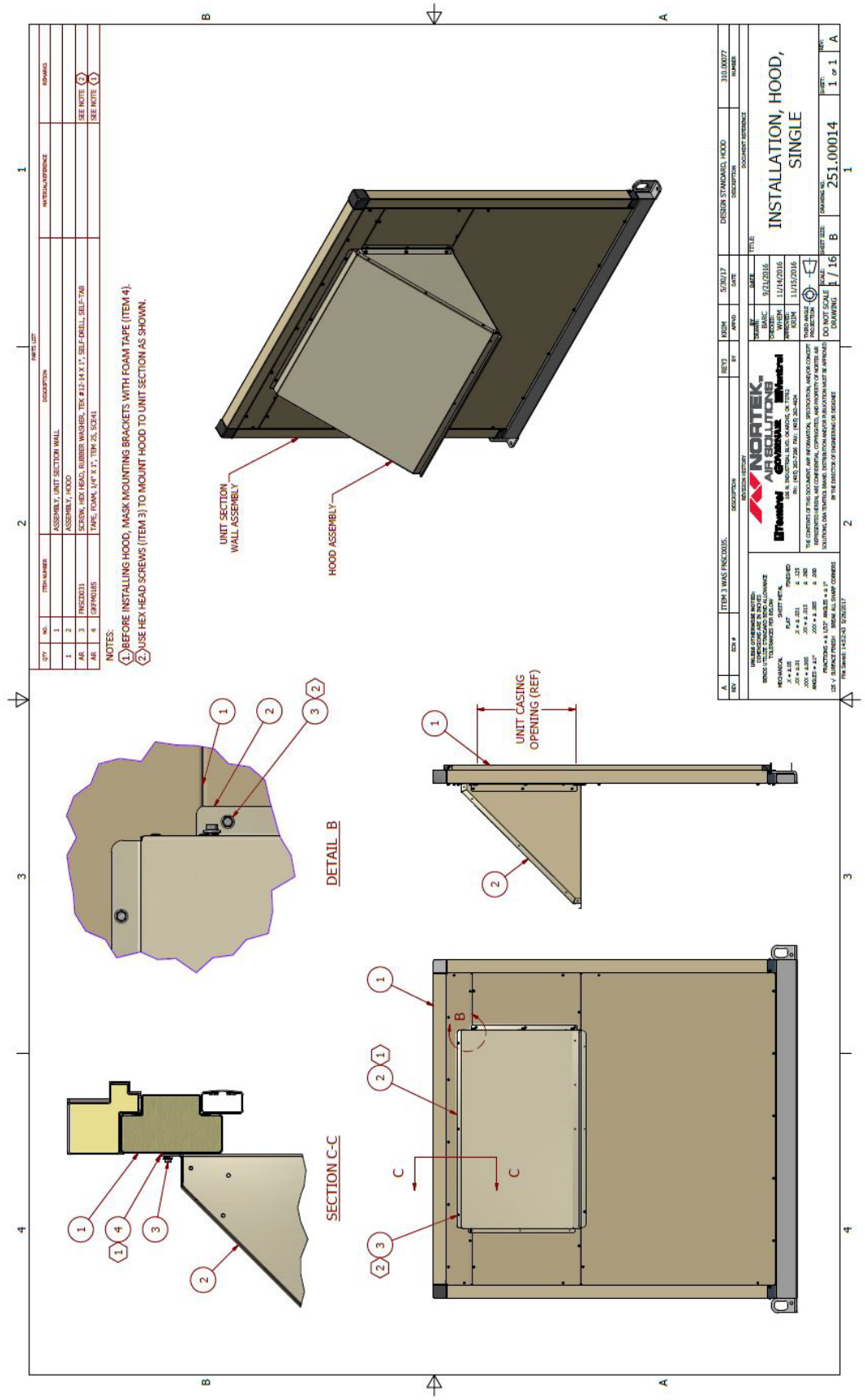
Water Shedding Components

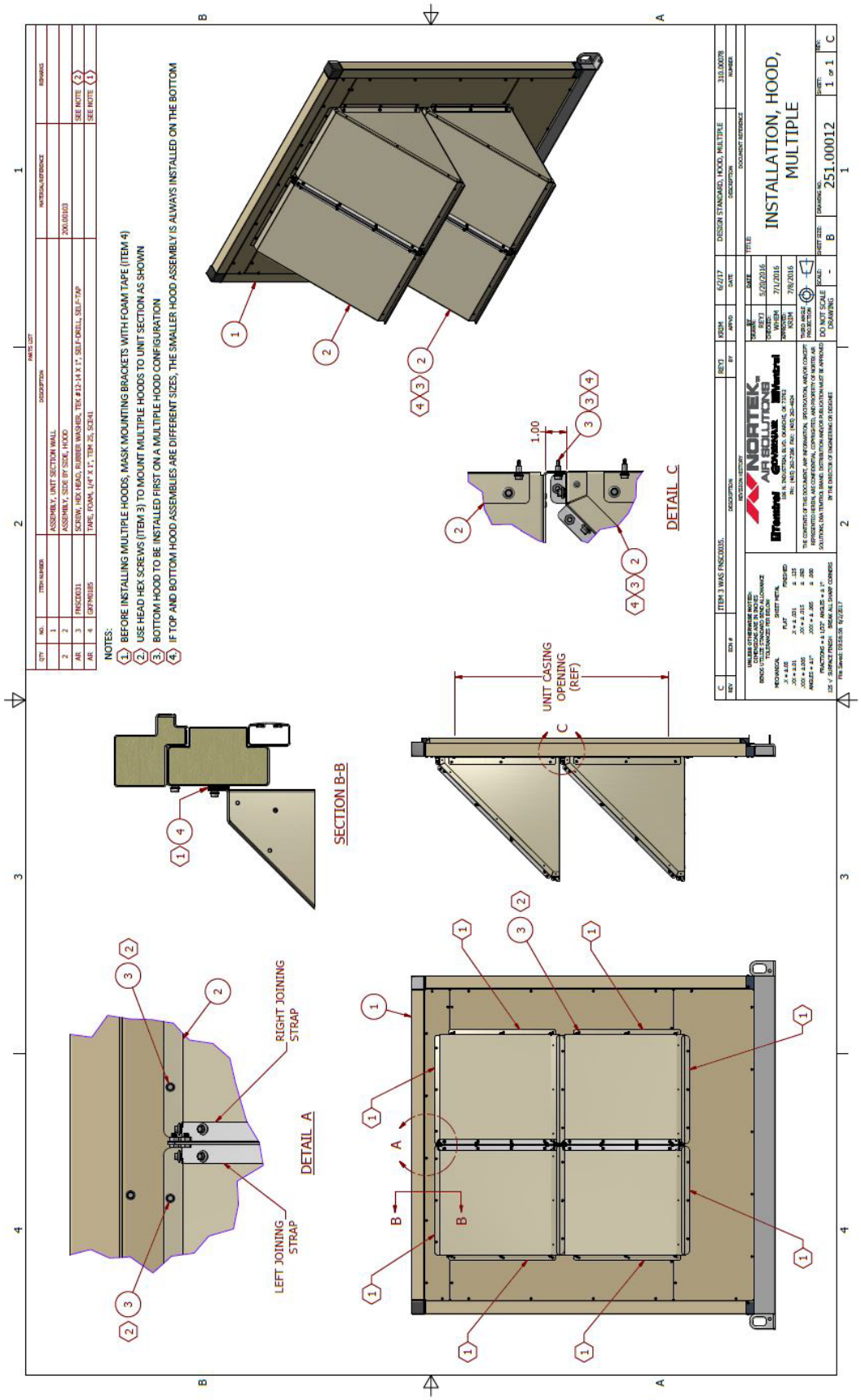
If the equipment is designed as an outdoor unit it will be supplied with a water shedding roof installed over the paneled roof. Trim components to complete the seal of demounted equipment will be shipped loose components. The below illustrations describe the installation of these components as related to the type of roof design incorporated into the equipment.

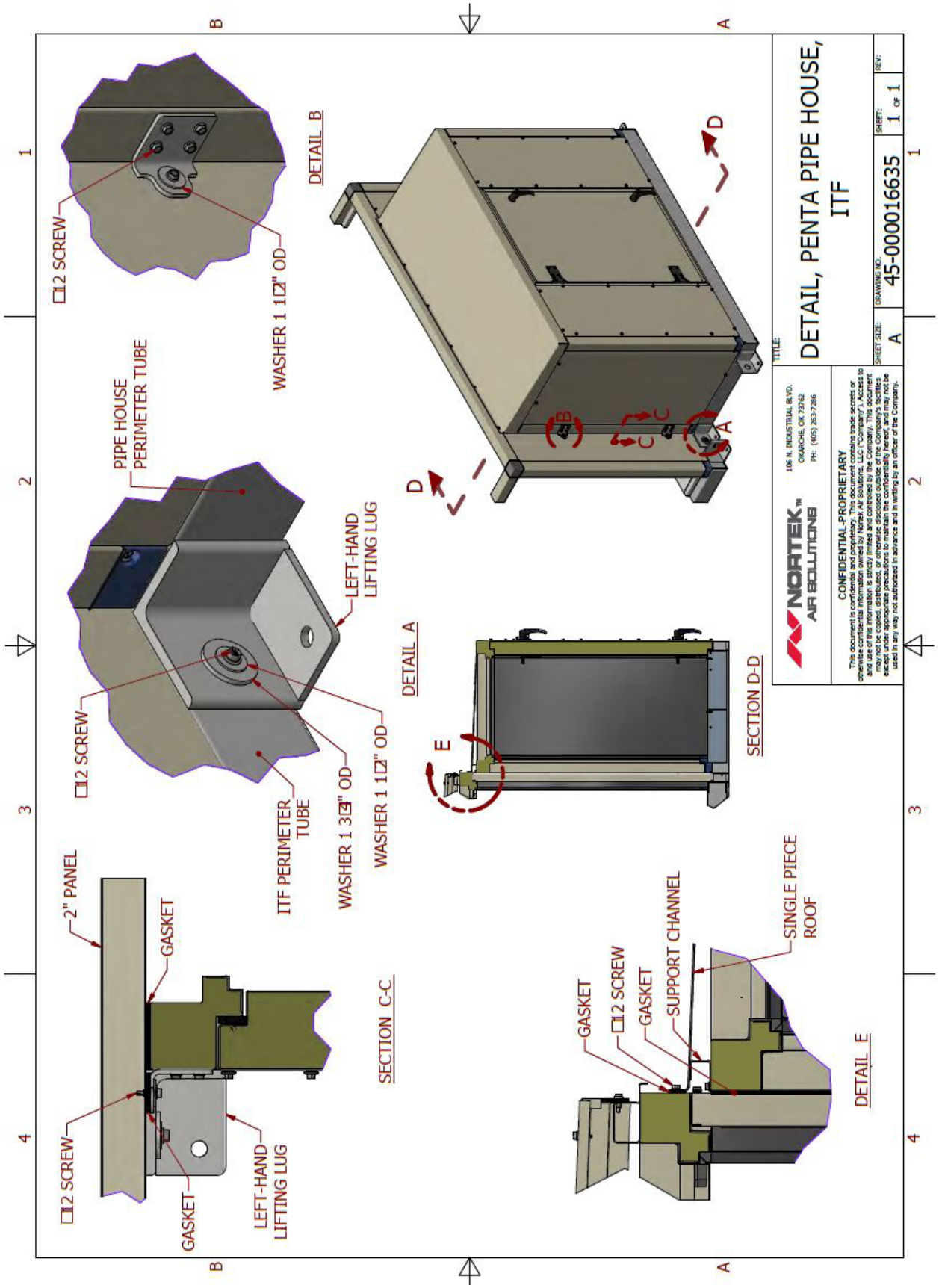





RIDGE CAP
(INSTALLED IN FIELD "BY OTHERS")
SELF DRILL SCREW
(SUPPLIED BY FACTORY)
WATERSHED ROOF ON UNIT
(INSTALLED AT FACTORY)
SELF DRILL SCREW
(INSTALLED IN FIELD
"BY OTHERS")
DEMOUNT
APPLY GASKET TO ONE SIDE OF
DEMOUNT BEFORE PULLING TOGETHER.
APPLY SEALANT ALONG JOINT.
(IN FIELD "BY OTHERS")
FASTEN SCREWS AT ENDS AND AT EACH
ROOF BATTEN CAP
(IN FIELD "BY OTHERS")
APPLY SEALANT ALONG EDGE OF RIDGE
CAP AND SIDE OF ROOF TRIM
(IN FIELD "BY OTHERS")
DEMOUNT


NOTES:
1. BEFORE INSTALLING HOOD, MASK MOUNTING BRACKETS WITH FOAM TAPE (ITEM 4).
2. USE HEX HEAD SCREWS (ITEM 3) TO MOUNT HOOD TO UNIT SECTION AS SHOWN.
UNIT SECTION WALL ASSEMBLY
HOOD ASSEMBLY
DETAIL B
SECTION C-C
UNIT CASING OPENING (REF)
INSTALLATION, HOOD, SINGLE
251.00014


NOTES:
1. BEFORE INSTALLING MULTIPLE HOODS, MASK MOUNTING BRACKETS WITH FOAM TAPE ((ITEM 4)
2. USE HEAD HEX SCREWS ((ITEM 3) TO MOUNT MULTIPLE HOODS TO UNIT SECTION AS SHOWN
3. BOTTOM HOOD TO BE INSTALLED FIRST ON A MULTIPLE HOOD CONFIGURATION
4. IF TOP AND BOTTOM HOOD ASSEMBLIES ARE DIFFERENT SIZES, THE SMALLER HOOD ASSEMBLY IS ALWAYS INSTALLED ON THE BOTTOM
DETAIL A
RIGHT JOINING STRAP
LEFT JOINING STRAP
SECTION B-B
DETAIL C
UNIT CASING OPENING (REF)
INSTALLATION, HOOD, MULTIPLE
251.00012


DETAIL, PENTA PIPE HOUSE, ITF
TITLE:
SHEET SIZE: A
DRAWING NO: 45-000016635
SHEET: 1 OF 1
REV:
NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286
CONFIDENTIAL-PROPRIETARY
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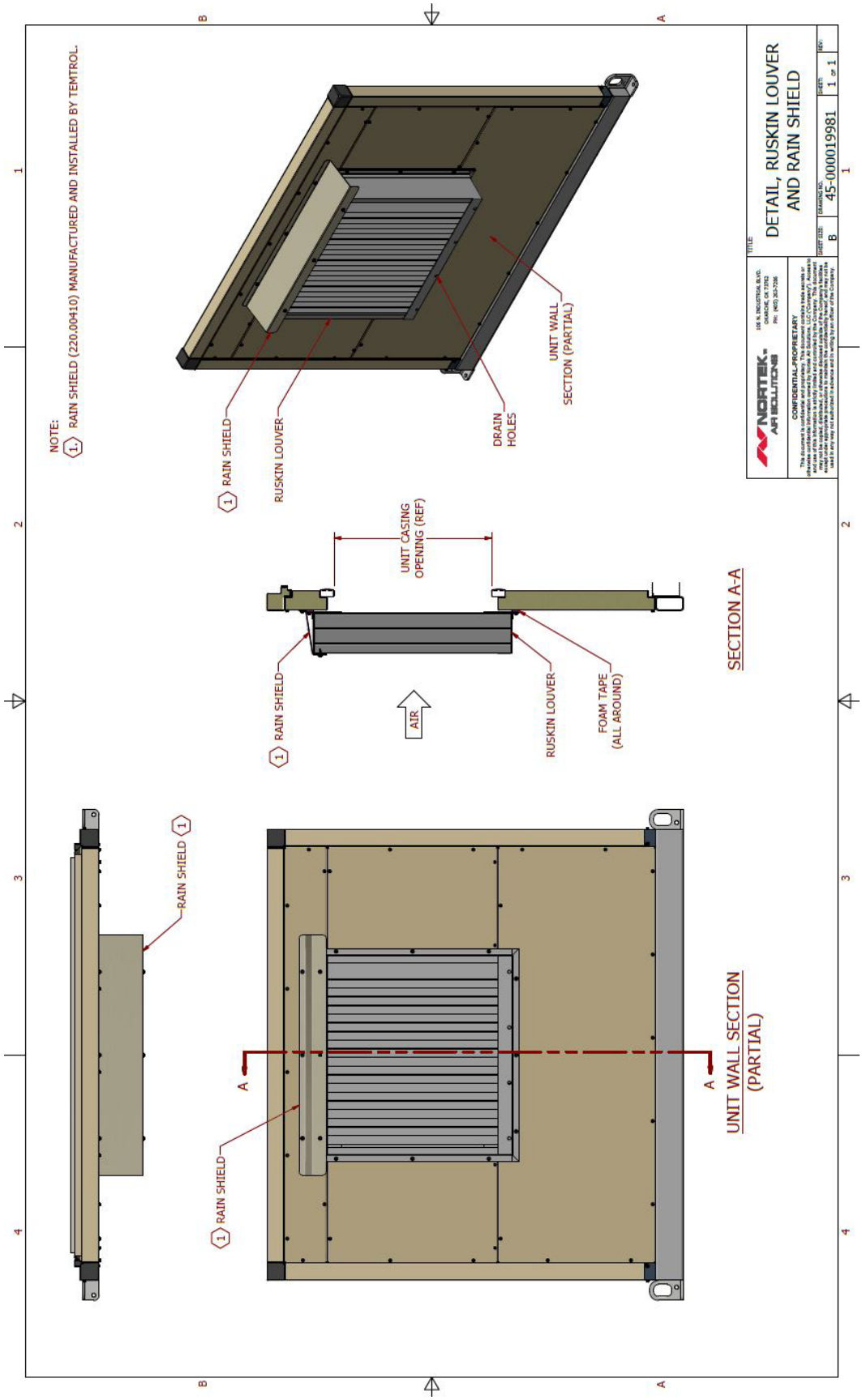
DETAIL B
DETAIL A
SECTION D-D
SECTION C-C
DETAIL E
PIPE HOUSE PERIMETER TUBE
WASHER 1 1/2" OD
12 SCREW
LEFT-HAND LIFTING LUG
WASHER 1 3/4" OD
ITF PERIMETER TUBE
2" PANEL
GASKET
SINGLE PIECE ROOF
SUPPORT CHANNEL


NOTE:
1. RAIN SHIELD (220.00410) MANUFACTURED AND INSTALLED BY TEMTROL.
1 RAIN SHIELD
RUSKIN LOUVER
DRAIN HOLES
UNIT WALL SECTION (PARTIAL)
UNIT CASING OPENING (REF)
1 RAIN SHIELD
AIR
RUSKIN LOUVER
FOAM TAPE (ALL AROUND)
SECTION A-A
RAIN SHIELD 1
1 RAIN SHIELD
A
A
UNIT WALL SECTION (PARTIAL)
CONFIDENTIAL-PROPRIETARY
DETAIL, RUSKIN LOUVER AND RAIN SHIELD
DRAWING NO. 45-000019981
SHEET 1 OF 1
REV B

Electrical

Electrical wiring for controls and internal lighting circuits will require splicing where they cross a demount line on the unit(s). A separate numbered terminal strip and conduit is provided for the control wiring and internal lighting circuits utilize wire nuts. For terminal strip connections, all wires are numbered to match the terminal strips. A short piece of flexible conduit is provided on one side and a terminal box housing the terminal strip is provided on the opposing side of demount to facilitate assembly.

Electrical power wiring to return air fans and or other components with high current draw are run in a separate conduit. Power circuits with wire size 2/0 THHN and smaller will utilize terminal strips similar to the above. Power circuits utilizing wire size 2/0 THHN and larger utilize single, unspliced conductors ran to the control panel. These conductors are shipped coiled up in the component section and will be required to be pulled through conduit provided for this purpose and re-terminated prior to start-up.

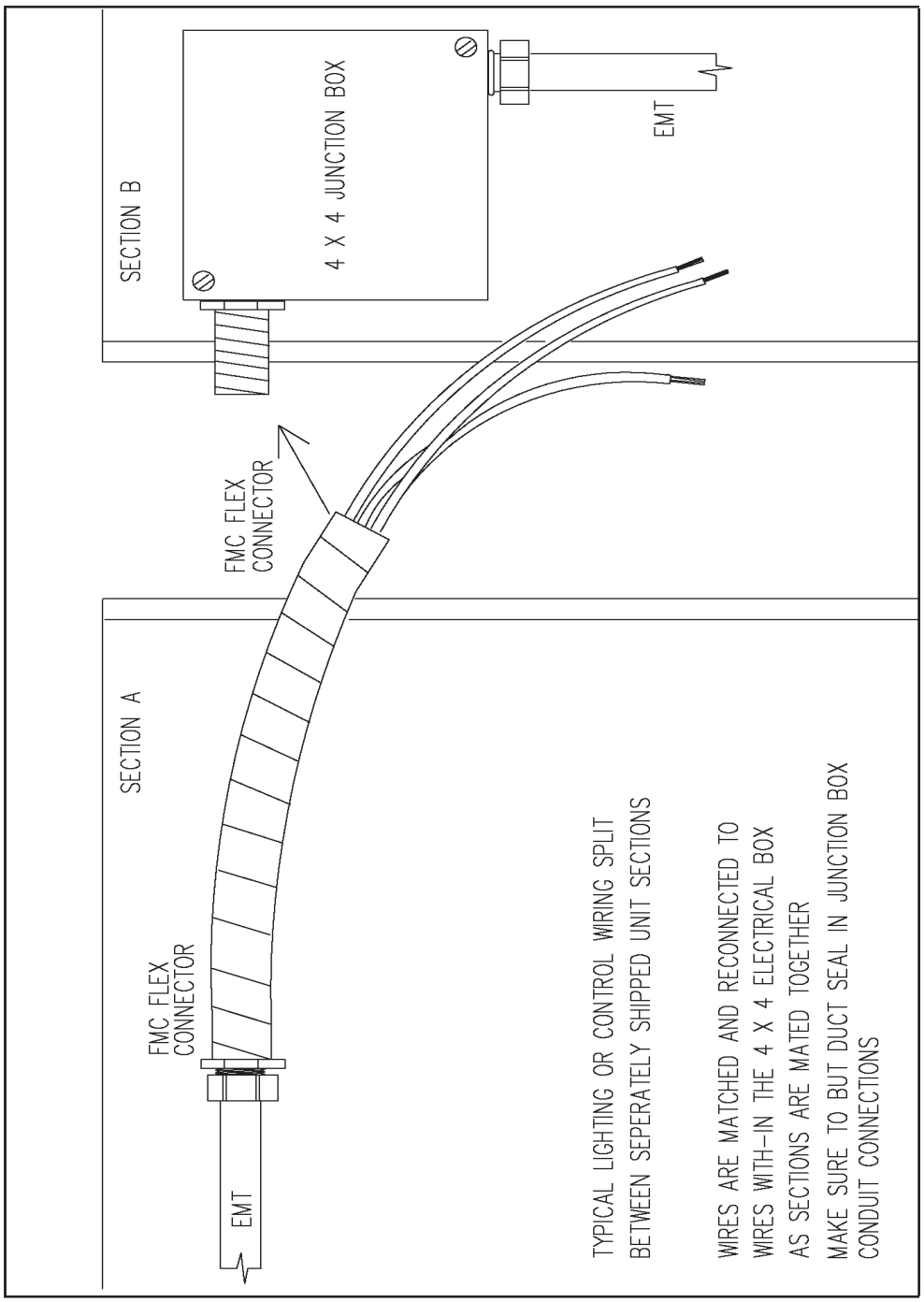
Note: Nortek Air Solutions is not responsible for reconnecting wiring at the unit splits.

Electrical Split Assembly

To be installed by others (Electrical Contractor).

DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout / tag out procedures. Failure to follow these procedures may result in injury or even death.

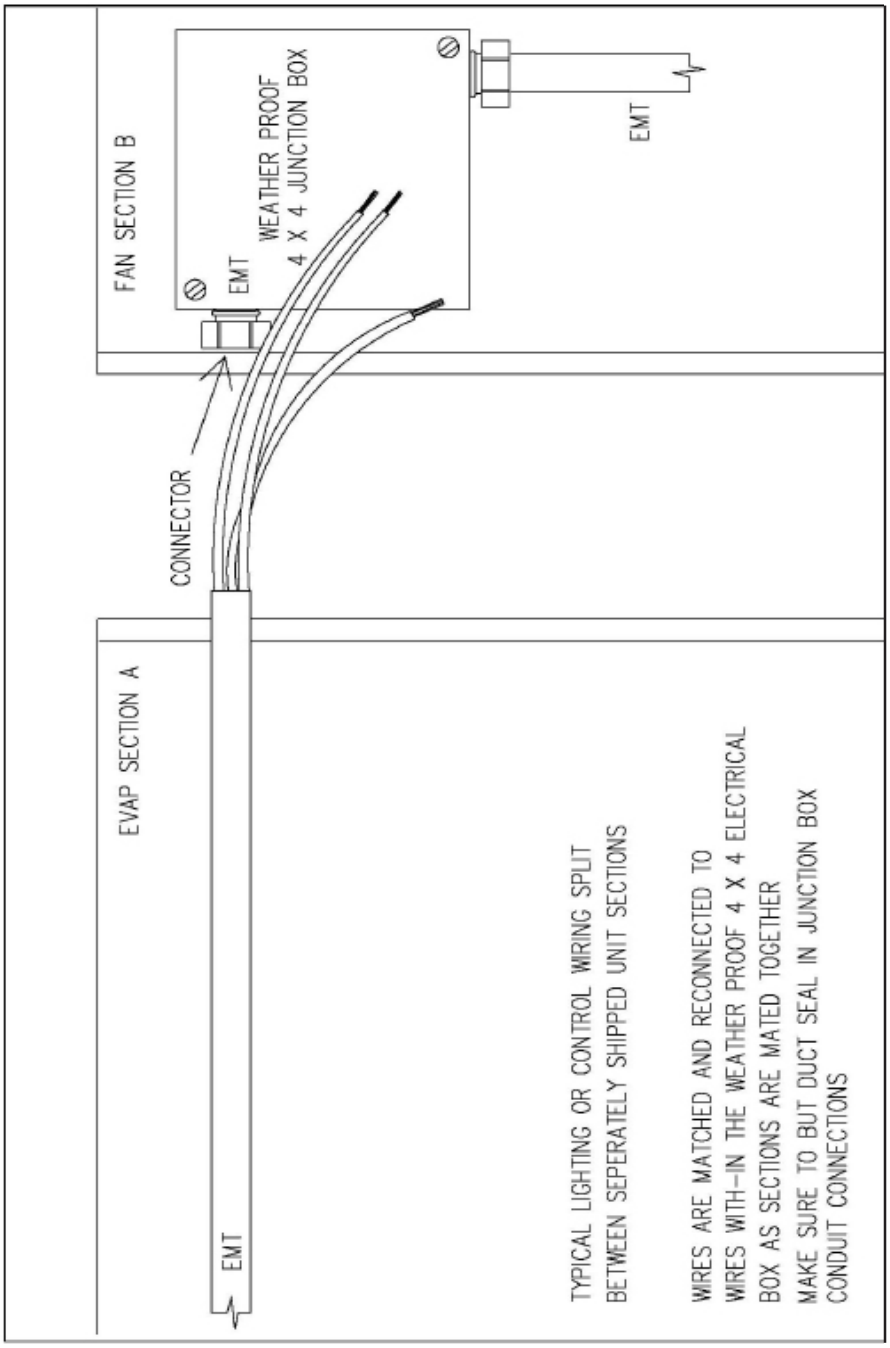


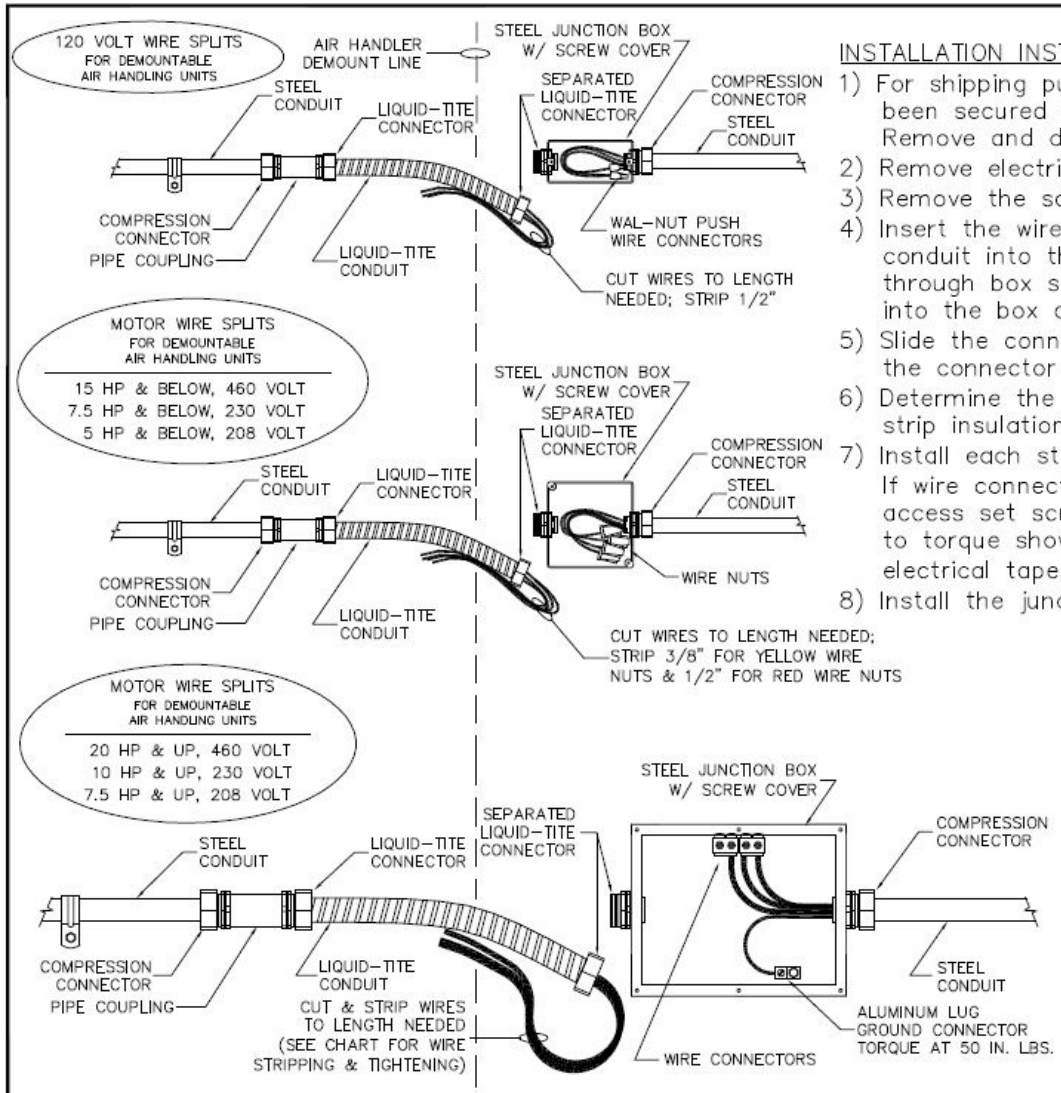
Evap Electrical Split Assembly

To be installed by others (Electrical Contractor).

DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout / tag out procedures. Failure to follow these procedures may result in injury or even death.





INSTALLATION INSTRUCTIONS:

1) For shipping purposes, the liquid-tite conduit may have been secured to unit casing with a conduit strap. Remove and discard strap to free conduit.
2) Remove electrical tape securing wires to liquid-tite conduit.
3) Remove the screw cover from junction box.
4) Insert the wires that are contained in the liquid-tite conduit into the liquid-tite connector, then pull wires through box so that the liquid-tite conduit can be fitted into the box connector.
5) Slide the connector nut, that is installed on the conduit, to the connector and thread nut on connector, then tighten.
6) Determine the length of each wire needed, then cut and strip insulation.
7) Install each stripped wire end into matching wire connector. If wire connector is "IT" model, remove rubber plugs to access set screws. Once wire is inserted, torque set screw to torque shown. Install rubber access plugs and secure with electrical tape. (See note under wire connector chart)
8) Install the junction cover.

CONNECTOR TORQUES (INCH POUNDS)

CONNECTOR MODEL / WIRE STRIP LENGTH		IT-4 11/16"	IT-1/0 7/8"	IT-3/0 1"	IT-250 1 1/4"
WIRE SIZES	#14-#10	35	35		
	#8	40	75		
	#6-#4	45	110	110	110
	#1-#3		150	150	150
	1/0		180	180	180
	2/0			180	180
	3/0			250	250
	4/0				250
	250				360

Temtrol
PO BOX 409 OKARCHE, OK 73762

WIRING SPLITS AT DEMOUNTS

8/18/2003

NOTE:
Wires must be torqued and insulation stripped as shown. The wire insulation on a properly installed wire must be inside the insulated connector conductor port no less than 3/8 inch. Install access plugs and secure plugs with at least two wraps of electrical tape across plugs and around connector body.

Condensate Traps

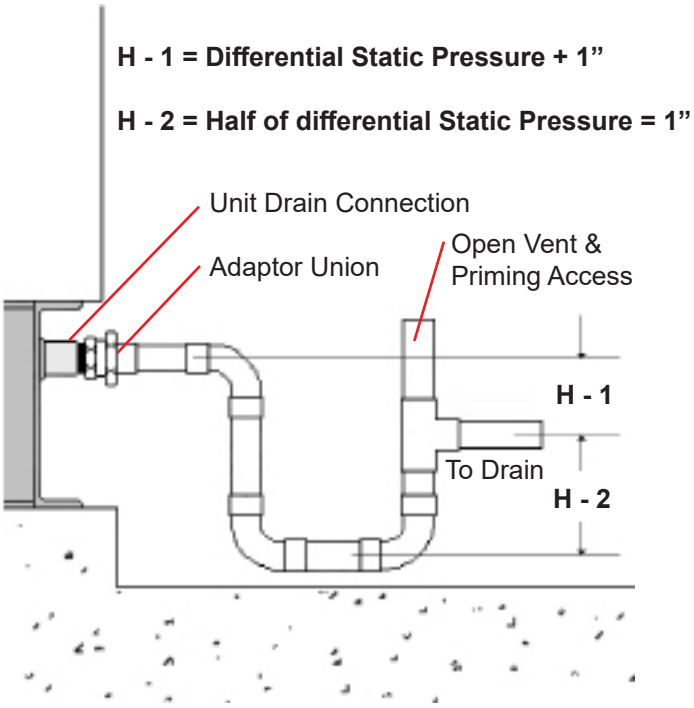
All air handlers with drains must have the condensate connections properly trapped to provide adequate drainage. Improperly trapped drain lines may restrict/prevent drainage causing pan to overflow inside the air handler and surrounding areas.

The two illustrations provided show the recommended construction and sizing procedure for a Draw - Through (Negative Pressure) and Blow - Through (Positive Pressure) applications.

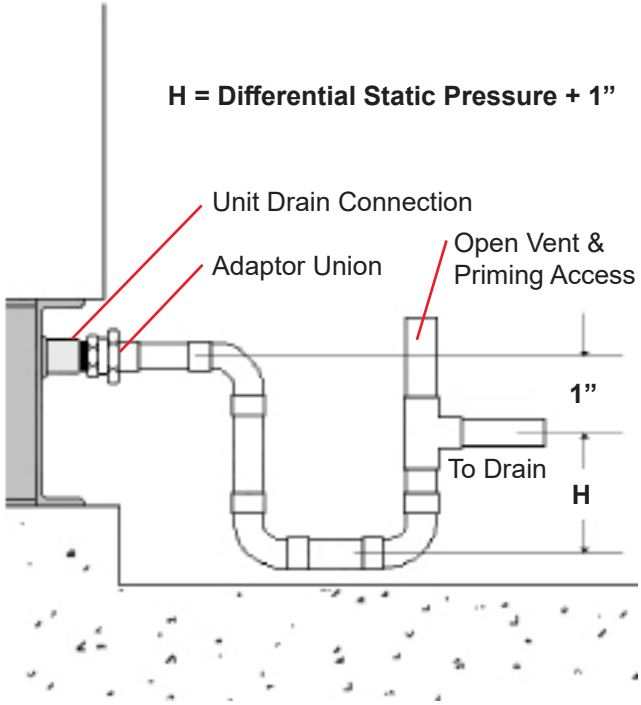
The ideal method of sizing the "H" dimension of the trap is to take a "Differential Static Pressure" measurement across the plenum in which the drain is located after the system has been installed and balanced. An alternative method is to develop an estimate of the plenum differential static from the Fans Peak Static Pressure.

For drain traps to function properly they must always be filled with water (Primed) and the piping connecting to it should be sloped down a minimum of 1/8" per foot in direction of water flow as shown in the illustrations. Precautions should be taken on outdoor air handlers to prevent drain traps from freezing in winter type conditions.

Note: Reducing the drain line diameter may cause the condensate pan to not drain. For example; connecting a temporary water hose during construction.



DRAW THROUGH
(Drain pan under negative pressure)

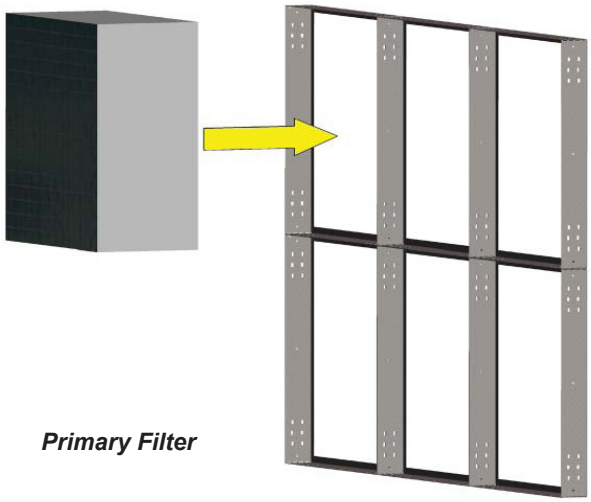


BLOW THROUGH
(Drain pan under positive pressure)

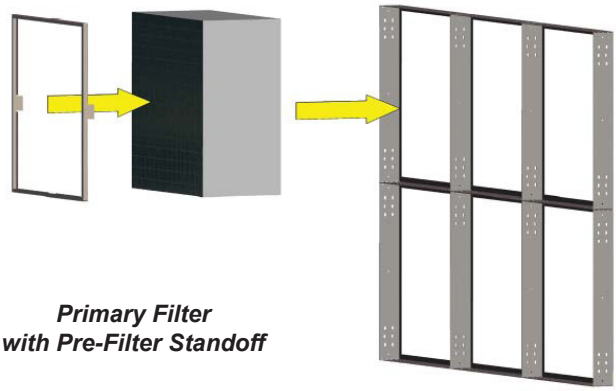
Filter Installation

Note: Make sure of air flow direction. Refer to next page for clips installation

1. Place primary filter into the filter rack and with secure with clips.
2. Pre-Filter Standoff Otional. Place the pre-filter standoff over the primary filter and place in fillter and secure with clips.



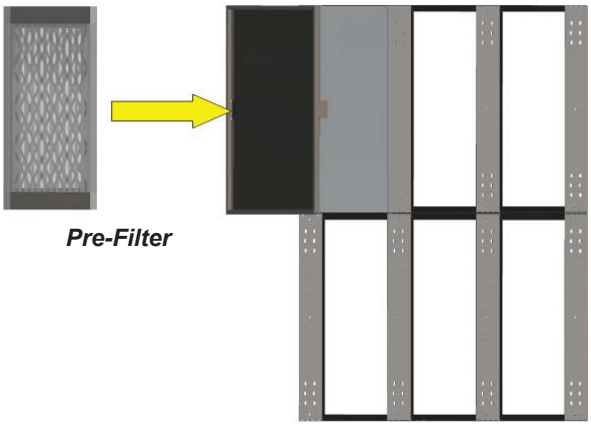
Primary Filter



Primary Filter with Pre-Filter Standoff

3. Place pre-filter clips on the top and bottom of the pre-filter standoff.

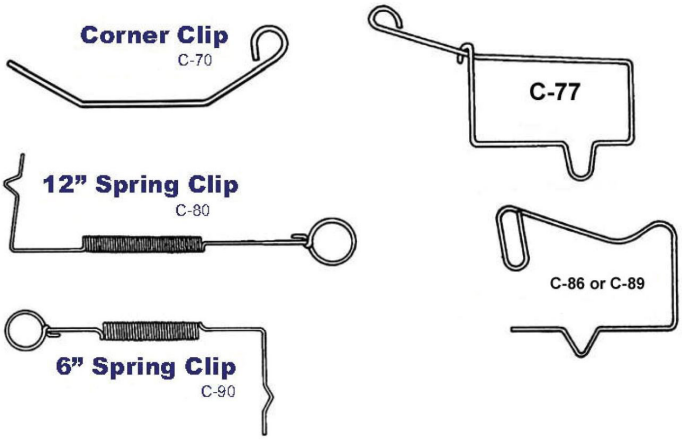
4. Carefuly place the pre-filter into the clips.



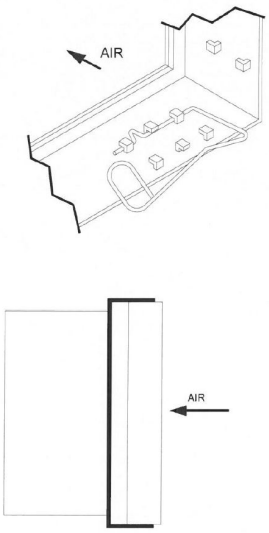
Pre-Filter

Filter Clips Installation

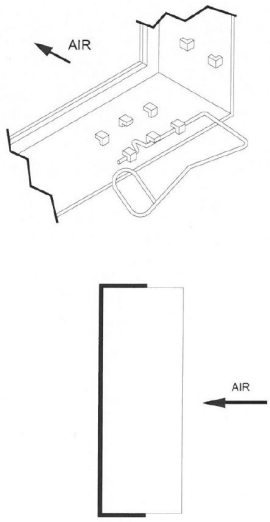
1. There are verious styles of clips for the filters.
2. Slide the proper clip into the notches on the side of the filter rack frame.



C-86 Filter Clip Application

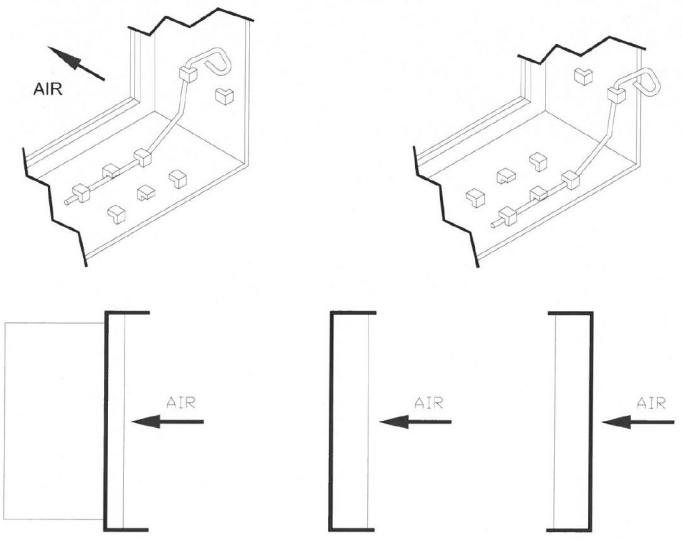


C-86 Clip location for 6" & 12" Rigid & Bag filters with peripheral header & 2" pre-filter for upstream access



C-86 Clip location for 4" filter for upstream access

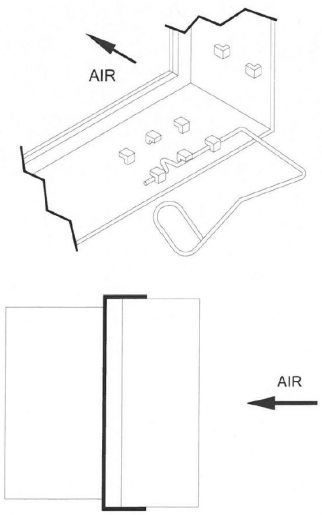
C-70 Filter Clip Application



C-70 Clip location for 6" & 12" Rigid & Bag filters with peripheral header for upstream access

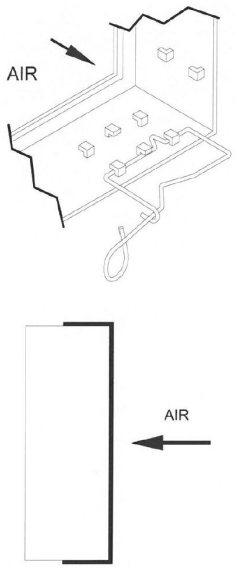
C-70 Clip location for 2" filter for up or downstream access

C-89 Filter Clip Application



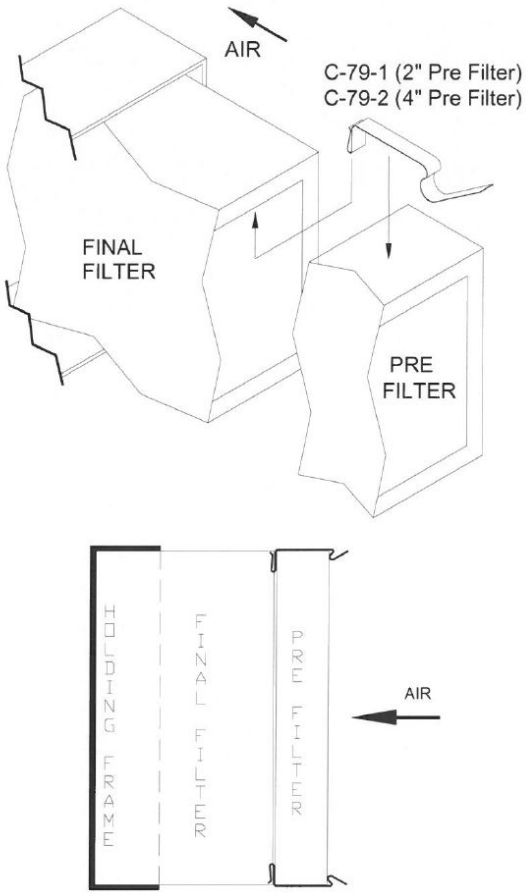
C-89 Clip location for 6" & 12" Rigid & Bag filters with peripheral header & 4" pre-filter for upstream access

C-89 Filter Clip Application



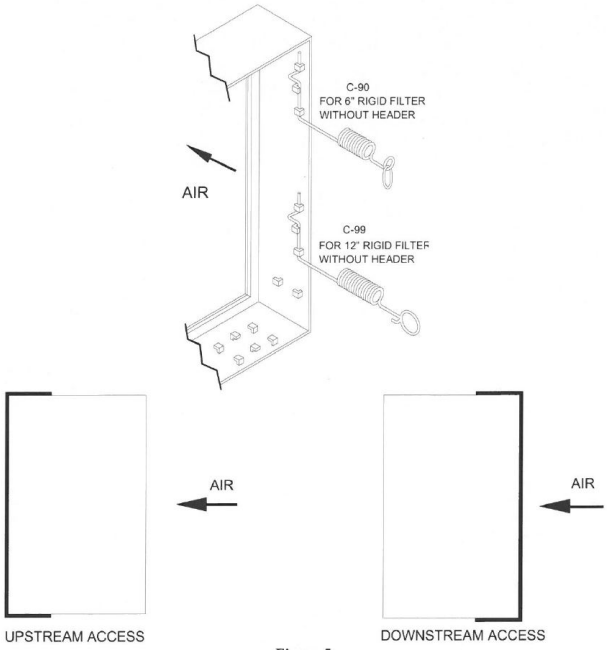
C-77 Clip location for 4” filter for downstream access

C-79 Filter Clip Application



C-79-1 & C-79-2 Filter Clip location for 2” & 4” Pre filter used with 6” & 12” Rigid filter without peripheral header for upstream access

C-90 & C-99 Filter Clip Application



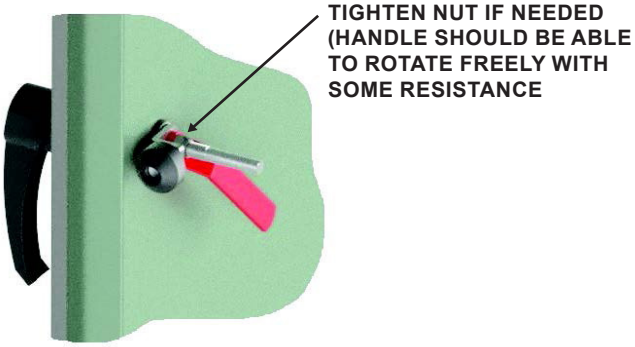
C-90 & C-99 Clip location for 6” & 12” Rigid filter without peripheral header for up & downstream access

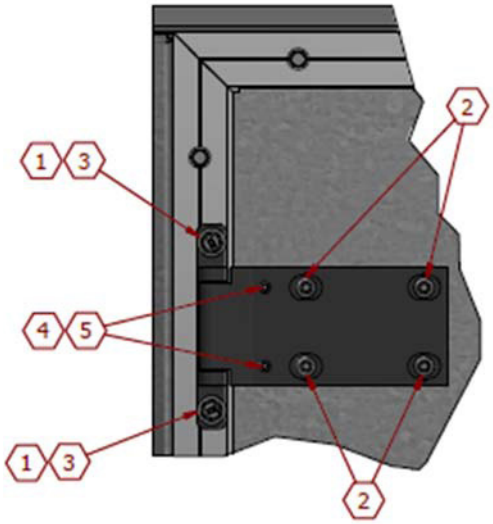
Doors

Check to see that all doors are square. The rigging process may move the doors out of alignment. This must be corrected before unit is started. Check all door latches and re-adjust if necessary to maintain a good tight seal.

Access Door Adjustment Instructions:

1. To mount door within the frame:
   - Place spacers on bottom of door frame as specified. Spacer to be approximately 1/8” thick.
   - Place door on spacers inside door frame.
   - Attach door hinges to door frame with self-drilling screw
2. To center door horizontally within the frame:
   - Loosen noted button head hex drive screws
   - Adjust door until spaced evenly within door frame and the door seals correctly
   - Retighten noted button head hex drive screws
3. To center door vertically within the frame:
   - Loosen noted self-drilling screws
   - Adjust door until evenly spaced within door frame and the door seals correctly
   - Retighten noted self-drilling screws
4. To increase door compression against gaskets:
   - Tighten set screws
5. To decrease door compression against gaskets:
   - Loosen set screws





Refrigerant Line and Piping

Note: All field piping should be self-supporting

All applicable refrigerant lines crossing a demount line will require joining prior to start-up. The units are shipped with the line cut capped and minimally pressurized with nitrogen. Slip on couplings are provided to make the connections. The refrigerant lines must be purged with nitrogen and the joints brazed with a suitable high temperature brazing compound *. The lines should then be pressure tested and evacuated to 200 microns before being placed in service. Additional refrigerant may be required to account for the fill of these line sets. Additional refrigerant is not furnished by Nortek Air Solutions.

Steam coils are drainable if unit is level. Water coils are also drainable except for special circuiting. When special circuitry has been furnished coil must be protected from freeze damage by means of anti-freeze liquids or heaters.

Chilled or Hot Water Coil - Type WC

Primary Surface
Round seamless copper tubes are mechanically expanded into the fin collars of the secondary surface. The mechanical expansion provides a permanent metal-to-metal bond for efficient heat transfer. Tubes are staggered in the direction of airflow.

Secondary Surface
Corrugated aluminum or copper plate type fin that is die-formed. Fin collars are full-drawn to provide accurate control of fin spacing and maximum contact with tubes.

Headers
Seamless copper with die-formed holes that provide a parallel surface to the coil tube for strong brazing joints. Standard 1/8" brass female pipe thread (FPT) vent and drain with optional 1/2" or 3/4". All circuiting is designed to gravity-drain with the coil mounted vertically and tubes running horizontally.

Connections
Red Brass Schedule 40 male pipe thread (MPT) std. with option copper female pipe thread (FPT), sweat and Victaulic Red Brass available.

Casing
Casing is die-formed with 1½" flanges to permit easy stacking and mounting. Intermediate tube supports are supplied on coils over 44" fin length with an additional support every 42".

Testing and Performance
All coil assemblies are leak tested under water with nitrogen at 315 PSIG. Standard construction is suitable for 250 PSIG and up to 300°F.

Performance is AHRI Certified™ to Air-Cooling and Air-Heating Coils AHRI Standard 410. Coil performance ratings are calculated using Nortek Air Solutions AHRI Certified™ selection software.

Rows	Fin Height	Fin Length	Fin Spacing	Fin Thickness ALUMINUM	Fin Thickness COPPER	Tube O.D. Tube Thickness	Tube Spacing Face x Row	Casing	Max. Std. Operating Conditions
1, 2, 3, 4, 5, 6, 8, 10, 12	6" to 60"	12" to 240"	1/2" 8 to 14 fins per inch 5/8" 6 to 14 fins per inch	1/2" 0.006" 5/8" 0.008" 0.010"	1/2" 0.006" 5/8" 0.006" 0.008" 0.010"	1/2" 0.017" 0.025" 5/8" 0.020" 0.025" 0.035" 0.049"	1/2" 1.25"x1.083" 5/8" 1.50"x1.299"	16 or 14 GA Galvanized Steel 304, 316 Stainless Steel	250 PSIG 300°F

Winterizing Water Coils

- Ensure all pipes and drains are insulated or heat traced
- Let water drain out of coils, and use an air compressor to clear any remaining water out.
- Independently fill each coil with low freezing point solution (antifreeze), then circulate and drain.
- Test the freezing point of the drained antifreeze mixture to ensure it was not diluted by trapped water.
- If tests indicate it to be too diluted, repeat step of filling coils with antifreeze and drain again.

Standard Steam Coil - Type SS

Primary Surface
Round seamless copper tubes are mechanically expanded into the fin collars of the secondary surface. The mechanical expansion provides a permanent metal-to-metal bond for efficient heat transfer. Tubes are staggered in the direction of airflow.

Secondary Surface
Corrugated aluminum or copper plate type fin that is die-formed. Fin collars are full-drawn to provide accurate control of fin spacing and maximum contact with tubes.

Headers
Seamless copper with die-formed holes that provide a parallel surface to the coil tube for strong brazing joints.

Connections
Red Brass Schedule 40 male pipe thread (MPT) std. with option copper female pipe thread (FPT) and sweat available. Maximum fin length of 108" with same end connections. Steam pressure above 50 PSIG will have opposite end connections.

Casing
Casing is die-formed with 1½" flanges to permit easy stacking and mounting. Coil as shown above must be mounted level (NO pitched case). Opposite end connection coils can be supplied with pitched casing. Intermediate tube supports are supplied on coils over 44" fin length with an additional support every 42".

Testing and Performance
All coil assemblies are leak tested under water with nitrogen at 315 PSIG. Standard construction is suitable for 25 PSIG and up to 300 degrees F. Heavier wall construction is available for steam pressures up to 100 PSIG.

Performance is AHRI Certified™ to Air-Cooling and Air-Heating Coils AHRI Standard 410. Coil performance ratings are calculated using Nortek Air Solutions AHRI Certified™ selection software.

Rows	Fin Height	Fin Length	Fin Spacing	Fin Thickness ALUMINUM	Fin Thickness COPPER	Tube O.D. Tube Thickness	Tube Spacing Face x Row	Casing	Max. Std. Operating Conditions	Connections
1, 2	6" to 54"	12" to 144"	6 to 14 fins per inch	0.008" 0.010"	0.006" 0.008" 0.010"	5/8" 0.025" 0.035" 0.049"	1.50"x1.299"	16 or 14 GA Galvanized Steel 304, 316 Stainless Steel	Standard 25 PSIG Optional 100 PSIG	Same-end Opposite

Condenser Coil - Type CX

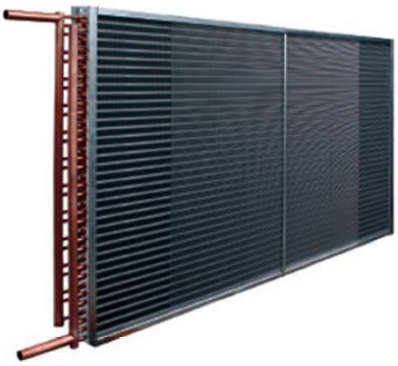
Primary Surface
Round seamless copper tubes are mechanically expanded into the fin collars of the secondary surface. The mechanical expansion provides a permanent metal-to-metal bond for efficient heat transfer. Tubes are staggered in the direction of airflow.

Secondary Surface
Corrugated aluminum or copper plate type fin that is die-formed. Fin collars are full-drawn to provide accurate control of fin spacing and maximum contact with tubes.

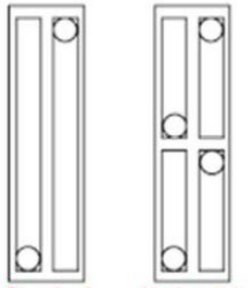
Headers
Seamless copper with die-formed holes that provide a parallel surface to the coil tube for strong brazing joints.

Connections
Copper outside diameter (O.D.) Sweat with standard arrangement for one compressor circuit. FACE SPLIT circuiting available for two or more compressors.

Casing
Casing is die-formed with 1½" flanges to permit easy stacking and mounting. Intermediate tube supports are supplied on coils over 44" fin length with an additional support every 42".



Circuiting
Coil circuiting options include: full face (std.) and horizontal (face) split.



Testing
All coil assemblies are leak tested under water with nitrogen at 400 PSIG.

Rows	Fin Height	Fin Length	Fin Spacing	Fin Thickness ALUMINUM	Fin Thickness COPPER	Tube O.D. Tube Thickness	Tube Spacing Face x Row	Casing	Max. Std. Operating Conditions
1, 2, 3, 4, 5, 6, 8, 10, 12	6" to 60"	12" to 157"	1/2" 8 to 14 fins per inch 5/8" 6 to 14 fins per inch	1/2" 0.006" 5/8" 0.008" 0.010"	1/2" 0.006" 5/8" 0.006" 0.008" 0.010"	1/2" 0.017" 0.025" 5/8" 0.020" 0.025"	1/2" 1.25"x1.083" 5/8" 1.50"x1.299"	16 or 14 GA Galvanized Steel 304, 316 Stainless Steel	250 PSIG

Direct Expansion Coil - Type DX

Primary Surface
Round seamless copper tubes are mechanically expanded into the fin collars of the secondary surface. The mechanical expansion provides a permanent metal-to-metal bond for efficient heat transfer. Tubes are staggered in the direction of airflow.

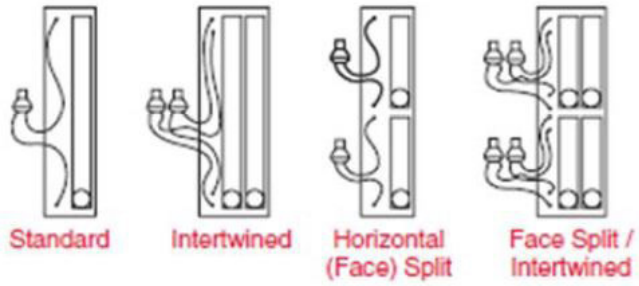
Secondary Surface
Corrugated aluminum or copper plate type fin that is die-formed. Fin collars are full-drawn to provide accurate control of fin spacing and maximum contact with tubes.

Headers
Seamless copper with die-formed holes that provide a parallel surface to the coil tube for strong brazing joints.

Connections
Interchangeable nozzle type refrigerant distributors are brass and suction connections are copper sweat. Standard coil has one distributor for one compressor circuit. An INTERTWINED coil has two distributors that provide full face control using two compressor circuits. A FACE SPLIT coil has two or more distributors for multiple compressor circuits.

Casing
Casing is die-formed with 1½" flanges to permit easy stacking and mounting. Intermediate tube supports are supplied on coils over 44" fin length with an additional support every 42".

Circuiting
Coil circuiting options include: full face (std.), intertwined, horizontal (face) split, and face split / intertwined.



Testing
All coil assemblies are leak tested under water with nitrogen at 315 PSIG.

Rows	Fin Height	Fin Length	Fin Spacing	Fin Thickness ALUMINUM	Fin Thickness COPPER	Tube O.D. Tube Thickness	Tube Spacing Face x Row	Casing	Max. Std. Operating Conditions
3, 4, 5, 6, 8, 10, 12	6" to 60"	12" to 157"	1/2" 8 to 14 fins per inch 5/8" 6 to 14 fins per inch	1/2" 0.006" 5/8" 0.008" 0.010"	1/2" 0.006" 5/8" 0.006" 0.008" 0.010"	1/2" 0.017" 0.025" 5/8" 0.020" 0.025"	1/2" 1.25"x1.083" 5/8" 1.50"x1.299"	16 or 14 GA Galvanized Steel 304, 316 Stainless Steel	250 PSIG

DX coils are sealed at the factory and contain a dry nitrogen charge, confirm that the coil is still charged prior to installation.

Steam Distributing Coil - Type NS, NO, NOD

Primary Surface
Round seamless copper tubes are mechanically expanded into the fin collars of the secondary surface. The mechanical expansion provides a permanent metal-to-metal bond for efficient heat transfer. The inner tube has proportionally spaced directional steam jet orifices that direct the condensate flow to the outlet.

Secondary Surface
Corrugated aluminum or copper plate type fin that is die-formed. Fin collars are full-drawn to provide accurate control of fin spacing and maximum contact with tubes.

Headers
Seamless copper with die-formed holes that provide a parallel surface to the coil tube for strong brazing joints.

Connections
Red Brass Schedule 40 male pipe thread (MPT) is standard with optional copper female pipe thread (FPT) and sweat available. Maximum fin length of 120" with same end connections. Fin length over 120" is recommended to have steam supplied at both ends (Type NOD). Any fin height over 48" will have two supply and two return connections.

Casing
Casing is die-formed with 1½" flanges to permit easy stacking and mounting. Casing is pitched nominal 1/8" per foot to facilitate condensate removal. Intermediate tube supports are supplied on coils over 44" fin length with an additional support every 42".

Testing and Performance
All coil assemblies are leak tested under water with nitrogen at 315 PSIG. Standard construction is suitable for 50 PSIG steam pressure. Heavier wall construction is available for steam pressures up to 100 PSIG.

Performance is AHRI Certified™ to Air-Cooling and Air-Heating Coils AHRI Standard 410. Coil performance ratings are calculated using Nortek Air Solutions AHRI Certified™ selection software.

Rows	Fin Height	Fin Length	Fin Spacing	Fin Thickness ALUMINUM	Fin Thickness COPPER	Tube O.D. Tube Thickness	Tube Spacing Face x Row	Casing	Max. Std. Operating Conditions
1	9" to 54"	12" to 144"	4 to 14 fins per inch	0.010"	0.010"	1-1/8" Outer 0.035" 0.049" 5/8" Inner	3"	16 or 14 GA Galvanized Steel 304, 316 Stainless Steel	Standard 50 PSIG Optional 100 PSIG

1. If the air temperature is below freezing maintain a minimum 5-psig steam and do not modulate the steam. Normal usage of this coil is in low-pressure steam systems 5 to 15 psig. 100-psig-steam pressure max.
2. Never operate any steam coil below 2-psig-steam.
3. The supply connection is normally in the center of the coil. It is recommended that each supply have its' own supply valve.
4. The return connection is always at the bottom of the coil. It is recommended that each return have its' own trap with a minimum of 12" of drop.
5. All field piping must be self-supporting. System piping should be flexible enough to allow for thermal expansion and contraction of the coil.

See Appendix (p.50) for Start-Up Procedure Checklist

CAUTION: This unit has rotating parts, high voltage, and possibly high temperature solutions or components. Safety precautions must be exercised during installation, operation and maintenance. Service should only be performed by a qualified technician who has been specially trained to service air conditioning equipment.

PRELIMINARY INSPECTION

1. Disconnect all power to unit. Lockout and label all disconnect means to prevent accidental power application.
2. Verify that all field electrical wiring and connections including electrical grounding are made in accordance with the National Electrical Code and local codes. Verify that supply voltage(s) agree with unit data plate. Check all wiring for completeness and terminals for tightness.
3. Inspect all supplementary cooling (if any) piping for leaks and conformance with the Uniform Plumbing Code and local codes.
4. Remove supply and exhaust fan compartment covers and make sure all steel banding, bolts and wood braces installed for shipping have been removed from fans prior to starting the unit.
5. Remove filter section access panel and ensure all filters are securely in place. Replace and secure the access panel.
6. Check all unit manual reset devices and reset if necessary.
7. Check supply and exhaust ducts for obstructions and damper positions and open all diffusers.

FAN START-UP

1. Open the fan access door and inspect the fan and drive assembly. A typical fan and motor arrangement using Fanwall Technology is shown above.
2. Before operation, start the motor slowly to ensure the fan rotation is correct. It should be rotating “CWR” when looking at the motor end. If the fan wheel is not rotating correctly, check the motor power leads for proper installation. Also check inlet cone alignment to the fan wheel. Fan wheel should not be rubbing on the inlet cone. If cone alignment is required loosen the retaining fasteners for the cone and adjust cone for proper clearance from fan wheel.
3. Replace and fasten down the fan housing access panel.

AIRFLOW VERIFICATION

IMPORTANT NOTE: Air quantities as specified on the unit data plate are essential for safe and economic operation. The unit fan RPMs were carefully set at the factory to deliver the specified air quantity at the specified external static pressure. We cannot overemphasize that these values be field verified as external static pressures are often found to be different than what was anticipated.

a. Air volume measurements should be made using AMCA suggested methods. This would normally be a traverse of the supply duct or ducts. For test and measurement guidelines, write to: AMCA, 30 West University Drive, Arlington Heights, IL 60004

b. Start the fan, observe the motorized inlet air damper (if any) to be certain that it fully opens (90°). Check the fan for proper rotation.

c. Measure airflow and compare to the value stamped on the ITF data plate. Adjust the supply fan motor drive pitch to increase or decrease the fan speed until the desired airflow is reached.

d. Once the proper air volume has been established, check the supply motor AMP draw against the motor nameplate full load amp’s to be sure the motor is not overloaded. All access doors must be closed while checking amps.

Note: Airflow rated volume (cfm) and static (inches w.g.) pressure shall not be exceeded.

Installation Section for Direct Fired Gas Burner

For detailed start-up procedures, please refer to the provided Heatco Installation, Operation and Maintenance Instructions document provided with the unit. For the burner assembly to operate, airflow and a heat enable signal needs to be present.

Service personnel shall perform a gas leak check during heater start-up, to verify the gas-tightness of the components and piping of the unit under normal operating conditions.

Each DF module comes with a Time Purge Delay Relay. This Time delay relay pauses the call for heat signal to the ignition control for a set time. This time is factory set during operation tests. In the field this Purge Time Delay Relay shall be adjusted to ensure (4) four complete air changeovers in the heater cabinet section and attached discharge duct work will be completed prior to burner start-up. This time can change based on job specific installations.

HEATING COIL START-UP
(For factory control valve loops)

1. Turn the unit off, remove the access panel and fully open both the supply and return shut-off valves.
2. Set the adjustable heating/cooling control about 10°F above the present outside air temperature and set the heating coil discharge air control at its highest setting.
3. Adjust balancing valves per instructions in the submittal. Refer to unit data plate for gpm.
4. Turn the unit on and after 5 minutes measure and record the supply and return line temperatures at the universal test taps provided. The modulating valve should move to full open (heat) position. Measure and record the inlet air and discharge air temperatures.
5. Verify that piping is leak-free.
6. Set the discharge air control to its lowest setting and after 5 minutes, repeat the temperature measurements taken in step 4. The modulating valve should move to full closed bypass position. Record these values.
7. Return heat/cool control to its original setting (typically 65°F). Return discharge air control to its original setting (typically 65°F).
8. Replace access panel.

HEATING COIL START-UP
(For factory face and bypass dampers)

1. Turn the unit off, remove the access panel and fully open both the supply and return shut-off valves.
2. Adjust balancing valves per instructions in the submittal. Refer to unit data plate for gpm.
3. Turn the unit on and after 5 minutes measure and record the supply and return line temperatures at the universal test taps provided. Measure and record the inlet air and discharge air temperatures. The modulating valve (if any) should move to full open (heat) position and damper should assume full face and zero bypass position.
4. Verify that piping is leak-free.
5. Set the discharge air control to its lowest setting and after 5 minutes, repeat the temperature measurements taken in step 4. The modulating valve (if any) should move to full closed bypass position and damper should assume full face and zero bypass position.
6. Replace access panel.

EVAPORATIVE COOLER START-UP

Water quality is crucial to maintaining optimum operating conditions for the evaporative cooler system. A water analysis is highly recommended before start-up. Maintain the pH of the recirculating water between 6 and 8.

1. Clean Evap Sump Tank before filling.
2. Media clean and in place. 45° flutes slope down towards air entering side.
3. Connect water service to the water inlet. This should include a shut-off valve for service. Extend the drain to the nearest available waste location as desired. Line pressure = Min. 50 psi / Max. 125 psi. Observe code requirements regarding these connections.
4. Open the service valve and fill the sump with water. If water spills over the edge of the sump, adjust the float valve and make sure the unit is level. Both front to back and side to side. Water level must be within 1” of the top of the sump. The circulating pump must be fully submerged to keep the motor from overheating.
5. Check the tube connections at the outlet of the pump and inlet of the water distribution pan located above the cooling media.
6. Apply power to the unit.
7. Flush and drain the media and sump a minimum of twice before operating the cooler.
8. Wait approximately 5 minutes for the water to thoroughly saturate the cooling media checking both inlet and outlet sides.
9. Manually turn on the pumps to run fresh water over the pads for about 30 minutes. Use as much water as possible.

CHILLED WATER COOLING START-UP
(For factory control valve loops)

1. Turn the unit off, remove the access panel and fully open both the supply and return shut-off valves.
2. Set the adjustable heating/cooling control about 10°F below the present outside air temperature and set the discharge air control at its lowest setting.
3. Adjust balancing valves per instructions in the submittal. Refer to the unit data plate for gpm.
4. Turn the unit on and after 5 minutes measure and record the supply and return line temperatures at the universal test taps provided. The modulating valve should move to full open position. Measure and record the inlet air and discharge air temperatures.
5. Verify that piping is leak free and that condensate forming on piping and the coil is collected by the condensate drain pans.
6. Set the discharge air control to its highest setting and after 5 minutes, repeat the temperature measurements taken in step 4. The modulating valve should move to full closed position.
7. Return the heat/cool control to its original setting (typically 65°F). Return discharge air control to its original setting (typically 65° F).
8. Replace access panel.

CHILLED WATER COOLING START-UP
(For factory face and bypass dampers)

1. Turn the unit off, remove the access panel and fully open both the supply and return shut-off valves.
2. Set the adjustable heating/cooling control about 10°F below the present outside air temperature and set the discharge air control at its lowest setting.
3. Adjust balancing valves (if any) per instructions in the submittal. Refer to the unit data plate for gpm.
4. Turn the unit on and after 5 minutes measure and record the supply and return line temperatures at the universal test taps provided. Measure and record the inlet air and discharge air temperatures. The modulating valve (if any) should move to full open position and damper should assume full face and zero bypass position.
5. Verify that piping is leak free and that condensate forming on piping and the coil is collected by the condensate drain pans.
6. Set the discharge air control to its highest setting and after 5 minutes, repeat the temperature measurements taken in step 4. Record these values. The modulating valve (if any) should move to full closed position and damper should assume zero face and full bypass position.
7. Return heat/cool control to its original setting (typically 65°F). Return discharge air control to its original setting (typically 65°F).
8. Replace access panel.

DIRECT EXPANSION COOLING START-UP

1. Carefully read the instructions for the remote condensing unit and perform all start-up checks required. If the remote condensing unit is provided by Huntair, this information will be found in the submittal. Ordinarily, power must be applied to the remote condensing unit for a period of 24 hours prior to start-up to allow the crankcase heater to vaporize the refrigerant out of the crankcase oil.
2. Set the adjustable heating/cooling control about 10°F below the present outside air temperature. If the unit is provided with a remote space thermostat, set it at its lowest setting.
3. Turn the unit on and observe that the remote condensing unit operates. There will be a slight delay in most cases as the inlet damper opens and the condensing unit internal time delay times out. This should be no more than 30 seconds total. 4. Allow the unit to operate for about 3 minutes and then measure and record the inlet and discharge air temperatures while the remote condensing unit is still running.
5. Adjust the heating/cooling control to its highest setting and, assuming this is higher than the outside air temperature, the remote condensing unit should not operate. Test the remote space thermostat (if any) in similar fashion by selecting a setting above the present space temperature.

IMPORTANT: Wait about 5 minutes after the remote condensing unit is shut-off prior to restarting it. This will allow system refrigerant pressures to equalize.

6. Remove access panel and verify that condensate forming on the tubing and the coil is collected by the condensate drain pans.
7. Return heating/cooling control to its original setting (typically 65°F). Return the remote thermostat to its original position (typically 72°F)
8. Replace access panel.

Motors are provided with a means to minimize electrical pitting due to arcing across bearings. Motors provided with hybrid ceramic bearings require no maintenance. Motors with an external spring-loaded shaft grounding stick should be checked after 3 years of run time for active length on the grounding stick, and every year thereafter, and replaced if necessary.

Please Direct Service Needs To:

Nortek Air Solutions Customer Service Manager:

Phone: (844) 899-6611
Email: service@nortek.com

parts.huntair@nortek.com

service.huntair@nortek.com

parts.ventrol@nortek.com

service.ventrol@nortek.com

parts.aston@nortek.com (Venmar)

service.aston@nortek.com (Venmar)

parts@nortek.com (Mammoth)

service.mammoth@nortek.com

parts.temtrol@nortek.com

service.temtrol@nortek.com

parts.governair@nortek.com

service.governair@nortek.com

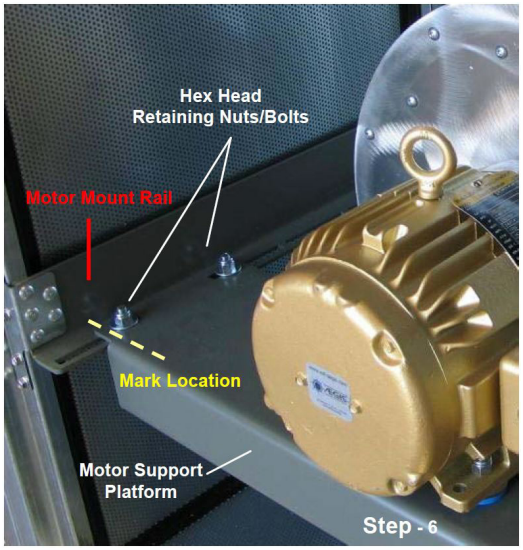
Fan Wheel/Motor Replacement

DANGER! Risk of Electric Shock

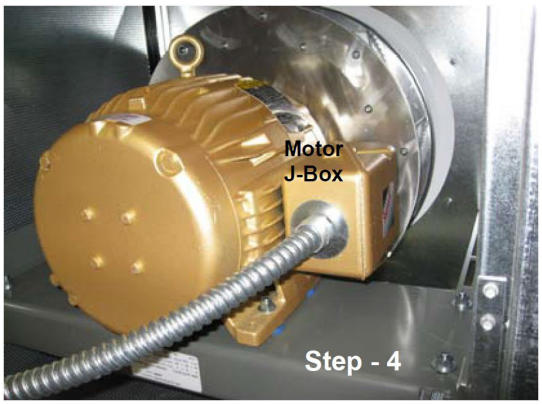
Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

DANGER! Risk of Shock

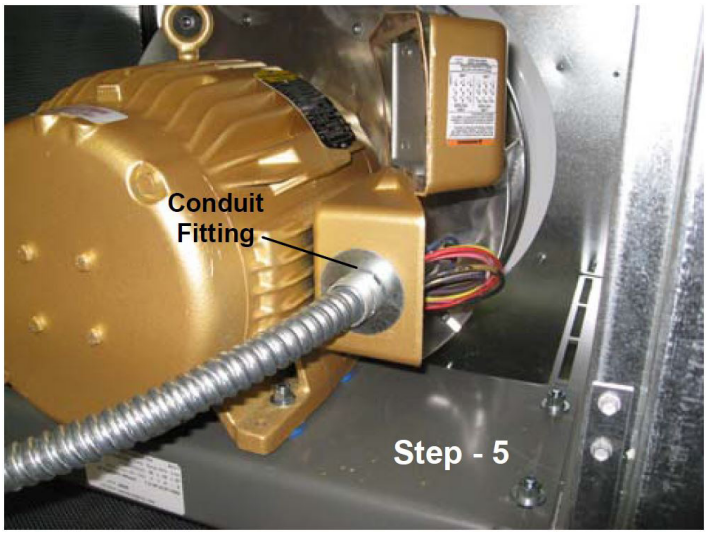
Always disconnect power to the fan motor before maintenance. Follow all lockout and tag out procedures.
If your unit has permanent magnet motors, high voltage can be generated whenever the motor is rotating, even if power is off. **ALWAYS MAKE SURE MOTORS CANNOT ROTATE DURING SERVICING.**



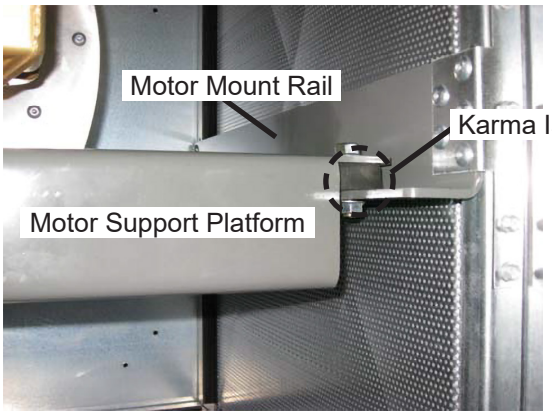
Note: Tools required for fan removal include torque wrench with 12” extension, 1-3/4” socket, and a length of pipe or wood block to brace fan wheel from spining.

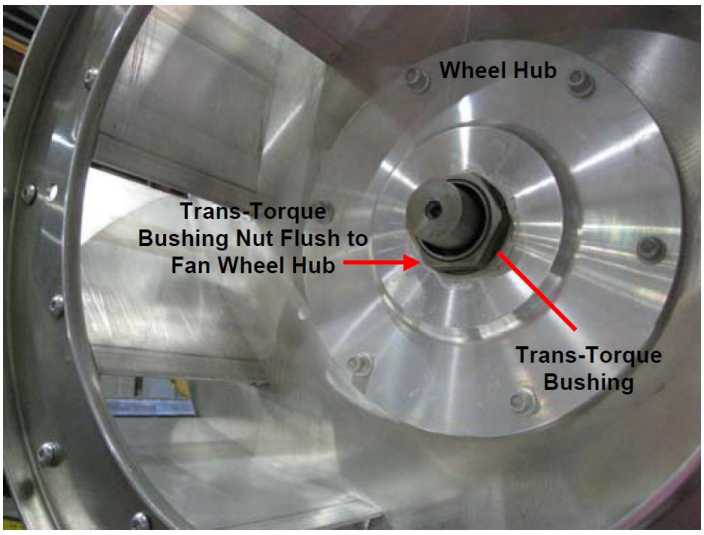


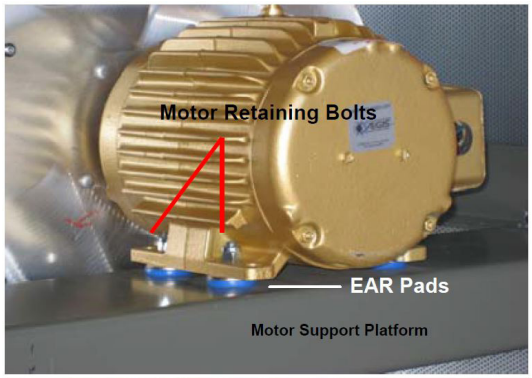
1. To replace a fan wheel/motor assembly, first disconnect power to the FWT at the main control panel.
2. To gain access to the fan/motor cartridge, remove the personel safety screen on the discharge side if applicable.
3. Disconnect power to the existing fan at the main disconnect control panel.
4. Make note of all wire locations for reinstallation later.
5. Disconnect motor power cable from terminal located in motor J-Box and conduit fitting from J-Box as shown.
6. Mark motor support platform location on the motor mount rail (both sides), then loosen and remove all (4) hex nuts/bolts that retain the motor support platform to the fan cartridge framing. (See below) Be careful not to loose the EAR pads (rubber blue bushings, if applicable)

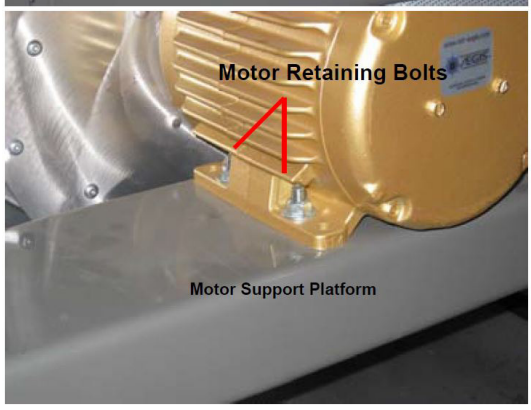


7. After all (4) hex nuts/bolts have been removed, (if applicable, being careful not to loose the Karma Isolator pads part# K373, see below) slide the motor support platform out a few inches away from inlet wall so that the motor lifting eye is clear of the fan cartridge framing.









8. Lift and remove the wheel / motor assembly from the motor support platform.
9. To remove the fan wheel from motor shaft, remove trans-torque bushing retaining hex nut. Be sure to measure and/or mark location of Trans-torque bushing nut on fan shaft. Loosen progressively until bushing is free from wheel hub and motor shaft.
10. Remove fan wheel / hub assembly from motor shaft. Trans-torque bushing:

    Loosen=Turn counter clockwise

    Tighten = Turn clockwise

    When reinstalling trans-torque bushing to hub, making sure that the Trans-torque bushing nut is flush to the fan wheel hub, tighten the bushing retaining hex nut progressively and torque down per bushing specifications (75 foot lb).
11. To install fan wheel / motor assembly into fan cartridge, reverse the steps above.
12. Follow Fan / Cone Alignment procedures starting on page 28.

Important: Before Restarting

Re-balance fan wheel once the complete motor pedestal/ fan wheel/motor assembly is re-installed.
Before operation, start the motor slowly to ensure the fan rotation is correct.
Drive Side = Clockwise rotation when looking at motor end
Inlet side = Counter-clockwise rotation looking at fan.
If the fan wheel is not rotating correctly, check the motor power leads for proper installation.
Also check inlet cone alignment to the fan wheel. Fan wheel should not be rubbing on the inlet cone. If cone alignment is required see instructions for “Fan Wheel/Cone Alignment” pages 17 - 18.

Fan Wheel/Cone Alignment

DANGER! Risk of Electric Shock

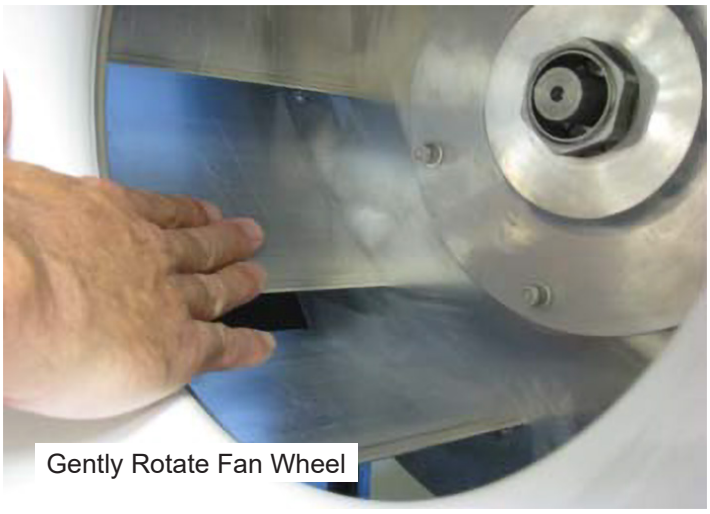
Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

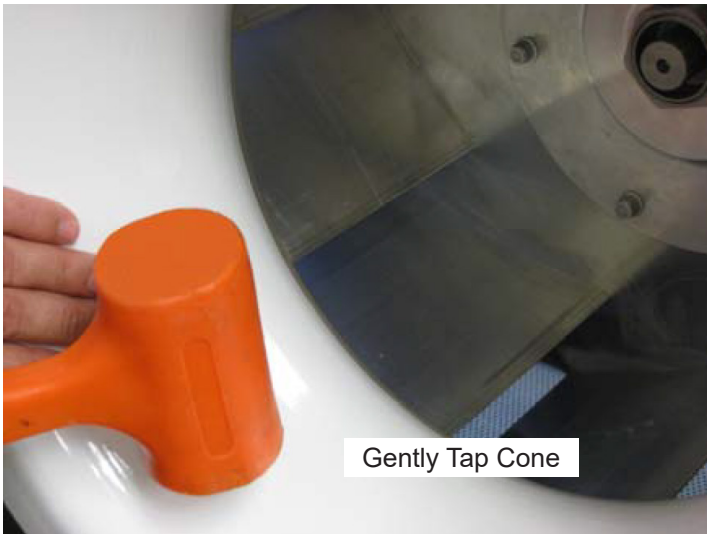
DANGER! Risk of Injury

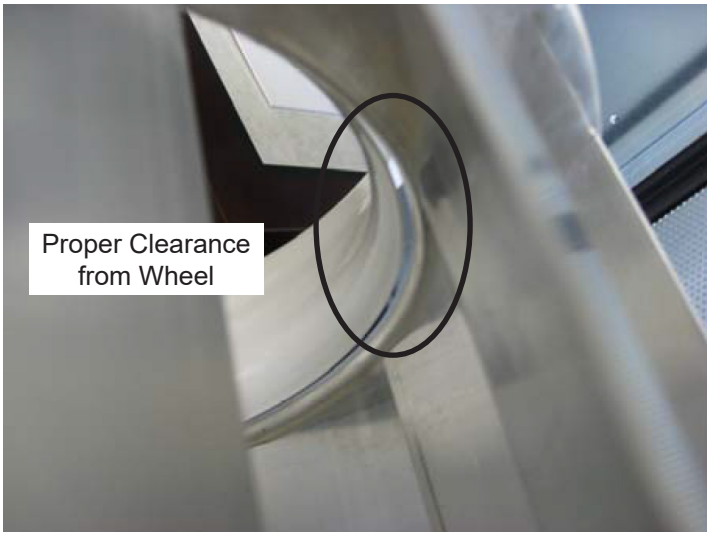
Always disconnect power to the fan motor before maintenance. Follow all lockout and tag out procedures.
If your unit has permanent magnet motors, high voltage can be generated whenever the motor is rotating, even if power is off. **ALWAYS MAKE SURE MOTORS CANNOT ROTATE DURING SERVICING.**

Backdraft damper furnished – reverse instruction on pages 19-23. Then continue with #2 of this section.

1. To align fan wheel/cone, first disconnect power to the FWR/FWT at the main control panel.
2. Gently rotate the fan wheel to verify location of adjustment.
3. To make adjustment, loose (***do not remove***) all the cone retaining fasteners)
4. Using a rubber mallet, gently, tap around the cone until desired clearance is acquired between fan wheel and cone.
5. Gently rotate the fan wheel to verify cone adjustment for proper clearance from fan wheel.


Gently Rotate Fan Wheel


Gently Tap Cone


Proper Clearance from Wheel

6. Tighten all the cone retaining fasteners.
7. Once again gently rotate the fan wheel to verify cone alignment.
8. To install fan wheel/cone assembly, reverse the steps above.

FBD - Backdraft Damper (*if applicable*)

DANGER! Risk of Electric Shock

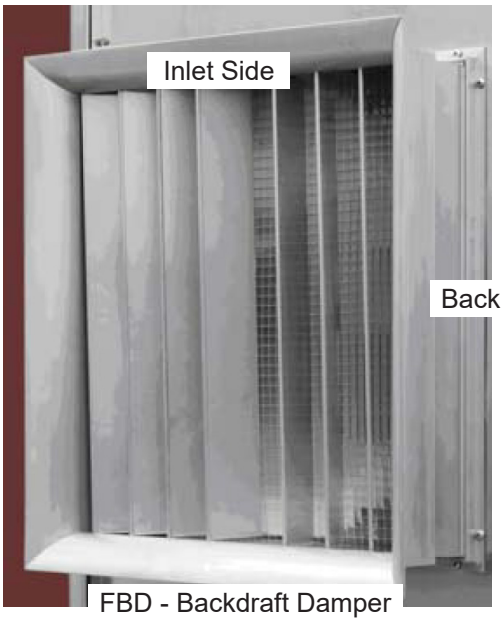
Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

DANGER! Risk of Injury

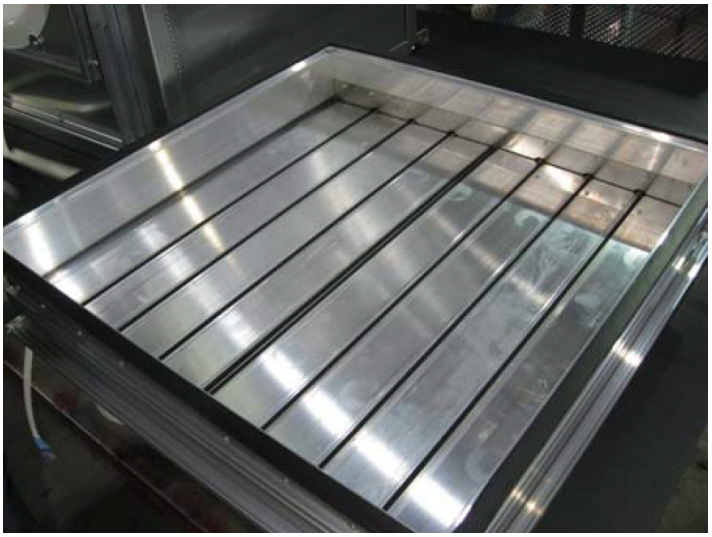
Rotating equipment. Always disconnect power to the fan motor before maintenance.

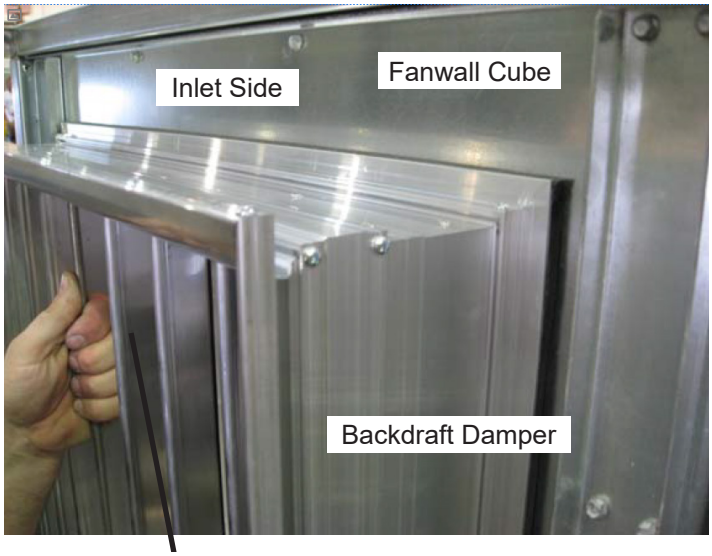
Backdraft damper furnished – reverse instruction on pages 19-23. Then continue with #2 of this section.

1. Units utilizing a fanwall may include a backdraft damper to cover the intake of a single fan so that the facility maintenance staff can block the back flow until service on the inoperative assembly can be preformed fan wheel/cone.
2. First disconnect power to the FWR/FWT at the main control panel.
3. On the back side frame of the backdraft damper apply gasketing on all four back sides prior to installation.
4. On the inlet side of the fanwall cube the backdraft damper is installed.
5. Note the direction of the damper blades. The blades should be running vertical, as shown in photo.



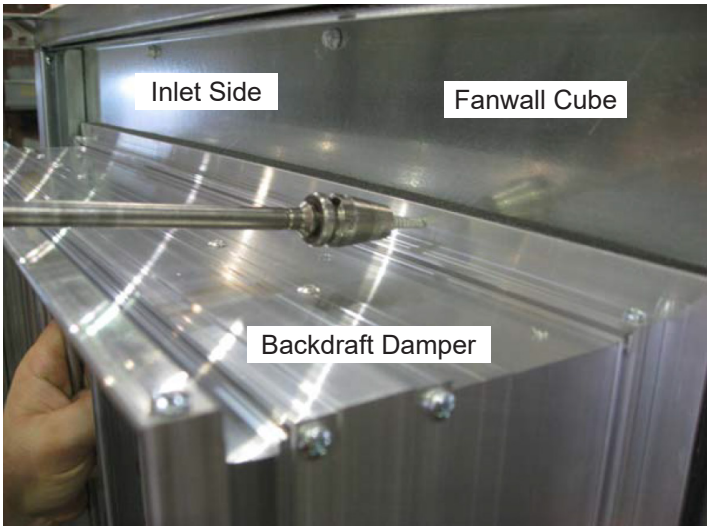
FBD - Backdraft Damper

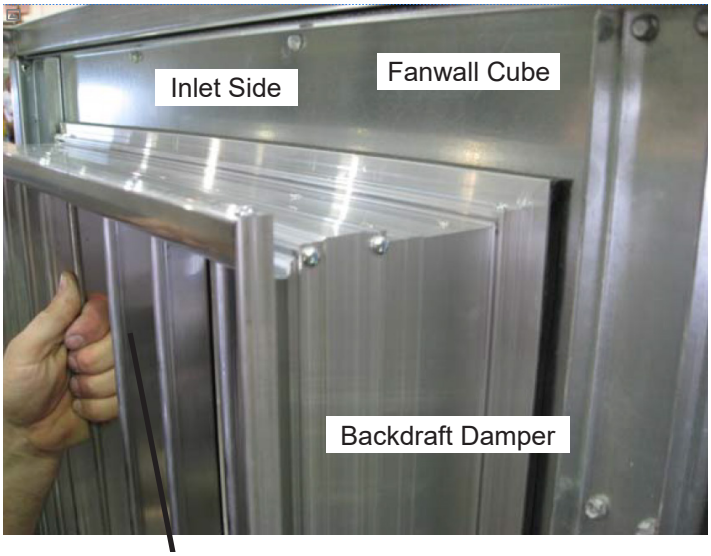




Note Direction of Damper Blades

6. Secure the backdraft damer with self-tapping hex head fasteners on all sides: top, left, right and bottom.
7. To remove backdraft damper, reverse steps above.





Note Direction of Damper Blades

Blank-Off Plate (*if applicable*)

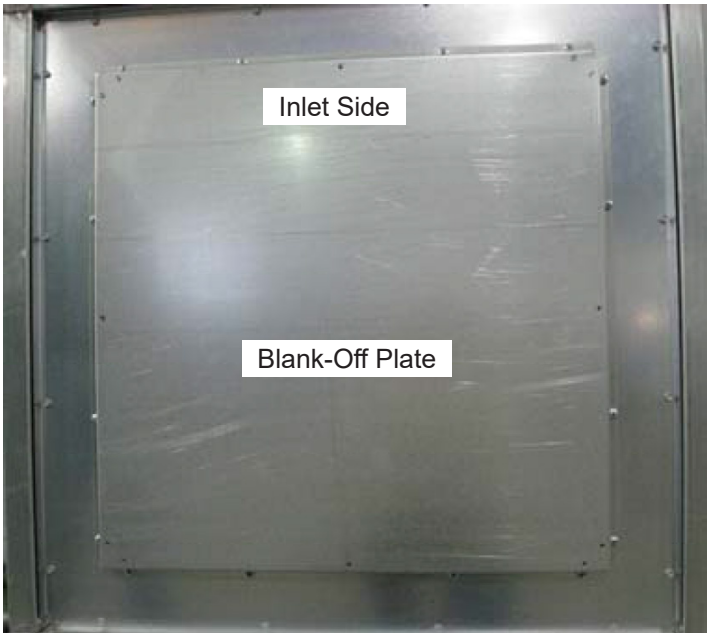
DANGER! Risk of Electric Shock

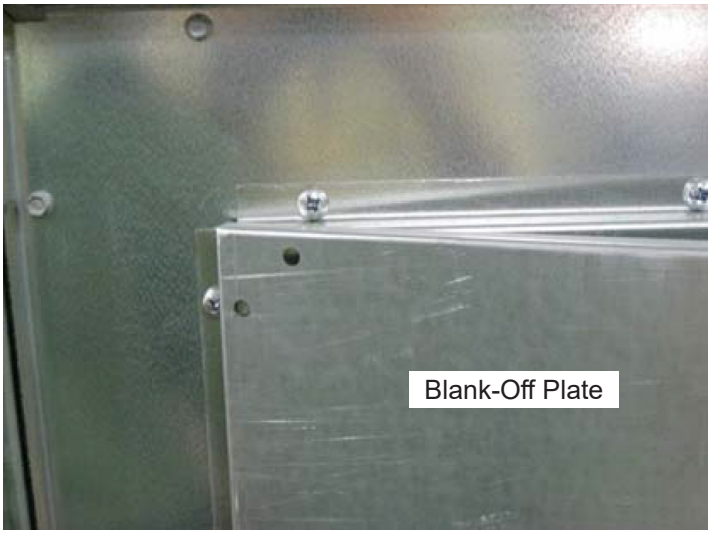
Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

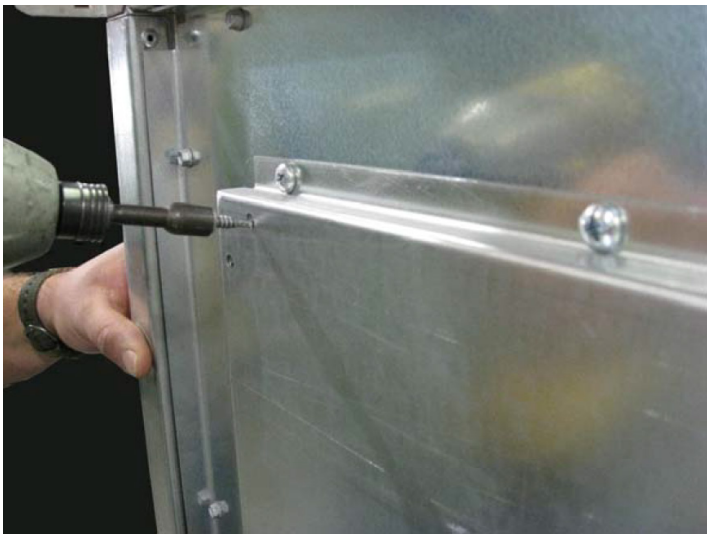
DANGER! Risk of Injury

Always disconnect power to the fan motor before maintenance. Follow all lockout and tag out procedures.
If your unit has permanent magnet motors, high voltage can be generated whenever the motor is rotating, even if power is off. **ALWAYS MAKE SURE MOTORS CANNOT ROTATE DURING SERVICING.**

1. Units utilizing a fanwall may include a blank-off plate to cover the intake of a single fan so that the facility maintenance staff can block the back flow until service on the inoperative assembly can be preformed fan wheel/cone.
2. First disconnect power to the FWR/FWT at the main control panel.
3. On the inlet side of the fanwall cube the pre-drilled holes match the pre-drilled holes in the blank off plate which are also located in the corners and the middle
4. Match up the holes in both airflow straightener and the blank-off plate, it may require a gently tap to set into place. Secure it with hex head fastener in the pre-drilled holes furnished.
5. To remove blank-off plate, reverse the steps above.







WARNING

UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere

Turn off accessory heater power if applicable. Electrical shock can cause personal injury or death.

General Inspection:

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

DANGER! Risk of Electric Shock

Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious for fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Extruded Fan Cell W/Formed Pedestal Fan Wheel/Motor Replacement

DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

Note: Tools required for fan removal include torque wrench with 12" extension, 1-3/4" socket, and a length of pipe or wood block to brace fan wheel from spining.

1. To replace a fan wheel/motor assembly, first disconnect power to the FWT at the main control panel.
2. To gain access to the fan/motor cartridge, remove the personal safety screen on the discharge side if applicable.
3. Disconnect power to the existing fan at the main disconnect control panel.
4. Make note of all wire locations for reinstallation later.
5. Disconnect existing fan motor power cable from terminal located in motor J-Box and conduit fitting from electrical chase.
6. Loosen and remove (4) 5/16-18 lock nuts at the bottom of the guide rails.
7. After removing the mounting bolts slide the motor pedestal to the point where the motor lifting ring is exposed enough to use. If a mechanical device is available for use, attach it to the lifting ring for use. Lift the motor/fan/pedestal assembly and turn 180°. Set back down on the motor guide rails so that the fan is now facing you.
8. Push the pedestal back in to the fan cell so that the fan wheel is in the cell. Block the fan from rotating by using a wood block or a pipe.
9. Mark the location of the transtorgue bushing on the shaft and the fan. To remove the fan wheel from the motor shaft, remove the trans torque bushing retaining hex nut by turning counterclockwise. Loosen progressively until bushing is free from wheel hub and motor shaft. Remove fan/hub assembly.
10. If needed the motor may now be removed for service by removing the 3/8" motor bolts.
11. With the motor pedestal on the guide rails that run front to back along the cell, set the motor on the pedestal using the same holes. Use proper lifting techniques, crane or motor/rail system if possible for lifting the motor into position. Once the motor is placed on the pedestal align the bolt holes on the motor to the bolt holes on the pedestal making sure that the motor shaft is pointing towards you.
    a. Next, insert 3/8" bolts into the holes from the underside, make sure to use a standard washer on the bolt side, only a locknut is required on the motor side.
    b. Square the motor and tighten the bolts to 40 ft-lbs.
12. Reinstall the fan on the motor shaft with the hub facing towards you. Line up the markings on the hub/trans torque bushing/shaft. Make sure that the trans torque bushing nut is flush to the hub, tighten the bushing nut to 80 ft-lbs.
13. Once the fan/motor/pedestal assembly is done, turn it 180° so the the fan is facing the inlet of the fan cell. Slide the pedestal forward to the line up with the holes in the motor rail. Insert 5/16 x 18 bolts into the holes. Hand-tighten the nuts for now.
14. Follow Fan / Cone Alignment procedures starting on page 28.

Important: Before Restarting

Re-balance fan wheel once the complete motor pedestal/fan wheel/motor assembly is re-installed. Before operation, start the motor slowly to ensure the fan rotation is correct.
Drive Side = Clockwise rotation when looking at motor end
Inlet side = Counter-clockwise rotation looking at fan.

Extruded Fan Cell
Fan Wheel/Motor Replacement Continue

15. For removing polymer fan wheel, you start by removing the two set screws in the taper lock bushing.

16. Reinsert one set screw in the middle hole and start tightening the set screw. This will seperate the taper lock bushing from the fan wheel hub.

17. Once the two have been seperated, carefully remove the taper lock bushing from the motor shaft. Make sure not to damage the polymer fan wheel when removing the taper lock bushing. Once the polymer fan wheel has been removed from the motor shaft, place taper lock busing back into the fan wheel hub. Align the three half holes in the bushing with the half holes in the fan wheel hub. Reinsert set screws far enough so that the bushing and set screw do not fall out of the fan wheel hub.

18. Replace bad motor on the pedestal. After the new motor has been installed on the pedestal, align the keyway in the bushing to the keyway on the motor shaft and carefully slide fan wheel on.

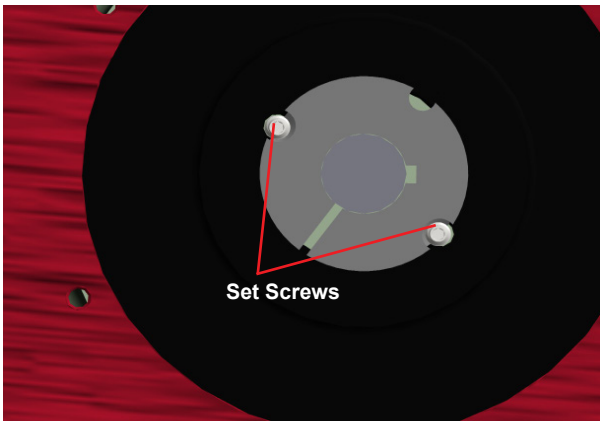
19. In a alternating pattern, tighten set screws. Make sure the fan wheel is no less than 1/4 inch from the shaft bearing. Torque set screws to the specs in the table below.

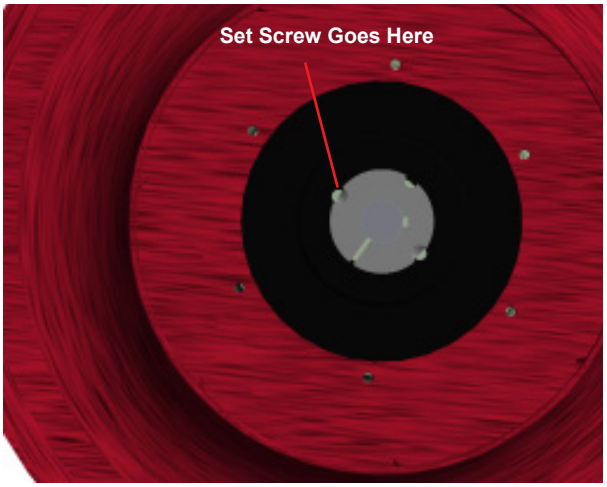
20. Inspect polymer fan wheel for any cracks or damage.

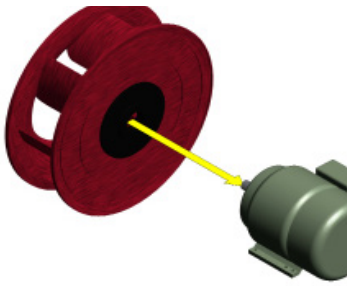
21. Once the fan/motor/pedestal assembly is done, turn it 180° so the the fan is facing the inlet of the fan cell. Slide the pedestal forward lining up Isolator Brackets A & B.

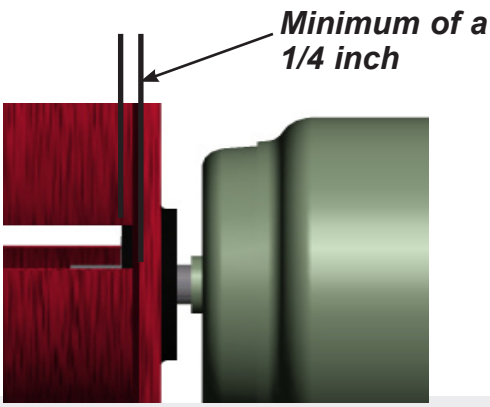
    a.Insert (4) 5/16-18x1.125 Torx screws into the holes. Do not tighten down all the way. Leave loose so that the motor assembly can slide back and forth freely.

22. Follow Fan / Cone Alignment procedures starting on page 28.









Important: Before Restarting

Re-balance fan wheel once the complete motor pedestal/ fan wheel/motor assembly is re-installed.
Before operation, start the motor slowly to ensure the fan rotation is correct.
Drive Side = Clockwise rotation when looking at motor end
Inlet side = Counter-clockwise rotation looking at fan.

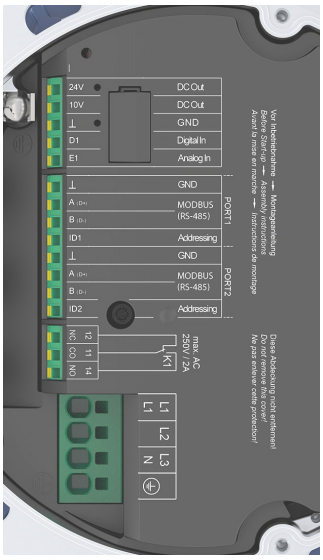
Polymer Fan Wheels:
Drive Side = Counter-clockwise rotation when looking at motor end
Inlet side = Clockwise rotation looking at fan.

Recommended Torque	
Bushing No.	**LB. – Ft.**
1210	15
2012	24
2517	36

Extruded Fan Cell w/Polymer Wheel and ECMI Motor Replacement

DANGER! Risk of Electric Shock

Always disconnect power to the fan control panel before maintenance. Follow all lockout and tag out procedures.

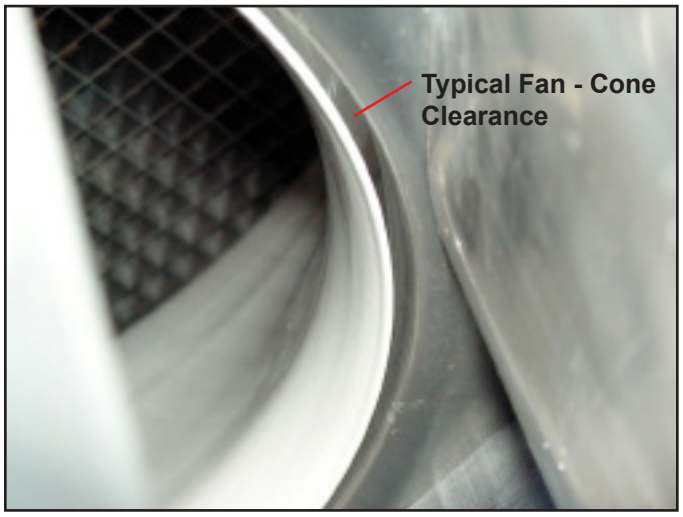


1. To replace a fan wheel/motor assembly, first disconnect power to the FWT at the main control panel.
2. To gain access to the fan/motor cartridge, remove the personel safety screen on the discharge side if applicable.
3. Disconnect power to the existing fan at the main disconnect control panel.
4. With a T20 Torx bit, remove the back plate on the ECMi motor.
5. Make note of all wire locations for reinstallation later.
6. For wiring connections L1, L2, L3, and ground, insert a small screwdriver in the square opening to release the wiring. Remove the power and data cable wires.
7. Loosen and remove (4) 5/16-18x1.125 Torx screws at the bottom of Isolator Bracket B that retain the motor pedestal to the guide rails.
8. After removing the mounting bolts slide the motor pedestal to the point where the motor lifting ring is exposed enough to use. If a mechanical device is available for use, attach it to the lifting ring for use.
9. Slowly rase the motor/fan wheel/pedistal and remove from the fan cell. Slowly lower the motor/fan wheel/ pedistal to the floor.
10. Removing the 3/8” motor bolts and attach the replacement motor and fan wheel, and insert the 3/8" motor bolts and finger tignten.
11. Lifting the motor/fan wheel/pedistal into position. Square the motor and tighten the bolts to 40 ft-lbs.
13. Once the fan/motor/pedestal assembly is done, turn it 180° so the the fan is facing the inlet of the fan cell. Slide the pedestal forward to the line up with the holes in the motor rail. Insert 5/16 x 18 bolts into the holes. Hand tighten the nuts for now.
14. Follow Fan / Cone Alignment procedures starting on page 28.

Important: Before Restarting

Before operation, start the motor slowly to ensure the fan rotation is correct.
Drive Side = Counter-clockwise rotation when looking at motor end
Inlet side = Clockwise rotation looking at fan.

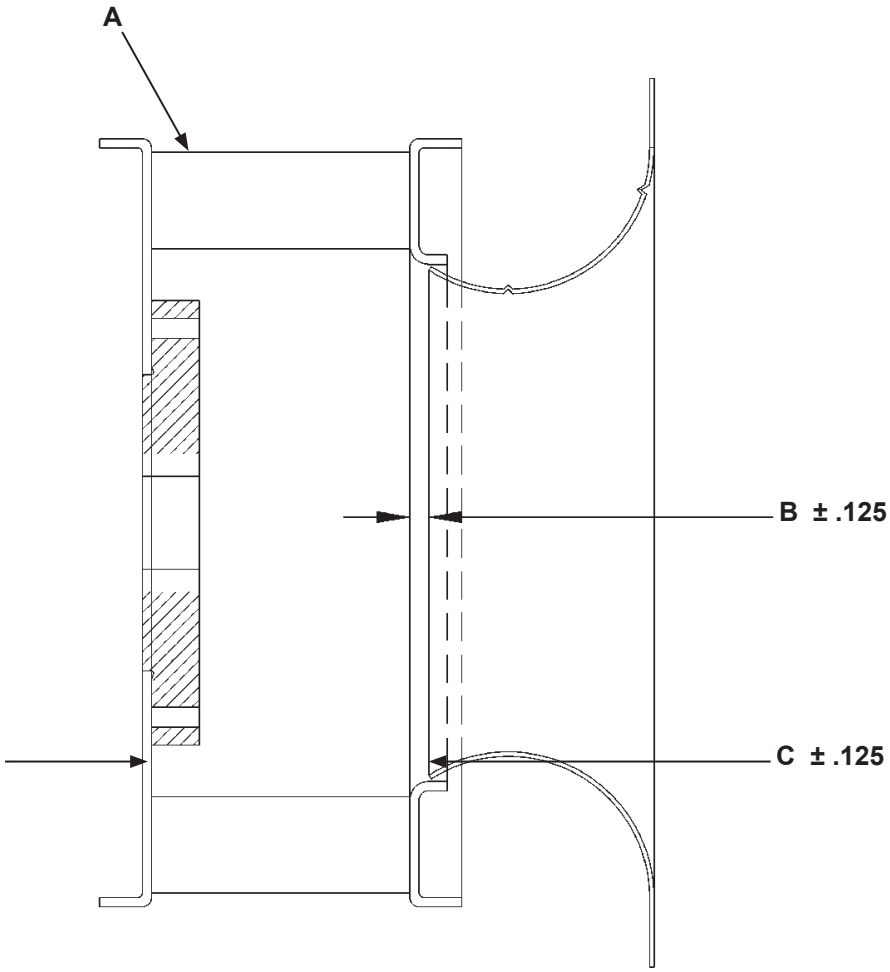
1. Temporarily attach the cone to the cell inlet using the screws and washers provided, or slightly loosen the screws holding the cone if already installed (remove the backdraft damper to access the cone). Use a minimum of four screws for this step.
   a. Refer to the fan wheel overlap drawings provided to determine where to set the wheel with respect to the cone. See page 27.
   b. Adjust the amount of overlap by moving the motor pedestal forward or backward to line up the cone with the wheel (wheel/cone overlap is designed to insert the cone 50% of the distance of the rolled shroud lip on the wheel). Once you have the wheel approximately located tighten the ½" pedestal bolts to 90ft-lbs.



2. Center the cone in the wheel shroud.
   a. The cone alignment can be a tedious process as there are no tools that effectively work to align the cone. It is a hands on process to align the cone. Huntair cones have a running clearance of about 1/16" (see image top right).
   b. Start by loosening the four screws that were used to hold the cone for the depth alignment. Hold the cone with one hand and with the other use a drill to attach a screw to hold the cone in place. Feel between the wheel inlet shroud and the cone and set the gap to approximately 1/16" and tighten the screw in that location (top of the cone is usually the best place to start). At this point you should be able to move the cone about that screw location, adjust the cone on the left or right until there is approximately a 1/16" gap.
   c. Spin the wheel by hand at this point to check for any clearance issues. If the wheel spins clear tighten the remaining screws on the cone. Check that the wheel spins clear after tightening each screw.

3. Attach the inlet backdraft damper using the predrilled holes in the faceplate (see middle image).
   a. Start by loosely installing (don't tighten screws all the way) the top two screws. Align the holes on the sides.
   b. Loosely install screws on side. Install bottom 2 screws.
   c. Tighten all screws (middle image).
   d. Install safety screen on discharge side if applicable.

WHEEL/CONE ALIGNMENT



A	B	C
Wheel Type & Dia (in)	Cone to Wheel Overlap (in)	Cone to Wheel Overlap (in)
Aluminum		
All Diameters	0.375	
Polymer		
10”		4.134
12”		5.158
14”		5.768
16”		6.437
18”		7.244
20”		8.189
22”		9.095

Note: Drawings not to scale

Water Coil Freeze Protection Instructions

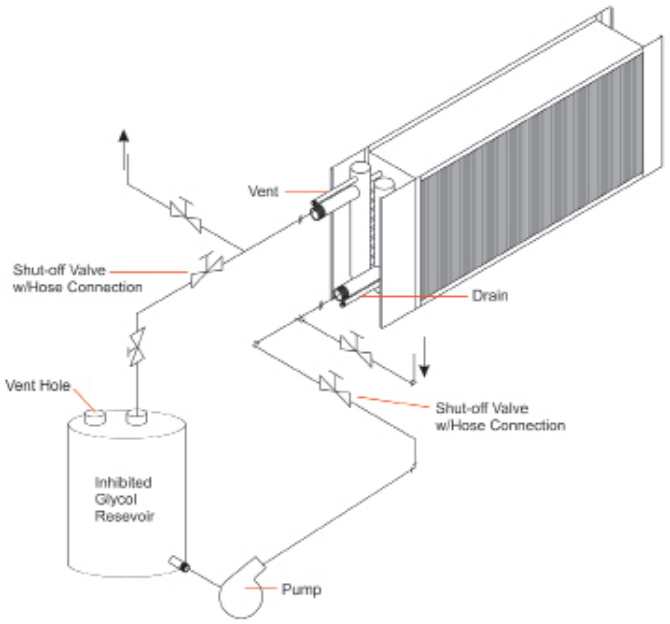
Air stratification and outside air damper failure are just a couple of causes that can trigger coil failure. Permanent coil damage can result. Chilled water coils need to be protected during the winter months by a variety of methods described below:

Coil Blow-Out

1. Close the valves on both supply and return lines to isolate the coil from the rest of the system.
2. Open all drain valves and/or the drain plug to drain coil. Remove the vent plug to speed the draining process.
3. When completely drained, hook up a blower. Ideal locations to hook up the blower are where end caps are installed on straight runsfor the supply and return connection. Do not hook up the blower to the air vent or drain.
4. Close the drain plug or vent tube on the header that the blower is attached to, open the cap or drain valve on the other header.
5. Run the blower for 45 minutes to an hour, then check the coil to see if it is dry. A small mirror placed in the discharge will fog if moisture is present. If so, continue running blower until coil is dry.
6. Let the coil stand for several minutes and blow once again. Repeat blowing process if water comes out.
7. Leave plugs out and drains open until freeze threats have passed.

Flushing Coils

1. The use of inhibited glycol designed specifically for HVAC applications is highly recommended by Huntair for use in their coils for corrosion protection. Uninhibited glycol can produce ant nest corrosion in copper tubing.
2. Estimate the volume of the coil in gallons. For 1/2” tubes (1.25” face tube spacing) (finned height in inches) x (finned length in inches) x (# of rows) x 0.00083 = gallons.
3. Close the valves on both supply and return lines.
4. Open all drain valves and/or drain plug and drain the coil. Remove the vent cap to speed the draining process.
5. Close the drain plug and valve(s).
6. Connect the flushing system to the coil.
7. Close the throttling valve and start the pump. When all the air is ventilated from the coil close the air vent.
8. Open the throttle valve 50% and circulate fluid through the coil for 15 minutes. Use a hydrometer or test kit to check the fluid strength.
9. Adjust fluid strength as needed and circulate 15 minutes more.
10. Check the strength of the fluid again. Repeat adjustments to fluid, circulate and test until desired concentration is reached.
11. Turn off pump and drain coil.



Evaporative Media Replacement

In order to get the best performance from your cooling pads, they must be installed properly. If you have pads with two equal angles, they can be installed in either direction, otherwise pads are manufactured with special angle combinations. Those having combinations of 15° x 45° or 30° x 45° are made to direct more water toward the air entering side of the pads. If installed backwards, the pads may not work properly.

Pads must be installed with the steeper flute angle sloping down toward the air entering side. The steeper angle puts more water on the entering side of the pad where the air is hot, dry, and dusty and extra water it is needed most. The unequal angles also counteract the tendency of the air to push the water toward the air leaving side of the pad.

Caution

Do not expose evaporative cooling pads to sparks, open flame, welding spatter, temperatures in excess of 350° F, or other sources which may ignite the paper.

1. Turn off all water supply lines.
2. Drain sump tank.

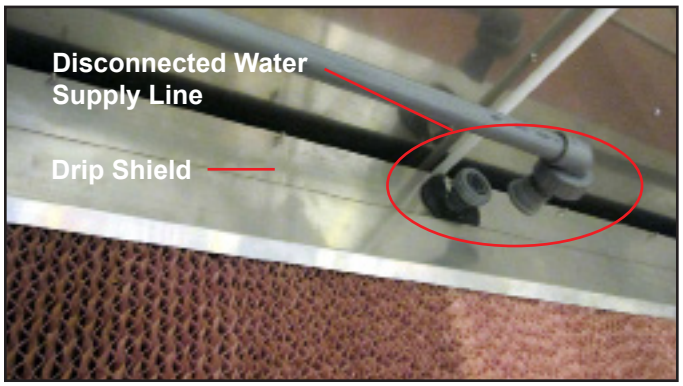
DANGER! Risk of Electric Shock

Always disconnect power to the evap cooler control panel before maintenance. Follow all lockout and tag out procedures.

3. Disconnect the water supply line going to the distribution manifold at the top of the evap cooler by turning the coupling counter-clockwise.
4. Remove the drip shield at the top on the evap cooler tower exposing the top layer of horizontal media. These are used to help distribute water evenly through the media below.

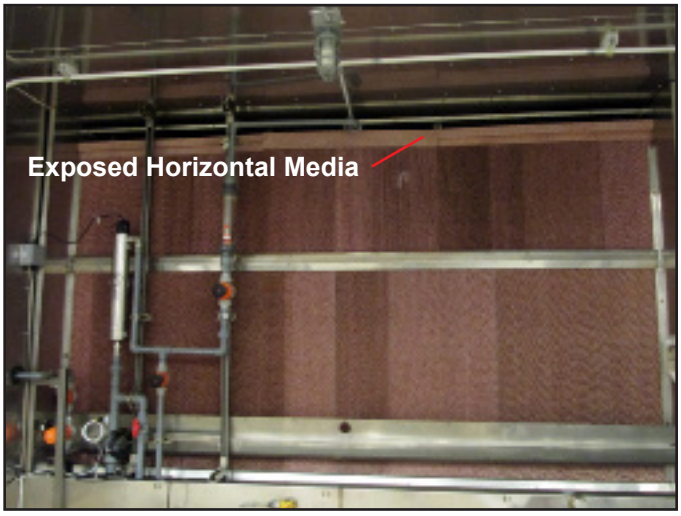
Evaporative Cooler Air Entering Side

Evaporative Cooler Air Leaving Side

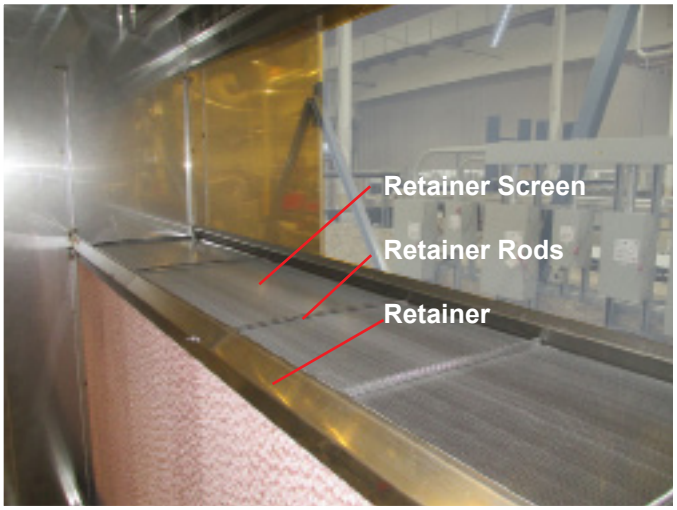


Top Center of Evaporative Cooler

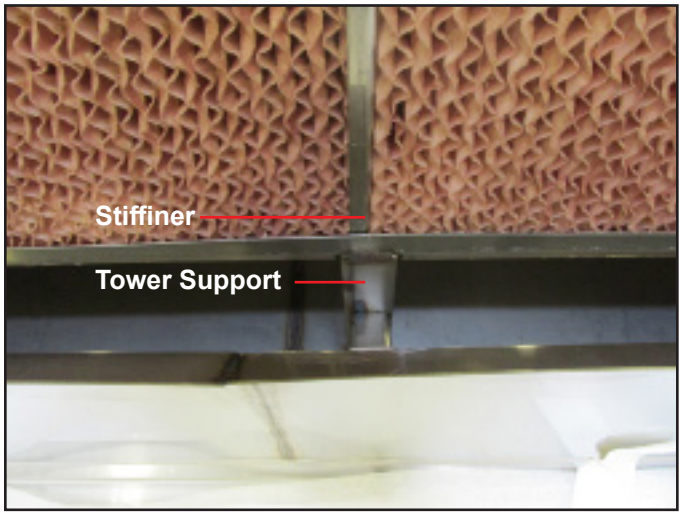
5. Remove horizontal layer of media. Remove vertical media starting in the center and working outward.



6. Remove retainer rods and then then retainer screen. Lift out bottom media starting in the middle and working outward.



7. Depending on the size of your evaporative cooler media, there may be stiffiner(s) between the media for additional support. Stiffiners are located over leg suppots for the evap tower.



Evap Cooler Air Entry Side

Cleaning the Water Distribution System

Refer to Maintenance section for suggested scheduled cleaning and flushing of the system to increase their service life.

When water evaporates, dirt and chemicals are left behind and build up on the pads and in the sump. Eventually, the water becomes so contaminated that it is harmful to the pads and gutters.

After removing media from evap cooler tower completely empty the sump of water and silt.

Refill with clean water.

Open the ends of the water distribution pipes to flush out debris which could clog the holes. Replace the covers when done. When using silt collection, remove plug and drain the system.

Gently hose stubborn deposits from the face of the pads.

Completely empty the sump to remove the old algae and dirt which was just rinsed off the pads.

Disinfect the system by adding the proper amount of approved chemical.

Check to make sure the bleed off is still functioning properly.

Refill with clean water.

Install cleaned or new pads.

Manually turn on the pumps to run fresh water over the pads for about 30 minutes. Use as much water as possible.

Auto-flush systems should be set for a nightly flushing.

Common Algae Treatment Chemicals

Algae control begins with cleaning and flushing of the system, after that process treatment with an approved disinfectant is advised. Use only products that are designed for use in evaporative coolers, many are commercially available. ***Do not use products that do not list active ingredients.*** Nonoxidizing biocides, copper compounds and quaternary amines are the three most common chemicals.

Quaternary amines examples include:
• Alkyl diMethyl Benzyl Ammonium Chloride
• Octyl Decyl diMethyl Amonium Chloride

Recommended usage: 30 to 50 PPM.
Commercial disinfectants, swimming pool chemicals and cooling water biocides include these chemicals.

Nonoxidizing biocides examples include:
• DBNPA
• Carbamates
• Methylene bis-thiocyanate
•Isothiazolin

Recommended usage: Follow product labeling.
These are available from industrial water treatment specialists.

Oxidizing biocides examples include:
• Hydrogen Peroxide
• Solid Calcium hypochloride
• Sodium hypochlorite (Chlorine bleach)
• Potassium peroxymonosulfate (non chlorine bleach)
• dimethyl Hydantoin
• Ethyl Methyl Hysantoin (Bromine)
• Copper compounds

Do not use in evaporative cooler, these products are detramental to cellulose and metals.

Allow drying of the pads for several hours at a time to prevent algae growth.

• Minimize the number of drying cycles, though. Too many will weather the pad. Ideally, during the cooling season, they should cycle on and off once each day.

• Set automatic controllers so the water to the pads turns off before the fans turn off. Pad pumps should be turned on last and turned off first.

• Do not allow the bottom of the pads to set down in the water when the system is not running. Adjust the float valve and overflow after the system shuts down and all of the water returns to the troug

Scale Control

Proper water distribution will aid in prolonging pad life by flushing away dirt and contaminants, which may be harmful to the pad. Areas that do not get enough water will clog or soften first.

- Check the pressure in the distribution pipe. The distribution systems consist of a perforated plastic pipe with holes directed at a splash plate. If the pressure is low, the water will not break up at the splash plate. Streaking and dry areas will occur.
- Check for adequate water flow. Adjust the flow until there are no dry streaks. When the pads are operating properly, they will be thoroughly wetted with a visible flow of water trickling down the flutes. Most of the water will pass over the pad and return to the sump. If there is little water running out the bottom of the pad, the dirt and minerals are not being flushed.
- Check for clogged holes in the distributer pipe. The simplest way to clean the holes is to install a ball valve or threaded end cap at the end of each distributer pipe. While the pump is running, open the valve and allow the water to flush the dirt and debris from the pipe. Usually the first signs of blockage will be at the end of the pipe farthest from the pump.
- Clean the water filter often. A dirty filter will substantially restrict the flow of water. Install a ball valve on the clean-out for the filter. This way the filter can be flushed without tools and without shutting off the pump.

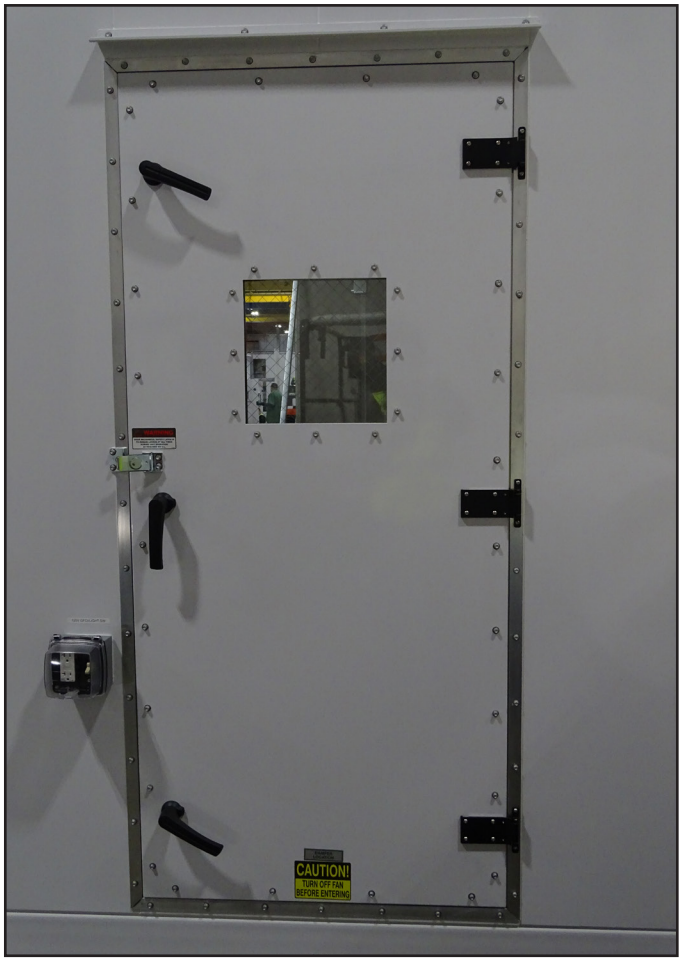
Required water flow for CELdek and GLASdek evaporative cooling pads:
4 inch depth 0.50 GPM/ linear foot of pad
6 inch depth 0.75 GPM/ linear foot of pad
8 inch depth 1.0 GPM/ linear foot of pad
12 inch depth 1.50 GPM/ linear foot of pad
18 inch depth 2.25 GPM/ linear foot of pad

Door Adjustment

The ITF Series air handler comes standard with 2” or 4” inward or outward opening doors equipped with removable hinges allowing doors to be easily removed by lifting, and making adjustments in the X, Y, and Z axis easy.

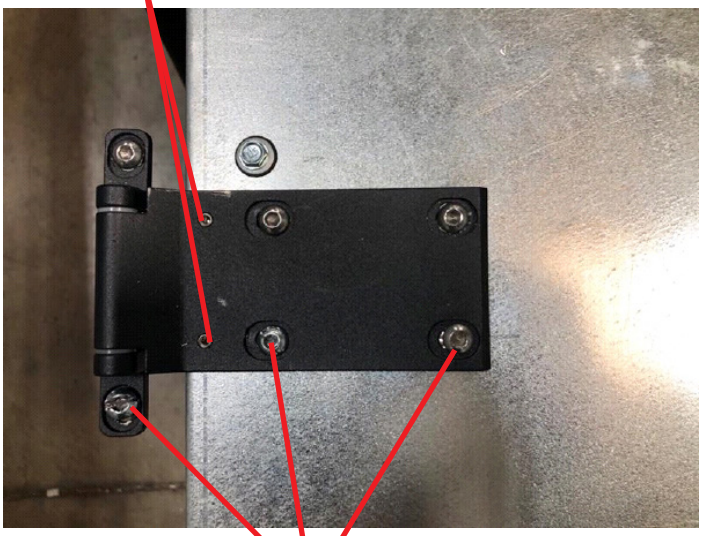
1. Centering the Door in Frame
   - **a.** Loosen the M6-1.0 screws with a 10mm Allen wrench (must be done to all hinges).
   - **b.** Shift door to desired position.
   - **c.**Tighten zinc screws to 100 in-lbs if screws. Stainless Steel screws tighten to 80 in-lbs.

2. Compression Adjustment
   - **a.** Adjust the compression adjustment screw on both the top and bottom hinges by turning them to achieve the desired compression of the door against the seal.



Standard Door with Adjustable Hinges

Compression Adjustment Screw



M6-1.0 x 2.0 Screws

APPENDIX

Unit Identification Information		Job Site Information	
Project:		Jobsite Contact:	
Job Name:		Jobsite Telephone:	
Job Address:		Jobsite Email:	
		Supervisory Company	
Model Number:		Supervisory Contact	
Serial Number:		Supervisory Telephone	
Tag:			
		Startup Company	
		Startup Contact	
		Startup Telephone	
		Startup Email	
		Startup Completion Date	

IMPORTANT

- Complete all forms under this appendix for each unit and email, fax or mail to Applicable Brand Service Providers – listed below immediately after start-up to validate warranty and to provide valuable information for personnel performing future maintenance or for factory assistance to address below.
- Read the Installation, Operation and Maintenance Instruction Manual and the Applicable Brand Control System Keypad Operation Guide and the Sequence of Operation before proceeding.
- Leave a copy of this report with the Owner and at the unit for future reference and permanent record.
- To ensure proper operation of each unit, qualified personnel should perform the start-up, complete the checklist and report.
- All units are functionally tested except when shipped in multiple pieces. Start-up adjustments may be required. If the unit is shipped as a single piece, blowers, enthalpy wheel and compressors (if equipped) are set up to run correctly when power is connected. If any blower is running backwards or compressor is making loud noises, disconnect power and switch two leads (on three-phase power) to ensure proper rotation and avoid damage.
- If units are equipped with compressors, power must be turned on for 24 hours prior to a call for cooling, for the compressor crank case heaters to be energizing to prevent possible damage.
- The HMI keypad located at the control panel will allow for manual override for start-up, mode of operation selection and includes an internal time clock if remote interlocks are not provided.

NOTE : Failure to return the startup report to Nortek with our contact information below will impact in the warranty being a maximum of 12 months from the date of shipping.

	CHECKLIST ITEM	YES	N/A
1	Attach photo showing the unit positioning and surounding areas.	☐	☐
2	Refer to IOM for clearances and accessibilities.	☐	☐
3	Check the electrical disconnect set to the 'Off' position.	☐	☐
4	Check the split section joints are properly installed on multi-sectional units.	☐	☐
5	Check that all holes that have been made by the Installing Contractor after receiving the unit in the casing, partitions or floor have been well sealed to prevent air and/or water infiltration.	☐	☐
6	Check the unit for obstructive packaging, objects near or in fans, dampers, energy recovery wheel, etc.	☐	☐
	a. Check that the inside of unit has been cleaned of all debris.	☐	☐
7	Traditional Fan Assemblies (Optional)	☐	☐
	Remove all retaining bolts on fan isolation bases.	☐	☐
	a. Check that the fan impellers are rotating freely.	☐	☐
	b. Check fan impellers and drive set screws. Tighten if required.	☐	☐
	c. Check the fan bearing set screws or locking collars. Tighten if required.	☐	☐
	d. Check fan belt alignment and tension.	☐	☐
	e. Check the fan flexible joint connections are well attached.	☐	☐
	f. Check for correct fan rotation. (Clock-wise).	☐	☐
8	Fanwall Fan Assemblies (Optional)	☐	☐
	a. Confirm wheels are not rubbing on cones.	☐	☐
	b. Confirm cone is secured tightly.	☐	☐
	c. Confirm fan dampers open and close.	☐	☐
	d. Confirm there is no fan damper damage with the blades, causing restrictions.	☐	☐

	CHECKLIST ITEM	YES	N/A
	e. Confirm the fan pressure hose is connected to the cone pressure tap.	☐	☐
	f. Check for correct fan rotation. (Clock-wise).	☐	☐
9	Fanwall ECMI Fan Assemblies (Optional)	☐	☐
	a. Confirm wheels are not rubbing on cones.	☐	☐
	b. Confirm cone is secured tightly.	☐	☐
	c. Confirm fan dampers open and close.	☐	☐
	d. Confirm there is no fan damper damage with the blades, causing restrictions.	☐	☐
	e. Confirm the fan pressure hose is connected to the cone pressure tap.	☐	☐
	f. Check for correct fan rotation. (COUNTER Clock-wise).	☐	☐
10	Condenser Fans (Optional)	☐	☐
	a. Confirm condenser fan baskets are secure.	☐	☐
	b. Confirm no broken condenser fan blades.	☐	☐
	c. Confirm fan blades turn freely.	☐	☐
	d. Check for correct fan rotation.	☐	☐
11	Check that the air filters are installed and clean. Replace if necessary. See Appendix F for optional downstream high efficiency HEPA filter installation (if supplied).	☐	☐
	a. Check all face mounted filters are attached with four clips each.	☐	☐
	b. Check each sliding filter has a retainer at the end track and well attached blank-offs.	☐	☐
	c. Check the filter pressure differential gauges, switches or sensors are free of dirt and set at a value satisfactory to the end user to trigger a filter change.	☐	☐
	d. Confirm the filter pressure hose is connected to the filter tap on air filter frames.	☐	☐
12	Check coils if fins have been damaged in shipping, installation or building construction and are clean. Straighten fins with a fin comb and clean coil if required (not applicable to brazed aluminum heat exchangers).	☐	☐

	CHECKLIST ITEM	YES	N/A
	a. Check all pipe connections are tight and that no damage has occurred during shipping or installation.	☐	☐
	b. Check that the piping to the coils and wshp have been completed, piping lines have been flushed, filled, vented and tested at 1.25 times the operating pressure. Refer to Appendix B.	☐	☐
13	Scroll compressor RIS vibration isolator bolts are factory tightened to the correct torque setting for operation and do not require field adjustment.	☐	☐
	a. Check the refrigerant components and piping are in good condition and have no damage or leaks from shipping or installation.	☐	☐
	b. Check that the refrigerant lines are spaced at least 1” apart and from the compressor after shipping and installation.	☐	☐
	c. Check that the refrigerant line clamps are still secure and have their rubber lining.	☐	☐
	d. Check that the clearance around the air cooled condenser is within minimum clearance and the discharge is not blocked.	☐	☐
	e. Check that the clearance around the air-cooled condenser coil is within minimum	☐	☐
	f. Confirm the compressor has the correct solid state module for the unit voltage.	☐	☐
	g. Confirm the compressor power wires in the junction box are secure.	☐	☐
	h. Make reference to the refrigeration appendix documents from the IOM.	☐	☐
14	Check motorized damper control arms, control rods and shafts for tightness.	☐	☐
	a. Check that non-motorized dampers rotate freely.	☐	☐
	b. Confirm complete actuation to stop position (closed & open)	☐	☐
	c. Confirm that the actuation is correct based on the sequence of operation.	☐	☐
15	Check the energy recovery wheel media for any defects from shipping or installation. See Maintenance section for details.	☐	☐
	a. Grease both pillow block bearings on the wheel(s) when grease nipples provided.	☐	☐
	b. Check that the wheel(s) are turning freely by hand and do not bind.	☐	☐
	c. Visually inspect the wheel(s) to ensure it is centered and does not tilt.	☐	☐

	CHECKLIST ITEM	YES	N/A
	d. Check that the wheel seals are properly positioned from the face of the wheel.	☐	☐
	e. Check that the wheel purge (if present) is set to the default angle as specified in the submittal.	☐	☐
	f. Check the mounting fasteners on the wheel(s) motor and gear reducer are tight.	☐	☐
	g. Check the belt and pulley on the wheel drive for correct alignment, tension and set screw tightness.	☐	☐
16	Check the plate media for any defects from shipping or installation.	☐	☐
17	Check the heat pipe fins for any fin defects from shipping or installation.	☐	☐
	a. Remove retaining bolts on heat pipe tilt mechanism.	☐	☐
	b. Check the heat pipe flexible connection is properly attached and sealed on tilt mechanism.	☐	☐
	c. Check the actuator control arm and linkages are tight on tilt mechanism.	☐	☐
18	Check that ductwork is connected, complete and free of obstructions.	☐	☐
19	Check that condensate drain connections have been trapped, installed correctly and filled.	☐	☐
20	Warning with an outdoor unit, if the outside ambient condition can get below water freezing temperatures, check that any condensate drain has a heat trace.	☐	☐
21	Check at all unit split sections that all factory internal high and low voltage wiring connections have been properly re-connected.	☐	☐
22	Check that all shipped loose or field supplied components have been correctly installed and wired.	☐	☐
23	Check that the wiring diagram has been marked up accordingly and left with the unit.	☐	☐
24	Check that all power supplies and control wiring have been inspected and approved by the Local Authorities having jurisdiction.	☐	☐
25	Check all factory and field wiring connections for tightness. Tighten if necessary.	☐	☐
26	Check that all settings of control are in accordance with the wiring schematic.	☐	☐
27	Check that all fuses are properly installed in holders.	☐	☐

	CHECKLIST ITEM	YES	N/A
28	Check the voltage at the disconnect switch against the nameplate and against phase-to-phase readings on three-phase. If the voltage is not within 10% of rated or 2% of phase to phase, have the condition corrected before continuing start-up.	☐	☐
29	Check that all field piping and venting installation and connections for heating and cooling options have been completed and tested.	☐	☐
30	Set the heating and cooling enable switches to the ‘Off’ position.	☐	☐
31	Refer to Appendix D for gas-fired furnace module and Appendix H for electric coil installation and maintenance and check that the installation is completed. Perform all gas-fired furnace and electric coil pre start-up checks..	☐	☐
32	For detailed start-up procedures, please refer to the provided Heatco Installation, Operation and Maintenance Instructions document	☐	☐
33	Gas module compartment enable switch, fan motor protectors, and compressor motor protectors.	☐	☐
34	Check that all safety switches, overloads or other manual reset devices are reset.	☐	☐
35	If the unit is equipped with compressors, power must be turned on with the unit in ‘Off’ mode for 24 hours before start-up. This will energize crank case heaters and assure no liquid refrigerant is present which could cause compressor damage or failure. Check that this has been completed.	☐	☐

	CHECKLIST ITEM	YES	N/A
1	Before proceeding, complete the pre start-up checklist.	☐	☐
2	Check that all access panels or doors are closed.	☐	☐
3	If units are equipped with compressors, feel the compressor crank cases. They should be warm if the disconnect has been 'On' for at least 24 hours. This will assure that no refrigerant liquid is present in the crank case which could cause compressor damage or failure to occur on start-up. Otherwise, turn the main disconnect to the 'On' position.	☐	☐
4	Disable the heating and cooling functions and set the unit to the occupied mode to bump start the fan wheel(s) and energy recovery wheel(s) to check their operation.	☐	☐
	a. Confirm that Gas module compartment enable switch, fan motor protectors, and compressor motor protectors are turned off.	☐	☐
	b. Use the unit HOA switch in the Hand mode to bump test the unit.	☐	☐
	c. Turn on one component at a time to check rotation and voltage.	☐	☐
5	Check that dampers are operating properly.	☐	☐
	a. Confirm complete actuation to stop position (closed & open)	☐	☐
	b. Confirm that the actuation is correct based on the sequence of operation.	☐	☐
6	Adjust the fan motor VFD(s) to the correct air volume/Hertz.	☐	☐
	a. The vfd nominal value should be based on the value from the wiring diagram for the component.	☐	☐
7	For occupied recirculation mode, adjust outside, exhaust and mixed or recirculation air damper positioners to achieve the required air volumes.	☐	☐
	a. Set the damper minimum and maximum values based on parameters from the DDC HMI.	☐	☐
8	Check amperage draw to each motor on each phase against motor nameplate FLA. If significantly different, check ductwork static and/or take corrective action.	☐	☐
9	Re-check the voltage at the disconnect switch against the nameplate and against phase-to-phase readings on three-phase with all blowers operating. If the voltage is not within 10% of rated or 2% of phase-to-phase have the condition corrected before continuing start-up.	☐	☐
10	Before activating the compressor on WSHP units, check that the water shut-off valves are open and water is circulating through the water-to-refrigerant heat exchanger. Check the incoming line water pressure to ensure is within design and acceptable limits.	☐	☐
11	Enable the cooling mode of operation. Check if the sound of the compressor is normal or if there is excessive vibration.	☐	☐
12	On units with integrated air cooled condensers check condenser fans are rotating in the correct direction.	☐	☐

	CHECKLIST ITEM	YES	N/A
13	Check all field and factory refrigerant and water piping connections for leaks and correct.	☐	☐
	a. Check that refrigeration piping insulation is in place where required	☐	☐
14	Operate the refrigerant system near full load conditions in both heating and cooling modes and check sub-cooling and superheat against the values from the submittal. in Appendix Q, Table Q1. If readings do not match, adjust the refrigerant charge. Refer to Appendix Q for information on adjusting the refrigeration charge.	☐	☐
15	On units with wshp, after a few minutes of operation:	☐	☐
	a. Check the supply discharge temperature status on the keypad for cooling air delivery. Measure the temperature difference between entering and leaving water. In cooling mode, the temperature difference should be approximately 1.5 times greater than the heating mode temperature difference. For example, if the cooling temperature difference is 15°F [8.3°C], the heating temperature difference should be approximately 7°F to 10°F [3.9°C to 5.6°C]. Alternatively, if a flow measuring valve or pressure gauge connections are included, take the flow reading or pressure drop compared to the submittal information and adjust the shut-off/ balancing valve in the return line to the correct flow/pressure drop reading.	☐	☐
	b. Measure the temperature difference between entering and leaving air and entering and leaving water. With entering water of 60°F to 80°F [15.6°C to 26.7°C], leaving temperature should rise through the unit. Should not exceed 35°F [19.4°C]. If the air temperature exceeds 35°F [19.4°C], then the water flow rate is inadequate or the airflow rate may be low and a second check may be required after airflow balancing.	☐	☐
16	On units with gas-fired furnace module or electric heating coils, check supply air proving interlock switch setting to ensure minimum supply airflow prior to burner operation.	☐	☐
17	Enable heating options, see start-up and check out instructions in Appendix D for gas-fired furnace module and Appendix H for electric coil.	☐	☐
18	For electric heating coil option check the amp draw on each stage, the operation of the sequence or SCR controller and the coil for any hot spots.	☐	☐
19	Check the operation of the control options provided on the unit.	☐	☐
20	Check the setpoints on the DDC Points Reference, adjust and record changes as required.	☐	☐
21	Has air balancing been completed for both occupied and unoccupied operation?	☐	☐
22	When unit has achieved steady state, take measurements and complete Start-up Readings portion of the Start-up Form and Checklist in Appendix E. Send a copy of the completed Start-up Form and Checklist to Venmar CES to validate warranty. Maintain a copy of the report at the unit for future reference.	☐	☐
23	Once completed, return setpoints to original or required values, return the unit to the correct mode of operation and adjust the time clock if required.	☐	☐

START-UP READINGS

- Allow unit to reach steady state before taking readings.
- Complete based on options included with unit.

Nameplate Voltage						
Input voltage	L1–L2		L2–L3		L1–L3	

SUPPLY FAN

	Rotation Correct	Full Load Amps (Nameplate Amps)	Amp Draw			O/L Amp Setting	Hertz	VFD RPM	RPM
			L1	L2	L3				
Fan 1									
Fan 2									
Fan 3									
Fan 4									
Fan 5									
Fan 6									
Fan 7									
Fan 8									
Fan 9									
Fan 10									
Fan 11									
Fan 12									

EXHAUST FAN

	Rotation Correct	Full Load Amps (Nameplate Amps)	Amp Draw			O/L Amp Setting	Hertz	VFD RPM	RPM
			L1	L2	L3				
Fan 1									
Fan 2									
Fan 3									
Fan 4									
Fan 5									
Fan 6									
Fan 7									
Fan 8									
Fan 9									
Fan 10									
Fan 11									
Fan 12									

CONDENSER FAN

	Rotation Correct	Full Load Amps (from Wiring Diagram)	Amp Draw			O/L Amp Setting	Hertz	VFD RPM	RPM Condenser Fans
			L1	L2	L3				
Fan 1									
Fan 2									
Fan 3									
Fan 4									
Fan 5									
Fan 6									
Fan 7									
Fan 8									
Fan 9									
Fan 10									
Fan 11									
Fan 12									
Fan 13									
Fan 14									
Fan 15									
Fan 16									

COMPRESSORS

	Full Load Amps (Nameplate Amps)	Amp Draw			After compressor has been running for 15 minutes check the following:					
		L1	L2	L3	Suction Pressure	Discharge Pressure	Superheat	Liquid Sub-Cooling	* Hot Gas Bypass Functioning	Outdoor Ambient Temp. During AC Cooling Startup (°F/°C)
Compressor 1										
Compressor 2										
Compressor 3										
Compressor 4										
Compressor 5										
Compressor 6										
Compressor 7										
Compressor 8										
Compressor 9										
Compressor 10										
Compressor 11										
Compressor 12										
Compressor 13										
Compressor 14										
Compressor 15										
Compressor 16										

WATER SOURCE HEAT PUMP

	Full Load Amps (from Wiring Diagram)	Amp Draw			O/L Amp Setting
		L1	L2	L3	
ERW 1					
ERW 2					
ERW 3					
ERW 4					

	Waterside Cooling Mode			Waterside Heating Mode					
	Entering Temp. (°F/°C)	Leaving Temp. (°F/°C)	Temp. Difference (°F/°C)	Entering Temp. (°F/°C)	Leaving Temp. (°F/°C)	Temp. Difference (°F/°C)	Entering Pressure (PSI)	Leaving Pressure (PSI)	US GPM
Condenser 1									
Condenser 2									
Condenser 3									
Condenser 4									
Condenser 5									
Condenser 6									
Condenser 7									
Condenser 8									
Condenser 9									
Condenser 10									
Condenser 11									
Condenser 12									
Condenser 13									
Condenser 14									
Condenser 15									
Condenser 16									

ELECTRIC HEATING COIL

	Stage	L1 Amps	L2 Amps	L3 Amps	Check for Hi Pot Test
1					
2					
3					
4					
5					
6					

ENERGY RECOVERY WHEEL

Fuel	__Natural Gas __Propane	Furnace #1	Furnace #2
Combustion air fan	Rotation correct2		
	Full load amps (nameplate amps)2		
	Amp draw L1/L2/L32		
	O/L amp setting2		
Induced draft fan motor	Rotation correct		
	Full load amps (nameplate amps)		
	Amp draw L1/L2/L3		
	O/L amp setting		
Low fire	Inlet gas pressure – in. w.c.		
	Regulator outlet pressure – in. w.c.		
	Manifold press – in. w.c.		
	Stack CO2 – %2		
	Stack O2 – %2		
	Net stack temperature – °F/°C2		
	Efficiency – %2		
	Flame signal – mA/VDC		
	Supply air inlet temperature – °F/°C		
	Supply air discharge temperature – °F/°C1		
	Supply air temperature rise – °F/°C		
High fire	Inlet gas pressure – in. w.c.		
	Regulator outlet pressure – in. w.c.2		
	Manifold press – in. w.c.		
	Stack CO2 – %2		
	Stack O2 – %2		
	Net stack temperature – °F/°C2		
	Efficiency – %2		
	Flame signal – mA/VDC		
	Supply air inlet temperature – °F/°C		
	Supply air discharge temperature – °F/°C1		
	Supply air temperature rise – °F/°C		

1. Measure downstream where temperature is even in duct.
2. For IG series drum and tube gas-fired duct furnace models only.

This unit has been checked out and started according with the above procedures and completed forms and is operating satisfactorily. After 24 hours of satisfactory operation shut down the unit and check all foundation bolts, shaft bearings, drive set screws, valve train and terminals. Tighten where required.

SHUTDOWN PROCEDURE FOR HEATCO DIRECT FIRED BURNER

When the 0-10v signal from the air handler controller is at 0v, the burner will not have any demand for heat. To shut down the burner, simply send a 0v control voltage and turn off the heater enable. The burner valving will stop the flow of gas and the burner will not ignite.

Item	No.	Description	Start-Up	Daily	Weekly	Monthly	Quarterly	Semi-Anually	Anually	Shut-Down
General	1	Inspect the general condition of the unit.	☑	☐	☐	☑	☐	☐	☐	☐
	2	Remove any dirt or debris.	☑	☐	☐	☑	☐	☐	☐	☑
	3	Check for unusual noise or vibration.	☑	☐	☐	☑	☐	☐	☐	☐
	4	Lubricate the door latch mechanisms.	☐	☐	☐	☐	☐	☐	☑	☐
	4a	Inspect protective finish for signs of corrosion.	☑	☐	☐	☐	☐	☐	☑	☐
	4b	Inspect door safety interlocks are functioning properly	☐	☐	☐	☐	☐	☐	☑	☐
Fans	5	Clean fans with stream of water. Do not use caustic cleaning solutions.	☐	☐	☐	☐	☐	☑	☐	☐
	6	Align or replace belts and drives.	☐	☐	☐	☐	☐	☑	☐	☐
	7	Adjust belt tension.	☑	☐	☐	☐	☐	☑	☐	☐
	8	Check motor voltage and current.	☑	☐	☐	☐	☐	☑	☐	☑
	9	Lubricate the fan motor and fan shaft bearings if applicable.	☑	☐	☐	☐	☐	☐	☑	☐
	9a	Motors with ceramic bearings require no maintenance. Motors with spring-loaded shaft grounding sticks should be checked after 3 years of run time and every year thereafter.	☐	☐	☐	☐	☐	☐	☑	☐
	9b	Check fan bearing locking collars.	☑	☐	☐	☐	☐	☑	☐	☐
	9c	Check fan for rotation without obstruction.	☑	☐	☐	☐	☐	☐	☐	☐
	9d	Check fan for proper rotation.	☑	☐	☐	☐	☐	☐	☐	☐
	9e	Check fans for unusual vibration	☑	☐	☐	☐	☐	☐	☐	☐
	10	Lubricate motor base adjusting screws.	☑	☐	☐	☐	☐	☑	☐	☑
Dampers	11	Visual inspection for dirt or leakage.	☐	☐	☐	☐	☑	☐	☐	☐
	12	Lubricate damper bushings and linkages. Use a petroleum-based penetrant and corrosion inhibitor lubricant.	☐	☐	☐	☐	☐	☑	☐	☐
Valves	12a	Lightly lubricate control valve linkages.	☐	☐	☐	☐	☐	☐	☑	☐

Note: Please review unit design to determine what sections are required for maintenance.
= Operating Requirement

Air Filters	13	Clean and replace prefilters.	☐	☐	☐	☐	☑	☐	☐	☐
	14	Clean and replace final filters.	☐	☐	☐	☐	☐	☑	☐	☐
	14a	Clean or replace electrical enclosure fan filters if applicable.	☐	☐	☐	☐	☐	☑	☐	☐
	15	Inspect holding frames/sliding rack.	☐	☐	☐	☐	☐	☐	☑	☐
Coils	16	Clean the coils.	☐	☐	☐	☐	☐	☐	☑	☑
	17	Winterize the water coil.	☐	☐	☐	☐	☐	☐	☑	☐
Energy Wheel	18	Verify that the wheel is rotating freely.	☐	☐	☐	☑	☐	☐	☐	☐
	19	Lubricate bearings.	☐	☐	☐	☐	☐	☑	☐	☐
	20	Inspect bearing bolts.	☐	☐	☐	☐	☐	☑	☐	☐
	21	Tighten bearing set screws.	☐	☐	☐	☐	☐	☑	☐	☐
	22	Tighten motor bolts (inspect one month after start-up).	☐	☐	☐	☐	☐	☐	☑	☐
	23	Inspect seals (inspect one month after start-up).	☐	☐	☐	☐	☑	☐	☐	☐
	24	Inspect belt.	☐	☐	☐	☐	☑	☐	☐	☐
	25	Inspect media, rim, spokes, and shaft (inspect one month after start-up).	☐	☐	☐	☐	☑	☐	☐	☐
Plate heat exchanger	26	Inspect the general condition of the plate heat exchanger.	☐	☐	☐	☐	☐	☑	☐	☐
	27	Measure pressure drop across the plate heat exchanger.	☐	☐	☐	☐	☑	☐	☐	☐
Gas Burner	28	Inspect the burner area for hazardous material.	☐	☐	☐	☐	☑	☐	☐	☐
	29	Inspect the stack.	☐	☐	☐	☐	☑	☐	☐	☐
	30	Inspect condensate drain connections and disposal system.	☐	☐	☐	☐	☑	☐	☐	☐
	31	Clean and recalibrate all controls.	☐	☐	☐	☐	☑	☐	☐	☐
	32	Inspect the gas piping. Check gas connections for tightness.	☐	☐	☐	☐	☑	☐	☐	☐
	33	Inspect burner motor (or every 500 hours, whatever comes first).	☐	☐	☐	☐	☑	☐	☐	☐

Note: Please review unit design to determine what sections are required for maintenance.
☑ = Operating Requirement

MAINTENANCE SUMMARY CHART

Item	No.	Description	Start-Up	Daily	Weekly	Monthly	Quarterly	Semi-Anually	Anually	Shut-Down
Electrical	34	Verify all electrical connections, tighten if necessary.	☐	☐	☐	☐	☐	☐	☑	☐
	35	Verify all fuse holders.	☐	☐	☐	☐	☐	☐	☑	☐
	36	Verify all motor overload settings.	☐	☐	☐	☐	☐	☐	☑	☐
Condenser fans	37	Inspect fan blades for cracks.	☐	☐	☐	☐	☐	☐	☑	☐
	38	Inspect for wear and tension.	☐	☐	☐	☐	☐	☐	☑	☐
Cooling section	39	Look for oil on all refrigeration components (including coils, compressors, etc.) to indicate a refrigerant leak.	☐	☐	☐	☐	☑	☐	☐	☐
	40	Verify for proper superheat.	☐	☐	☐	☐	☑	☐	☐	☐
	41	Verify each circuit refrigerant site glass when the circuit is operating under steady state, full load conditions. It should be full and clear. If not, look for refrigerant leaks.	☐	☐	☐	☐	☑	☐	☐	☐
	42	Check evaporative cooler pads for bowing and sagging or dry streaks.	☐	☑	☐	☐	☐	☐	☐	☐
	43	Remove any debris from the evaporative sump tank and make sure the water level is correct.	☐	☑	☐	☐	☐	☐	☐	☐
	44	Dry the evaporative cooler pads.	☐	☑	☐	☐	☐	☐	☐	☐
	45	During the cooling season, flush the evaporative cooler pads, gutter, and sump tank to prevent algae buildup.	☐	☐	☑	☐	☐	☐	☐	☐
	46	Check evaporative sump tank fluid levels and adjust if necessary.	☐	☐	☑	☐	☐	☐	☐	☐
	47	Clean and flush the evaporative cooling pads. Drain and disinfect the entire water distribution system.	☐	☐	☐	☑	☐	☐	☐	☐

Note: Please review unit design to determine what sections are required for maintenance.
= Operating Requirement

MAINTENANCE RELUBRICATION CHART - *Use this table as a relubrication guide.*

Conditions			
Add grease slowly with shaft rotating until a slight bead forms at the seals.			
Speed (RPM)	**Temperature (degrees F)**	**Cleanliness**	**Grease Interval**
100 RPM	Up to 120	Clean	6 to 12 months
500 RPM	Up to 150	Clean	2 to 6 months
1000 RPM	Up to 180	Clean	2 to 8 weeks
1500 RPM	Over 210	Clean	Weekly
Any Speed	Up to 150	Dirty	1 Day to 14 Days
Any Speed	Over 150	Dirty	1 Day to 14 Days
Any Speed	Any Temperature	Very Dirty	1 Day to 14 Days
Any Speed	Any Temperature	Extreme Condition	1 Day to 14 Days

MAINTENANCE DAILY CHART - *Email to Service.Nortek@nortek.com*

Item	No.	Description	Date performed	Person who performed the work	Company performing the work
Cooling Section	42	Check evaporative cooler pads for bowing and sagging or dry streaks.			
	43	Remove any debris from the evaporative sump tank and make sure the water level is correct.			
	44	Dry the evaporative cooler pads.			

MAINTENANCE WEEKLY CHART - *Email to Service.Nortek@nortek.com*

Item	No.	Description	Date performed	Person who performed the work	Company performing the work
Cooling Section	45	During the cooling season, flush the evaporative cooler pads, gutter, and sump tank to prevent algae buildup.			
	46	Check and adjust bleed-off rate if necessary.			

MAINTENANCE MONTHLY CHART - *Email to Service.Nortek@nortek.com*

Item	No.	Description	Date performed	Person who performed the work	Company performing the work
General	1	Inspect the general condition of the unit.			
	2	Remove any dirt or debris.			
	3	Check for unusual noise or vibration.			
Energy Wheel	18	Verify that the wheel is rotating freely.			
	47	Clean and flush the evaporative cooling pads. Drain and disinfect the entire water distribution system.			

MAINTENANCE QUARTERLY CHART - *Email to Service.Nortek@nortek.com*

Item	No.	Description	Date performed	Person who performed the work	Company performing the work
Dampers	11	Visual inspection for dirt or leakage.			
Air filters	13	Clean and replace prefilters.			
	23	Inspect seals (inspect one month after start-up).			
	24	Inspect belt.			
	25	Inspect media, rim, spokes, and shaft (inspect one month after start-up).			
	27	Measure pressure drop across the plate heat exchanger.			
Gas Burner	28	Inspect the burner area for hazardous material.			
	29	Inspect the stack.			
	30	Inspect condensate drain connections and disposal system.			
	31	Clean and recalibrate all controls.			
	32	Inspect the gas piping.			
	33	Inspect burner motor (or every 500 hours, whatever comes first).			
Cooling Section	39	Look for oil on all refrigeration components (including coils, compressors, etc.) to indicate a refrigerant leak.			
	40	Verify for proper superheat.			
	41	Verify each circuit refrigerant site glass when the circuit is operating under steady state, full load conditions. It should be full and clear. If not, look for refrigerant leaks.			

MAINTENANCE SEMI-ANNUAL CHART - *Email to Service.Nortek@nortek.com*

Item	No.	Description	Date performed	Person who performed the work	Company performing the work
Fans	5	Clean fans with stream of water. Do not use caustic cleaning solutions.			
	6	Align or replace belts and drives.			
	7	Adjust belt tension.			
	8	Check motor voltage and current.			
	9	Lubricate the fan motor and fan shaft bearings if applicable.			
	9b	Check fan bearing locking collars.			
	10	Lubricate motor base adjusting screws.			
Dampers	12	Lubricate damper bushings and linkages. Use a petroleum-based penetrant and corrosion inhibitor lubricant.			
Air Filters	14	Clean and replace final filters.			
	14a	Clean or replace electrical enclosure fan filters if applicable.			
Coils	17	Winterize the water coil.			
Energy Wheel	19	Lubricate bearings.			
	20	Inspect bearing bolts.			
	21	Tighten bearing set screws.			
Plate Heat Exchanger	26	Inspect the general condition of the plate heat exchanger.			

MAINTENANCE ANNUAL CHART - *Email to Service.Nortek@nortek.com*

Item	No.	Description	Date performed	Person who performed the work	Company performing the work
General	4	Lubricate the door latch mechanisms.			
	4a	Inspect protective finish for signs of corrosion.			
Fans	9a	Motors with ceramic bearings require no maintenance. Motors with spring-loaded shaft grounding sticks should be checked after 3 years of run time and every year thereafter.			
Valves	12a	Lightly lubricate control valve linkages.			
	15	Inspect holding frames/sliding rack.			
Coils	16	Clean the coils.			
Energy Wheel	22	Tighten motor bolts (inspect one month after start-up).			
Electrical	34	Verify all electrical connections, tighten if necessary.			
	35	Verify all fuse holders.			
	36	Verify all motor overload settings.			
Condenser Fans	37	Inspect fan blades for cracks.			
	38	Inspect for wear and tension.			

MAINTENANCE SHUTDOWN CHART - *Email to Service.Nortek@nortek.com*

Item	No.	Description	Date performed	Person who performed the work	Company performing the work
General	2	Remove any dirt or debris.			
Fans	9	Lubricate the fan motor and fan shaft bearings if applicable.			
	10	Lubricate motor base adjusting screws.			
Coils	16	Clean the coils.			

FANWALL

Fanwall Will Not Start Or Run At All	No main power	a. Check main power fuses with ohm meter
		b. Correct problem and replace fuses with size indicated on electrical diagram.
		c. Check disconnect switch.
		d. Turn to "On" position.
		e. Use volt meter to check for proper main voltage to unit.
		f. Restore power to unit.
	Faulty control circuit auxiliary contact on unit disconnect switch	a. Check contact with ohm meter.
		b. Replace switch if faulty.
	No control transformer output	a. Check primary and secondary fuses on transformer.
		b. Correct problem and replace fuse(s) with size indicated on electrical diagram.
		c. Check control transformer primary and secondary voltages.
		d. Replace transformer if faulty.
	Tripped overloads on motor starters	a. Verify overload trip setting is at or slightly above the motor nameplate fla.
		b. Reset overloads and measure operating current of motors.
		c. If current values are above nameplate fla, go to Motor Failure.
		d. Consult Baldor Service Center.
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter	a. Check source of power. Check overloads, fuses, controls, etc
Motor Failure	Improper supply voltage	a. Check voltage at motor.
		b. If incorrect, correct to proper value.
		c. Check for proper wiring at motor.
		d. Wire motor per diagram on motor or inside motor junction box.
	Motor overheating	a. Verify correct supply cfm.
		b. Adjust cfm to unit data plate value.
		c. Check for temperatures above 110°F
		d. Consult Baldor Service Center.

FANWALL (CONTINUED)

Motor Failure (Continued)	Motor overloaded	a. Check amperage at motor.
		b. motor junction box. If amperage outside of motor nameplate limits, conduct additional field tests that follow.
		c. Check rotation of fan.
		d. Correct rotation, if necessary.
		e. Check motor shaft for freedom of movement.
		f. Replace motor or motor bearings if necessary.
		g Check for excessive cfm and/or static pressure.
		h. Correct cause of high static pressure and adjust airflow per start-up section instructions
	Overload. Compare actual amps (measured) with nameplate rating	a. Locate and remove source of excessive friction in motor or load.
		b. Reduce load or replace with motor of greater capacity.
	Single Phasing	a. Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation	a. Check external cooling fan to be sure air is moving properly across cooling fins.
		b. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage	a. Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator	a. Check air gap clearance and bearings.
		b. Tighten “Through Bolts”.
	Over voltage or under voltage	a. Check input voltage at each phase to motor.
	Open stator winding	a. Check stator resistance at all three phases for balance.
	Grounded winding	a. Perform dielectric test and repair as required.
	Improper connections	a. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
		b. Refer to motor lead connection diagram
Excessive humming	High Voltage Eccentric air gap	a. Check input line connections.
		b. Have motor serviced at local Baldor service center.

FANWALL (CONTINUED)

Fan Capacity Low	High external static pressure	a. Check actual pressure against unit data plate pressure.
		b. Correct static pressure. If not possible, consult factory.
	Dampers improperly positioned	a. Verify proper position of unit air control dampers (if any) and all external dampers/ diffusers.
		b. Correct damper position.
	Air leaks in system	a. Check ductwork and duct connections for leaks.
		b. Repair any leaks.
	Damaged fan wheel	a. Visually inspect wheel.
		b. Replace fan wheel if necessary.
	Incorrect fan rotation	a. Check wheel rotation with arrow on fan.
		b. Correct rotation if backwards.
	Obstructed inlet	a. Inspect inlet.
		b. Clear inlet.
Vibration And Noise	Misalignment	a. Check and align motor and driven equipment.
	Misalignment of wheel	a. Check alignment.
		b. Align if necessary.
	Dirty fan wheel	a. Inspect fan wheel.
		b. Clean fan wheel.
	Broken or loose bolts or set screws	a. Check bolts and setscrews for tightness.
		b. Replace or tighten as necessary.
	Fan delivering more than rated capacity	a. Refer to airflow verification in start-up procedure section
		b. Adjust drives per instructions in start-up procedure section.
	Loose dampers	a. Inspect dampers.
		b. Tighten dampers if loose.
	Shipping bolts and/or braces not removed	a. Verify all shipping blocks and braces are removed.
		b. Remove shipping attachments.
	Rubbing between rotating parts and stationary parts	a. Isolate and eliminate cause of rubbing.
		b. See “Fan Wheel/Cone Alignment” Section for adjustment.

FANWALL (CONTINUED)

Vibration And Noise (Continued)	Rotor out of balance	a. Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance	a. Tune system or contact your Baldor Service Center for assistance.
	Foreign material in air gap or ventilation openings	a. Remove rotor and foreign material.
		b. Reinstall rotor.
		c. Check insulation integrity.
		d. Clean ventilation openings.

TRADITIONAL FANS

Noise	Impeller hitting inlet ring	a. Impeller not centered in inlet ring.
		b. Inlet ring damaged
		c. Crooked or damaged impeller
		d. Shaft loose in bearing
		e. Impeller loose on shaft
		f. Bearing loose in bearing support
	Impeller hitting cutoff	a. Cutoff not secure in housing
		b. Cutoff damaged
		c. Cutoff improperly positioned.
	Drive	a. Sheave not tight on shaft (motor and/or fan)
		b. Belts too loose. Adjust for belt stretching after 48 hours of operation.
		c. Belts too tight.
		d. Variable pitch sheaves not adjusted so each groove has same pitch dia. (multi-belt drives).
		e. Misaligned sheaves
		f. Belts worn
		g. Isolation base shipping restraints not removed.
		h. Belts oily or dirty
	Bearing	a. Defective bearing b. Needs Lubrication
		c. Loose on bearing supports d. Loose on shaft
		e. Seals misaligned
		f. Foreign material inside bearing
		g. Worn bearing
		h. Fretting corrosion between inner race and shaft.
	Shaft Seal Squeal	a. Need lubrication
		b. Misaligned
	Impeller	a. Loose on shaft
		b. Defective Impeller Do not run fan - Contact manufacturer.
		c. Unbalanced
		d. Worn as result of abrasive or corrosive material moving through flow passage
	Housing	a. Foreign material in housing
		b. Cutoff or other part loose (rattling during operation)
	Electrical	a. AC hum in motor or relay
		b. Starting relay chatter
		c. Noisy motor bearings
		d. Single phasing a 3 phase motor

TRADITIONAL FANS (CONTINUED)

Noise (Continued)	High Air Velocity	a. Duct work too small for application.
		b. Fan selection too small for application.
		c. Registers or grilles too small for application.
		d. Heating or cooling coil with insufficient face area for application.
	Pulsation or Surge	a. Restricted system causes fan to operate at poor point of rating.
		b. Fan too large for application
		c. Ducts vibrate at same frequency as fan pulsations.
	Rattles and/or Rumbles	a. Vibrating duct work
		b. Vibrating cabinet parts
		c. Vibrating parts not isolated from building.
CFM Low - Insufficient Air Flow	Fan	a. Mecanical volume control device is improperly set.
		b. Fan running backwards
		c. Cutoff missing or improperly installed.
		d. Dirty fan blades.
		e. Loose or slipping belts
		f. Fan speed too slow
	Duct System	a. Actual system is more restrictive (more resistant to flow)
		b. Dampers closed
		c. Registers closed
		d. Leaks in supply ducts
		e. Insulating duct liner loose.
	Filters	a. Dirty or clogged
	Coils	a. Dirty or clogged
	Obstructed Fan Inlets	a. Elbows, cabinet walls or other obstructions restrict air flow. Inlet obstructions cause more restrictive systems but do not cause increased negative pressure readings near the fan inlet(s). Fan speed may be increased to counteract the effect of restricted fan inlet(s)

TRADITIONAL FANS (CONTINUED)

CFM Low - Insufficient Air Flow (Continued)	No Straight Duct at Fan Outlet	a. Fans which are normally used in duct system are tested with a length of straight duct at fan outlet. If there is no straight duct at the fan outlet, decreased performance will result. If it is not practical to install a straight section of duct at the fan outlet, the fan speed may be increased to overcome this pressure loss.
	Obstructions in High Velocity Air Stream	a. Obstruction near fan outlet
		b. Sharp elbows near fan outlet
		c. Improperly designed turning vanes
		d. Projections, dampers or other obstructions in part of system where air velocity is high
CFM High - Too Much Air Flow	System	a. Oversized duct work
		b. Access door open
		c. Registers or grilles not installed
		d. Damper set to by-pass coils
		e. Filter(s) none in place
		f. System resistance much lower than anticipated
	Fan	a. Fan speed too fast
Incorrect Static Pressure	System, Fan or Interpretation of Measurements	General Discussion: • The velocity pressure at any point of measurement is function of the velocity of the air or gas and its density. • The static pressure measured in a “loose” or oversized system will be less than the static pressure in a “tight” or undersized system for the same air flow rate • In most systems, pressure measurements are indicators of how the installation is operating. These measurements are the result of air flow and as such are useful indicators in defining system characteristics. • Field static pressure measurements rarely correspond with laboratory static pressure measurements unless the fan inlet and fan outlet conditions of the installation are exactly the same as the inlet and outlet conditions in the laboratory

TRADITIONAL FANS (CONTINUED)

Static Pressure Low, CFM High	System	System has less resistance to flow than expected This is a common occurrence. Fan speed may be reduced to obtain desired flow rate. This will reduce HP (operating cost).
	Fan	a. Backward inclined impeller installed backwards. HP will be high
		b. Fan speed too high
Static Pressure Low, CFM Low	System	a. Fan inlet and/or outlet conditions not same as tested.
Static Pressure High, CFM Low	System	a. Obstruction in system
		b. Dirty filters
		c. Dirty coils
		d. System too restricted
HP High	Fan	a. Backward inclined impeller installed backwards
		b. Fan speed too high
		c. Too low system resistance for forward curved fa
	System	a. Oversized duct work
		b. Face and by-pass dampers oriented so coil dampers are open at same time by-pass dampers are open
		c. Filter(s) - left out
		d. Access door open
	Fan Selection	a. Fan not operating at efficient point of rating. Fan size or type may not be best for application
Fan Does Not Operate	Electrical or Mechanical	a. Blown fuses
		b. Broken belts
		c. Loose pulleys
		d. Electricity turned off

HEATING COILS

Coil Does Not Operate	Steam Valve Failure	a. Check steam valve. If air operated, check proper air pressure. If electrically operated check for no power or loose connection. If manual valve, check to see if valve is open. If necessary repair or replace valve.
		b. Defective thermostat or wrong setting
	Steam trap failure (Steam Coil)	Condensate backs up into coil. Check steam trap, repair or replace
	Diverter valve (Hot Water Coil)	a. Check power to valve as above
		b. Diverter valve piped wrong
Coil Does Not Deliver Adequate Heat	No steam or hot water	Check boiler for proper steam pressure or hot water temperature setting.
	Thermostat	a. Thermostat improperly located, relocate.
		b. Thermostat defective, replace
		c. Improper set point, reset
		d. Defective controls, see above
	Coil Undersized	Replace with larger coil
	Insufficient steam pressure	Check boiler controls
	Lack of hot water	Hot water pump undersized or malfunctioning
	Dirty finned tubes	Vacuum or use air hose to gently clean dirt from finned tubes
Coil Leaks	Crack in brazed connection	Repair brazed joint
	Internal corrosion	Replace coil

COOLING COILS

Coil Does Not Deliver Adequate Cooling	Lack of chilled water	Chilled water pump undersized or malfunctioning
	Dirty finned tubes	Vacuum or use air hose to gently clean dirt from finned tubes
	Coil undersized	Replace with larger coil
Coil Leaks	Crack in brazed connection	Repair brazed joint
	Internal corrosion	Replace coil

COOLING COILS (CONTINUED)

Moisture on Walls Downstream of Cooling Coil	Excess capicity through cooling coil	Check air flow through coil
	Standing water in drain pan	See “Condensate Drain Pan” Section
	V.A.V. unit (Low Volume Air Flow - High Volume Water Flow)	Verify that the air flow and water flow are synchronized

CONDENSATE DRAIN PAN

Standing Water in Drain Pan	Unit is not level	Check level of unit, shim if required.
	Drain connection is clogged	Remove dirt or debris from drain pan
	Condensate drain line to drain is not correctly pitched.	Check pitch in line towards floor drain.
	Trap is sized incorrectly	All condensate drain connections and floor drains must be trapped. Failure to properly trap a drain will result in flooding of the drain pan and potential water damage to the air-handling unit and other building facilities.

ELECTRIC MOTORS

Motor Fails to Start	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker
	Overload trips	Check and reset overload
	Improper line connections	Check connections with diagram supplied with motor
	Open circuit in winding or starting switch. Evidence by humming sound from motor when switch is closed	Check inside motor to determine if switch is closed. Check for loose connections.
	Improper current supplied	Check to determine that power supply agrees with motor nameplate specifications.
	Mechanical failure	Determine that motor and drive turn freely. Check bearings and lubrication
	Short circuited stator	Indicated by blown fuses. Motors must be rewound
	Poor stator coil connection	Remove end bells and locate with a test lamp.

ELECTRIC MOTORS (CONTINUED)

Motor Fails to Start (Continued)	Defective rotor	Look for broken bars or end rings. Replace rotor
	Motor overloaded	Reduce load or replace unit with larger motor
	With a 3 phase power source one phase may be open	Check line for open phase
	Defective capacitor	Replace capacitor
Motor Stalls	Wrong application	Change type or replace unit with a larger motor, consult factory
	Overloaded motor	Reduce load or replace unit with a larger motor.
	Low line voltage	Check across AC line and correct if possible
Motor Runs and Then Dies Down	Partial loss of line voltage	Check for loose connections. Determine adequacy of main power supply
	Stator shorts when motor warms up.	Replace stator
Motor Does Not Come Up to Speed	Motor under designed for application	Replace with a larger motor
	Voltage too low at motor terminals	Check across AC line and correct if possible
	Line wiring to motor too small	Install larger line wiring
	Broken rotor bars	Look for broken bars or end rings, replace motor.
	60 cycle motor connected to 50 cycle line supply	Replace unit with a 50 cycle motor.
Motor Takes Too Long to Accelerate	Excessive load	Replace with larger motor
	Loose connection(s)	Check connections and tighten where necessary
Wrong Rotation (3 Phase)	Improperly wired to AC line (Wrong sequence of phases)	Check wiring diagram on motor nameplate and correct. Reverse any two motor leads at line connection
Motor Overheats (Temperature Rise Above Ambient Greater Than Nameplate Specifications)	Motor overloaded	Replace with larger motor.
	Motor fan may be clogged with dirt preventing proper ventilation	Remove fan cover and clean, replace fan cover
	Motor (3 phase) may have one phase open	Check to insure that all connections are tight

ELECTRIC MOTORS (CONTINUED)

Motor Overheats (Temperature Rise Above Ambient Greater Than Nameplate Specifications) (Continued)	Partially shorted stator coil	Must be rewound
	Line voltage too high	Check across AC line and correct. Step-down transformer may be required
	Rotor rubs stator bore	Check motor bearings and replace
	Worn bearings	Replace bearings and seals
Motor Vibrates When Connected to Driven Equipment	Motor mounting bolts loose	Tighten mounting bolts
	Rigid type coupling used to connect motor to driven equipment	Replace coupling with a proper coupling
	Driven equipment unbalanced	Balance driven equipment
	Worn motor bearings	Replace bearings and seals
	Motor (3 phase) running on single phase	Check for open circuit and correct
	Bent motor shaft	Replace shaft or rotor
Rapid Motor Bearing Wear	Excessive overhung load due to over tensioned drive	Check overhung load, retension drive.
	Excessive overhung load due to a smaller diameter sheave than recommended minimum used on motor shaft	Check “NEMA Sheave Selection Guide” in the Browning Catalog. Replace sheave with one of size equal to or greater than listing

Drives

- ABB - https://www.baldor.com/brands/baldor-reliance
- Yaskawa - https://www.yaskawa.com/

Gas Furnaces

- Reznor - http://literature.nortekhvac.com/Reznor
- Heatco - https://www.heatco.com/docs/
- Nagas - https://www.nagasinnovation.com/

Heat Wheels

- Innergytech - https://www.innergytech.com/library
- Novelaire - https://www.novelaire.com/downloads.html
- SG America - https://www.sgamerica.com/product-docs

Heat Pipes

- Innergytech - https://www.innergytech.com/library
- Heatpipe Technologies - https://www.heatpipe.com/products/

Plate Exchangers

- Innergytech - https://www.innergytech.com/library
- Recuperator - http://www.recuperator.eu/eng/areaclienti.html#page

Evaporative Coolers

- Munters - https://www.munters.com/en/knowledgebank/document-library/
- Condair - https://www.nortechumidifierparts.com/repair-help

Humidifiers

- Condair - https://www.condair.com/downloads-results
- Dristeem - https://www.dristeem.com/homepage

Electric Heating Coils

- Neptronic - https://www.neptronic.com/Heaters/Heaters.aspx
- Thermolec - http://www.thermolec.com/en/
- Indeeco - https://indeeco.com/resources

Unit Heaters

- Ouellet - https://www.ouellet.com/en-us/default.aspx
- Brasch - https://braschmfg.com/home/

Coils

- Aerofin - https://www.aerofin.com/resources
- LJ Wing - https://www.ljwing.com/product-literature-download.asp

Fans

- Twin City - https://www.tcf.com/#

Dampers

- Tamco - https://tamcodampers.com/#
- Ruskin - https://www.ruskin.com/
- Greenheck - https://www.greenheck.com/resources

These Terms and Conditions of Sale and the non-conflicting provisions in Seller's quotation, acknowledgement or invoice from Seller form the parties' agreement (the "**Agreement**") which governs all sales of any products ("**Products**") and services ("**Services**") from Nortek Air Solutions, LLC or its North American affiliates or business units selling Products and Services ("**Seller**") to purchaser ("**Buyer**"). Seller disclaims any Buyer terms that are different or conflicting. Any agreed exceptions to these terms and conditions shall be made in writing and attached to this Agreement.

1. Prices and Taxes. Prices are those in effect when Seller accepts a purchase order. Seller may accept or reject purchase orders in its sole discretion. All sales are subject to prior credit approval. Buyer must pay or promptly reimburse Seller for any sales, use or any other local, state, provincial or federal taxes arising from the sale or delivery of the Products and Services or provide an exemption certificate.

2. Payment. Unless otherwise agreed in writing, Buyer shall pay invoices, without setoff, NET 30 days from invoice date in the currency specified on the invoice. If Buyer fails to make payment (a) Buyer shall pay all of Seller's costs arising from Buyer's failure to pay according to terms including attorneys' fees, commissions, and product cancellation costs, (b) Seller may accelerate all Buyer payments, and (c) Seller may terminate or suspend further performance under the Agreement and any other agreements with Buyer. Past due amounts are subject to service charges of 1½% per month (or the maximum amount permitted by law) and, if credit terms have been agreed to in writing, Seller reserves the right to charge lawful rates of interest upon any outstanding balance, whether past due or not. If in Seller's judgment, reasonable grounds for insecurity arise concerning Buyer's ability to make payment when due, Seller may demand additional satisfactory security or adequate assurance of due performance, may refuse delivery except for cash, including payment for all goods previously delivered under the contract, or may stop delivery or reclaim the Products, in addition to all other remedies provided for by law. Buyer's purchase order, and any shipping or delivery instructions, shall each constitute the Buyer's separate written representation that it is solvent.

3. Changes. Seller may revise prices, dates of delivery, and warranties upon acceptance of requests by Buyer for modifications to Products or Services. If Buyer rejects proposed changes to made-to-order Products deemed necessary by Seller to conform to the applicable specification, Seller is relieved of its obligation to conform to such specification.

4. Shipment and Delivery. Deliveries of Products, risk of loss and title (subject to reservation of Seller's security interest) pass to Buyer FCA Seller's facility (Incoterms 2010) for domestic shipments or EXW Seller's Facility (Incoterms 2010) for international shipments. Buyer is responsible for all demurrage or detention charges. Title to any software provided with Products remains with Seller or its supplier. Any claims for shortages or transit damages must be submitted directly to the carrier. All shipping dates are approximate and not guaranteed. Seller reserves the right to make partial shipments. Seller is not bound to tender delivery of any Products for which Buyer has not provided shipping instructions. If shipment of Products is postponed or delayed by Buyer for any reason, including a Force Majeure Event (see Section 9), Seller may move Products to storage at Buyer's cost and risk of loss, the Products then deemed delivered. Products may not be returned except with the prior written consent of Seller, which may include additional terms.

5. Inspection and Acceptance. Unless otherwise agreed in writing signed by Seller, Buyer shall inspect Products upon receipt at the first delivery destination. Buyer's failure to inspect Products and give written notice to Seller of rejection within ten (10) days after receipt at first delivery destination shall constitute Buyer's irrevocable acceptance of Products delivered. Notice of any latent defect must be delivered to Seller in writing within ten (10) days of start-up.

6. Limited Warranty. Unless otherwise agreed in writing signed by Seller:

(a) Seller warrants: (i) All Products (excluding software and spare parts) manufactured by Seller will conform to the specifications and submittals provided by Seller and will be free of defects in material and workmanship ("Defects") for 12 months following start-up or 18 months following ship date, whichever occurs first, under normal use and regular service and maintenance, if installed and maintained pursuant to Seller's instructions. Extended warranties, if offered, may be purchased for an additional fee at the time of Product sale. For warranty purposes, start-up occurs when the equipment (or any portion thereof) is started for operation regardless of when the building may be ready for operation. (Per submittal, certain DX Products require Seller or its authorized Agent to perform start up or Product warranties are void. Any Seller required completed start-up form shall be delivered to Seller within six (6) months from shipment, or start-up will be deemed to have occurred on the ship date.)

With the exception of OEM parts that may provide a longer pass-through warranty term from the third party manufacturer, new spare parts will be free of Defects for 3 months following ship date. Refer to New Spare Parts Warranty Policy.

Buyer must notify Seller in writing of any Defect promptly upon discovery and if such notification occurs within the applicable warranty period, Seller shall remedy such Defect by, at Seller's option, adjustment, repair or replacement of Products or any affected portion of Products, or providing a refund of the portion of the purchase price attributable to the defective portion of the Product. Buyer must grant Seller access to the premises at which Products are located at all reasonable times so that Seller may evaluate the Defect and make repairs or replacements on site. Repaired or eplaced portions of Products are warranted until the later of the end of the original warranty period applicable to the defective portion of Products repaired or replaced or 30 days following the completion of the repair or ship date of the replacement parts; and (ii) Services will be of workmanlike quality. If Buyer notifies Seller in writing of any nonconforming Services within 30 days after Services are completed, Seller shall re-perform, if able to be cured, those Services directly affected by such failure, at its sole expense. Buyer's sole remedy for such

nonconforming Services is limited to eller's cost of re-performing the Services.

b) Buyer is responsible for disassembly, removal and re-assembly or otherwise of non-Seller supplied products. Seller does not warrant and shall have no obligation with respect to any Products or parts that: (i) have been repaired or altered by someone other than Seller or Seller's authorized representative; (ii) have been subject to misuse, abuse, neglect, intentional misconduct, accident, Buyer or third party negligence, unauthorized modification or alteration, use beyond rated capacity, improper grounding, voltage irregularities, a Force Majeure Event, or improper, or a lack of, maintenance; (iii) are comprised of materials provided by, or designed pursuant to instructions from, Buyer; (iv) have failed due to ordinary wear and tear; or (v) have been exposed to adverse operating or environmental conditions, including but not limited to contaminants, corrosive agents, chemicals or minerals, (vi) were manufactured or furnished by others and which are not an integral part of a product manufactured by Selleror (vii) have not been fully paid for by Buyer. Refrigerants, fluids, oils and expendable items such as filters are not covered by this Limited Warranty. If Seller has relied upon any specifications, information, representations or descriptions of operating conditions or other data supplied by Buyer or its agents to Seller in the selection or design of Products, and actual operating conditions or other conditions differ, any warranties or other provisions contained herein that are affected by such conditions will be null and void.

(c) Buyer is solely responsible for determining the fitness and suitability of Products for the use contemplated by Buyer. Buyer shall ensure that (i) the Products are used only for the purposes and in the manner for which they were designed and supplied, (ii) all persons likely to use or come into contact with the Products receive appropriate training and copies of applicable instructions and documentation supplied by Seller, (iii) all third parties who use or may be affected by or rely upon the Products are given full and clear warning of any hazards associated with them or limitations of their effectiveness and that safe working practices are adopted and complied with, (iv) any warning notices displayed on the Products are not removed or obscured, (v) any third party to whom the Products are supplied agrees not to remove or obscure such warning notices.

(d) If Software is Licensed: To the extent available and authorized by the Third Party Software supplier, Seller hereby assigns to Buyer any warranties provided by Third Party Software providers. Seller provides Third Party Software "as is," without any warranties, express or implied. Seller has no obligation for Third Party Software failures.

(e) THE WARRANTIES SET FORTH IN THIS SECTION 6 ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES WITH RESPECT TO PRODUCTS, SOFTWARE AND SERVICES, AND ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY AGAINST INFRINGEMENT; AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY, USAGE OF TRADE, AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to Buyer. SELLER DOES NOT WARRANT THAT THE OPERATION OF SOFTWARE WILL BE UNINTERRUPTED OR ERROR FREE, OR THAT ANY DEFECT OR MALFUNCTION IN THE SOFTWARE IS CORRECTABLE OR WILL BE CORRECTED. THE REMEDIES PROVIDED IN THIS SECTION 6 ARE BUYER'S EXCLUSIVE REMEDIES FOR ANY AND ALL CLAIMS ARISING FROM OR RELATED TO PRODUCTS AND SERVICES. All warranty claims must be received by Seller in writing on or before the end of the applicable warranty period.

7. Limitation of Remedy and Liability. Unless otherwise provided by law, Seller's total liability under the Agreement, whether in law, equity, contract, infringement, negligence, strict liability or other otherwise, shall not exceed the price paid by Buyer under the Agreement for the Product or Services giving rise to the claim. Under no circumstances shall Seller be liable for special, incidental, indirect, delay or liquidated, punitive or consequential damages for any reason. "**Consequential damages**" includes, without limitation, loss of anticipated profits; business interruption; loss of use, revenue, reputation or data; costs incurred, including without limitation, costs for capital, fuel or power; loss or damage to property or equipment; and environmental clean-up. Any action arising under or relating to the Agreement, (whether based in law, equity, contract, infringement, negligence, strict liability, other tort or otherwise), must be commenced with one year from the date the claim arose. Seller assumes no obligation or liability for technical advice given or not given, or results obtained. Seller has set its prices and entered into the Agreement in reliance upon the limitations of liability and other terms and conditions specified herein, which allocate the risk between Buyer and Seller and form a basis of this bargain between the parties.

8. Indemnity. (a) Seller shall defend at its own expense any action brought against Buyer by a third party alleging that Products (the "**Indemnified Items**") directly infringe any United States patent, and shall pay all damages and costs finally awarded in any such action, provided that Buyer has promptly notified Seller in writing of the action, delivers all necessary assistance in the defense of the action, and permits Seller to control all aspects of the defense, including settlement rights. Seller has no obligation with regard to: (i) any non-Seller originated Products, software or processes, including Indemnified Items or processes which have been modified or combined with non-Seller products or processes; (ii) any Indemnified Items or process provided pursuant to a design provided by or on behalf of Buyer; (iii) any patent issued after the date of the Agreement; (iv) any action settled or otherwise terminated without the prior written consent of Seller; or (v) any claims arising from, or related to, Seller's adherence to any specifications or instructions provided by or on behalf of Buyer.

(b) Buyer shall indemnify, defend and hold harmless Seller and its affiliates and their respective shareholders, officers, directors, members, agents and employees against all expenses, costs (including reasonable attorneys' fees), claims, demands, damages, liability, suits or the like arising in connection with or out of (i) any breach by Buyer of the Agreement; or (ii) Seller's adherence to specifications or use of material furnished or specified by Buyer

or any of its agents. Additionally, if all or a part of the Indemnified Items sold hereunder are incorporated into an improvement to real property owned by a third party, Buyer will indemnify, defend and hold harmless Seller and its affiliates and their respective shareholders, officers, directors, members, agents and employees against any claim by such third party or its guests or invitees to the extent that the claim seeks to recover damages or otherwise to invoke any legal or equitable remedies beyond those for which Seller has agreed to be liable hereunder.

9. Excuse of Performance. Seller has no liability for nonperformance due to acts of God; acts of Buyer; war (declared or undeclared); terrorism or other criminal conduct; fire; flood; weather; sabotage; strikes, or labor or civil disturbances; governmental requests, restrictions, laws, regulations, orders, omissions or actions; unavailability of, or delays in, utilities or transportation; default of suppliers or other inability to obtain necessary materials; embargoes or any other events or causes beyond Seller's reasonable control (each, a "**Force Majeure Event**"). Deliveries or other performance may be suspended for an appropriate period of time or canceled by Seller upon notice to Buyer in the event of a Force Majeure Event, but the remainder of the Agreement will otherwise remain unaffected as a result of the Force Majeure Event. If Seller determines that its ability to perform the Services or the total demand for Products is hindered, limited or made impracticable due to a Force Majeure Event, Seller may delay delivery of Products and Services and allocate its available supply of Products (without obligation to acquire other supplies of any such Products) among its customers on such basis as Seller determines to be equitable without liability for any failure of performance. In the event of a Force Majeure Event, the date of delivery will be extended by a period equal to the delay plus a reasonable time to train and resume production, and the price will be equitably adjusted to compensate Seller for such delay and related costs and expenses.

10. Laws and Regulations. Compliance with any federal, state, provincial or local laws, regulations and directives ("**Laws**") relating to the installation, operation or use of Products or Services is the sole responsibility of Buyer. In addition, Buyer shall comply with all applicable laws, rules, regulations and orders related to anti-bribery or anticorruption legislation (including without limitation the U.S. Foreign Corrupt Practices Act of 1977 and all national, state, provincial or territorial anti-bribery and anti-corruption statutes). The Agreement is governed by the laws of the State where Seller's principal office is located, without giving effect to its conflict of laws rules, and the parties consent to the exclusive jurisdiction and venue of the federal and state courts located in such State. The application of the United Nations Convention on Contracts for the International Sale of Goods does not apply.

11. Drawings. Any designs, manufacturing drawings or other information submitted to Buyer remain the exclusive property of Seller. Buyer shall not, without Seller's prior written consent, copy such information or disclose such information to a third party.

12. Cancellation. Buyer may cancel orders only upon reasonable advance written notice and upon payment to Seller of cancellation charges which include: (a) all costs and expenses incurred by Seller, and (b) a fixed sum of 10% of the total price of Products to compensate for disruption in scheduling, planned production and other indirect and administrative costs.

13. Export Control. Certain Products may be subject to export controls under the Laws of the US and other countries. Buyer must comply with all such Laws and not export, re-export or transfer, directly or indirectly, any such Product except in compliance with such Laws.

14. Assignment. Buyer acknowledges that Seller, through its affiliates (i.e., parents, subsidiaries and other affiliates) offers expanded manufacturing capability, and Seller may in its sole discretion manufacture, supply or deliver from any location or source, including any of its affiliates, any Products or Services and such manufacture, supply or delivery from such affiliates shall also be subject to these Terms and Conditions.

15. General Provisions. The Agreement constitutes the entire agreement between the parties and supersedes all other communications between the parties relating to the subject matter of the Agreement. Seller's quotations are offers that may only be accepted in full. No conditions, usage or trade, course of dealing or performance, understanding or agreement purporting to modify, vary, explain, reject, or supplement the Agreement shall be binding unless made in writing and signed by both parties, expressly and specifically referencing the Agreement, and no modification or objection shall be caused by Seller's receipt, acknowledgment, or acceptance of purchase orders, shipping instruction forms, or other documentation containing different or additional terms to those set forth herein. No waiver by either party with respect to any breach or default or of any right or remedy and no course of dealing, shall be deemed to constitute a continuing waiver of any other breach or default or of any other right or remedy, unless such waiver is expressed in writing signed by both parties, specifically referencing the Agreement. Nothing in the Agreement confers upon any person other than Seller and Buyer any right or remedy under or by reason of this Agreement. All typographical or clerical errors made by Seller in any quotation, acknowledgment or publication are subject to correction.

BUYER accepts these terms and conditions:

Signature: _____

Print Name: _____

Title:_____

Company: _____

Date: _____

ITF - INTEGRATED FRAME CONSTRUCTION

Featuring Penta Cube Fan Cell Construction

NORTEK™
AIR SOLUTIONS

Nortek Air Solutions, LLC
19855 SW 124th Ave, • Tualatin, Oregon 97062 U.S.A.
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pettitpettit
CONSULTING ENGINEERS, INC

REVIEW OF MECHANICAL SUBMITTALS

Project: UCA – Snow Fine Arts Renovation
Location: Univ. of Central Arkansas, Conway, AR
Date of Receipt: Monday, November 13, 2023
Date of Review: Wednesday, November 15, 2023
Reviewed by: Terry Jacks, P.E.
Email: tjacks@pettitinc.com

P&P Job No. 22-002

Signed: _____

Checking is for conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

Item	Approval Status		Comments
Section 23 73 13 – Modular Central Station Air Handlers	Approved as Noted	o	- Field-Installed pipe vestibule shall be installed as directed by manufacturer. Excessive gaps between air handling unit cabinet and pipe vestibule will not be allowed. - Coordinate with UV light vendor for exact installation and commissioning requirements. - Provide caution labels on units as recommended by UV light manufacturer. - Field coordinate all electrical requirements with electrical contractor. - Field coordinate all additional control wiring requirements as noted in submittal documents with controls contractor. - Air handling units shall not be operated without proper air filtration. - Provide final inspection and startup service per 23 73 13, paragraph 3.06.

✓ ✗ o ✳

Note:

SUBMITTAL DATA

EQUIPMENT: Nortek - Temtrol Air Handling Units

TAGS: RTU-1, RTU-2 and AH-6

PROJECT: UCA Snow Fine Arts

LOCATION: Conway, AR

ENGINEER:

CONTRACTOR:

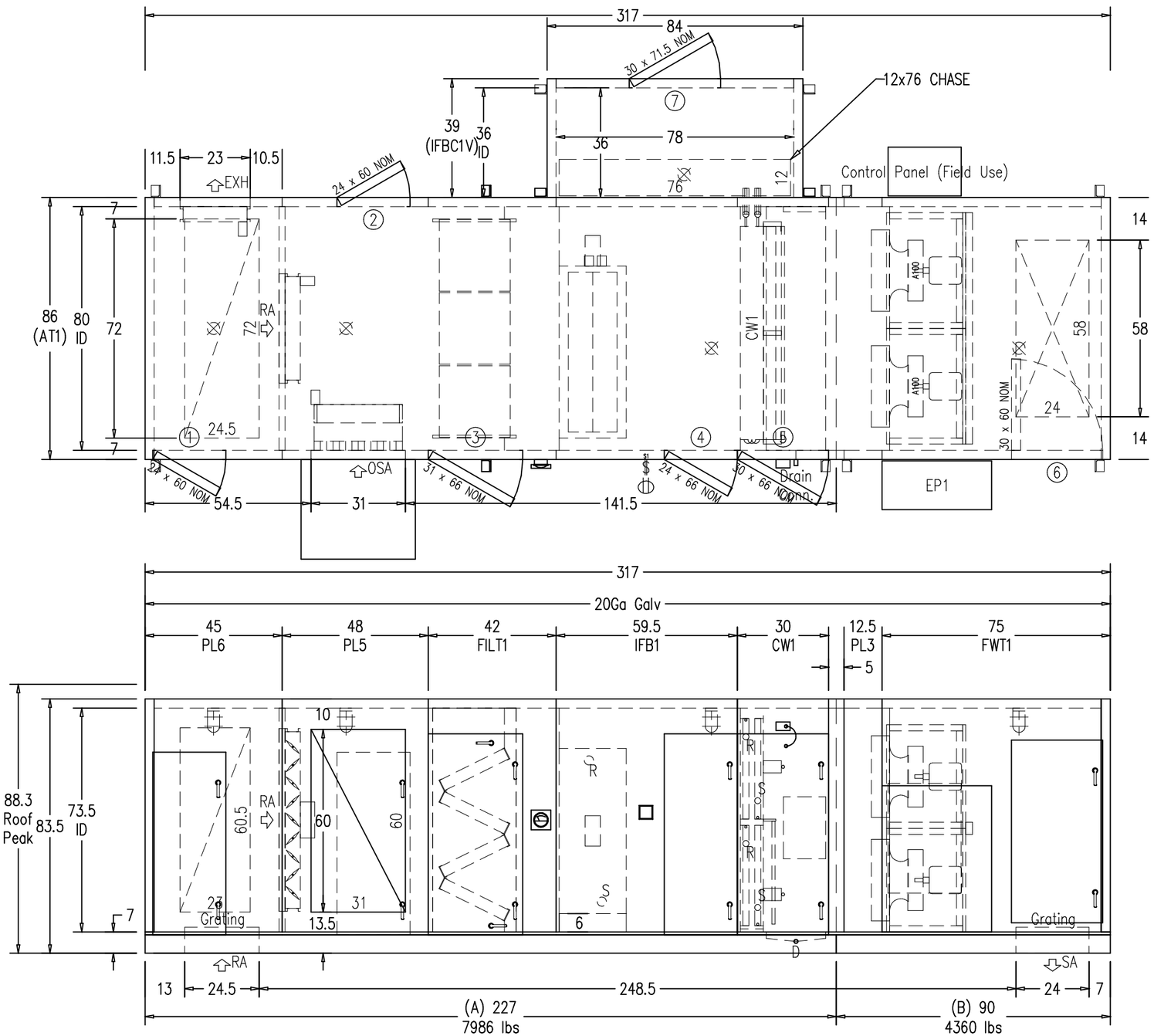
DATE: 10/31/2023

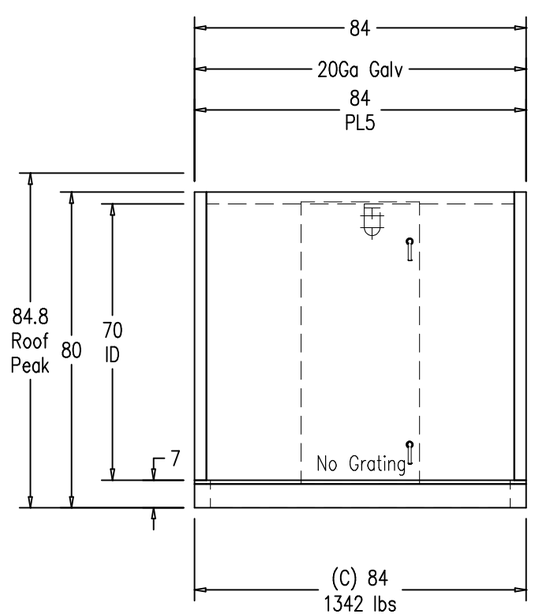
SUBMITTED BY: Forrest Moseley
forrest@airetechcorp.com
0

Submittal Comment Sheet

Due to the project completion date being 180 days out, it was important to have these submittals turned in immediately for review. The final electrical portion of this submittal was not able to be included. A final submittal for record will be sent in.

Preliminary





All dimensions shown in inches, Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.
ITF – Integrated Frame Construction 14,500 ACFM
Roof curb provided by others

NORTEK™ AIR SOLUTIONS TEMTROL
106 N Industrial Blvd. (405) 817-9700
Okarche, OK 73762 www.nortekair.com

Rev	Revision Description	Date m/d/y
	UCA Snow Fine Arts	

Unit Tag: RTU-1			Unit Type: Outdoor		Dsg Qty: 1
Rep Firm: Airetech Corp North Little Rock, AR, US			Weight: 13,763		Box Qty: 3
Rep Contact: Forrest Moseley, 501-280-0404			Model No: ITF-RDHE64		
SALES ORDER #: N003312-001	JOB #: N003312001	NASDA Ver: 9.1.0	Factory SAE: BRS	Date m/d/y: 7/24/2023	Rev: A

Printed (yyyy-MM-dd): 2023-11-03

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

NOT PRODUCTION READY
INFORMATION NEEDED

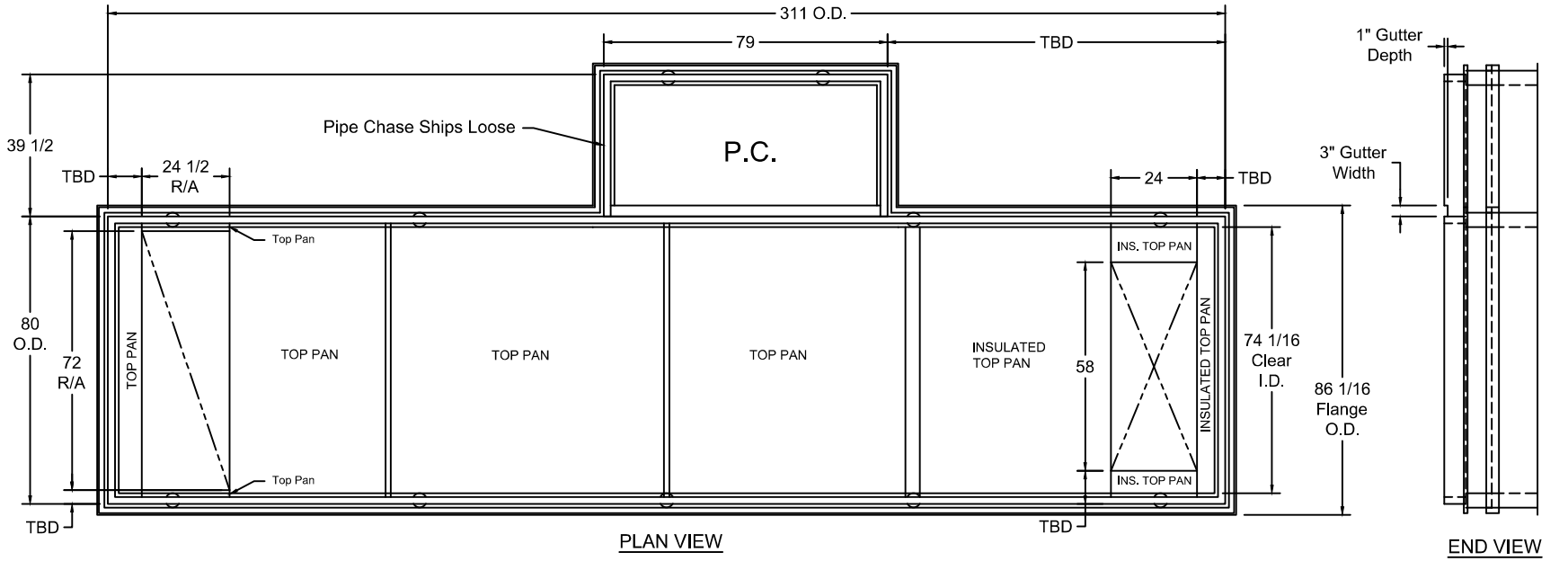
☐ APPROVED
☐ APPROVED PENDING CHANGES
BY:
DATE: / /

SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

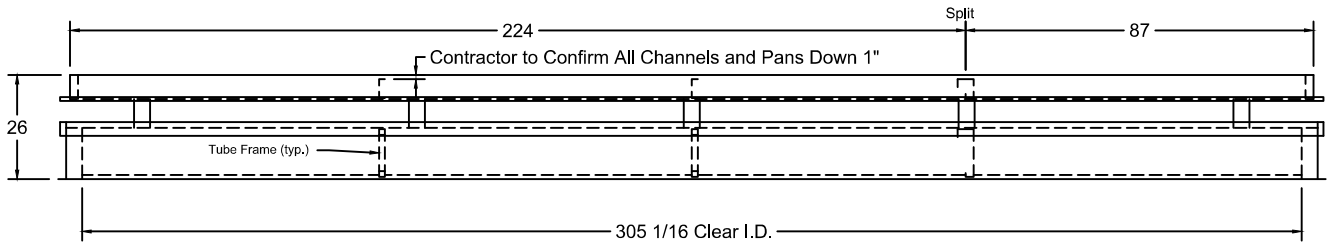
VERIFY ROOF PITCH AND DIRECTION

NOTES:
-CONTRACTOR TO FIELD-CUT SUPPLY & RETURN OPENINGS THROUGH THYBAR CURB FLOOR.
-CONTRACTOR TO SEAL BOTTOM OF UNIT TO TOP OF CURB AND PANS
-CONTRACTOR TO VERIFY SUPPLY, RETURN AND PIPE CHASE LOCATIONS PRIOR TO PRODUCTION

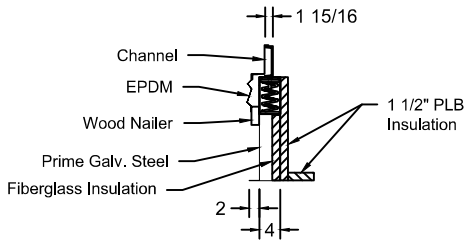


PLAN VIEW

END VIEW



ELEVATION VIEW



SECTION AA
2" Spring Deflection

Rev.	Int.	Date	Description
1	MS	10/24/23	changed to vibrocurb

REVISION HISTORY

(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 8/22/23

Insulated RoofCurb Plenum S and R with pipe chase
New Nortek Custom Unit

Airtech Corporation/ UCA Snow Fine Arts

Qty.: 2 | Job# : Q-25597
Tag:
Drawn: DR
File: S20501-1 | Rev: ----

thybar CORPORATION
Thybar makes it right the first time, every time

Curb final dimensions will be coordinated

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-001
JOB #	N003312001
UNIT TAG	RTU-1
QUANTITY	1

Unit Design Options

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

100 Unit Design Summary

100.1 Electrical

1. Short Circuit Current Rating (SCCR) @ 65 kA
2. ◊ Fans wired to Electrical panel equipped with ABB ACH580 VFD, provided and mounted by Factory. Electrical Panel to have internal overloads with aux. contacts wired in series for field wiring to remote monitoring.
3. ◊ All fan air monitoring with Magnesense transducer.
4. ◊ Factory to provide and mount 24" x 36" NEMA 3R enclosure w/fan, for field installed controls.
5. ◊ All lights controlled by a single light switch. One GFI outlet provided.
6. ◊ 120 volt power for lighting and/or GFI outlets shall be provided by Others.
7. ◊ Unit to ship in individual, bagged sections.

◊ **Project specific requirements**

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

101 Unit Details

101.1 Weights / Jobsite Elevation

1. Shipping Weight	13,599 lb	3. Elevation	266 ft
2. Operating Weight	13,763 lb		

101.2 Preparation for Shipment

1. Knockdown Construction	No

102 Unit Construction

102.1 Construction

1. Cabinet Construction	ITF - Integrated Frame	6. Thermal Break	Modified Thermal Break
2. Design Environment	Outdoor	7. Mounting	Curb Mounted
3. Panel Depth	3 in	8. Roof Curb By	Others
4. Caulk Type	Standard	9. Curb Height	8.000 in
5. Model #	ITF-RDHE64		

102.2 Cabinet Material

1. Exterior Material	16Ga Galv Pre-Paint	7. Blankoff Finish	None
2. Interior Liner type(s)	See Drawing	8. Internal Wall Material	16Ga Galv
3. Exterior Paint Type	Polyester Resin	*Insulation by liner type*	
4. Interior Paint Type	None	9. Solid liner	HD Fiberglass Roll (R12.5)
5. Paint Color	Sandstone	10. Perforated liner	N/A
6. Meets Salt Spray Rating	2500 Hours		

Exceptions:
1. Chilled Water Coil 1: blankoff material is 16Ga 304 SS

102.3 Base Construction

1. Base Structure Material	Steel Tube	6. Base Structure Height	See Drawing
2. Base Floor Material	16Ga Galv	7. Sub Floor Material	20Ga Galv
3. Insulation	Polyurethane Foam	8. Floor Coating	None
4. Floor Drain	None	9. Lifting Lugs	Yes - Welded
5. Floor Options	None		

102.4 Notes / Features

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

103 Doors

103.1 All Doors (including those associated with specific components)

#	Box	Section	Type[1]	Width	Height	Hinge	Swing	Window	Interior	Exterior	Options[3]
1	A	PL6	3" TBF	24	60	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
2	A	PL5	3" TBF	24	60	RH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
3	A	FILT1	3" TBF	31	66	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
4	A	IFB1	3" TBF	24	66	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
5	A	CW1	3" TBF	30	66	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	MS TO
6	B	FWT1	3" TBF	30	60	LH	In	None	16Ga Galv	16Ga Galv Pre-Paint	TO
7	C	PL5	3" TBF	30	71.5	RH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO

103.2 Notes / Features

1. Door Types
   TBF = Thermal Break Factory
2. All doors insulated with Polyurethane Foam.
3. Options: MS = Manual Safety Interlock, TO = Tool Operated Handle

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

104 Drains

104.1 All Drains (including those associated with specific components)

Box	Section	Type	Conn (in)	Hand	Grating Material	Pan Material
A	CW1	Drain Pan	1.25	Right	None	16Ga 304 SS

104.2 Notes / Features

1. Drain Constructions included: Triple Pitched

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

106 Static Pressure Summary

106.1 Condition 1

106.1.1 Supply

Tunnel	*Description*	*APD (in.H20)*
AirTunnel 1	RA Opening - Damper (Return Air)	0.13
AirTunnel 1	OSA Opening - Damper (Outside Air)	0.01
AirTunnel 1	Filter 1, 4" MERV 13 (Average Pressure Drop)	0.89
AirTunnel 1	IFB Coil 1	0.64
AirTunnel 1	Chilled Water Coil 1	0.59
AirTunnel 1	UVLight 1	0.02
AirTunnel 1	FANWALL 1 (Supply) 14,500 ACFM @ 5.83 in.H20	0.00
AirTunnel 1	SA Opening (Supply Air)	0.35
	ESP:	3.20
	Total Static Pressure:	5.83

Legend: ESP - External Static Pressure, OSA - Outside Air, EXH - Exhaust Air, RA - Return Air, SA - Supply Air

106.2 Notes/Legend

1. Summary report does not include static pressure of components supplied by others in the field unless otherwise noted.

106 N Industrial Blvd. Okarche, Ok 73762
(405) 817-9700 FAX (405) 263-4980

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-001
JOB #	N003312001
UNIT TAG	RTU-1
QUANTITY	1

Fans

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

200 FANWALL 1 (Supply) : FWT1 : Box B — 20-60 - 184T - 34 x 38 x 26 - B2

200.1 Configuration / Quantity

1. Function	Supply Fan
2. Quantity	4
3. Array	2 Rows x 2 Cols
4. Construction	PentaCube
5. Stand Height	N/A

Cell Size	6.Height	7.Width	8.Depth	9.Overall Depth
	34	38	26	33.25

10. Elev. / Temp.	266 ft / 70.0 °F		
11. Motor & Wheel Weight	168 lb	13. Redundant	0
12. Fan Cell Weight	368 lb	14. Empty	0
15. Ship Loose Fan (Wheel, Motor and Mounting Base)			0

200.2 Options

1. Coplanar Insulation	Standard Melamine	8. Cell Finish	None
2. Extended Coplanar	No	9. Insulation Retainer	No
3. Back Draft Dampers	FBD8	10. Inlet Attenuation	None
4. Inlet Cone Type	A100 Curved Cone	11. Blankoff Material	16Ga Galv
5. Solid Perimeter Material	None	12. Blankoff Finish	None
6. Discharge Safety Guard	No	13. Removal Rail	No
7. Cell Material	Steel		

200.3 Fan Wheel

1. Wheel Type	HPF-A100	3. Width	60
2. Diameter	20	4. Max RPM	3521
		5. Wheel Finish	None

200.4 Motor

1. Manufacturer	Toshiba	6. Efficiency	89.5
2. HP Each / Total	5 / 20	7. Service Factor	1.15
3. Poles / RPM	4-Pole / 1,755	8. Shaft Isolation	Ceramic Bearings
4. Frame / Casing	184T / TEAO	9. FLA Each / Total	13.8 / 55.2 Amps
5. Volts / Phase / Hz	208/3/60	10. Motor HP Safety Factor	3.0 %

200.5 Control System

1. Redundant VFD	No	6. Flow Monitoring	Yes
2. Bypass Circuit	None	7. Fans to Monitor	All Fans
3. Drive	Standard	8. Display	Magnesense
4. Optimization Control	No		
5. Control Method	By Others		

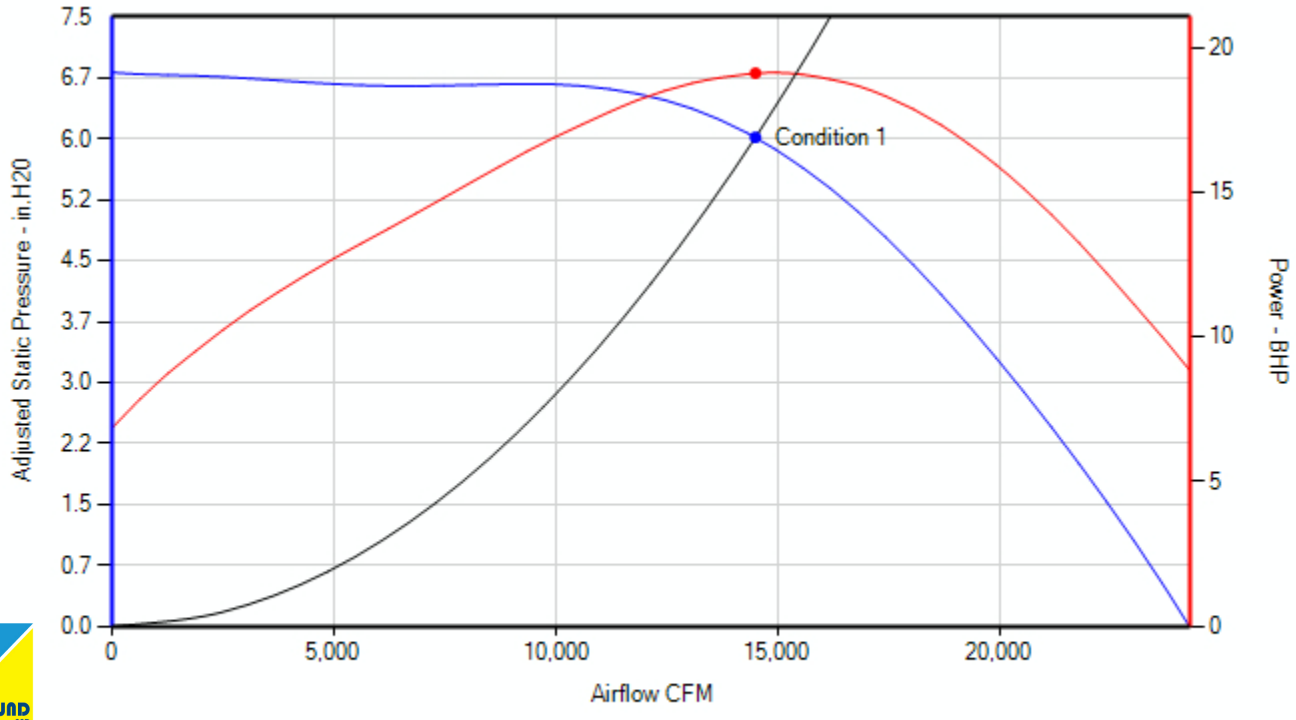
200.6 Notes / Features

1. To view patents and other pending U.S. or Canadian applications visit www.nortekair.com/patents.
2. (4) airflow measurement taps. Cone constant = 2524, cone flow differential pressure = 2.04 in.H2O at 3625 CFM per fan.
3. The estimated VFD input watts are based on the motor and VFD efficiency at the selected load and RPM.
4. Fans balanced to a maximum allowable level of 0.022 inches per second peak.

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

200 FANWALL 1 (Supply) : FWT1 : Box B (Continued) 20-60 - 184T - 34 x 38 x 26 - B2



AMCA Licensed for Sound and Air Performance Without Appurtenances (Accessories).
Performance certified is for installation type A: Free Inlet/Free Outlet
Power [bhp] excludes drives

200.7 Operating Conditions

Operating Condition	Usage (%)	CFM	SP (in.H20)		Cell Qty			RPM	Hz	Fanwheel BHP		Vel. (ft/min)	Watts	FEG % O.P.	FEI
			Input	Adj.	On	Off	Fail			Each	Total				
Condition 1	100	14,500	5.83	5.98	4	0	0	2,382	81.4	4.78	19.11	512	16,439	FEG80 2%	1.25

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

Operating Condition		63	125	250	500	1k	2k	4k	8k	LwA	Lw
Condition 1	Inlet	84	81	96	92	84	84	84	81	94	98
	Outlet	90	85	90	86	83	79	76	67	89	95

200 FANWALL 1 (Supply) : FWT1 : Box B (Continued) 20-60 - 184T - 34 x 38 x 26 - B2

200.9 AMCA Statement

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-1.6 / May 2022

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-001
JOB #	N003312001
UNIT TAG	RTU-1
QUANTITY	1

Coils

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

300 Chilled Water Coil 1 : CW1 : Box A — 5WC - 6 - 33 x 70 x 4 - 12 AL

300.1 Coil Layout

1. Coil Hand	Left	6. Rack Style	None
2. Configuration	Single	7. Rack Finish	None
3. Connection Orientation	Straight	8. Blankoff Material	16Ga 304 SS
4. Connection Material	Red Brass	9. Blankoff Finish	None
5. Connection Type	MPT		

300.2 Construction

1. Quantity	2	8. Stand Height	1 in	14. Casing	16Ga 304 SS
2. Serpentine	0.6666667	*Tube Detail - Primary Surface*		15. Coating	None
3. Fin Height	33.000 in	9. Material	Copper	*Fin Detail - Secondary Surface*	
4. Fin Length	70.000 in	10. O.D. x Wall	0.625 x 0.020 in	16. Material	Aluminum
5. Rows	4	11. Spacing	1.500 x 1.299 in	17. Thickness	0.008 in
6. Fins per Inch	12	12. Internal	Smooth	18. Configuration	Corrugated, Waffle with Straight Edge
7. Face Area	32.08 ft²	13. Return Bends	0.028 in		

Single Bank, Left Hand, 2 per unit — **5WC - 6 - 33 x 70 x 4 - 12 AL**

Supply / Return Connections				*Vent and Drain*		
Quantity	Type	Pipe Size	Material	Type	Vent Location	Drain Location
2	MPT	2.0 in	Red Brass	0.750 in MPT Extended	Return Header	Supply Header

300.3 Condition 1

Entering		*Leaving*	
1. Actual Airflow	14,500 ACFM	10. Total Capacity	636.7 MBH
2. Standard Airflow	14,077 SCFM	11. Sensible Capacity	413.0 MBH
3. Elevation	266 ft	12. Actual Face Velocity	451.95 ft/min
4. Entering Air DB	80.7 °F	13. Leaving Air DB	54.1 °F
5. Entering Air WB	68.4 °F	14. Leaving Air WB	53.9 °F
6. Fluid Type	Water	15. APD	0.59 in.H20
7. Entering Fluid Temp	45.0 °F	16. Leaving Fluid Temp	55.0 °F
8. Fluid Flow Rate	126.9 GPM	17. Fluid Velocity	5.03 ft/s
9. Fluid Fouling Internal	0.0000	18. Fluid Pressure Drop	13.77 ft.H20

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

300.4 Notes / Features

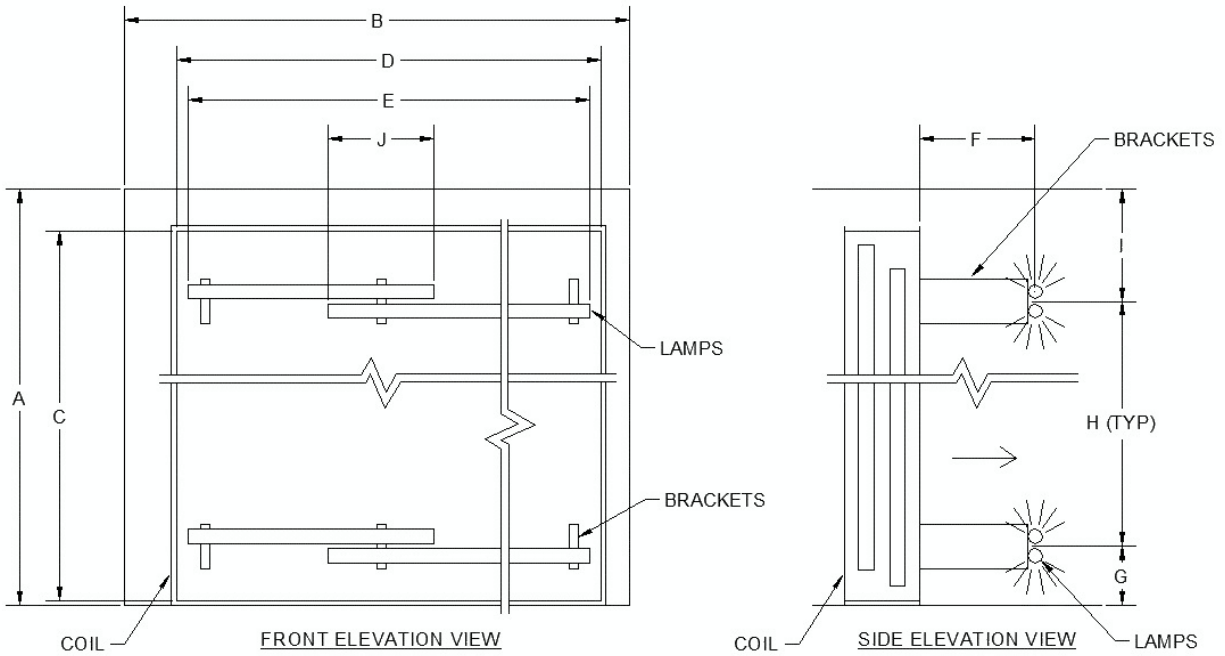
1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation and EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is 741 lb.
6. Total fluid volume is 18.7 Gal.

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

301 UVLight 1 : CW1 : Box A

301.1 Construction			
1. Provided By	Factory	12. Safety Switch	Factory Supplied
2. Product Type	RLM Xtreme	13. 12V Contact Connector	No
3. Fixture	Lamp Included	14. Extra Relay Switches	0
4. Voltage	120/1/60	15. UV Report™	No
5. Total Watts	740	16. UV Repeat™	No
6. Watts at Coil Surface	17.04 Watts/ft²	17. Warning Sign	No
7. Rows of Lights	2	18. UV-C Hour Meter	No
8. Fixtures Per Row	2	19. Conduit Loom Kits	Yes
9. Total Lamp Sets	1	20. LampLoom Down Exit	Yes
10. Encapsulamp	Yes		
11. X-Box Panel Type	P - 12V Contact Controller Not Included		



301.2 Dimensional Data (in)									
A	B	C	D	E	F	G	H	I	J
73.50	80.00	70.00	70.00	70.00	6.00	12.30	41.90	19.30	52.00

301.3 Purchased Items		
UVR Part Num	Description	Quantity
55086551	RLM Xtreme 61" Single Ended- High Output EncapsuLamp	4
55008022	RLM Conduit Loom Kit-20' S/S Flex Conduit w/Down Exit LampHolder	4
55000009	Dual LampHolster - Extended Base	2
55800064	RLM-X-Box 4P 120-277V w/CU2	1

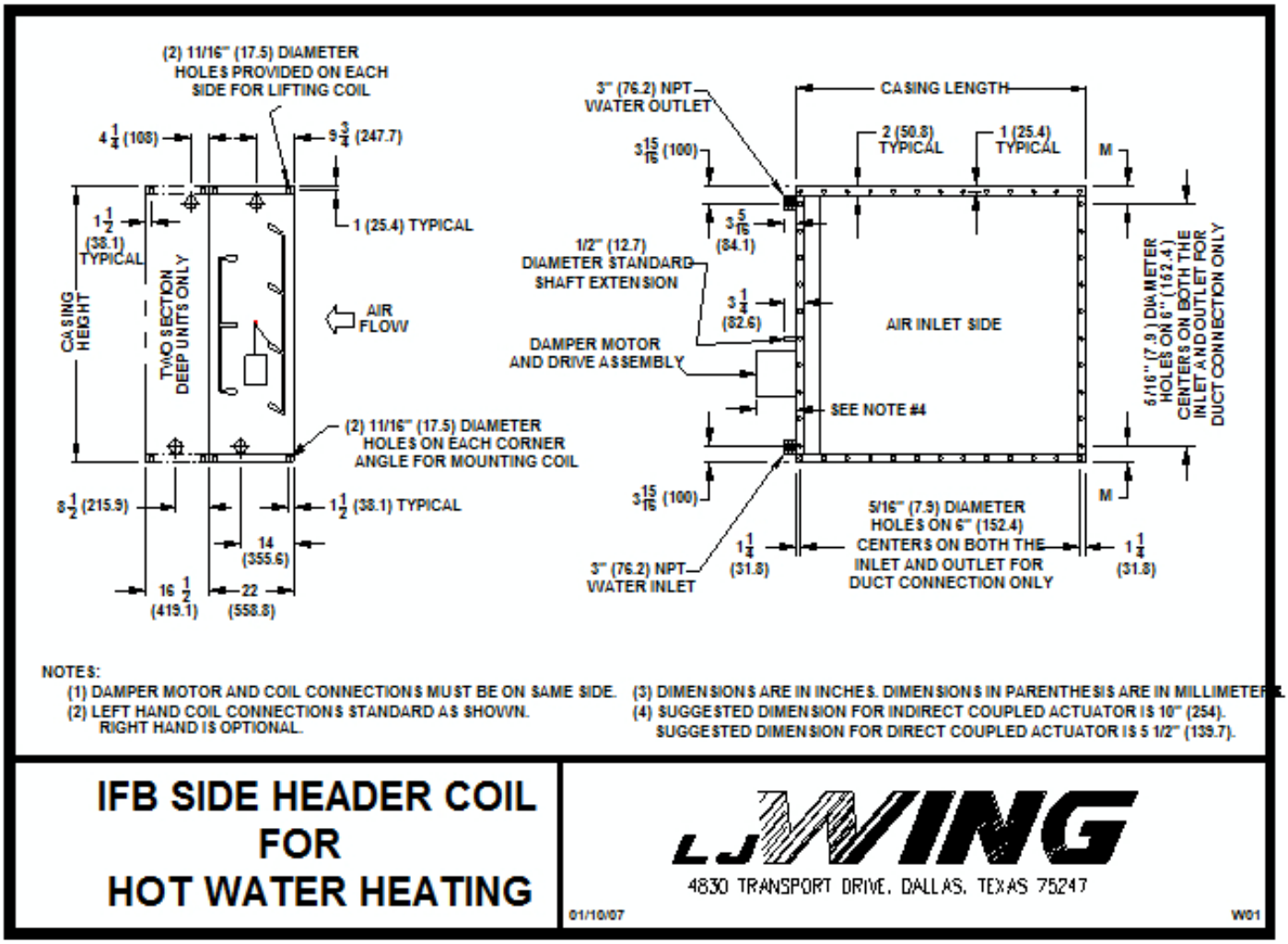
301.4 Electrical Service Information			
1. Volt/Phase/Hertz	120/1/60	3. Provides power to	UVLight 1
2. MCA	6.2		
1. For electrical loads see electrical drawings			

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

302 IFB Coil 1 : IFB1 : Box A — E - 48

302.1 Construction			
1. Fin Material	Aluminum	8. Fin Spacing	12
2. Tube Material	Copper	9. Tube OD	0.625 in
3. Connection Material	Steel	10. Tube Wall	0.035 in
4. Rows	2 (One Section)	11. Connection Location	Far Side
5. Total Face Area	21.3 ft²	12. Stand Height	6 in
6. Casing Finish	Air Dried Enameled Paint (Std.)	13. Anti-Stratification Baffles	No
7. Elevation	266 ft	14. Actuator Location	Left



302.2 Coil Dimensions (in)											
Casing Height	Casing Length	M	N	Q	Z	L	P	R	S	Y	X
54.25	56.5	3.125	-	-	-	-	-	-	-	-	-

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

302 IFB Coil 1 : IFB1 : Box A (Continued) E - 48

302.3 Condition 1

Entering		*Leaving*	
1. Actual Airflow	14,500 ACFM	7. Sensible Capacity	538.9 MBH
2. Standard Airflow	15,961 SCFM	8. Face Velocity	865.12 ft/min
3. Entering Air DB	15.0 °F	9. Leaving Air DB	49.6 °F
4. Fluid Type	Water	10. APD	0.64 in.H20
5. Entering Fluid Temp	160.0 °F	11. Leaving Fluid Temp	138.2 °F
6. Fluid Flow Rate	50.0 GPM	12. Fluid Pressure Drop	1.36 ft.H20

Notes:
1. ARI Certified

302.4 Notes / Features

1. SCFM is corrected for Elevation and EDB.
2. Total operating weight is 789 lb

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-001
JOB #	N003312001
UNIT TAG	RTU-1
QUANTITY	1

Components

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

500 Filter 1 : FILT1 : Box A

500.1 Pre-Filter Size & Quantity			
1. Loading	V Side Load	5. Bank Size	72.000 in W x 56.875 in H
2. Filter Clips	By Others	6. Qty / set & Frame Size 1	(12) 24 in x 24 in
3. Blankoff / Rack Material	16Ga Galv	7. Qty / set & Frame Size 2	
4. Blankoff / Rack Finish	None	8. Qty / set & Frame Size 3	
		9. Qty / set & Frame Size 4	

500.2 Pre Filter			
1. Filter Depth	4.000 in	4. Number of Sets	
2. Efficiency		5. Max Face Velocity	302.08 ft/min at 14,500 ACFM
3. Manufacturer		6. Model	

500.3 Pressure Gage Specifications - Gage 2			
1. Manufacturer	Dwyer	3. Options	Hinged Cover
2. Model / Range	Magnehelic 2002 (0-2" w.c.)	4. Quantity	1

500.4 Notes / Features
1. Filters provided by Others.

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

600 OSA Opening : OSA : Box A : Near Side

600.1 Opening Construction			
1. Description	Outside Air	4. Shape	Rectangle
2. Max CFM	4,775 ACFM	5. Max APD	0.01 in.H20
3. Size	31 W x 60 H in		

600.2 Damper Specifications			
1. Manufacturer	Ruskin	6. Jackshaft	Yes
2. Model	Ruskin AMS 050 (Aluminum)	7. Max Face Velocity	408.80 ft/min
3. Size	29.000 in (Blade Direction) x 58.000 in	8. End Switches	No
4. Blade Config	Parallel		
5. Blade Orientation	Horizontal		

Notes:
1. Ordered with 2" frame flange
2. Damper Options: Integrated Controller and Actuators
3. Minimum airflow: 3,875 CFM, Maximum airflow: 25,833 CFM, Set Point airflow: 4,775 CFM

600.3 Damper Actuator			
1. Location	Face Mounted (RH)	3. Floor Mounted	No
2. Type	Modulating 24V – NC	4. Furnished By	Factory
		5. Mounted By	Factory
		6. Wiring By	Others

600.4 Notes / Features

1. Weather hood included: 2 sections (37.500 in W x 32.750 in H x 32.75 D) - custom sizing. Maximum weather hood velocity 357 ft/min. Shipped Loose.

601 SA Opening : SA : Box B : Floor

601.1 Opening Construction			
1. Description	Supply Air	4. Shape	Rectangle
2. Max CFM	14,500 ACFM	5. Max APD	0.35 in.H20
3. Size	58 W x 24 H in	6. Max Velocity	1,500.00 ft/min

601.2 Notes / Features

1. Steel Floor Grate included.

602 RA Opening : RA : Box A : Floor

602.1 Opening Construction			
1. Description	Return Air	4. Shape	Rectangle
2. Max CFM	14,500 ACFM	5. Max APD	0.05 in.H20
3. Size	72 W x 24.5 H in	6. Max Velocity	1,184.00 ft/min

602.2 Notes / Features

1. Steel Floor Grate included.

603 EXH Opening : EXH : Box A : Far Side

603.1 Opening Construction			
1. Description	Exhaust Air	4. Shape	Rectangle
2. Max CFM	9,500 ACFM	5. Max APD	0.14 in.H20
3. Size	23 W x 60.5 H in		

603 EXH Opening : EXH : Box A : Far Side (Continued)

603.2 Damper Specifications			
1. Manufacturer	Ruskin	6. Jackshaft	Yes
2. Model	Ruskin CD 60 (Galvanized)	7. Max Face Velocity	983.11 ft/min
3. Size	23.000 in (Blade Direction) x 60.500 in	8. End Switches	No
4. Blade Config	Opposed		
5. Blade Orientation	Horizontal		

Notes:
1. Ordered with 1" frame flange

603.3 Damper Actuator			
1. Location		3. Floor Mounted	
2. Type		4. Furnished By	Others
		5. Mounted By	Others
		6. Wiring By	Others

603.4 Notes / Features

1. Damper Actuators and mounting accessories furnished and mounted by Others at Face Mounted (RH) location.
2. Damper Actuators wired by Others

604 RA Opening : RA : Box A : Internal Wall

604.1 Opening Construction			
1. Description	Return Air	4. Shape	Rectangle
2. Max CFM	14,500 ACFM	5. Max APD	0.13 in.H20
3. Size	36 W x 60 H in		

604.2 Damper Specifications			
1. Manufacturer	Ruskin	6. Jackshaft	Yes
2. Model	Ruskin CD 60 (Galvanized)	7. Max Face Velocity	966.67 ft/min
3. Size	36.000 in (Blade Direction) x 60.000 in	8. End Switches	No
4. Blade Config	Opposed		
5. Blade Orientation	Horizontal		

Notes:
1. Ordered with 1" frame flange

604.3 Damper Actuator			
1. Location		3. Floor Mounted	
2. Type		4. Furnished By	Others
		5. Mounted By	Others
		6. Wiring By	Others

604.4 Notes / Features

1. Damper Actuators and mounting accessories furnished and mounted by Others at Face Mounted (LH) location.
2. Damper Actuators wired by Others

605 Opening : Box C : Floor

605.1 Opening Construction			
1. Max CFM	14,500 ACFM	3. Shape	Rectangle
2. Size	12 W x 76 H in	4. Max APD	0.00 in.H20
		5. Max Velocity	0.00 ft/min

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-001
JOB #	N003312001
UNIT TAG	RTU-1
QUANTITY	1

Electrical

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

700 ElecPanel 1 : FWT1 : Box B : Near Side

700.1 Construction			
1. Enclosure Type	Electrical Panel	4. Mounting	Surface mount on unit
2. Type	NEMA 4 Indoor / Outdoor		
3. Size	See electrical drawings		

701 Control Panel (Field Use) : FWT1 : Box B : Far Side

701.1 Construction			
1. Enclosure Type	Electrical Panel	4. Mounting	Surface mount on unit
2. Type	NEMA 3R Outdoor		
3. Size	See electrical drawings		

702 Additional Lighting

702.1 Switches / Outlets

	Name	Box	Section	Type	Mounted	Illum. Switch	Timer	Cover	GFCI	MOCP
	ElecSwitch 1	A	IFB1	Light Switch / 120V Outlet	External	No	None	Yes	Yes	20.0 Amps

702.2 Lighting Types and Quantities

(5) Vapor Proof 14W LED

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-001
JOB #	N003312001
UNIT TAG	RTU-1
QUANTITY	1

Unit Data

Unit Data

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

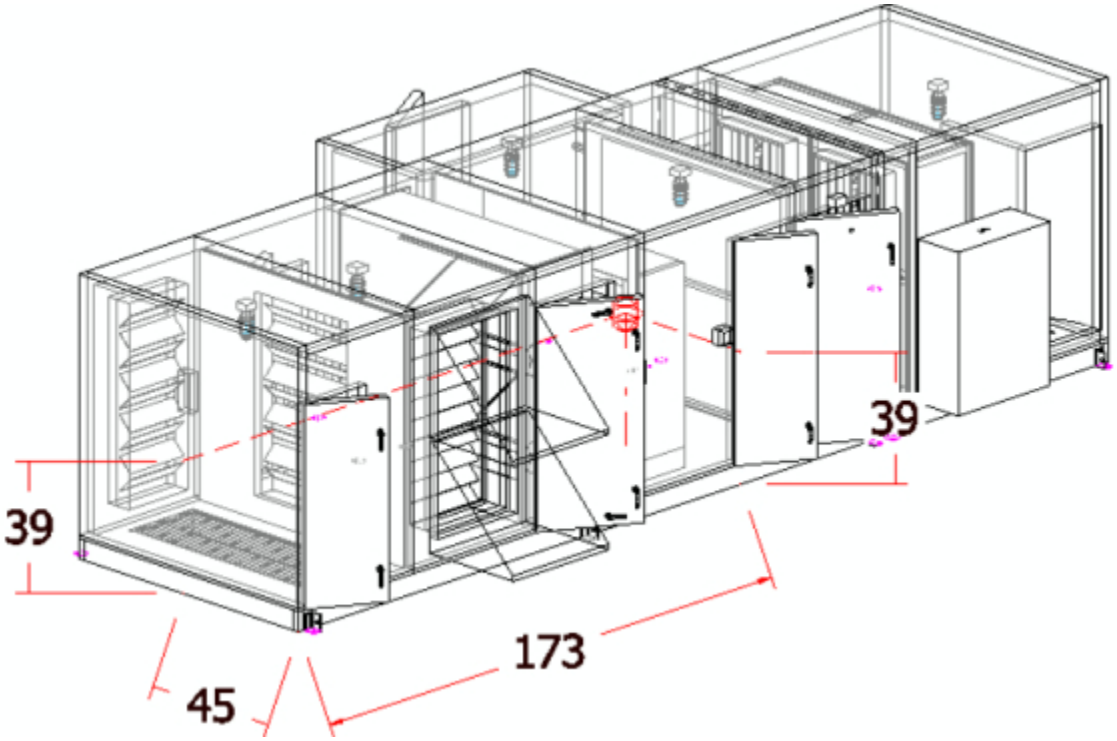
Sales Order #: N003312-001
Job #: N003312001

106 N Industrial Blvd. Okarche, Ok 73762
(405) 817-9700 FAX (405) 263-4980

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

901 Center of Gravity



Size (Inches)			Operating Weight (Pounds)	Center of Gravity (Inches)		
X	Y	Z		X	Y	Z
317.00	125.00	83.50	13,688	173.00	45.00	39.00

901.1 Notes

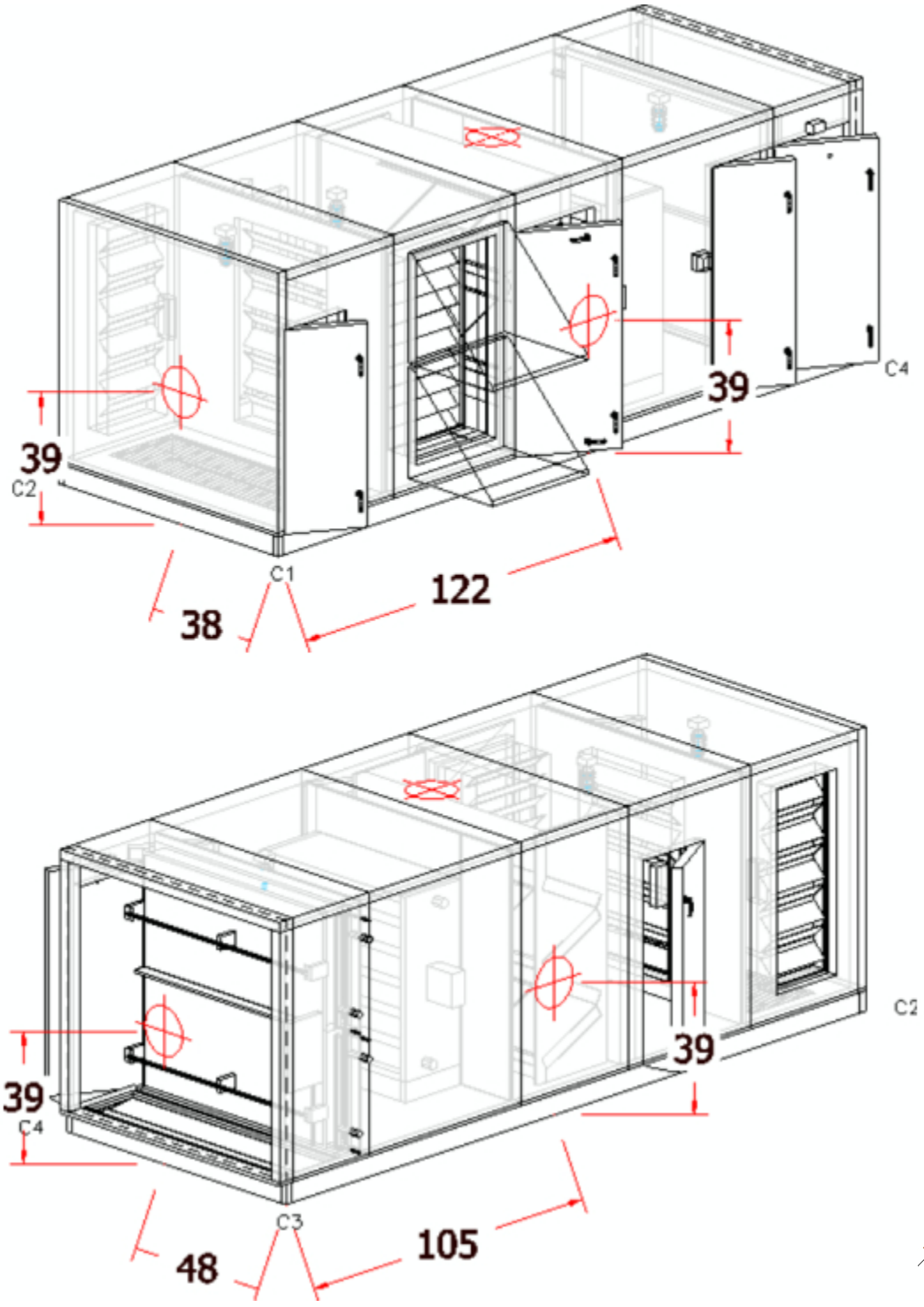
1. Center of gravity and weights are estimates and subject to change.
2. The center of gravity and weights shown above are based on operating weights and do not include packaging materials.
3. A 5% safety factor has been applied to the operating weights.
4. Weights shown do not include roof curbs provided by others.
5. Corner weights apply to rectangular boxes only.
6. Corner weights are to assist in handling of the unit. Some units are not intended to be supported only at the corners. Contact your Sales Representative for support information.

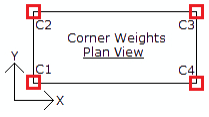
Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

901 Center of Gravity (Continued)

901.2 Box A





Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
227.00	86.00	83.50	7,822	2,039	1,614	1,842	2,327

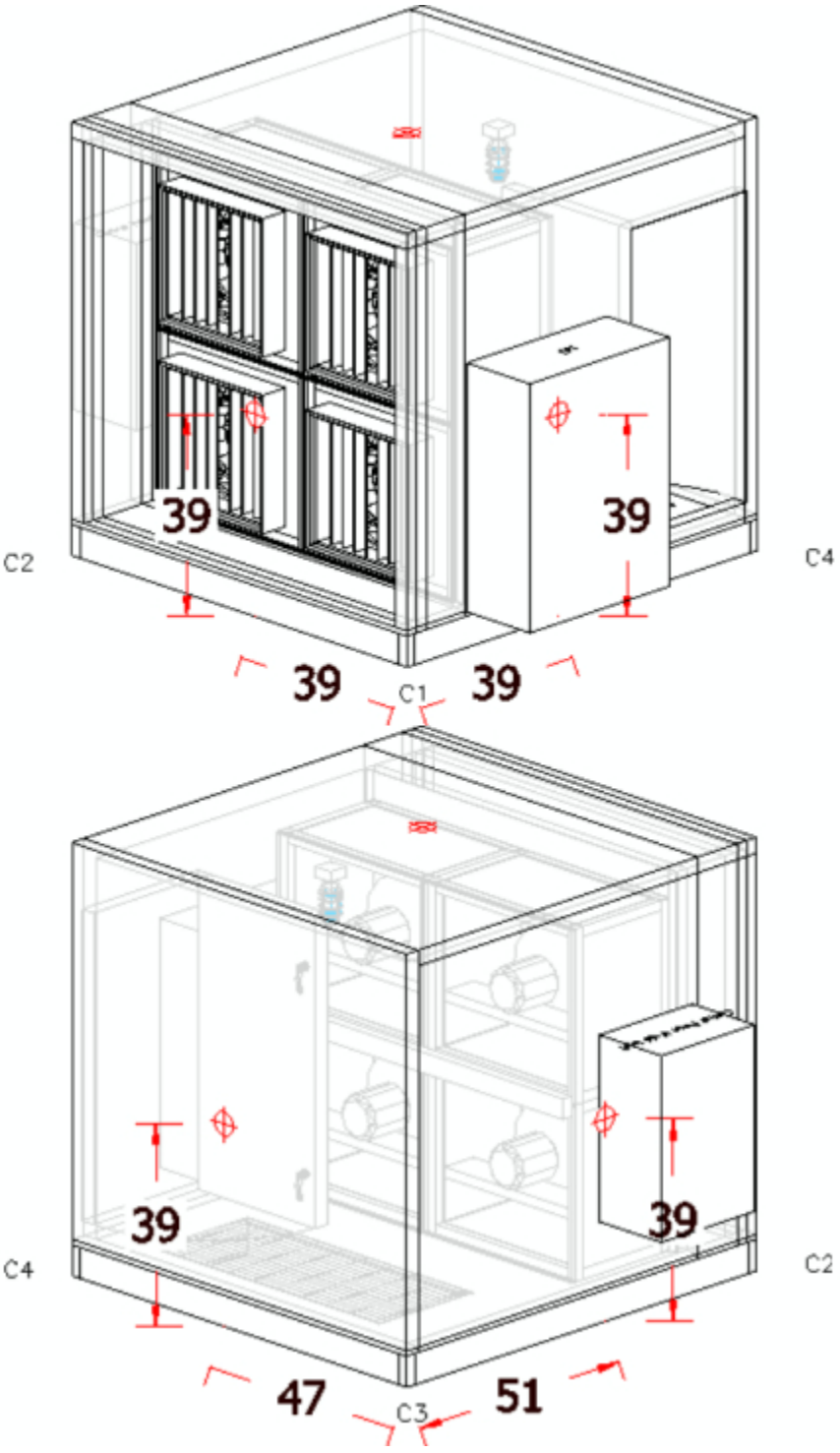
◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

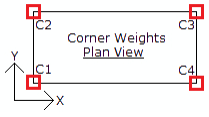
Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

Sales Order #: N003312-001
Job #: N003312001

901 Center of Gravity (Continued)

901.3 Box B





Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
90.00	86.00	83.50	4,360	1,350	1,120	857	1,032

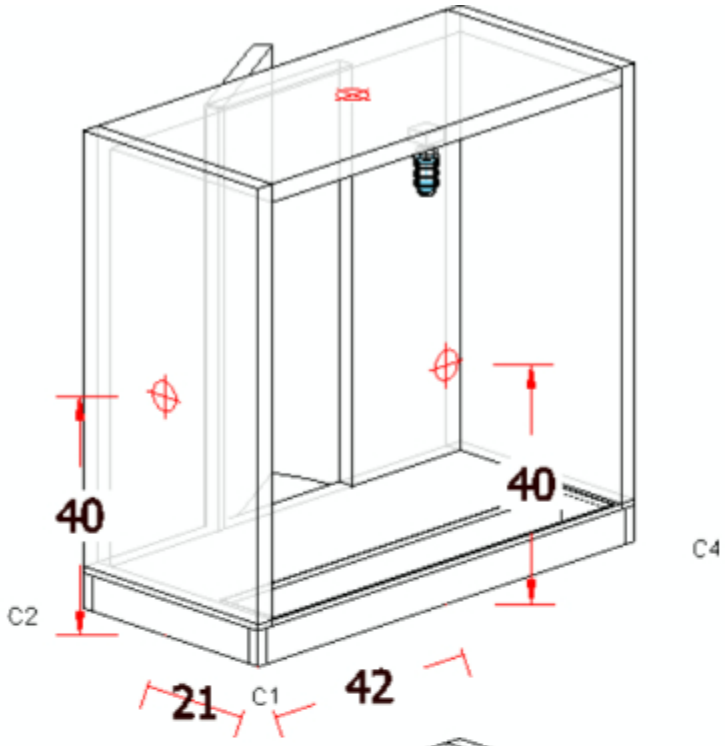
◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

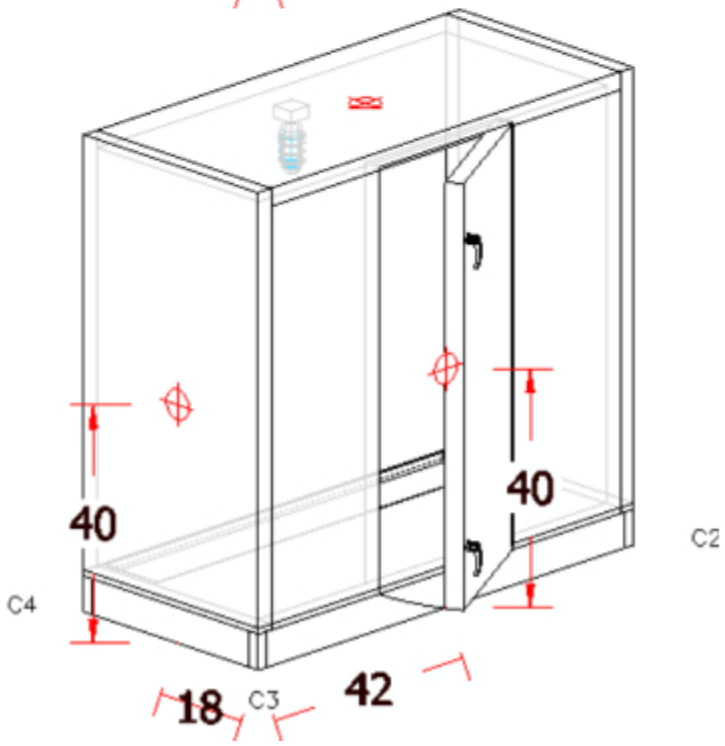
Project Name: UCA Snow Fine Arts
Unit Tag: RTU-1

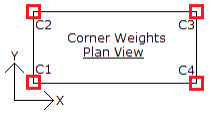
Sales Order #: N003312-001
Job #: N003312001

901 Center of Gravity (Continued)

901.4 Box C





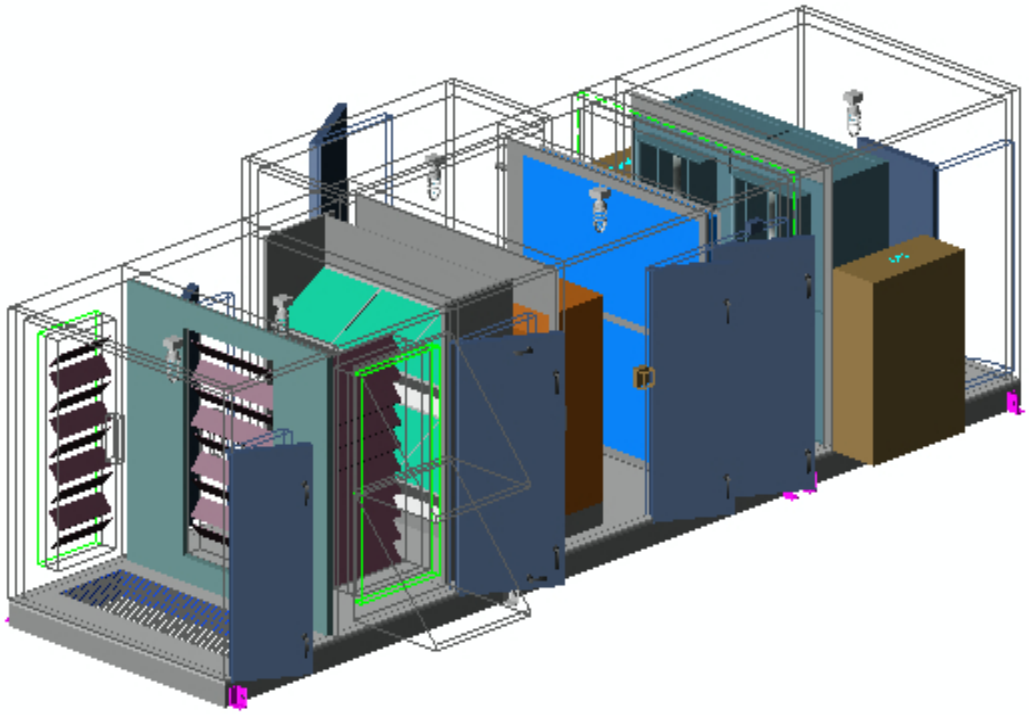


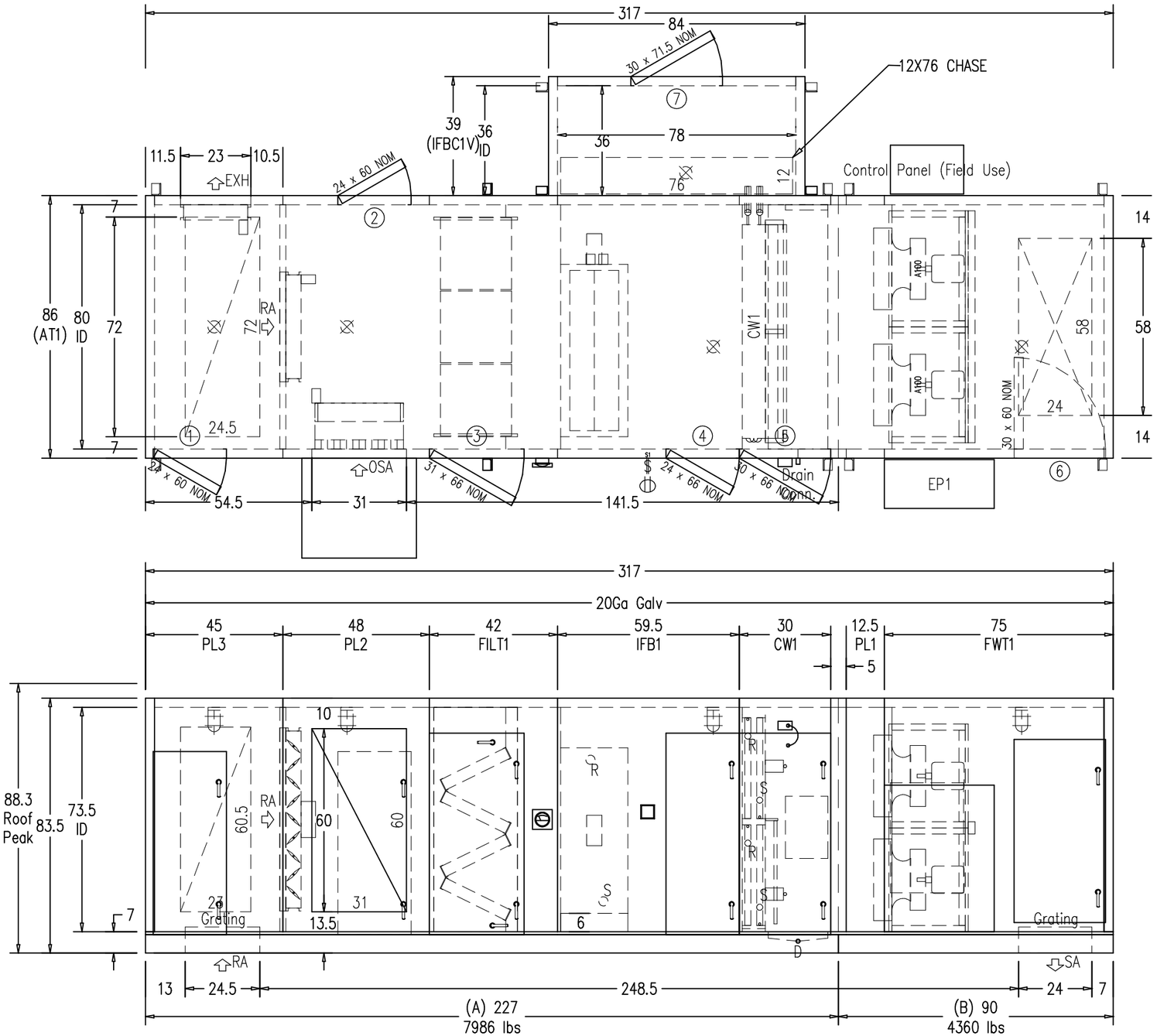
Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
84.00	39.00	80.00	1,342	310	361	361	310

◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-002
JOB #	N003312002
UNIT TAG	RTU-2
QUANTITY	1

Revision History		
Date	Rev	Revision Description





All dimensions shown in inches, Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.
ITF – Integrated Frame Construction 14,500 ACFM
Roof curb provided by others

NORTEK™
AIR SOLUTIONS
TEMTROL
106 N Industrial Blvd.
Okarche, OK 73762
(405) 817-9700
www.nortekair.com

Rev	Revision Description	Date m/d/y

UCA Snow Fine Arts

Unit Tag: RTU-2			Unit Type: Outdoor		Dsg Qty: 1
Rep Firm: Airetech Corp North Little Rock, AR, US			Weight: 13,763		Box Qty: 3
Rep Contact: Forrest Moseley, 501-280-0404			Model No: ITF-RDHE64		
SALES ORDER #: N003312-002	JOB #: N003312002	NASDA Ver: 9.1.0	Factory SAE: BRS	Date m/d/y: 7/24/2023	Rev: A

Printed (yyyy-MM-dd): 2023-11-03

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

NOT PRODUCTION READY
INFORMATION NEEDED

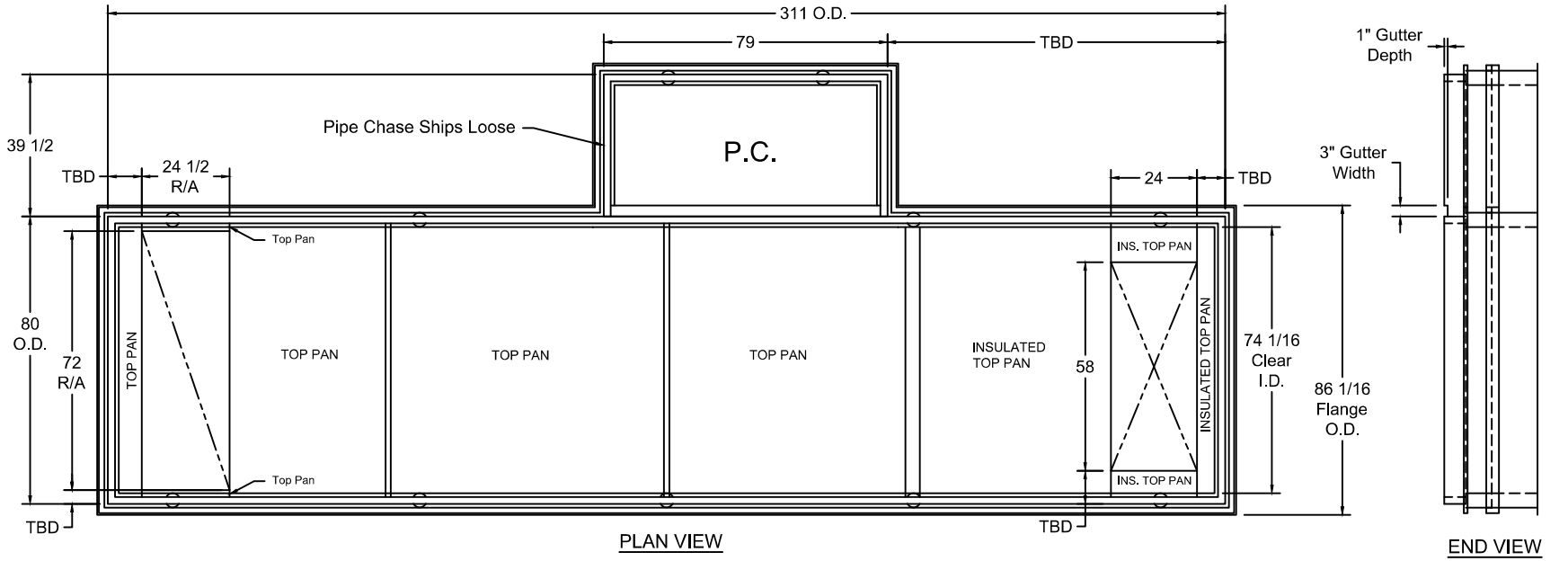
☐ APPROVED
☐ APPROVED PENDING CHANGES
BY:
DATE: / /

SUBMITTAL

CURB WALL THICKNESS AND RESTRAINT REQUIREMENTS TO BE DETERMINED BY SEISMIC/WINDLOAD CALCULATIONS.

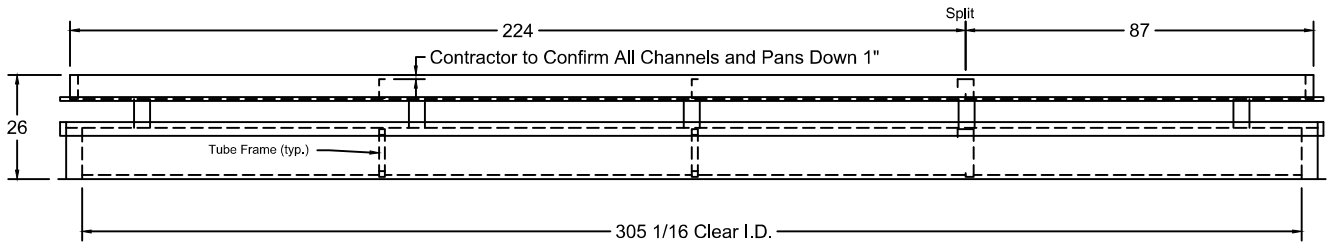
VERIFY ROOF PITCH AND DIRECTION

NOTES:
-CONTRACTOR TO FIELD-CUT SUPPLY & RETURN OPENINGS THROUGH THYBAR CURB FLOOR.
-CONTRACTOR TO SEAL BOTTOM OF UNIT TO TOP OF CURB AND PANS
-CONTRACTOR TO VERIFY SUPPLY, RETURN AND PIPE CHASE LOCATIONS PRIOR TO PRODUCTION

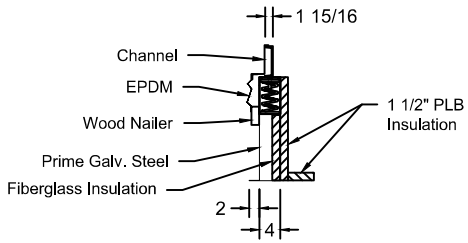


PLAN VIEW

END VIEW



ELEVATION VIEW



SECTION AA
2" Spring Deflection

Rev.	Int.	Date	Description
1	MS	10/24/23	changed to vibrocurb

REVISION HISTORY

(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Date: 8/22/23

Insulated RoofCurb Plenum S and R with pipe chase
New Nortek Custom Unit

Airtech Corporation/ UCA Snow Fine Arts

Qty.: 2 | Job# : Q-25597
Tag:
Drawn: DR
File: S20501-1 | Rev: ----

thybar CORPORATION
Thybar makes it right the first time, every time

Curb final dimensions will be coordinated

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-002
JOB #	N003312002
UNIT TAG	RTU-2
QUANTITY	1

Unit Design Options

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

100 Unit Design Summary

100.1 Electrical

1. Short Circuit Current Rating (SCCR) @ 65 kA
2. ◊ Fans wired to Electrical panel equipped with ABB ACH580 VFD, provided and mounted by Factory. Electrical Panel to have internal overloads with aux. contacts wired in series for field wiring to remote monitoring.
3. ◊ All fan air monitoring with Magnesense transducer.
4. ◊ Factory to provide and mount 24" x 36" NEMA 3R enclosure w/fan, for field installed controls.
5. ◊ All lights controlled by a single light switch. One GFI outlet provided.
6. ◊ 120 volt power for lighting and/or GFI outlets shall be provided by Others.
7. ◊ Unit to ship in individual, bagged sections.

◊ **Project specific requirements**

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

101 Unit Details

101.1 Weights / Jobsite Elevation

1. Shipping Weight	13,599 lb	3. Elevation	266 ft
2. Operating Weight	13,763 lb		

101.2 Preparation for Shipment

1. Knockdown Construction	No

102 Unit Construction

102.1 Construction

1. Cabinet Construction	ITF - Integrated Frame	6. Thermal Break	Modified Thermal Break
2. Design Environment	Outdoor	7. Mounting	Curb Mounted
3. Panel Depth	3 in	8. Roof Curb By	Others
4. Caulk Type	Standard	9. Curb Height	8.000 in
5. Model #	ITF-RDHE64		

102.2 Cabinet Material

1. Exterior Material	16Ga Galv Pre-Paint	7. Blankoff Finish	None
2. Interior Liner type(s)	See Drawing	8. Internal Wall Material	16Ga Galv
3. Exterior Paint Type	Polyester Resin	*Insulation by liner type*	
4. Interior Paint Type	None	9. Solid liner	HD Fiberglass Roll (R12.5)
5. Paint Color	Sandstone	10. Perforated liner	N/A
6. Meets Salt Spray Rating	2500 Hours		

Exceptions:
1. Chilled Water Coil 1: blankoff material is 16Ga 304 SS

102.3 Base Construction

1. Base Structure Material	Steel Tube	6. Base Structure Height	See Drawing
2. Base Floor Material	16Ga Galv	7. Sub Floor Material	20Ga Galv
3. Insulation	Polyurethane Foam	8. Floor Coating	None
4. Floor Drain	None	9. Lifting Lugs	Yes - Welded
5. Floor Options	None		

102.4 Notes / Features

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

103 Doors

103.1 All Doors (including those associated with specific components)

#	Box	Section	Type[1]	Width	Height	Hinge	Swing	Window	Interior	Exterior	Options[3]
1	A	PL3	3" TBF	24	60	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
2	A	PL2	3" TBF	24	60	RH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
3	A	FILT1	3" TBF	31	66	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
4	A	IFB1	3" TBF	24	66	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
5	A	CW1	3" TBF	30	66	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	MS TO
6	B	FWT1	3" TBF	30	60	LH	In	None	16Ga Galv	16Ga Galv Pre-Paint	TO
7	C	PL4	3" TBF	30	71.5	RH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO

103.2 Notes / Features

1. Door Types
   TBF = Thermal Break Factory
2. All doors insulated with Polyurethane Foam.
3. Options: MS = Manual Safety Interlock, TO = Tool Operated Handle

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

104 Drains

104.1 All Drains (including those associated with specific components)

Box	Section	Type	Conn (in)	Hand	Grating Material	Pan Material
A	CW1	Drain Pan	1.25	Right	None	16Ga 304 SS

104.2 Notes / Features

1. Drain Constructions included: Triple Pitched

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

106 Static Pressure Summary

106.1 Condition 1

106.1.1 Supply

Tunnel	*Description*	*APD (in.H20)*
AirTunnel 1	RA Opening - Damper (Return Air)	0.13
AirTunnel 1	OSA Opening - Damper (Outside Air)	0.01
AirTunnel 1	Filter 1, 4" MERV 13 (Average Pressure Drop)	0.89
AirTunnel 1	IFB Coil 1	0.64
AirTunnel 1	Chilled Water Coil 1	0.59
AirTunnel 1	UVLight 1	0.02
AirTunnel 1	FANWALL 1 (Supply) 14,500 ACFM @ 5.83 in.H20	0.00
AirTunnel 1	SA Opening (Supply Air)	0.35
	ESP:	3.20
	Total Static Pressure:	5.83

Legend: ESP - External Static Pressure, OSA - Outside Air, EXH - Exhaust Air, RA - Return Air, SA - Supply Air

106.2 Notes/Legend

1. Summary report does not include static pressure of components supplied by others in the field unless otherwise noted.

106 N Industrial Blvd. Okarche, Ok 73762
(405) 817-9700 FAX (405) 263-4980

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-002
JOB #	N003312002
UNIT TAG	RTU-2
QUANTITY	1

Fans

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

200 FANWALL 1 (Supply) : FWT1 : Box B — 20-60 - 184T - 34 x 38 x 26 - B2

200.1 Configuration / Quantity

1. Function	Supply Fan
2. Quantity	4
3. Array	2 Rows x 2 Cols
4. Construction	PentaCube
5. Stand Height	N/A

Cell Size	6.Height	7.Width	8.Depth	9.Overall Depth
	34	38	26	33.25

10. Elev. / Temp.	266 ft / 70.0 °F		
11. Motor & Wheel Weight	168 lb	13. Redundant	0
12. Fan Cell Weight	368 lb	14. Empty	0
15. Ship Loose Fan (Wheel, Motor and Mounting Base)			0

200.2 Options

1. Coplanar Insulation	Standard Melamine	8. Cell Finish	None
2. Extended Coplanar	No	9. Insulation Retainer	No
3. Back Draft Dampers	FBD8	10. Inlet Attenuation	None
4. Inlet Cone Type	A100 Curved Cone	11. Blankoff Material	16Ga Galv
5. Solid Perimeter Material	None	12. Blankoff Finish	None
6. Discharge Safety Guard	No	13. Removal Rail	No
7. Cell Material	Steel		

200.3 Fan Wheel

1. Wheel Type	HPF-A100	3. Width	60
2. Diameter	20	4. Max RPM	3521
		5. Wheel Finish	None

200.4 Motor

1. Manufacturer	Toshiba	6. Efficiency	89.5
2. HP Each / Total	5 / 20	7. Service Factor	1.15
3. Poles / RPM	4-Pole / 1,755	8. Shaft Isolation	Ceramic Bearings
4. Frame / Casing	184T / TEAO	9. FLA Each / Total	13.8 / 55.2 Amps
5. Volts / Phase / Hz	208/3/60	10. Motor HP Safety Factor	3.0 %

200.5 Control System

1. Redundant VFD	No	6. Flow Monitoring	Yes
2. Bypass Circuit	None	7. Fans to Monitor	All Fans
3. Drive	Standard	8. Display	Magnesense
4. Optimization Control	No		
5. Control Method	By Others		

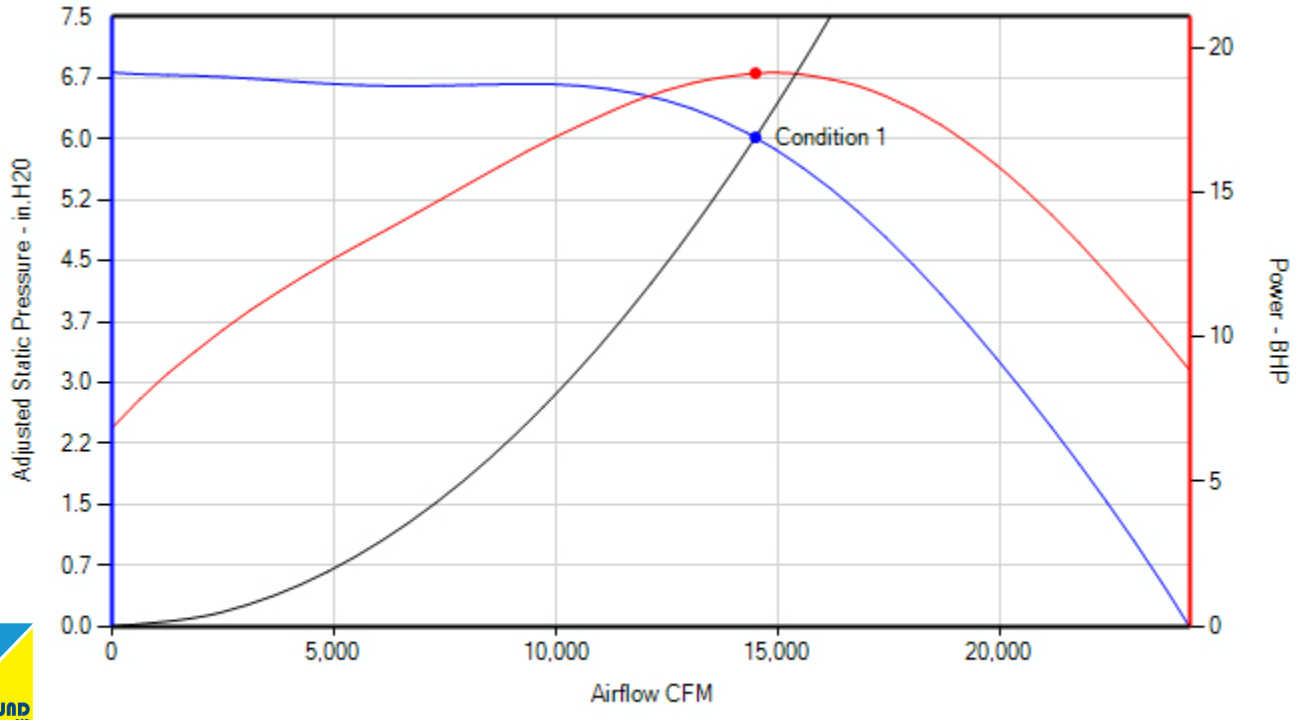
200.6 Notes / Features

1. To view patents and other pending U.S. or Canadian applications visit www.nortekair.com/patents.
2. (4) airflow measurement taps. Cone constant = 2524, cone flow differential pressure = 2.04 in.H2O at 3625 CFM per fan.
3. The estimated VFD input watts are based on the motor and VFD efficiency at the selected load and RPM.
4. Fans balanced to a maximum allowable level of 0.022 inches per second peak.

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

200 FANWALL 1 (Supply) : FWT1 : Box B (Continued) 20-60 - 184T - 34 x 38 x 26 - B2



AMCA Licensed for Sound and Air Performance Without Appurtenances (Accessories).
Performance certified is for installation type A: Free Inlet/Free Outlet
Power [bhp] excludes drives

200.7 Operating Conditions

Operating Condition	Usage (%)	CFM	SP (in.H20)		Cell Qty			RPM	Hz	Fanwheel BHP		Vel. (ft/min)	Watts	FEG % O.P.	FEI
			Input	Adj.	On	Off	Fail			Each	Total				
Condition 1	100	14,500	5.83	5.98	4	0	0	2,382	81.4	4.78	19.11	512	16,439	FEG80 2%	1.25

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

Operating Condition		63	125	250	500	1k	2k	4k	8k	LwA	Lw
Condition 1	Inlet	84	81	96	92	84	84	84	81	94	98
	Outlet	90	85	90	86	83	79	76	67	89	95

200 FANWALL 1 (Supply) : FWT1 : Box B (Continued) 20-60 - 184T - 34 x 38 x 26 - B2

200.9 AMCA Statement

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-1.6 / May 2022

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-002
JOB #	N003312002
UNIT TAG	RTU-2
QUANTITY	1

Coils

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

300 Chilled Water Coil 1 : CW1 : Box A — 5WC - 6 - 33 x 70 x 4 - 12 AL

300.1 Coil Layout

1. Coil Hand	Left	6. Rack Style	None
2. Configuration	Single	7. Rack Finish	None
3. Connection Orientation	Straight	8. Blankoff Material	16Ga 304 SS
4. Connection Material	Red Brass	9. Blankoff Finish	None
5. Connection Type	MPT		

300.2 Construction

1. Quantity	2	8. Stand Height	1 in	14. Casing	16Ga 304 SS
2. Serpentine	0.6666667	*Tube Detail - Primary Surface*		15. Coating	None
3. Fin Height	33.000 in	9. Material	Copper	*Fin Detail - Secondary Surface*	
4. Fin Length	70.000 in	10. O.D. x Wall	0.625 x 0.020 in	16. Material	Aluminum
5. Rows	4	11. Spacing	1.500 x 1.299 in	17. Thickness	0.008 in
6. Fins per Inch	12	12. Internal	Smooth	18. Configuration	Corrugated, Waffle with Straight Edge
7. Face Area	32.08 ft²	13. Return Bends	0.028 in		

Single Bank, Left Hand, 2 per unit — **5WC - 6 - 33 x 70 x 4 - 12 AL**

Supply / Return Connections				*Vent and Drain*		
Quantity	Type	Pipe Size	Material	Type	Vent Location	Drain Location
2	MPT	2.0 in	Red Brass	0.750 in MPT Extended	Return Header	Supply Header

300.3 Condition 1

Entering		*Leaving*	
1. Actual Airflow	14,500 ACFM	10. Total Capacity	636.7 MBH
2. Standard Airflow	14,077 SCFM	11. Sensible Capacity	413.0 MBH
3. Elevation	266 ft	12. Actual Face Velocity	451.95 ft/min
4. Entering Air DB	80.7 °F	13. Leaving Air DB	54.1 °F
5. Entering Air WB	68.4 °F	14. Leaving Air WB	53.9 °F
6. Fluid Type	Water	15. APD	0.59 in.H20
7. Entering Fluid Temp	45.0 °F	16. Leaving Fluid Temp	55.0 °F
8. Fluid Flow Rate	126.9 GPM	17. Fluid Velocity	5.03 ft/s
9. Fluid Fouling Internal	0.0000	18. Fluid Pressure Drop	13.77 ft.H20

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

300.4 Notes / Features

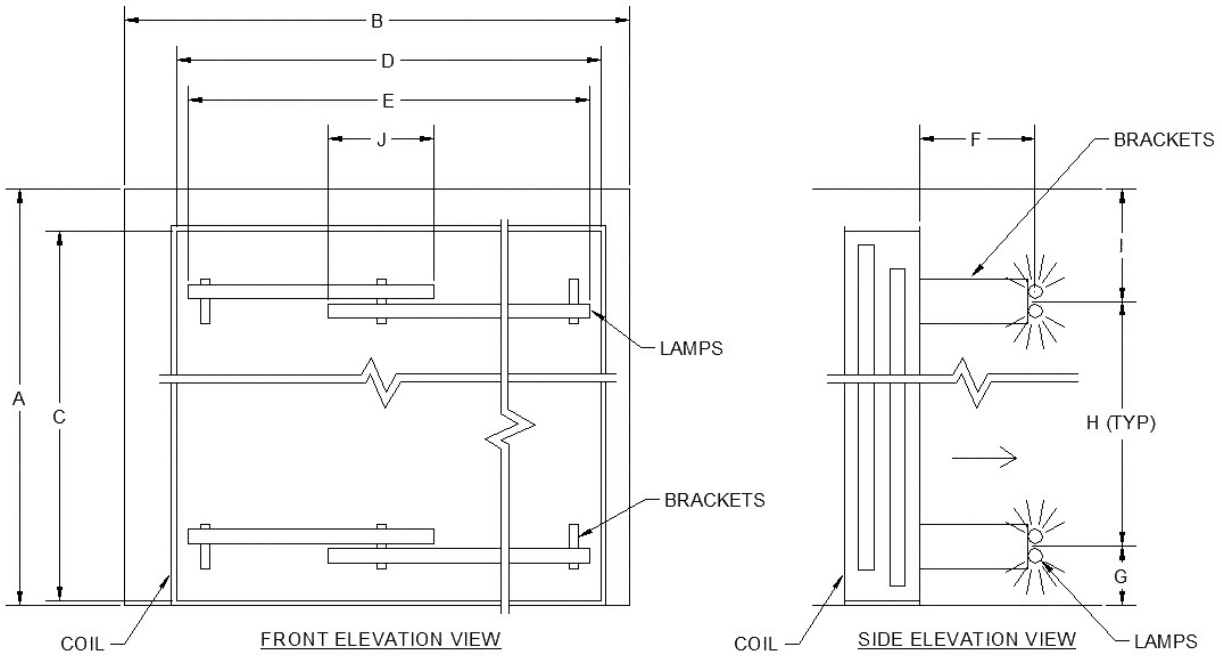
1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation and EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is 741 lb.
6. Total fluid volume is 18.7 Gal.

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

301 UVLight 1 : CW1 : Box A

301.1 Construction			
1. Provided By	Factory	12. Safety Switch	Factory Supplied
2. Product Type	RLM Xtreme	13. 12V Contact Connector	No
3. Fixture	Lamp Included	14. Extra Relay Switches	0
4. Voltage	120/1/60	15. UV Report™	No
5. Total Watts	740	16. UV Repeat™	No
6. Watts at Coil Surface	17.04 Watts/ft²	17. Warning Sign	No
7. Rows of Lights	2	18. UV-C Hour Meter	No
8. Fixtures Per Row	2	19. Conduit Loom Kits	Yes
9. Total Lamp Sets	1	20. LampLoom Down Exit	Yes
10. Encapsulamp	Yes		
11. X-Box Panel Type	P - 12V Contact Controller Not Included		



301.2 Dimensional Data (in)									
A	B	C	D	E	F	G	H	I	J
73.50	80.00	70.00	70.00	70.00	6.00	12.30	41.90	19.30	52.00

301.3 Purchased Items		
UVR Part Num	Description	Quantity
55086551	RLM Xtreme 61" Single Ended- High Output EncapsuLamp	4
55008022	RLM Conduit Loom Kit-20' S/S Flex Conduit w/Down Exit LampHolder	4
55000009	Dual LampHolster - Extended Base	2
55800064	RLM-X-Box 4P 120-277V w/CU2	1

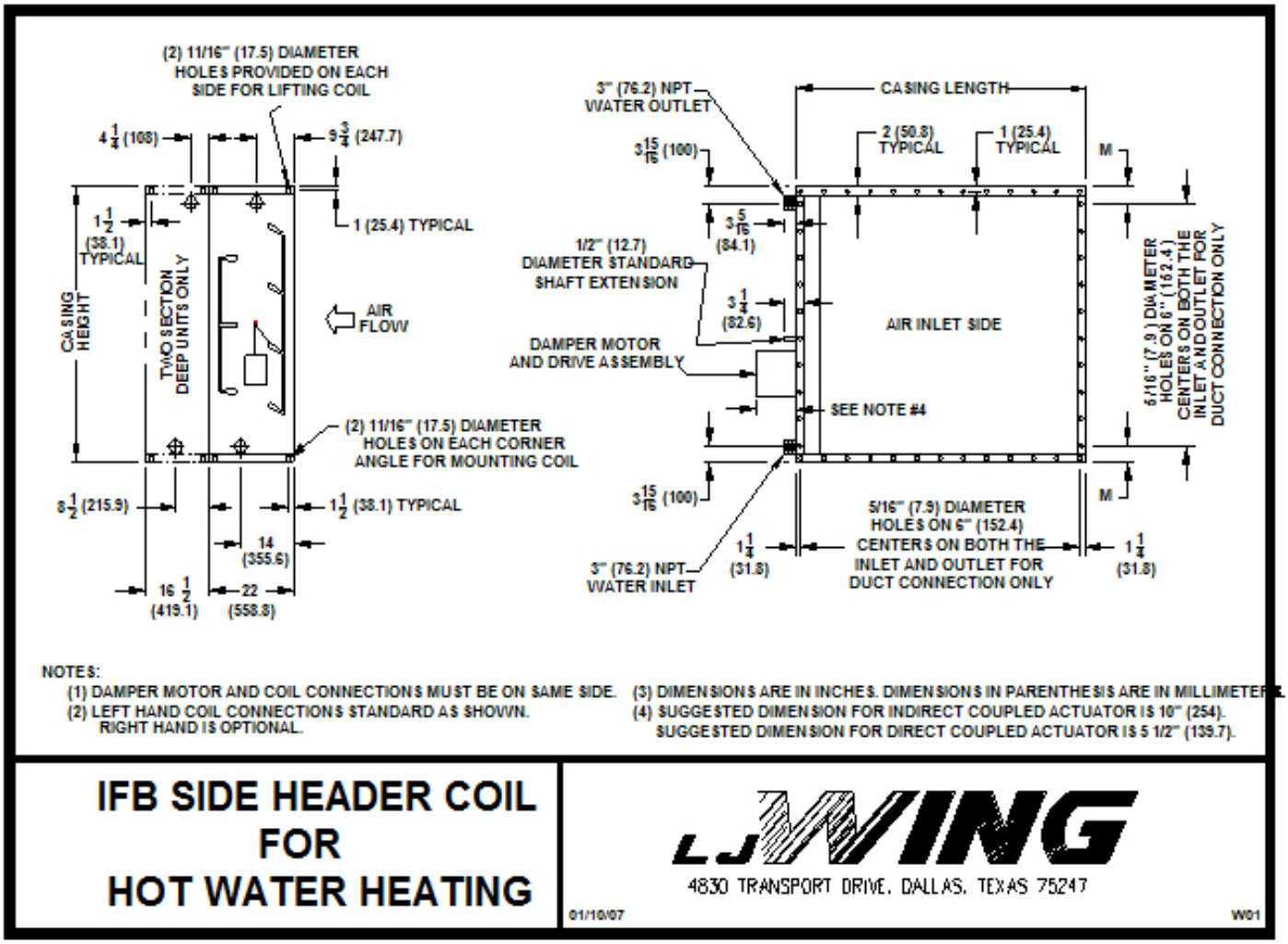
301.4 Electrical Service Information			
1. Volt/Phase/Hertz	120/1/60	3. Provides power to	UVLight 1
2. MCA	6.2		
1. For electrical loads see electrical drawings			

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

302 IFB Coil 1 : IFB1 : Box A — E - 48

302.1 Construction			
1. Fin Material	Aluminum	8. Fin Spacing	12
2. Tube Material	Copper	9. Tube OD	0.625 in
3. Connection Material	Steel	10. Tube Wall	0.035 in
4. Rows	2 (One Section)	11. Connection Location	Far Side
5. Total Face Area	21.3 ft²	12. Stand Height	6 in
6. Casing Finish	Air Dried Enameled Paint (Std.)	13. Anti-Stratification Baffles	No
7. Elevation	266 ft	14. Actuator Location	Left



NOTES:
(1) DAMPER MOTOR AND COIL CONNECTIONS MUST BE ON SAME SIDE.
(2) LEFT HAND COIL CONNECTIONS STANDARD AS SHOWN. RIGHT HAND IS OPTIONAL.
(3) DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS.
(4) SUGGESTED DIMENSION FOR INDIRECT COUPLED ACTUATOR IS 10" (254). SUGGESTED DIMENSION FOR DIRECT COUPLED ACTUATOR IS 5 1/2" (139.7).

IFB SIDE HEADER COIL FOR HOT WATER HEATING

LJ WING
4830 TRANSPORT DRIVE, DALLAS, TEXAS 75247
01/10/07 W01

302.2 Coil Dimensions (in)											
Casing Height	Casing Length	M	N	Q	Z	L	P	R	S	Y	X
54.25	56.5	3.125	-	-	-	-	-	-	-	-	-

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

302 IFB Coil 1 : IFB1 : Box A (Continued) E - 48

302.3 Condition 1

Entering		*Leaving*	
1. Actual Airflow	14,500 ACFM	7. Sensible Capacity	538.9 MBH
2. Standard Airflow	15,961 SCFM	8. Face Velocity	865.12 ft/min
3. Entering Air DB	15.0 °F	9. Leaving Air DB	49.6 °F
4. Fluid Type	Water	10. APD	0.64 in.H20
5. Entering Fluid Temp	160.0 °F	11. Leaving Fluid Temp	138.2 °F
6. Fluid Flow Rate	50.0 GPM	12. Fluid Pressure Drop	1.36 ft.H20

Notes:
1. ARI Certified

302.4 Notes / Features

1. SCFM is corrected for Elevation and EDB.
2. Total operating weight is 789 lb

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-002
JOB #	N003312002
UNIT TAG	RTU-2
QUANTITY	1

Components

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

500 Filter 1 : FILT1 : Box A

500.1 Pre-Filter Size & Quantity			
1. Loading	V Side Load	5. Bank Size	72.000 in W x 56.875 in H
2. Filter Clips	By Others	6. Qty / set & Frame Size 1	(12) 24 in x 24 in
3. Blankoff / Rack Material	16Ga Galv	7. Qty / set & Frame Size 2	
4. Blankoff / Rack Finish	None	8. Qty / set & Frame Size 3	
		9. Qty / set & Frame Size 4	

500.2 Pre Filter			
1. Filter Depth	4.000 in	4. Number of Sets	
2. Efficiency		5. Max Face Velocity	302.08 ft/min at 14,500 ACFM
3. Manufacturer		6. Model	

500.3 Pressure Gage Specifications - Gage 2			
1. Manufacturer	Dwyer	3. Options	Hinged Cover
2. Model / Range	Magnehelic 2002 (0-2" w.c.)	4. Quantity	1

500.4 Notes / Features
1. Filters provided by Others.

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

600 OSA Opening : OSA : Box A : Near Side

600.1 Opening Construction			
1. Description	Outside Air	4. Shape	Rectangle
2. Max CFM	5,180 ACFM	5. Max APD	0.01 in.H20
3. Size	31 W x 60 H in		

600.2 Damper Specifications			
1. Manufacturer	Ruskin	6. Jackshaft	Yes
2. Model	Ruskin AMS 050 (Aluminum)	7. Max Face Velocity	443.47 ft/min
3. Size	29.000 in (Blade Direction) x 58.000 in	8. End Switches	No
4. Blade Config	Parallel		
5. Blade Orientation	Horizontal		

Notes:
1. Ordered with 2" frame flange
2. Damper Options: Integrated Controller and Actuators

600.3 Damper Actuator			
1. Location	Face Mounted (RH)	3. Floor Mounted	No
2. Type	Modulating 24V – NC	4. Furnished By	Factory
		5. Mounted By	Factory
		6. Wiring By	Others

600.4 Notes / Features

1. Weather hood included: 2 sections (37.500 in W x 32.750 in H x 32.75 D) - custom sizing. Maximum weather hood velocity 387 ft/min. Shipped Loose.

601 SA Opening : SA : Box B : Floor

601.1 Opening Construction			
1. Description	Supply Air	4. Shape	Rectangle
2. Max CFM	14,500 ACFM	5. Max APD	0.35 in.H20
3. Size	58 W x 24 H in	6. Max Velocity	1,500.00 ft/min

601.2 Notes / Features

1. Steel Floor Grate included.

602 RA Opening : RA : Box A : Floor

602.1 Opening Construction			
1. Description	Return Air	4. Shape	Rectangle
2. Max CFM	14,500 ACFM	5. Max APD	0.05 in.H20
3. Size	72 W x 24.5 H in	6. Max Velocity	1,184.00 ft/min

602.2 Notes / Features

1. Steel Floor Grate included.

603 EXH Opening : EXH : Box A : Far Side

603.1 Opening Construction			
1. Description	Exhaust Air	4. Shape	Rectangle
2. Max CFM	9,500 ACFM	5. Max APD	0.14 in.H20
3. Size	23 W x 60.5 H in		

603 EXH Opening : EXH : Box A : Far Side (Continued)

603.2 Damper Specifications			
1. Manufacturer	Ruskin	6. Jackshaft	Yes
2. Model	Ruskin CD 60 (Galvanized)	7. Max Face Velocity	983.11 ft/min
3. Size	23.000 in (Blade Direction) x 60.500 in	8. End Switches	No
4. Blade Config	Opposed		
5. Blade Orientation	Horizontal		

Notes:
1. Ordered with 1" frame flange

603.3 Damper Actuator			
1. Location		3. Floor Mounted	
2. Type		4. Furnished By	Others
		5. Mounted By	Others
		6. Wiring By	Others

603.4 Notes / Features

1. Damper Actuators and mounting accessories furnished and mounted by Others at Face Mounted (RH) location.
2. Damper Actuators wired by Others

604 RA Opening : RA : Box A : Internal Wall

604.1 Opening Construction			
1. Description	Return Air	4. Shape	Rectangle
2. Max CFM	14,500 ACFM	5. Max APD	0.13 in.H20
3. Size	36 W x 60 H in		

604.2 Damper Specifications			
1. Manufacturer	Ruskin	6. Jackshaft	Yes
2. Model	Ruskin CD 60 (Galvanized)	7. Max Face Velocity	966.67 ft/min
3. Size	36.000 in (Blade Direction) x 60.000 in	8. End Switches	No
4. Blade Config	Opposed		
5. Blade Orientation	Horizontal		

Notes:
1. Ordered with 1" frame flange

604.3 Damper Actuator			
1. Location		3. Floor Mounted	
2. Type		4. Furnished By	Others
		5. Mounted By	Others
		6. Wiring By	Others

604.4 Notes / Features

1. Damper Actuators and mounting accessories furnished and mounted by Others at Face Mounted (LH) location.
2. Damper Actuators wired by Others

605 Opening : Box C : Floor

605.1 Opening Construction			
1. Max CFM	14,500 ACFM	3. Shape	Rectangle
2. Size	12 W x 76 H in	4. Max APD	0.00 in.H20
		5. Max Velocity	0.00 ft/min

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-002
JOB #	N003312002
UNIT TAG	RTU-2
QUANTITY	1

Electrical

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

700 ElecPanel 1 : FWT1 : Box B : Near Side

700.1 Construction			
1. Enclosure Type	Electrical Panel	4. Mounting	Surface mount on unit
2. Type	NEMA 4 Indoor / Outdoor		
3. Size	See electrical drawings		

701 Control Panel (Field Use) : FWT1 : Box B : Far Side

701.1 Construction			
1. Enclosure Type	Electrical Panel	4. Mounting	Surface mount on unit
2. Type	NEMA 3R Outdoor		
3. Size	See electrical drawings		

702 Additional Lighting

702.1 Switches / Outlets

	Name	Box	Section	Type	Mounted	Illum. Switch	Timer	Cover	GFCI	MOCP
	ElecSwitch 1	A	IFB1	Light Switch / 120V Outlet	External	No	None	Yes	Yes	20.0 Amps

702.2 Lighting Types and Quantities

(5) Vapor Proof 14W LED

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-002
JOB #	N003312002
UNIT TAG	RTU-2
QUANTITY	1

Unit Data

Unit Data

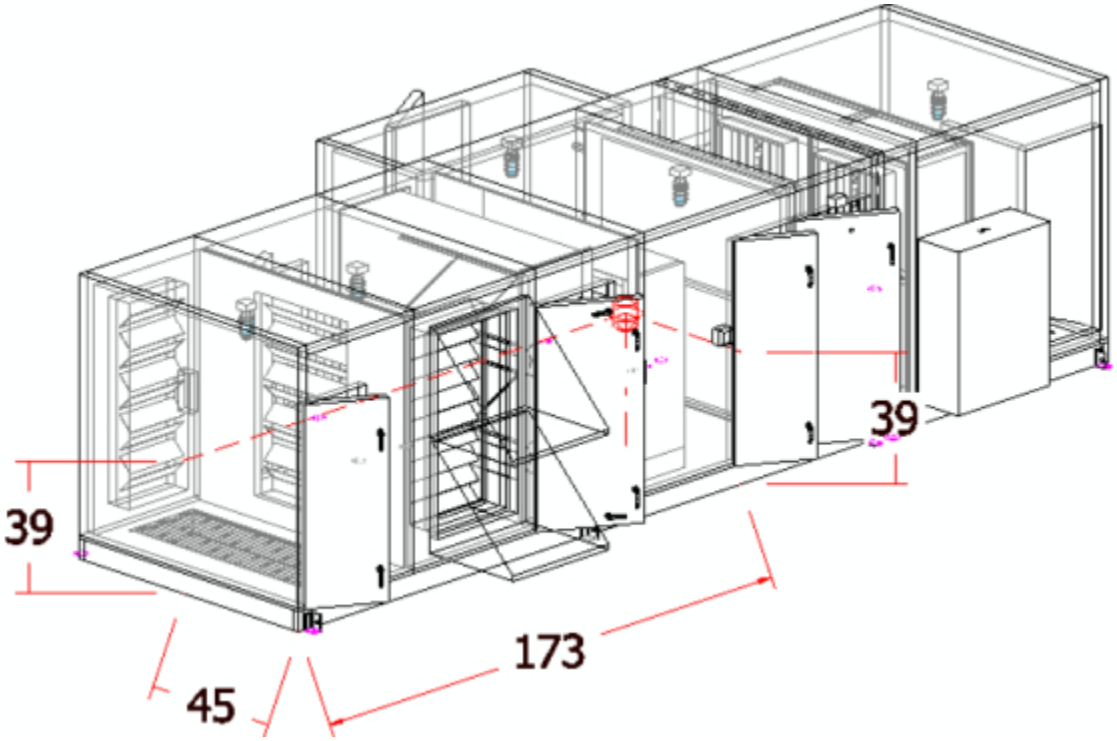
Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

901 Center of Gravity



Size (Inches)			Operating Weight (Pounds)	Center of Gravity (Inches)		
X	Y	Z		X	Y	Z
317.00	125.00	83.50	13,688	173.00	45.00	39.00

901.1 Notes

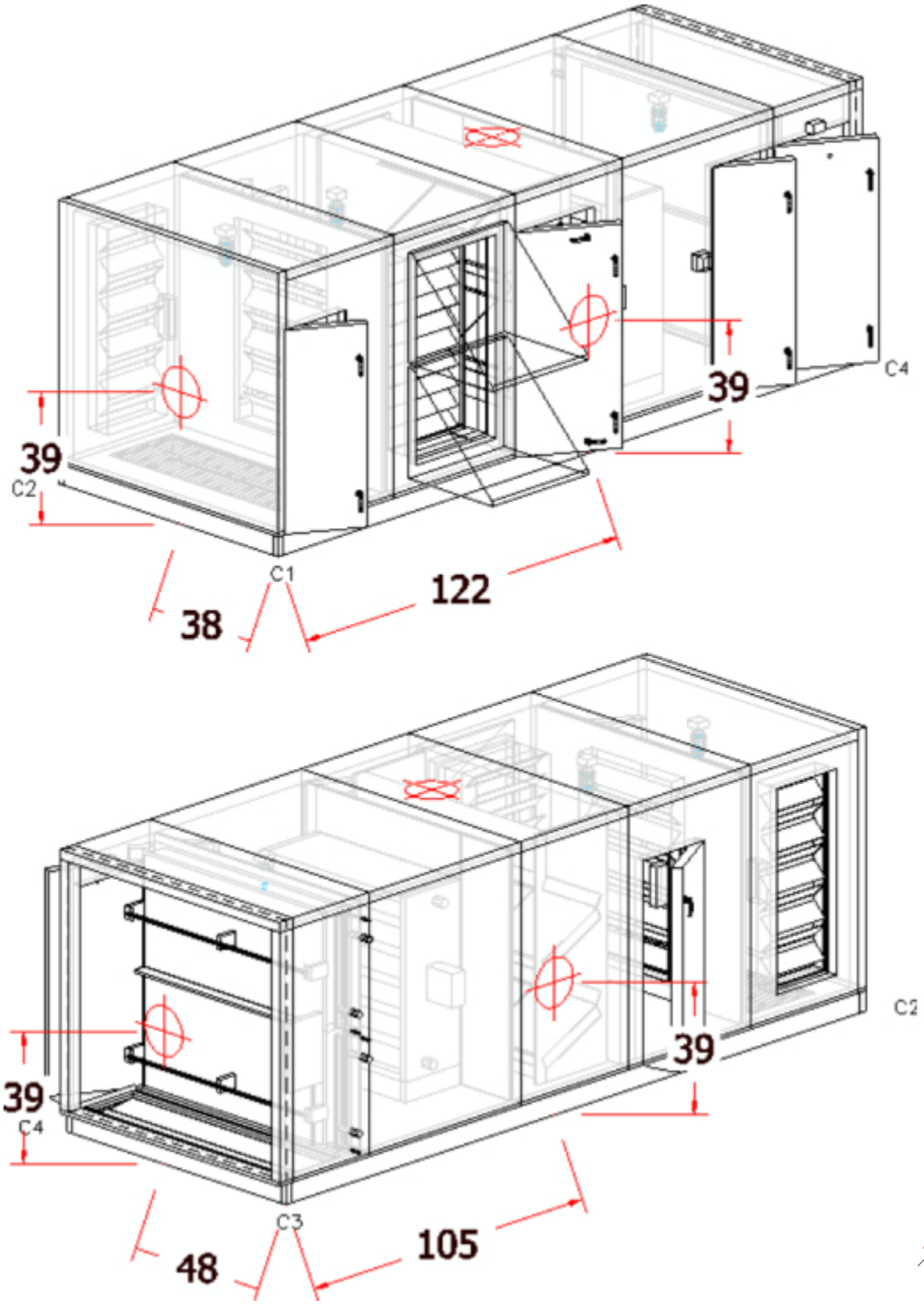
1. Center of gravity and weights are estimates and subject to change.
2. The center of gravity and weights shown above are based on operating weights and do not include packaging materials.
3. A 5% safety factor has been applied to the operating weights.
4. Weights shown do not include roof curbs provided by others.
5. Corner weights apply to rectangular boxes only.
6. Corner weights are to assist in handling of the unit. Some units are not intended to be supported only at the corners. Contact your Sales Representative for support information.

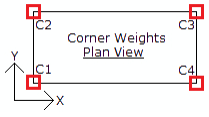
Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

901 Center of Gravity (Continued)

901.2 Box A





Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
227.00	86.00	83.50	7,822	2,039	1,614	1,842	2,327

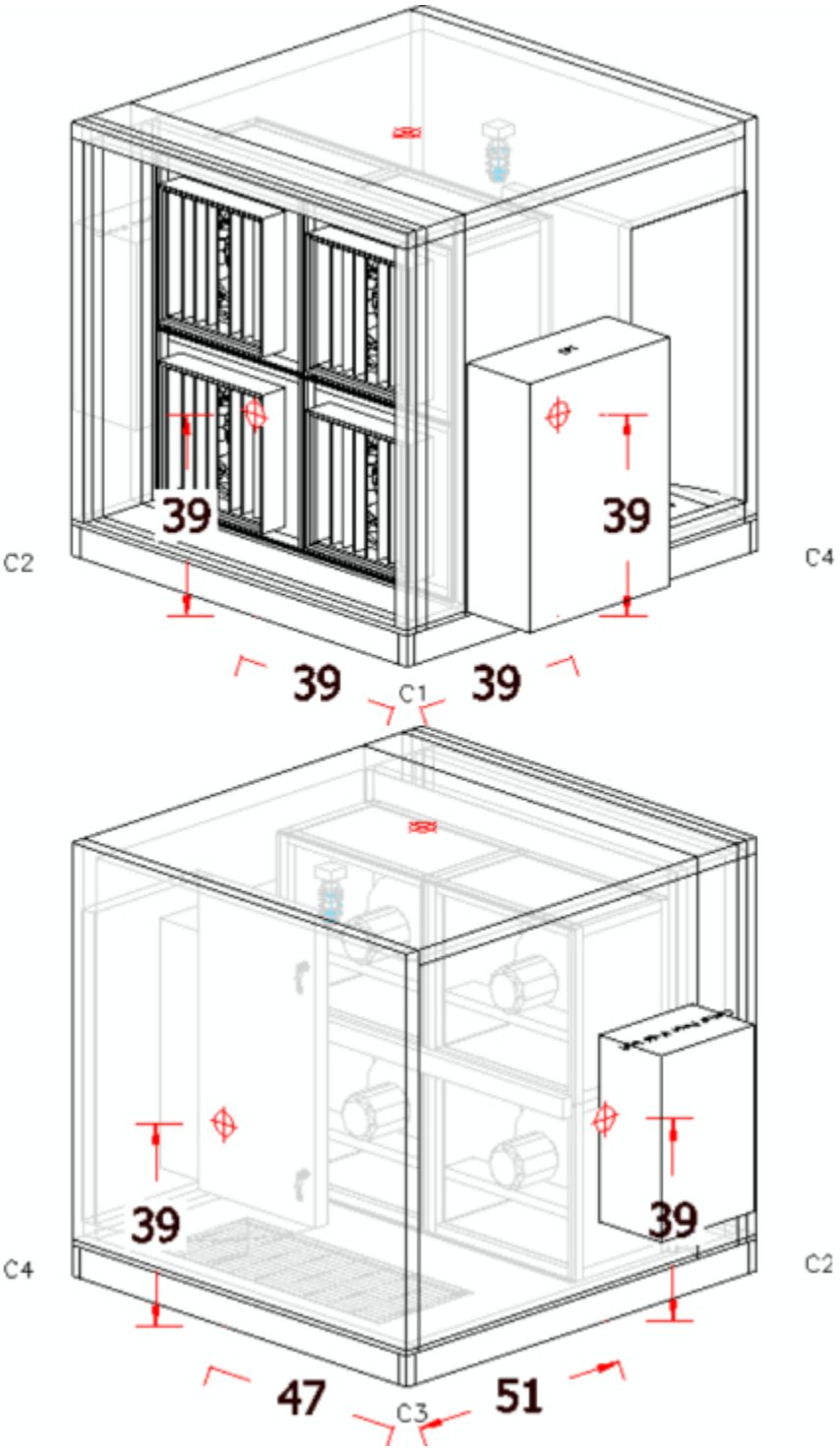
◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

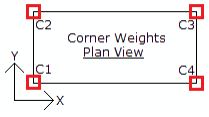
Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

Sales Order #: N003312-002
Job #: N003312002

901 Center of Gravity (Continued)

901.3 Box B





Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
90.00	86.00	83.50	4,360	1,350	1,120	857	1,032

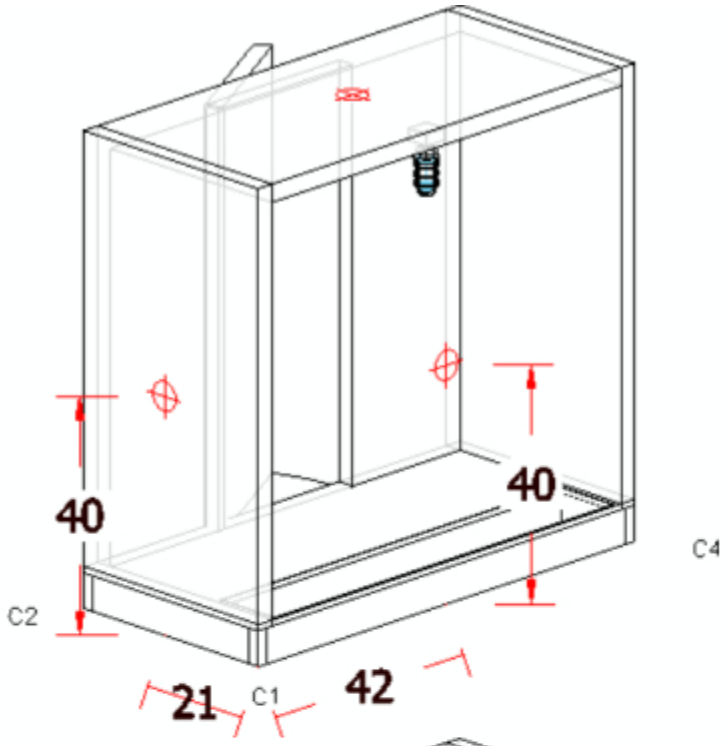
◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

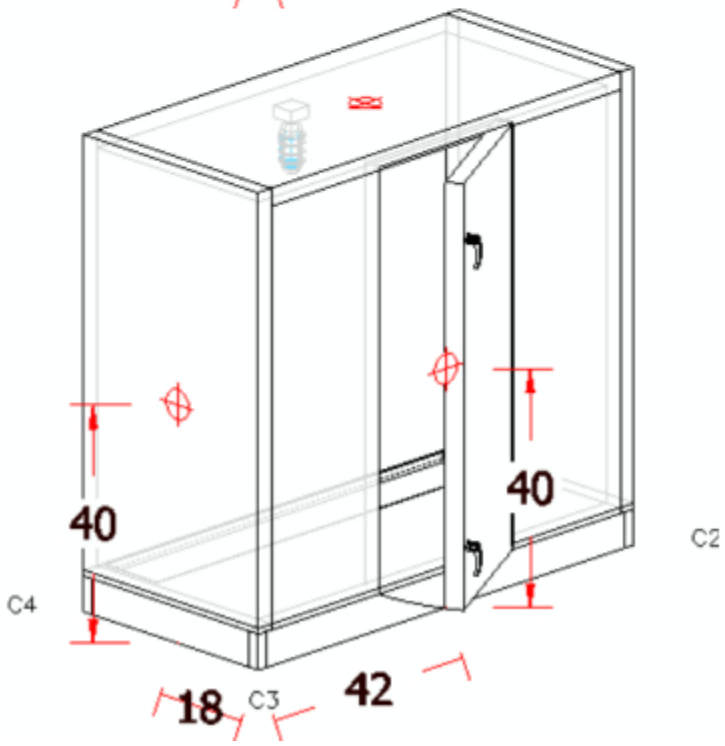
Project Name: UCA Snow Fine Arts
Unit Tag: RTU-2

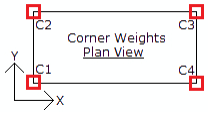
Sales Order #: N003312-002
Job #: N003312002

901 Center of Gravity (Continued)

901.4 Box C







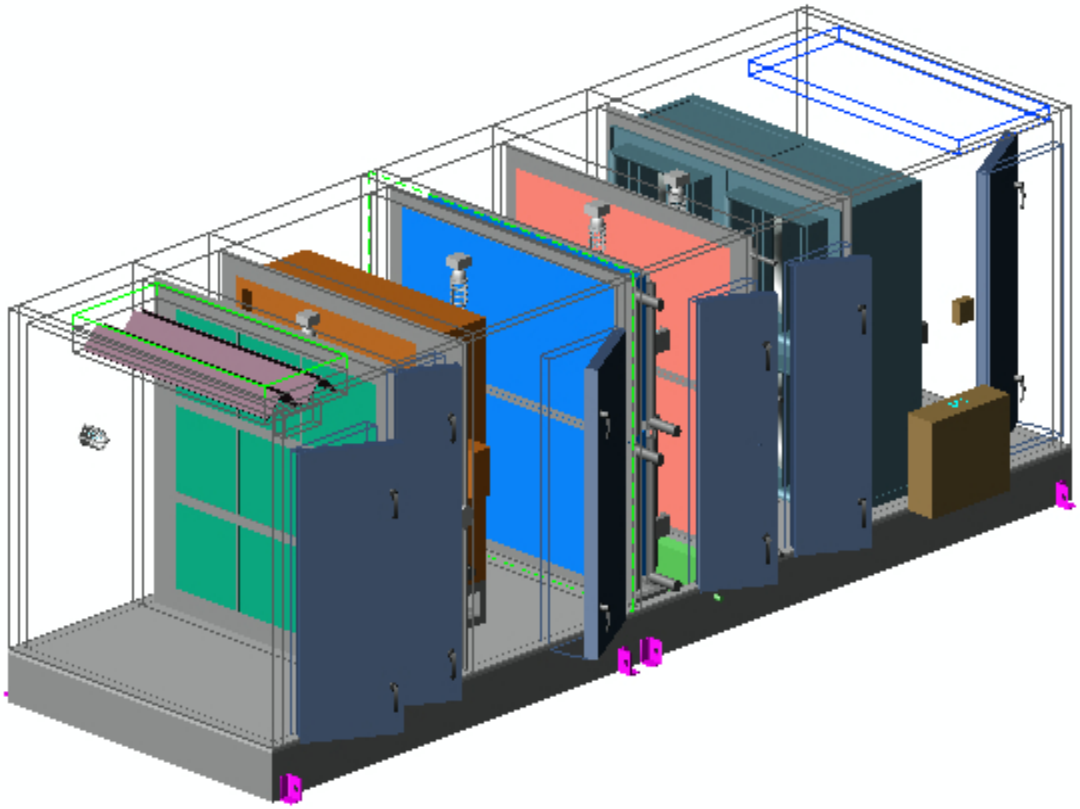
Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
84.00	39.00	80.00	1,342	310	361	361	310

◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

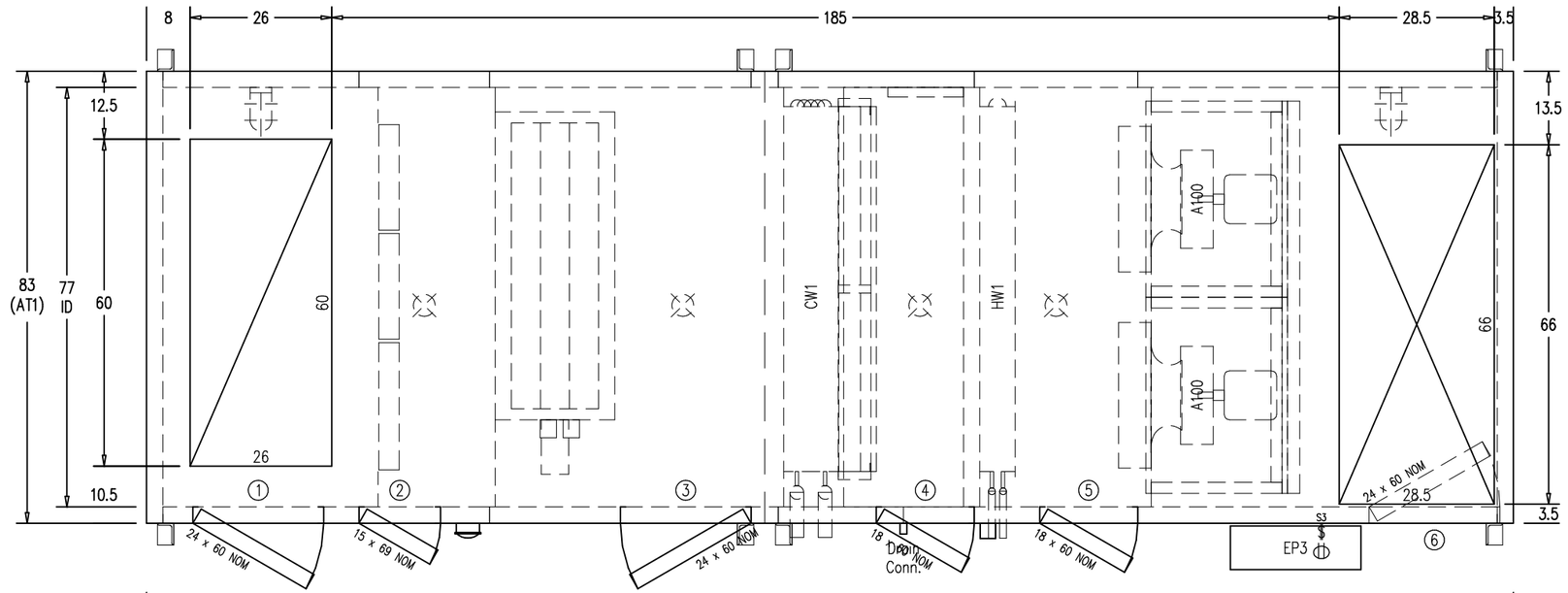
PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-003
JOB #	N003312002
UNIT TAG	AH-6
QUANTITY	1

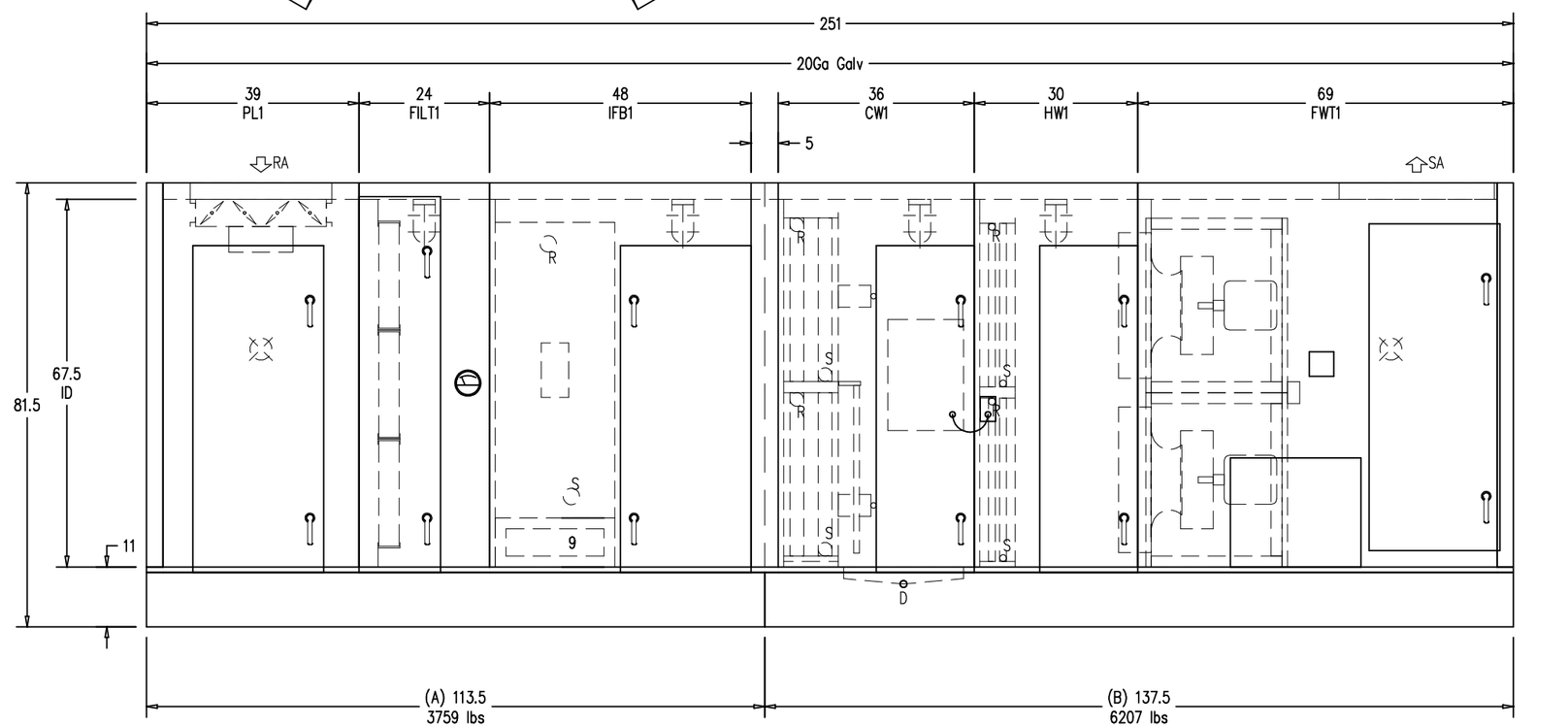
Revision History

Date	Rev	Revision Description



Preliminary





All dimensions shown in inches, Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.
ITF – Integrated Frame Construction 13,000 ACFM

NORTEK AIR SOLUTIONS
TEMTROL

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Okarche, OK 73762
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www.nortekair.com

Rev	Revision Description	Date m/d/y

UCA Snow Fine Arts

Unit Tag: AH-6				Unit Type: Indoor	Dsg Qty: 1
Rep Firm: Airetech Corp North Little Rock, AR, US				Weight: 10,035	Box Qty: 2
Rep Contact: Forrest Moseley, 501-280-0404			Model No: ITF-RDHE64		
SALES ORDER #: N003312-003	JOB #: N003312002	NASDA Ver: 9.1.0	Factory SAE: BRS	Date m/d/y: 8/9/2023	Rev: A

Printed (yyyy-MM-dd): 2023-11-03

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-003
JOB #	N003312002
UNIT TAG	AH-6
QUANTITY	1

Unit Design Options

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

100 Unit Design Summary

100.1 Electrical

1. Short Circuit Current Rating (SCCR) @ 65 kA
2. ◊ Fans wired to Standard MOP with aux. contacts wired in series for field wiring to remote monitoring, provided and mounted by Factory.
3. ◊ All fan air monitoring with Magnesense transducer.
4. ◊ All lights controlled by a single light switch. One GFI outlet provided.
5. ◊ 120 volt power for lighting and/or GFI outlets shall be provided by Others.
6. ◊ Unit to ship in individual, bagged sections.

◊ **Project specific requirements**

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

101 Unit Details

101.1 Weights / Jobsite Elevation

1. Shipping Weight	9,748 lb	3. Elevation	266 ft
2. Operating Weight	10,035 lb		

101.2 Preparation for Shipment

1. Knockdown Construction	No

102 Unit Construction

102.1 Construction

1. Cabinet Construction	ITF - Integrated Frame	6. Thermal Break	Modified Thermal Break
2. Design Environment	Indoor	7. Mounting	Slab Mounted
3. Panel Depth	3 in		
4. Caulk Type	Standard		
5. Model #	ITF-RDHE64		

102.2 Cabinet Material

1. Exterior Material	16Ga Galv Pre-Paint	7. Blankoff Finish	None
2. Interior Liner type(s)	See Drawing	*Insulation by liner type*	
3. Exterior Paint Type	Polyester Resin	8. Solid liner	HD Fiberglass Roll (R12.5)
4. Interior Paint Type	None	9. Perforated liner	N/A
5. Paint Color	Sandstone		
6. Meets Salt Spray Rating	2500 Hours		

Exceptions:
1. Chilled Water Coil 1: blankoff material is 16Ga 304 SS

102.3 Base Construction

1. Base Structure Material	Steel Tube	6. Base Structure Height	See Drawing
2. Base Floor Material	16Ga Galv	7. Sub Floor Material	20Ga Galv
3. Insulation	Polyurethane Foam	8. Floor Coating	None
4. Floor Drain	None	9. Lifting Lugs	Yes - Welded
5. Floor Options	None		

102.4 Notes / Features

1. Box dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.

103 Doors

103.1 All Doors (including those associated with specific components)

#	Box	Section	Type[1]	Width	Height	Hinge	Swing	Window	Interior	Exterior	Options[3]
1	A	PL1	3" TBF	24	60	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
2	A	FILT1	3" TBF	15	69	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
3	A	IFB1	3" TBF	24	60	RH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
4	B	CW1	3" TBF	18	60	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	MS TO
5	B	HW1	3" TBF	18	60	LH	Out	None	20Ga Galv	16Ga Galv Pre-Paint	TO
6	B	FWT1	3" TBF	24	60	LH	In	None	16Ga Galv	16Ga Galv Pre-Paint	TO

103.2 Notes / Features

1. Door Types
   TBF = Thermal Break Factory
2. All doors insulated with Polyurethane Foam.
3. Options: MS = Manual Safety Interlock, TO = Tool Operated Handle

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

104 Drains

104.1 All Drains (including those associated with specific components)

Box	Section	Type	Conn (in)	Hand	Grating Material	Pan Material
B	CW1	Drain Pan	1.25	Right	None	16Ga 304 SS

104.2 Notes / Features

1. Drain Constructions included: Triple Pitched

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

106 Static Pressure Summary

106.1 Condition 1

106.1.1 Unassigned

Tunnel	*Description*	*APD (in.H20)*
AirTunnel 1	RA Opening - Damper (Return Air)	0.04
AirTunnel 1	Filter 1, Final Filter (Average Pressure Drop)	1.03
AirTunnel 1	IFB Coil 1	0.95
AirTunnel 1	Chilled Water Coil 1	0.81
AirTunnel 1	UVLight 1	0.02
AirTunnel 1	Hot Water Coil 1	0.15
AirTunnel 1	FANWALL 1 (Supply) 13,000 ACFM @ 3.72 in.H20	0.00
AirTunnel 1	SA Opening (Supply Air)	0.12
	FANWALL 1 (Supply) - Supply Air - SA Opening ESP:	0.60
	Total Static Pressure:	3.72

Legend: ESP - External Static Pressure, OSA - Outside Air, EXH - Exhaust Air, RA - Return Air, SA - Supply Air

106.2 Notes/Legend

1. Summary report does not include static pressure of components supplied by others in the field unless otherwise noted.

106 N Industrial Blvd. Okarche, Ok 73762
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PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-003
JOB #	N003312002
UNIT TAG	AH-6
QUANTITY	1

Fans

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

200 FANWALL 1 (Supply) : FWT1 : Box B — 18-80 - 182T - 32 x 36 x 26 - B2

200.1 Configuration / Quantity

1. Function	Supply Fan
2. Quantity	4
3. Array	2 Rows x 2 Cols
4. Construction	PentaCube
5. Stand Height	N/A

Cell Size	6.Height	7.Width	8.Depth	9.Overall Depth
	32	36	26	33.25

10. Elev. / Temp.	266 ft / 70.0 °F		
11. Motor & Wheel Weight	159 lb	13. Redundant	0
12. Fan Cell Weight	349 lb	14. Empty	0
15. Ship Loose Fan (Wheel, Motor and Mounting Base)			0

200.2 Options

1. Coplanar Insulation	Standard Melamine	8. Cell Finish	None
2. Extended Coplanar	No	9. Insulation Retainer	No
3. Back Draft Dampers	FBD8	10. Inlet Attenuation	None
4. Inlet Cone Type	A100 Curved Cone	11. Blankoff Material	16Ga Galv
5. Solid Perimeter Material	None	12. Blankoff Finish	None
6. Discharge Safety Guard	No	13. Removal Rail	No
7. Cell Material	Steel		

200.3 Fan Wheel

1. Wheel Type	HPF-A100	3. Width	80
2. Diameter	18	4. Max RPM	3862
		5. Wheel Finish	None

200.4 Motor

1. Manufacturer	Toshiba	6. Efficiency	89.5
2. HP Each / Total	3 / 12	7. Service Factor	1.15
3. Poles / RPM	4-Pole / 1,760	8. Shaft Isolation	Ceramic Bearings
4. Frame / Casing	182T / TEAO	9. FLA Each / Total	8.6 / 34.4 Amps
5. Volts / Phase / Hz	208/3/60	10. Motor HP Safety Factor	3.0 %

200.5 Control System

1. Redundant VFD	No	5. Flow Monitoring	Yes
2. Drive	Standard	6. Fans to Monitor	All Fans
3. Optimization Control	No	7. Display	Magnesense
4. Control Method	By Others		

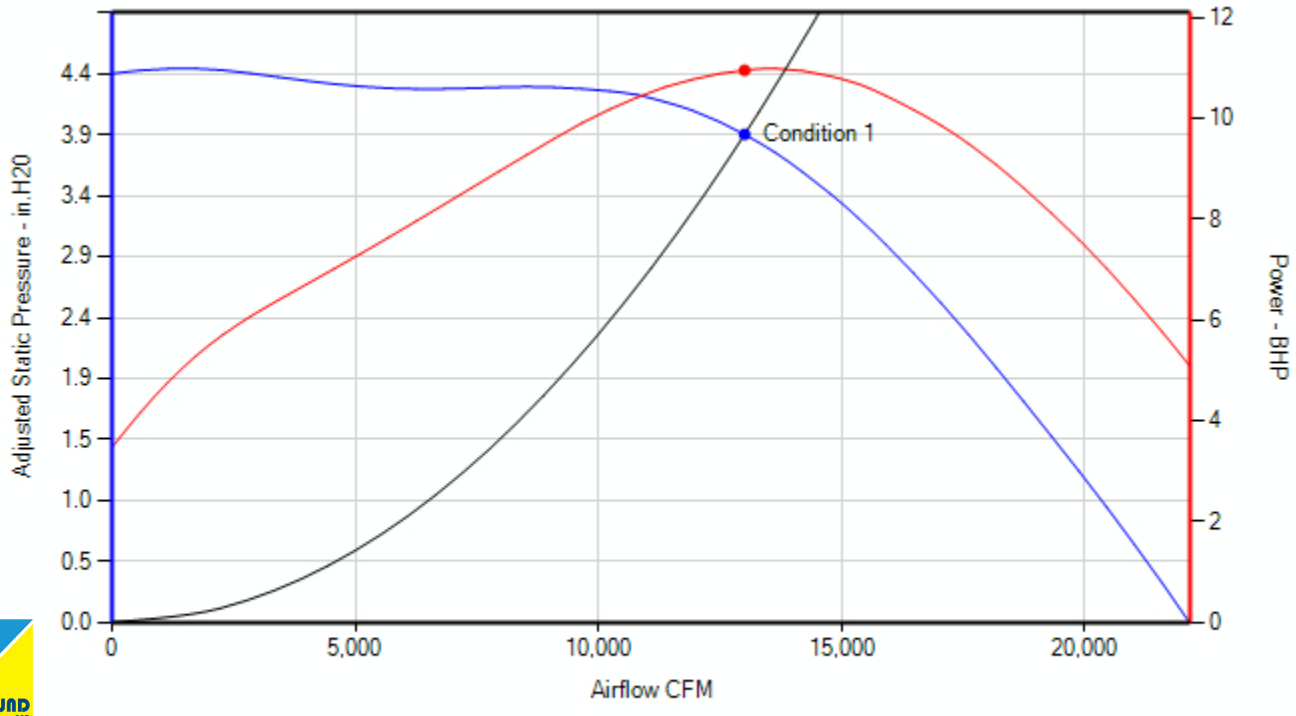
200.6 Notes / Features

1. To view patents and other pending U.S. or Canadian applications visit www.nortekair.com/patents.
2. (4) airflow measurement taps. Cone constant = 2104, cone flow differential pressure = 2.36 in.H2O at 3250 CFM per fan.
3. The estimated VFD input watts are based on the motor and VFD efficiency at the selected load and RPM.
4. Fans balanced to a maximum allowable level of 0.022 inches per second peak.

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

200 FANWALL 1 (Supply) : FWT1 : Box B (Continued) 18-80 - 182T - 32 x 36 x 26 - B2



AMCA Licensed for Sound and Air Performance Without Appurtenances (Accessories).
Performance certified is for installation type A: Free Inlet/Free Outlet
Power [bhp] excludes drives

200.7 Operating Conditions

Operating Condition	Usage (%)	CFM	SP (in.H20)		Cell Qty			RPM	Hz	Fanwheel BHP		Vel. (ft/min)	Watts	FEG % O.P.	FEI
			Input	Adj.	On	Off	Fail			Each	Total				
Condition 1	100	13,000	3.72	3.90	4	0	0	2,101	71.6	2.74	10.96	522	9,522	FEG85 2%	1.32

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

Operating Condition		63	125	250	500	1k	2k	4k	8k	LwA	Lw
Condition 1	Inlet	78	75	96	84	78	79	78	76	91	97
	Outlet	84	79	90	79	78	75	71	62	85	92

200 FANWALL 1 (Supply) : FWT1 : Box B (Continued) 18-80 - 182T - 32 x 36 x 26 - B2

200.9 AMCA Statement

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-1.6 / May 2022

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-003
JOB #	N003312002
UNIT TAG	AH-6
QUANTITY	1

Coils

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

300 Chilled Water Coil 1 : CW1 : Box B — 5WC - 4 - 30 x 67 x 6 - 11 AL

300.1 Coil Layout

1. Coil Hand	Right	6. Rack Style	None
2. Configuration	Single	7. Rack Finish	None
3. Connection Orientation	Straight	8. Blankoff Material	16Ga 304 SS
4. Connection Material	Red Brass	9. Blankoff Finish	None
5. Connection Type	MPT		

300.2 Construction

1. Quantity	2	8. Stand Height	1 in	14. Casing	16Ga 304 SS
2. Serpentine	1.5	*Tube Detail - Primary Surface*		15. Coating	None
3. Fin Height	30.000 in	9. Material	Copper	*Fin Detail - Secondary Surface*	
4. Fin Length	67.000 in	10. O.D. x Wall	0.625 x 0.020 in	16. Material	Aluminum
5. Rows	6	11. Spacing	1.500 x 1.299 in	17. Thickness	0.008 in
6. Fins per Inch	11	12. Internal	Smooth	18. Configuration	Corrugated, Waffle with Straight Edge
7. Face Area	27.92 ft²	13. Return Bends	0.028 in		

Single Bank, Right Hand, 2 per unit — **5WC - 4 - 30 x 67 x 6 - 11 AL**

Supply / Return Connections				*Vent and Drain*		
Quantity	Type	Pipe Size	Material	Type	Vent Location	Drain Location
2	MPT	2.5 in	Red Brass	0.125 in FPT	Return Connection	Supply Connection

300.3 Condition 1

Entering		*Leaving*	
1. Actual Airflow	13,000 ACFM	10. Total Capacity	573.6 MBH
2. Standard Airflow	12,590 SCFM	11. Sensible Capacity	388.9 MBH
3. Elevation	266 ft	12. Actual Face Velocity	465.67 ft/min
4. Entering Air DB	82.0 °F	13. Leaving Air DB	54.0 °F
5. Entering Air WB	68.5 °F	14. Leaving Air WB	53.9 °F
6. Fluid Type	Water	15. APD	0.81 in.H20
7. Entering Fluid Temp	45.0 °F	16. Leaving Fluid Temp	55.0 °F
8. Fluid Flow Rate	114.2 GPM	17. Fluid Velocity	2.11 ft/s
9. Fluid Fouling Internal	0.0000	18. Fluid Pressure Drop	4.02 ft.H20

Notes:
1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.
2. Chilled water velocity is below recommended minimum of 2.5 fps

300.4 Notes / Features

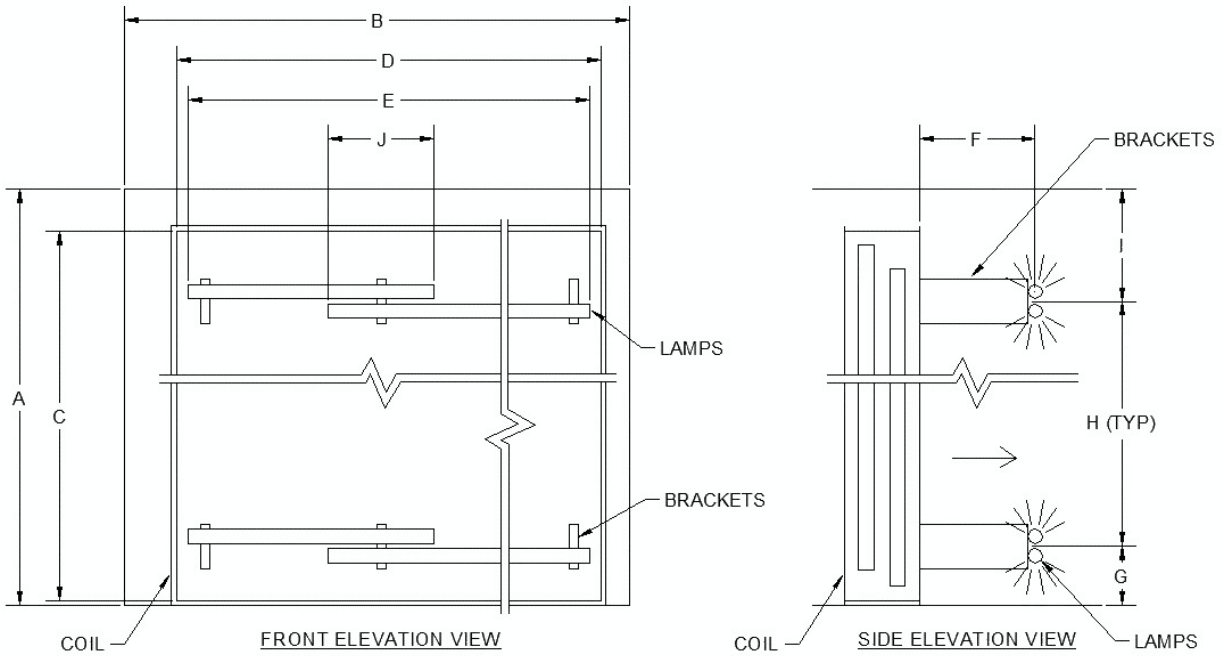
1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation and EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is 919 lb.
6. Total fluid volume is 24.7 Gal.

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

301 UVLight 1 : CW1 : Box B

301.1 Construction			
1. Provided By	Factory	12. Safety Switch	Factory Supplied
2. Product Type	RLM Xtreme	13. 12V Contact Connector	No
3. Fixture	Lamp Included	14. Extra Relay Switches	0
4. Voltage	120/1/60	15. UV Report™	No
5. Total Watts	740	16. UV Repeat™	No
6. Watts at Coil Surface	19.48 Watts/ft²	17. Warning Sign	No
7. Rows of Lights	2	18. UV-C Hour Meter	No
8. Fixtures Per Row	2	19. Conduit Loom Kits	Yes
9. Total Lamp Sets	1	20. LampLoom Down Exit	Yes
10. Encapsulamp	Yes		
11. X-Box Panel Type	P - 12V Contact Controller Not Included		



301.2 Dimensional Data (in)									
A	B	C	D	E	F	G	H	I	J
67.50	77.00	64.00	67.00	67.00	6.00	11.30	38.40	17.80	55.00

301.3 Purchased Items		
UVR Part Num	Description	Quantity
55086551	RLM Xtreme 61" Single Ended- High Output EncapsuLamp	4
55008022	RLM Conduit Loom Kit-20' S/S Flex Conduit w/Down Exit LampHolder	4
55000009	Dual LampHolster - Extended Base	2
55800064	RLM-X-Box 4P 120-277V w/CU2	1

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

302 Hot Water Coil 1 : HW1 : Box B — 5WC - 4 - 30 x 67 x 2 - 8 AL

302.1 Coil Layout

1. Coil Hand	Right	6. Rack Style	None
2. Configuration	Single	7. Rack Finish	None
3. Connection Orientation	Straight	8. Blankoff Material	16Ga Galv
4. Connection Material	Red Brass	9. Blankoff Finish	None
5. Connection Type	MPT		

302.2 Construction

1. Quantity	2	*Tube Detail - Primary Surface*		13. Casing	16Ga Galv
2. Serpentine	0.5	8. Material	Copper	14. Coating	None
3. Fin Height	30.000 in	9. O.D. x Wall	0.625 x 0.020 in	*Fin Detail - Secondary Surface*	
4. Fin Length	67.000 in	10. Spacing	1.500 x 1.299 in	15. Material	Aluminum
5. Rows	2	11. Internal	Smooth	16. Thickness	0.008 in
6. Fins per Inch	8	12. Return Bends	0.028 in	17. Configuration	Corrugated, Waffle with Straight Edge
7. Face Area	27.92 ft²				

Single Bank, Right Hand, 2 per unit — **5WC - 4 - 30 x 67 x 2 - 8 AL**

Supply / Return Connections				*Vent and Drain*		
Quantity	Type	Pipe Size	Material	Type	Vent Location	Drain Location
2	MPT	1.25 in	Red Brass	0.125 in FPT	Return Connection	Supply Connection

302.3 Condition 1

Entering		*Leaving*	
1. Actual Airflow	13,000 ACFM		
2. Standard Airflow	13,251 SCFM	9. Sensible Capacity	579.9 MBH
3. Elevation	266 ft	10. Actual Face Velocity	465.67 ft/min
4. Entering Air DB	55.0 °F	11. Leaving Air DB	95.4 °F
5. Fluid Type	Water	12. APD	0.15 in.H20
6. Entering Fluid Temp	160.0 °F	13. Leaving Fluid Temp	130.0 °F
7. Fluid Flow Rate	39.3 GPM	14. Fluid Velocity	2.18 ft/s
8. Fluid Fouling Internal	0.0000	15. Fluid Pressure Drop	3.32 ft.H20

Notes:
1. Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.
2. Hot water velocity is below recommended minimum of 2.5 fps

302.4 Notes / Features

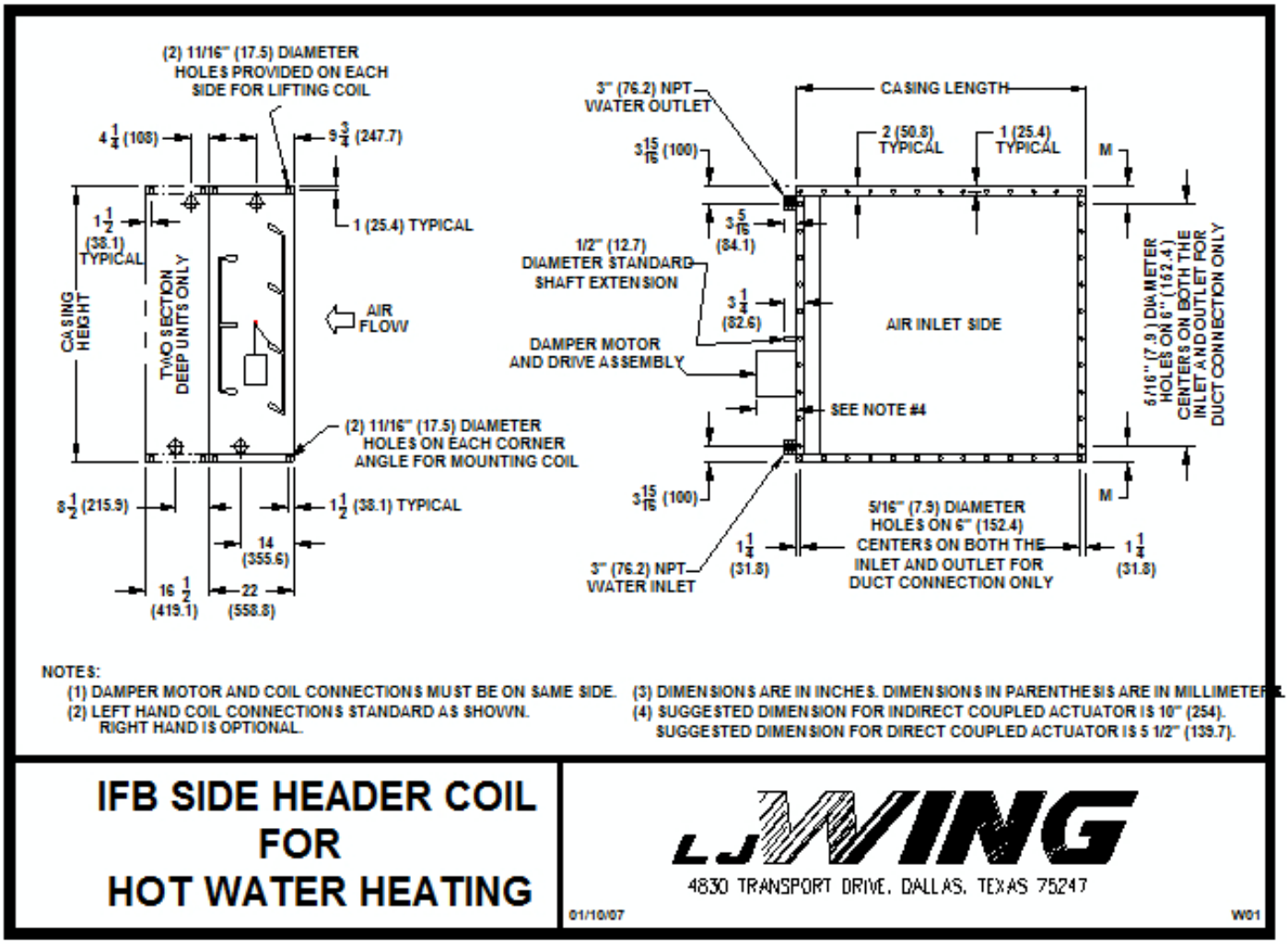
1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation and EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is 352 lb.
6. Total fluid volume is 8.0 Gal.

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

303 IFB Coil 1 : IFB1 : Box A — E - 48 - TR

303.1 Construction			
1. Fin Material	Aluminum	8. Fin Spacing	9
2. Tube Material	Copper	9. Tube OD	0.625 in
3. Connection Material	Steel	10. Tube Wall	0.035 in
4. Rows	3 (One Section)	11. Connection Location	Near Side
5. Total Face Area	21.3 ft²	12. Stand Height	9 in
6. Casing Finish	Air Dried Enameled Paint (Std.)	13. Anti-Stratification Baffles	No
7. Elevation	266 ft	14. Actuator Location	Right



303.2 Coil Dimensions (in)											
Casing Height	Casing Length	M	N	Q	Z	L	P	R	S	Y	X
54.25	56.5	3.125	-	-	-	-	-	-	-	-	-

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

303 IFB Coil 1 : IFB1 : Box A (Continued) E - 48 - TR

303.3 Condition 1

Entering		*Leaving*	
1. Actual Airflow	13,000 ACFM	7. Sensible Capacity	555.4 MBH
2. Standard Airflow	14,310 SCFM	8. Face Velocity	775.66 ft/min
3. Entering Air DB	15.0 °F	9. Leaving Air DB	54.8 °F
4. Fluid Type	Water	10. APD	0.95 in.H20
5. Entering Fluid Temp	160.0 °F	11. Leaving Fluid Temp	130.5 °F
6. Fluid Flow Rate	38.0 GPM	12. Fluid Pressure Drop	2.90 ft.H20

Notes:
1. ARI Certified

303.4 Notes / Features

1. SCFM is corrected for Elevation and EDB.
2. Total operating weight is 806 lb

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-003
JOB #	N003312002
UNIT TAG	AH-6
QUANTITY	1

Components

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

500 Filter 1 : FILT1 : Box A

500.1 Final Filter Size & Quantity			
1. Loading	Side Load	5. Bank Size	64.000 in W x 60.000 in H
2. Filter Clips	By Others	6. Qty / set & Frame Size 1	(6) 20 in x 20 in
3. Blankoff / Rack Material	16Ga Galv	7. Qty / set & Frame Size 2	(3) 20 in x 24 in
4. Blankoff / Rack Finish	None	8. Qty / set & Frame Size 3	
		9. Qty / set & Frame Size 4	

500.2 Final Filter			
1. Filter Depth	4.000 in	4. Number of Sets	
2. Efficiency		5. Max Face Velocity	487.50 ft/min at 13,000 ACFM
3. Manufacturer		6. Model	

500.3 Pressure Gage Specifications - Gage 1			
1. Manufacturer	Dwyer	3. Options	
2. Model / Range	Magnehelic 2002 (0-2" w.c.)	4. Quantity	1

500.4 Notes / Features
1. Filters provided by Others.

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

600 SA Opening : SA : Box B : Roof

600.1 Opening Construction			
1. Description	Supply Air	4. Shape	Rectangle
2. Max CFM	13,000 ACFM	5. Max APD	0.12 in.H20
3. Size	66 W x 28.5 H in	6. Max Velocity	996.00 ft/min

601 RA Opening : RA : Box A : Roof

601.1 Opening Construction			
1. Description	Return Air	4. Shape	Rectangle
2. Max CFM	13,000 ACFM	5. Max APD	0.04 in.H20
3. Size	60 W x 26 H in		

601.2 Damper Specifications			
1. Manufacturer	Ruskin	6. Jackshaft	Yes
2. Model	Ruskin CD 60 (Galvanized)	7. Max Face Velocity	1,200.00 ft/min
3. Size	60.000 in (Blade Direction) x 26.000 in	8. End Switches	No
4. Blade Config	Opposed		
5. Blade Orientation	Horizontal		

Notes:
1. Ordered with 1" frame flange

601.3 Damper Actuator			
1. Location		3. Floor Mounted	
2. Type		4. Furnished By	Others
		5. Mounted By	Others
		6. Wiring By	Others

601.4 Notes / Features
1. Damper Actuators and mounting accessories furnished and mounted by Others at Face Mounted (RH) location.
2. Damper Actuators wired by Others

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-003
JOB #	N003312002
UNIT TAG	AH-6
QUANTITY	1

Electrical

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

700 ElecPanel 3 : FWT1 : Box B : Near Side

700.1 Construction			
1. Enclosure Type	MSP Panel	4. Mounting	Surface mount on unit
2. Type	NEMA 4 Indoor / Outdoor		
3. Size	See electrical drawings		

701 Additional Lighting

701.1 Switches / Outlets

	Name	Box	Section	Type	Mounted	Illum. Switch	Timer	Cover	GFCI	MOCP
	ElecSwitch 3	B	FWT1	Light Switch / 120V Outlet	External	No	None	No	Yes	20.0 Amps

701.2 Lighting Types and Quantities

(6) Vapor Proof 14W LED

ACH580 6-Pulse drive package rated UL (NEMA) Type 1. Provided with Main Input Disconnect with VFD fuses and E-Clipse Bypass (Vertical). Rated for 46.2 amps (15 HP) at 208 VAC three phase provided shipped loose for field installation by others. Output of VFD to be field wired to manual motor protector panel mounted on the AHU

NORTEK AIR SOLUTIONS TEMTROL

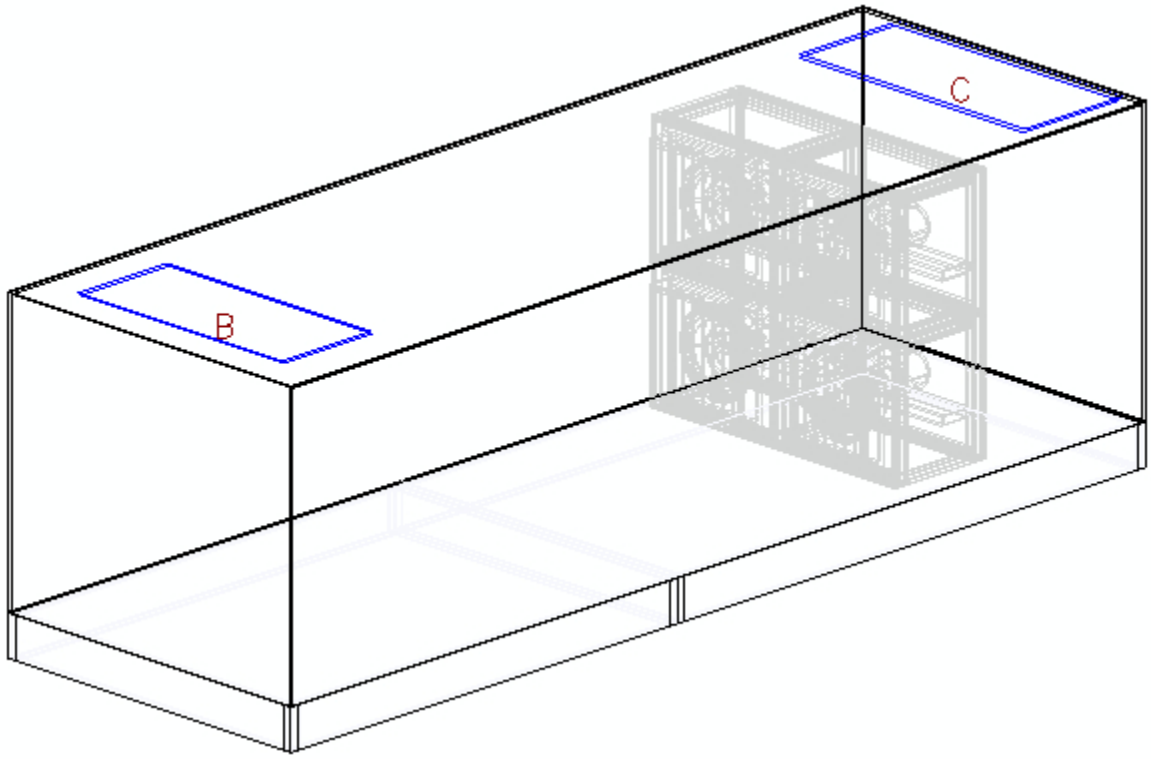
PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312-003
JOB #	N003312002
UNIT TAG	AH-6
QUANTITY	1

Unit Data

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

900 Air Handler Sound Power Projection



900.1 Sound Power Data

Openings - Condition 1				Octave Band Freq. Sound Power (db re: 10E-12 watts)									
Tag	Title	Cabinet Liner	Area	63	125	250	500	1k	2k	4k	8k	LwA	Lw
B	RA Opening	Solid	10.8 ft²	73	72	93	81	76	77	76	74	87	94
C	SA Opening	Solid	13.1 ft²	84	79	90	79	78	75	71	62	85	92
Casing Radiated				73	69	78	61	56	56	54	52	71	80
Floor Radiated				67	63	72	45	38	35	35	35	64	74

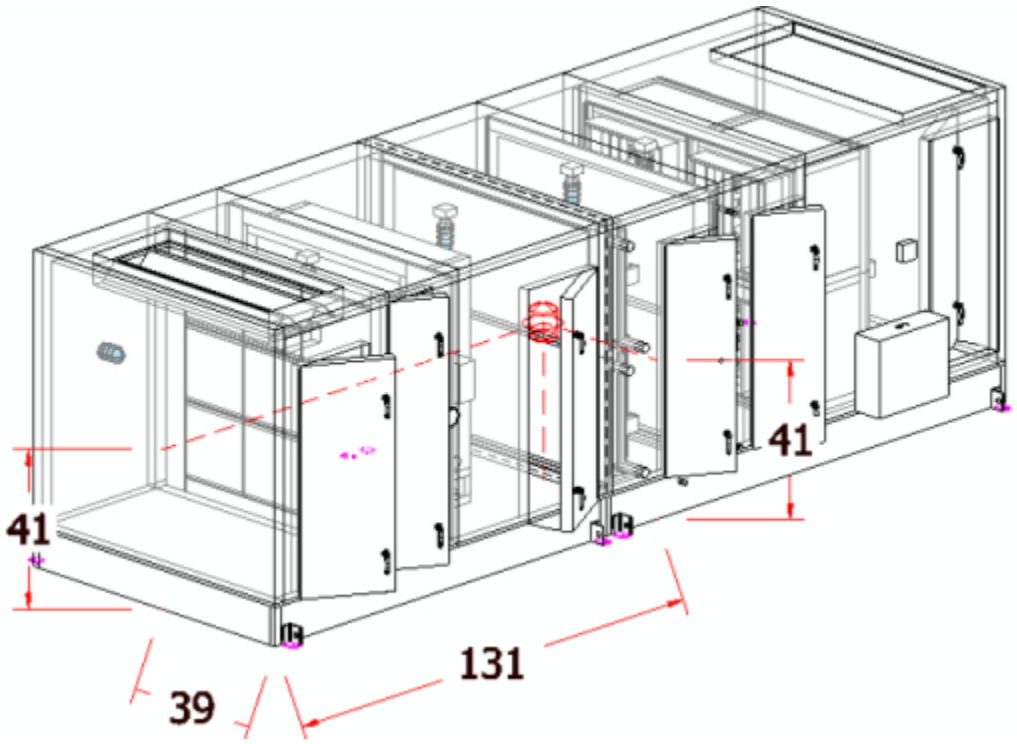
900.2 Notes

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 for opening velocities over 1,500 ft/min.
3. Sound power projects are not valid with VFD motor control carrier frequencies of less than 8KHz.

Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

901 Center of Gravity



Size (Inches)			Operating Weight (Pounds)	Center of Gravity (Inches)		
X	Y	Z		X	Y	Z
251.00	83.00	81.50	9,966	131.00	39.00	41.00

901.1 Notes

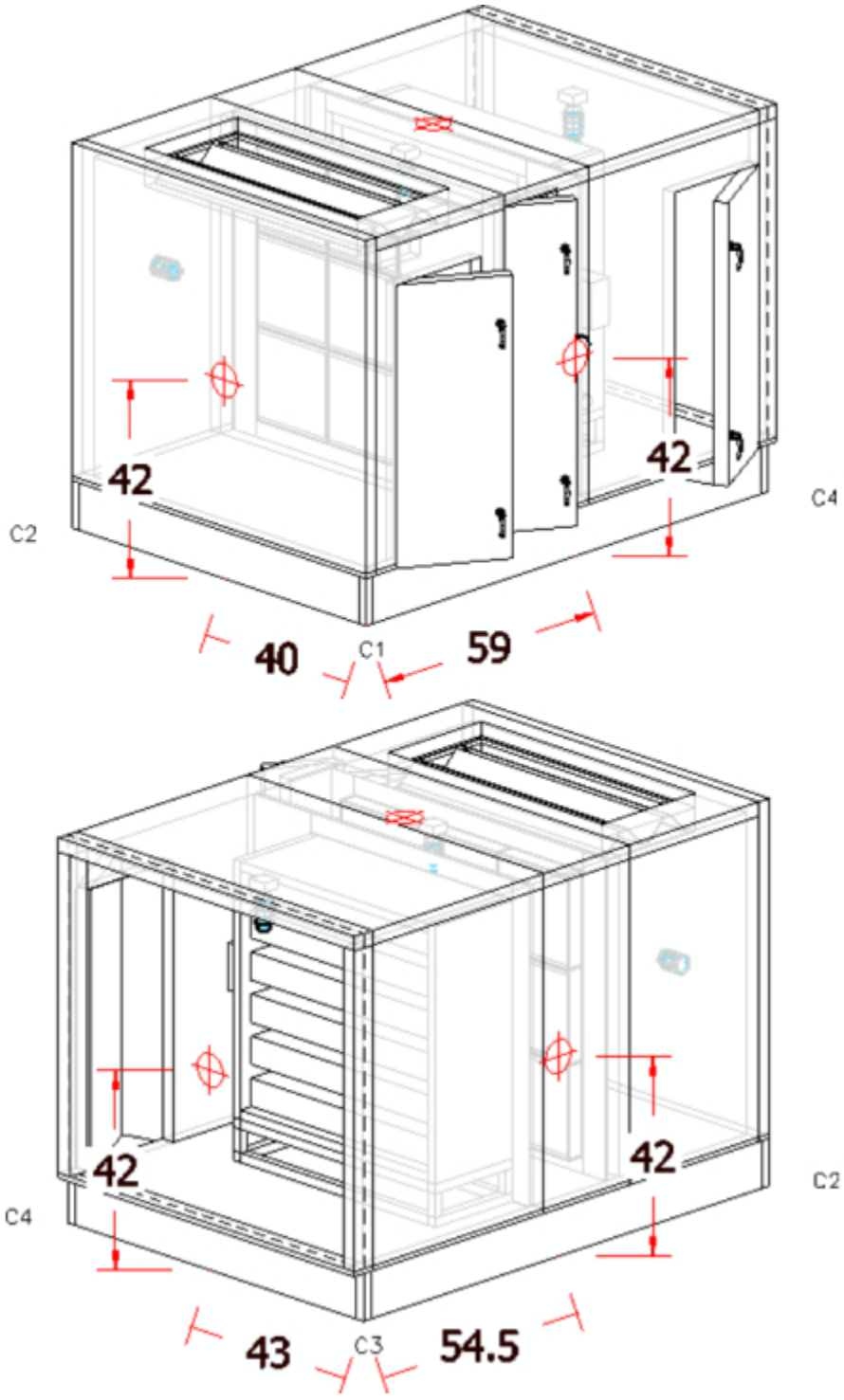
1. Center of gravity and weights are estimates and subject to change.
2. The center of gravity and weights shown above are based on operating weights and do not include packaging materials.
3. A 5% safety factor has been applied to the operating weights.
4. Corner weights apply to rectangular boxes only.
5. Corner weights are to assist in handling of the unit. Some units are not intended to be supported only at the corners. Contact your Sales Representative for support information.

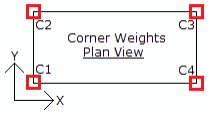
Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

901 Center of Gravity (Continued)

901.2 Box A





Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
113.50	83.00	81.50	3,759	935	870	942	1,012

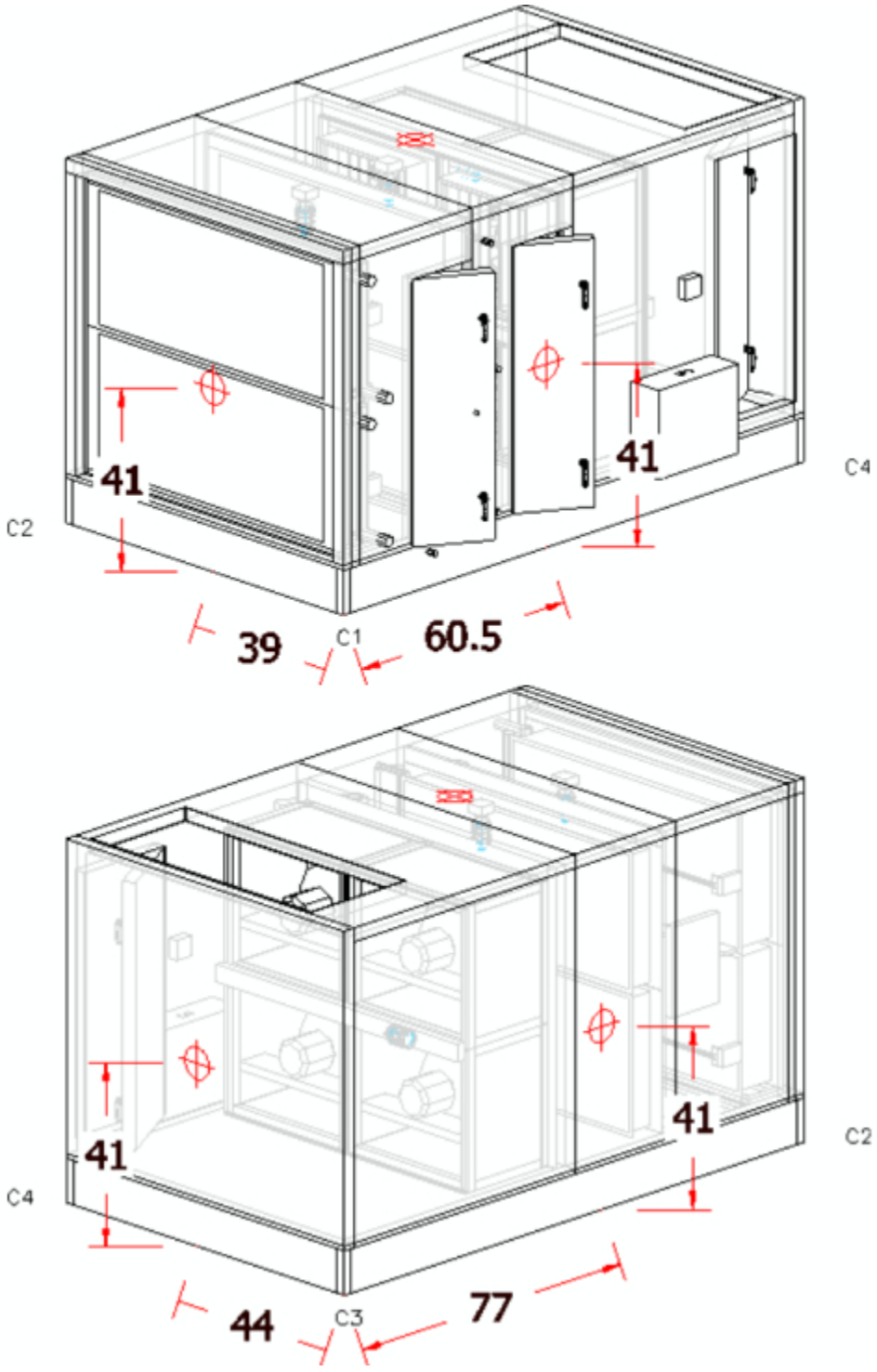
◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

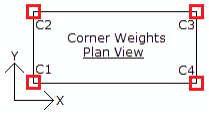
Project Name: UCA Snow Fine Arts
Unit Tag: AH-6

Sales Order #: N003312-003
Job #: N003312002

901 Center of Gravity (Continued)

901.3 Box B





Size (Inches)			Shipping Weight (Pounds)	Corner Weights (Pounds)			
X	Y	Z		C1	C2	C3	C4
137.50	83.00	81.50	5,920	1,712	1,517	1,264	1,426

◊ Center of gravity, weight, and corner weights shown are based on shipping weight. Values are estimates and subject to change.

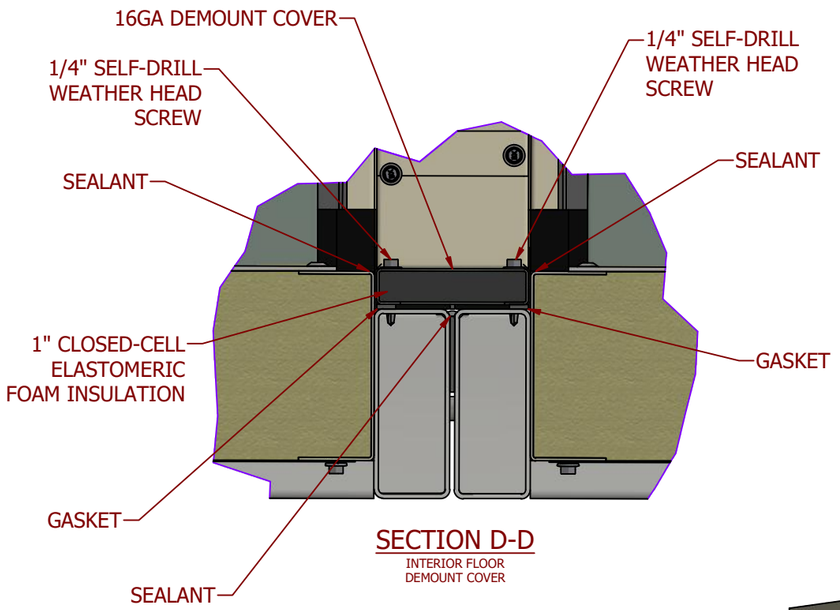
PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312
QUOTE #	23-1950

Appendix

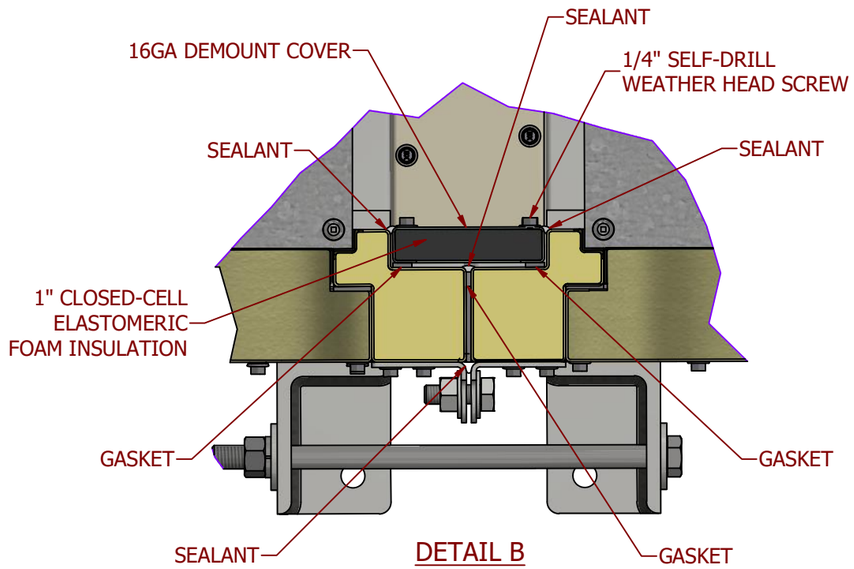
NORTEK AIR SOLUTIONS TEMTROL

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312
QUOTE #	23-1950

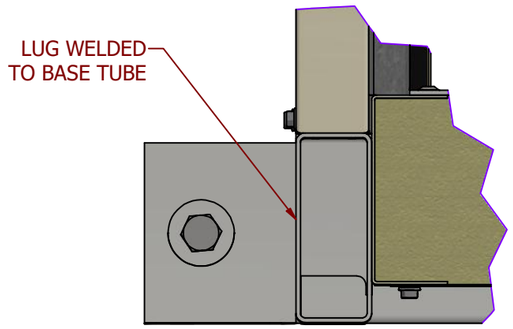
ITF Construction Details



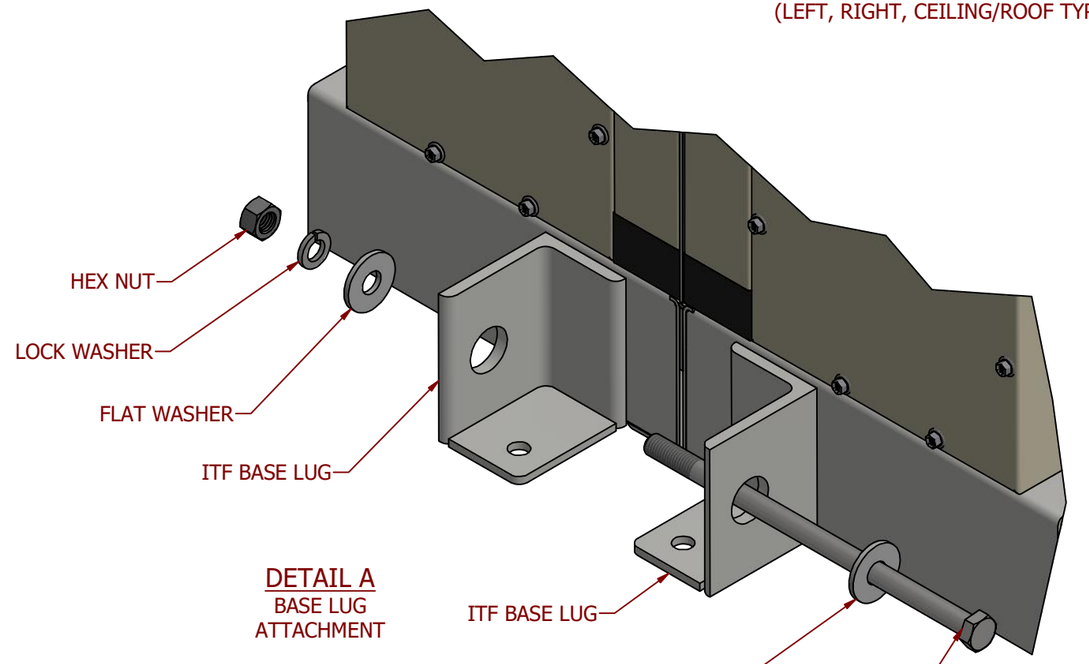
SECTION D-D
INTERIOR FLOOR DEMOUNT COVER



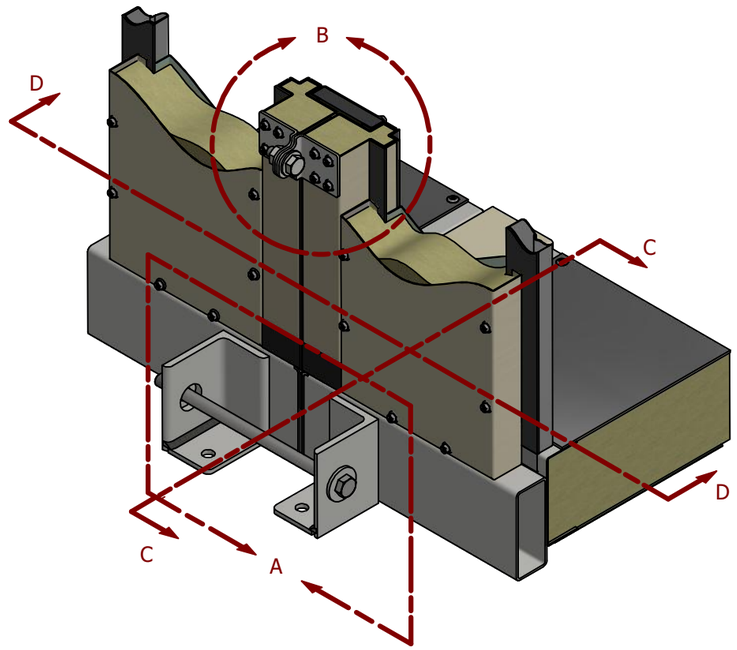
DETAIL B
INTERIOR WALL DEMOUNT COVER (LEFT, RIGHT, CEILING/ROOF TYP)



SECTION C-C
BASE LUG



DETAIL A
BASE LUG ATTACHMENT



NOTE:
1. SEALANT TO BE APPLIED IN THE FIELD AFTER SECTION ASSEMBLY.
2. PANELS/LINERS NOT SHOWN FOR CLARITY.
3. DOCUMENT PREVIOUSLY RELEASED AS 221.00055

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:
DETAIL DEMOUNT, INDOOR, ITF

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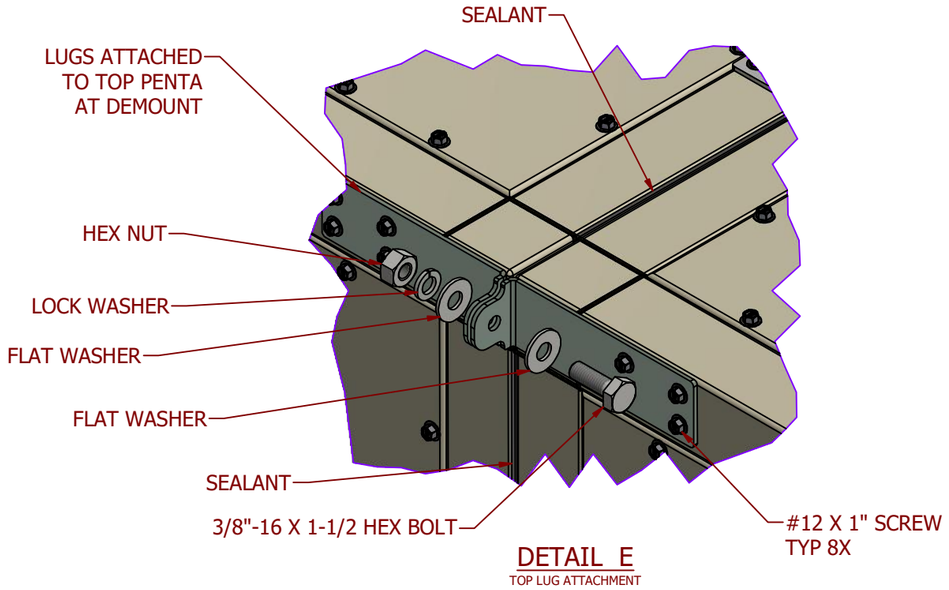
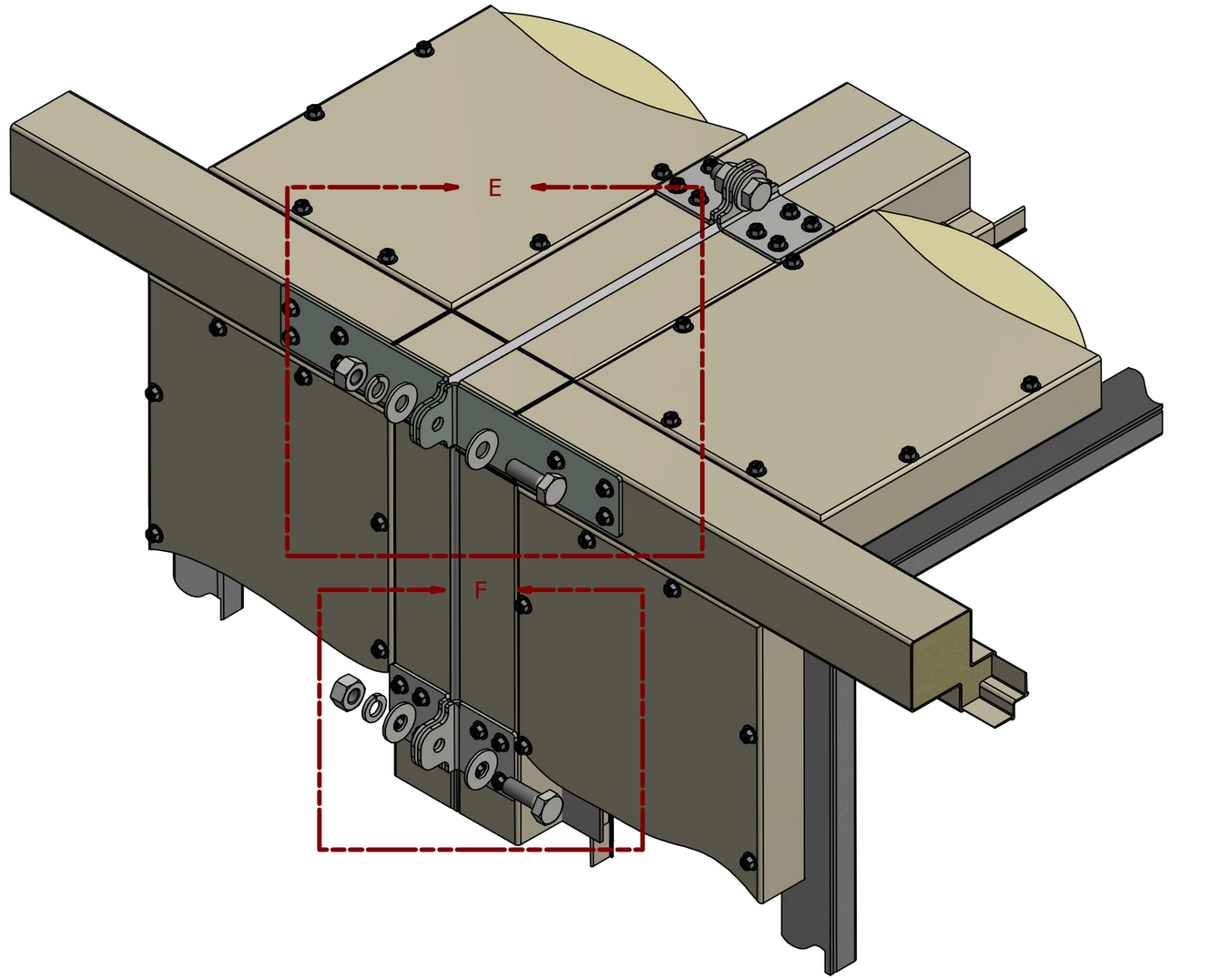
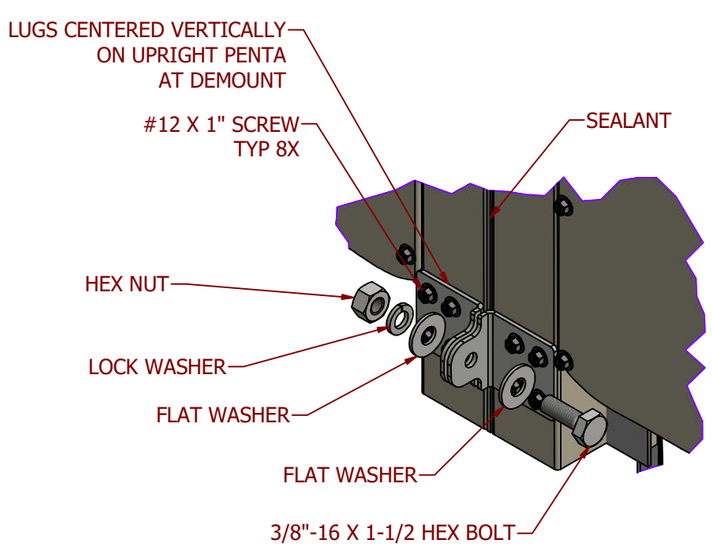


DETAIL E
TOP LUG ATTACHMENT





DETAIL F
MID LUG ATTACHMENT

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:
DETAIL
DEMOUNT, INDOOR, ITF

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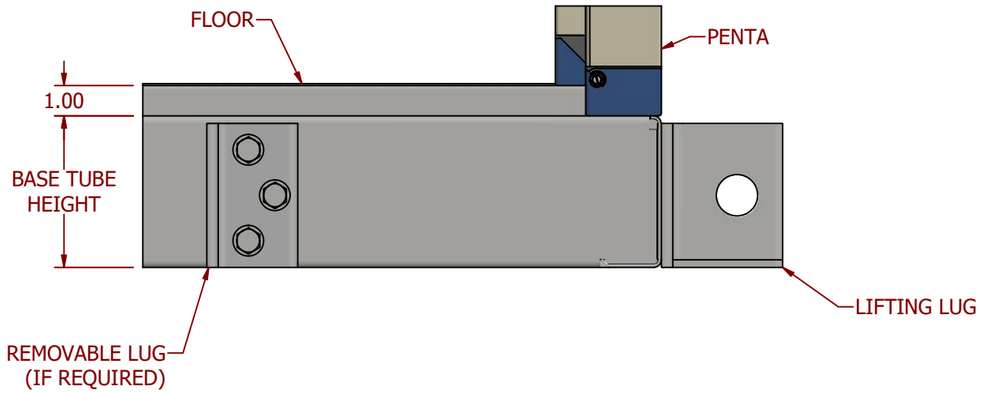

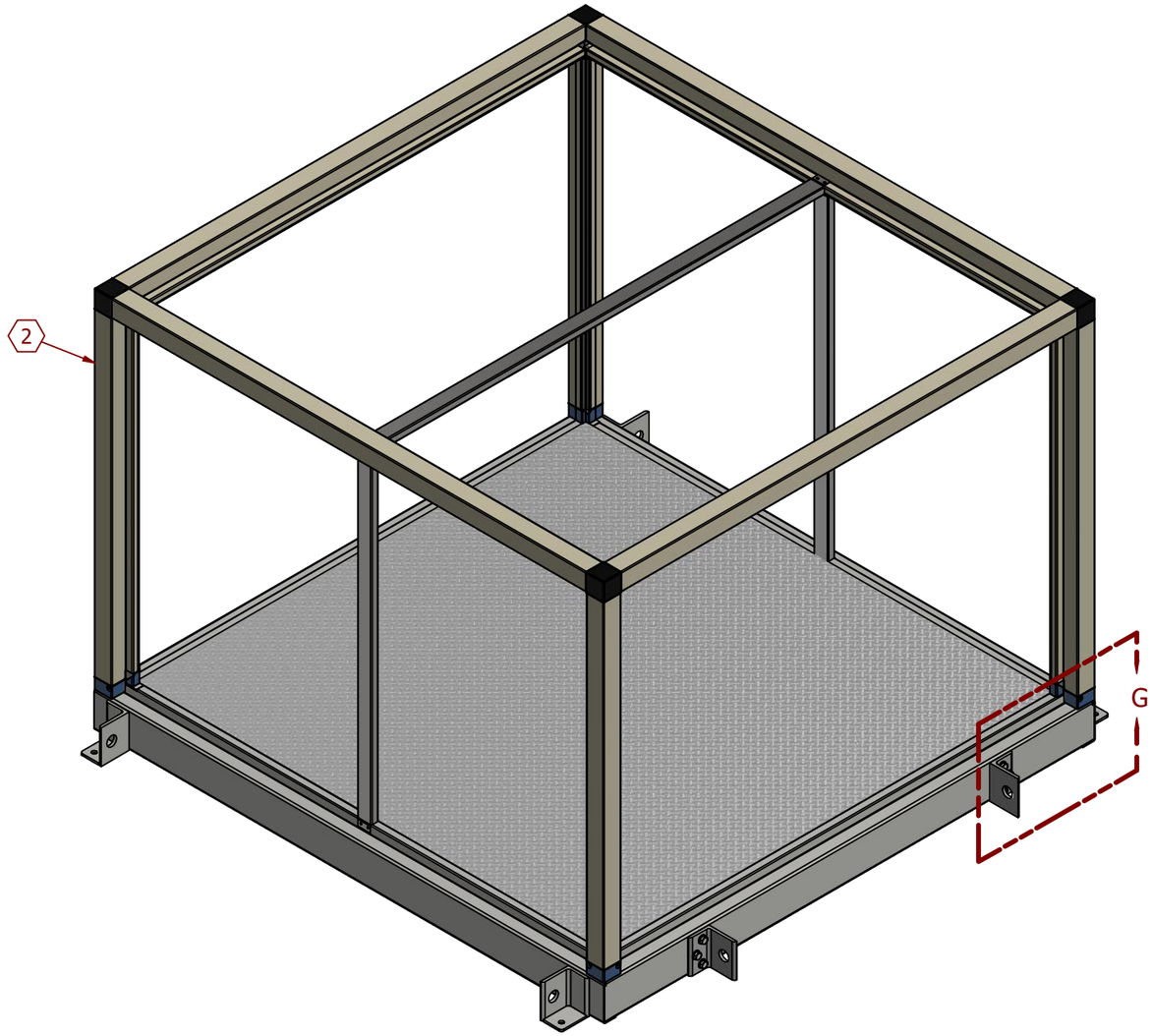

NORTEK AIR SOLUTIONS	106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762 PH: (405) 263-7286	TITLE: DETAIL DEMOUNT, INDOOR, ITF

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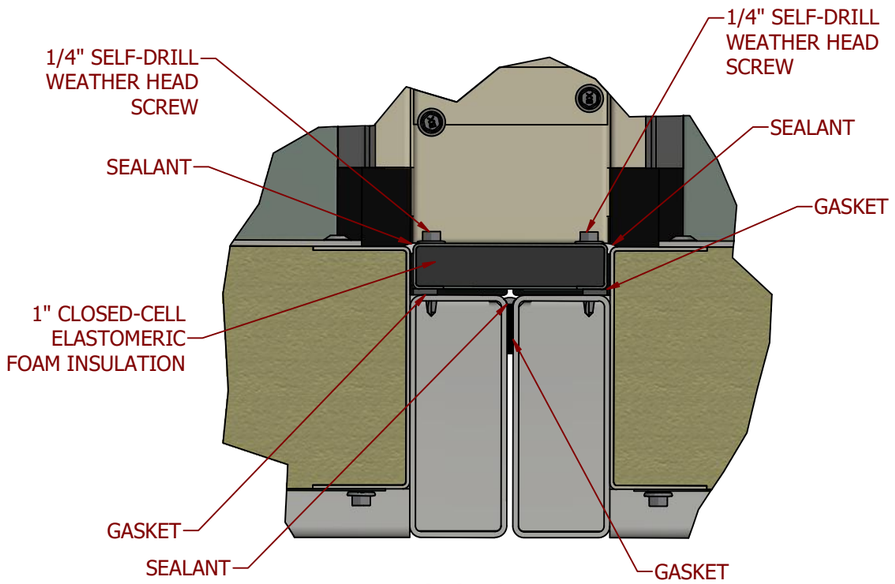
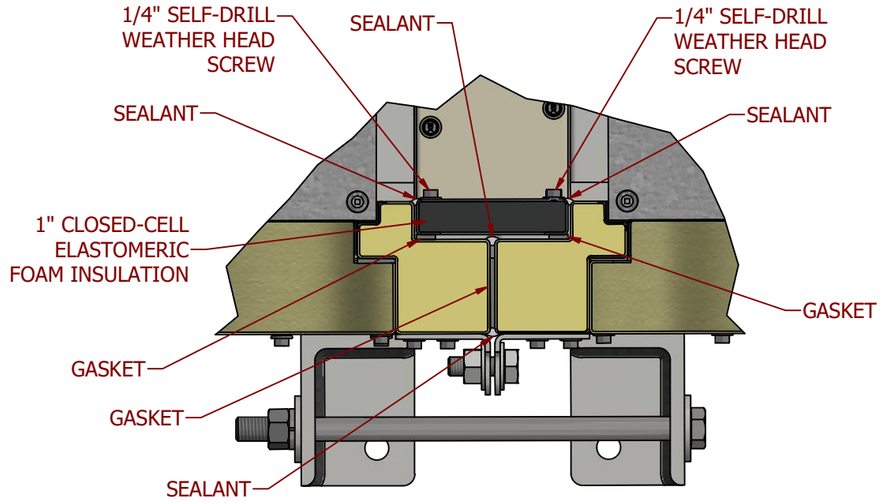
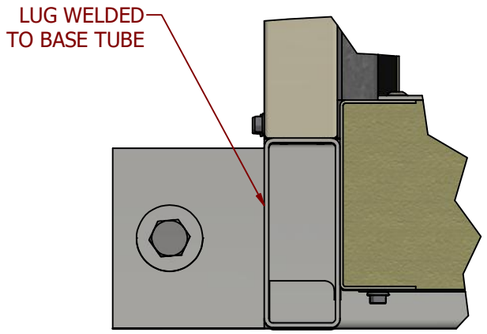


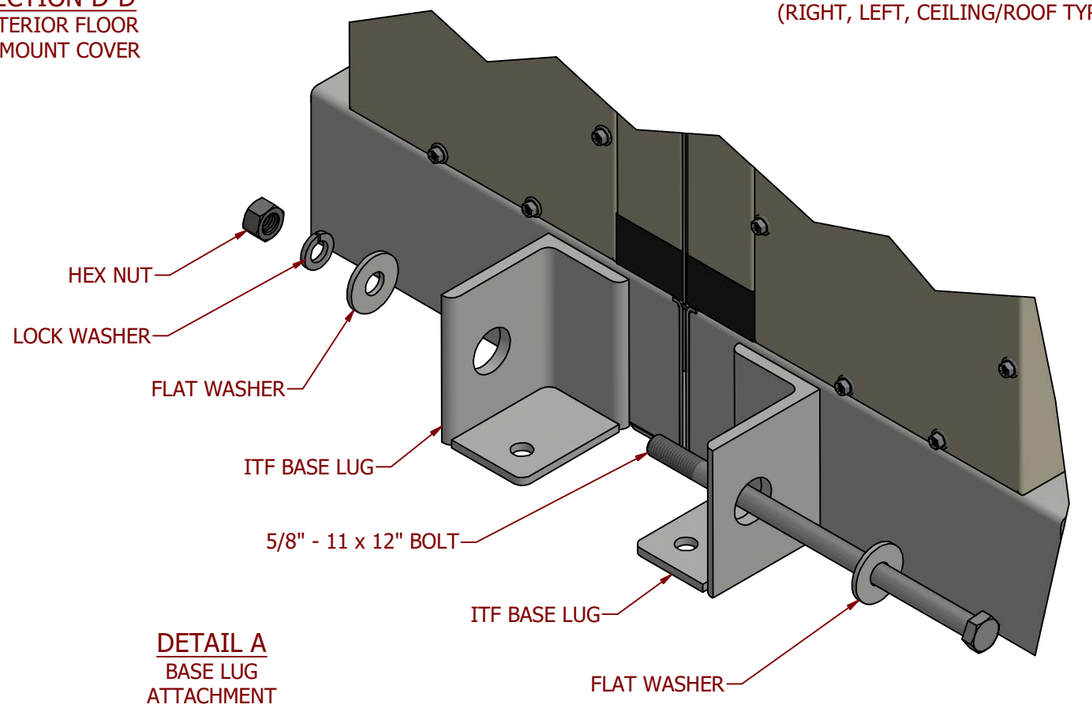
SECTION D-D
INTERIOR FLOOR
DEMOUNT COVER



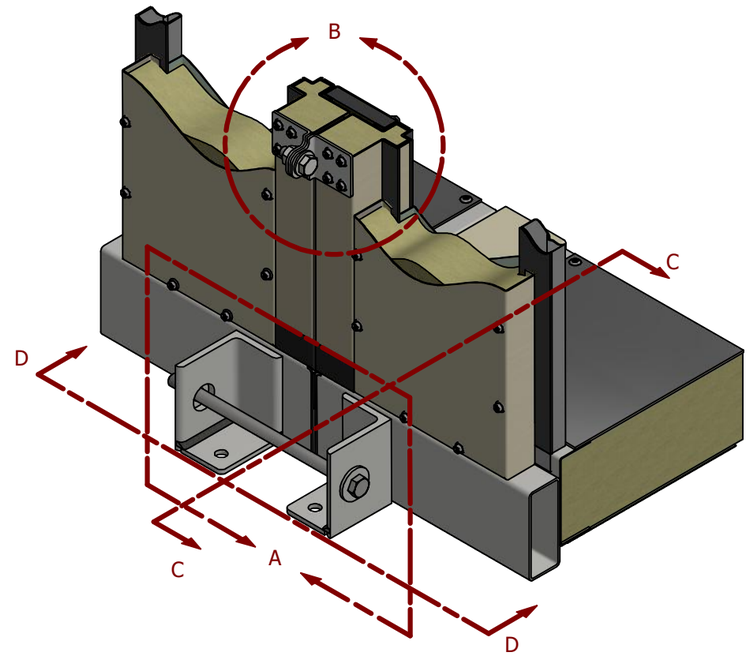
DETAIL B
INTERIOR WALL
DEMOUNT COVER
(RIGHT, LEFT, CEILING/ROOF TYP)



SECTION C-C
BASE LUG



DETAIL A
BASE LUG
ATTACHMENT



NOTE:
1. SEALANT TO BE APPLIED IN THE FIELD AFTER SECTION ASSEMBLY.
2. PANELS/LINERS NOT SHOWN FOR CLARITY.
3. DOCUMENT PREVIOUSLY RELEASED AS 221.00079.

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:
DETAIL, DEMOUNT, OUTDOOR, ITF

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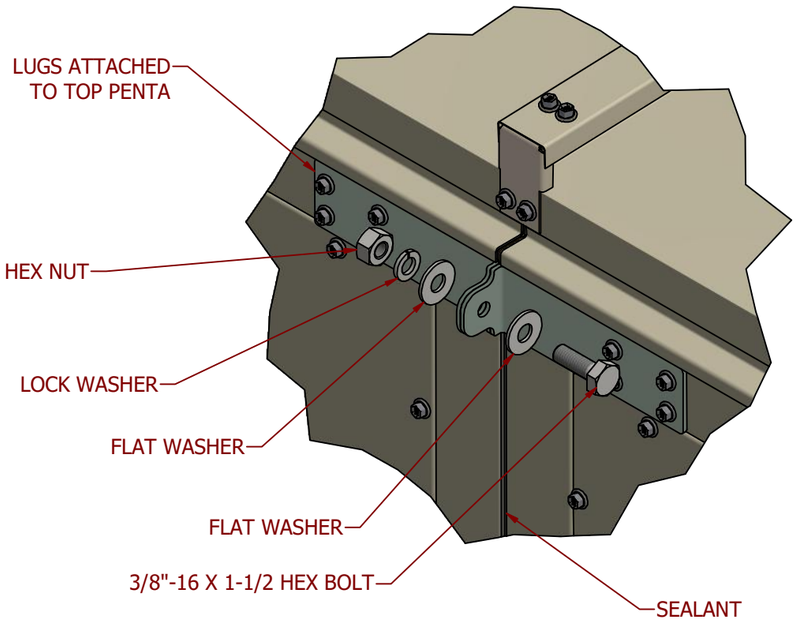
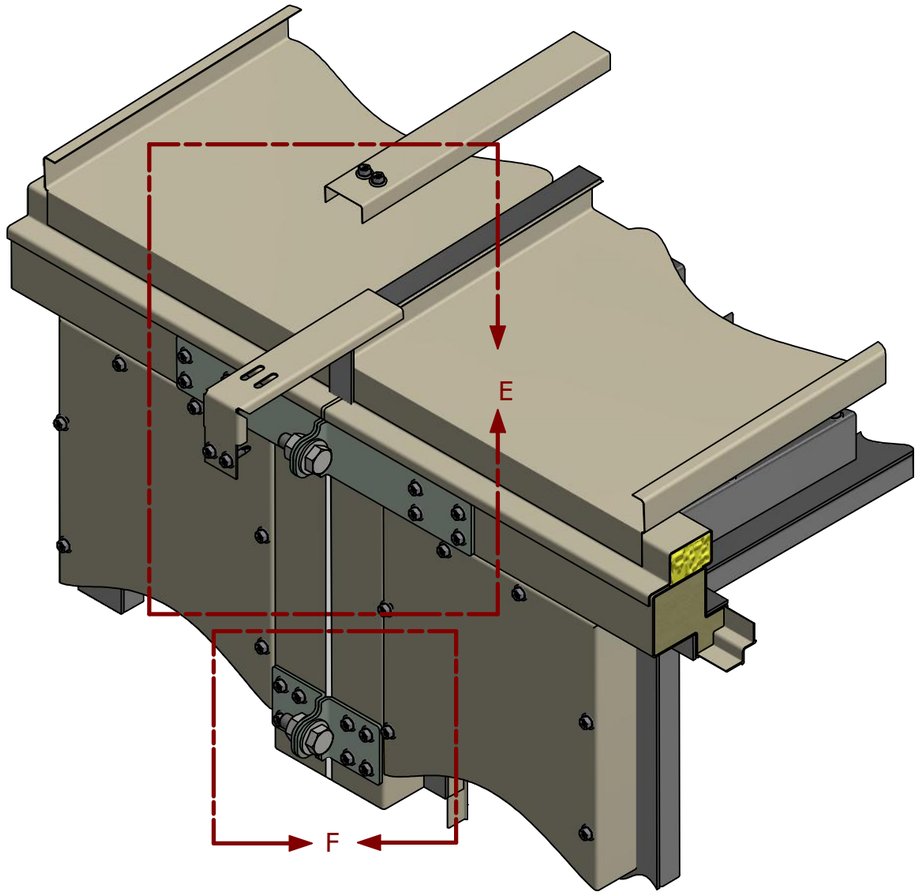
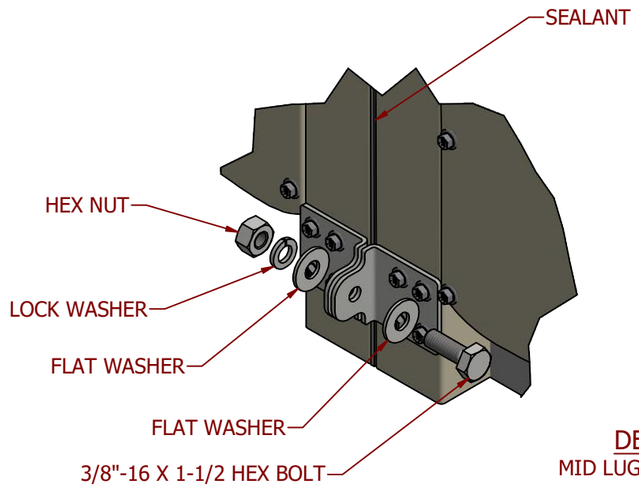
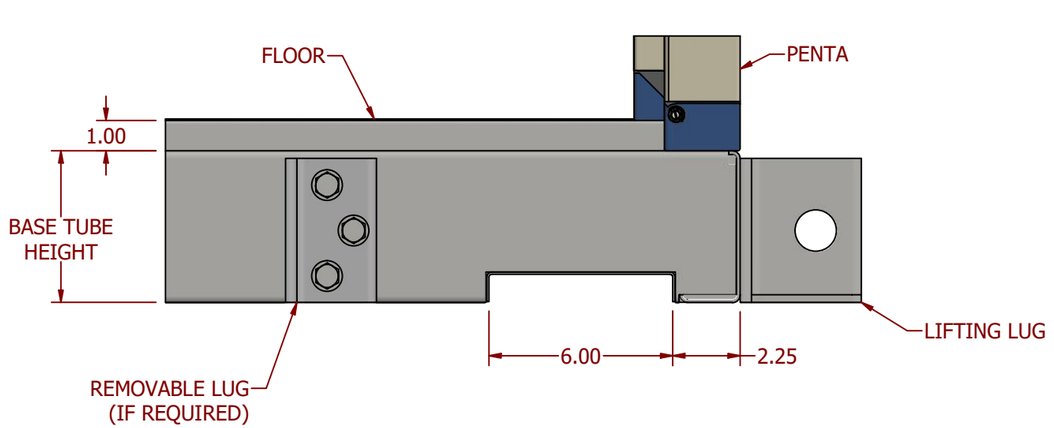


DETAIL E
TOP LUG ATTACHMENT

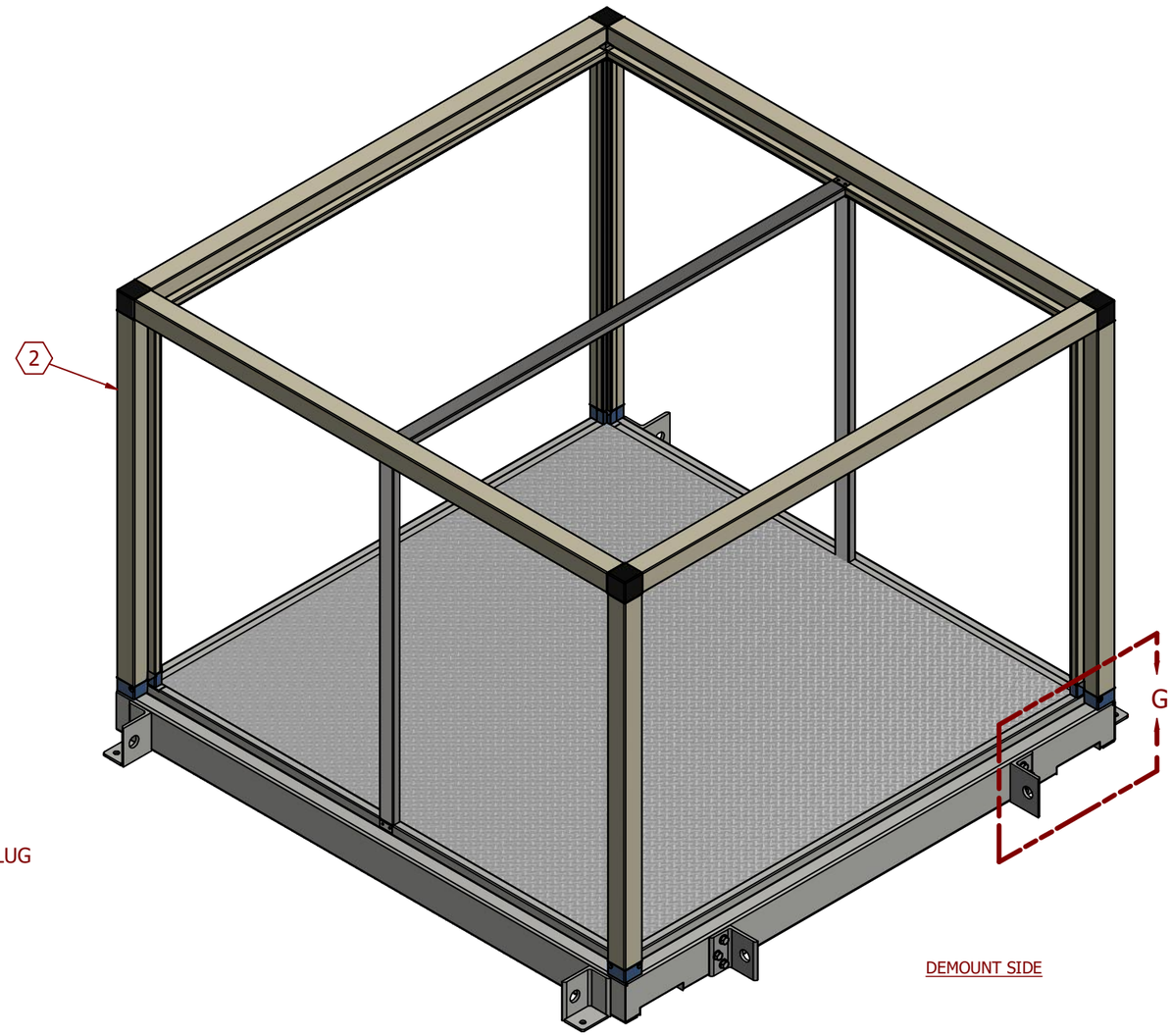




DETAIL F
MID LUG ATTACHMENT



DETAIL G
TYPICAL BOTH ENDS OF DEMOUNT

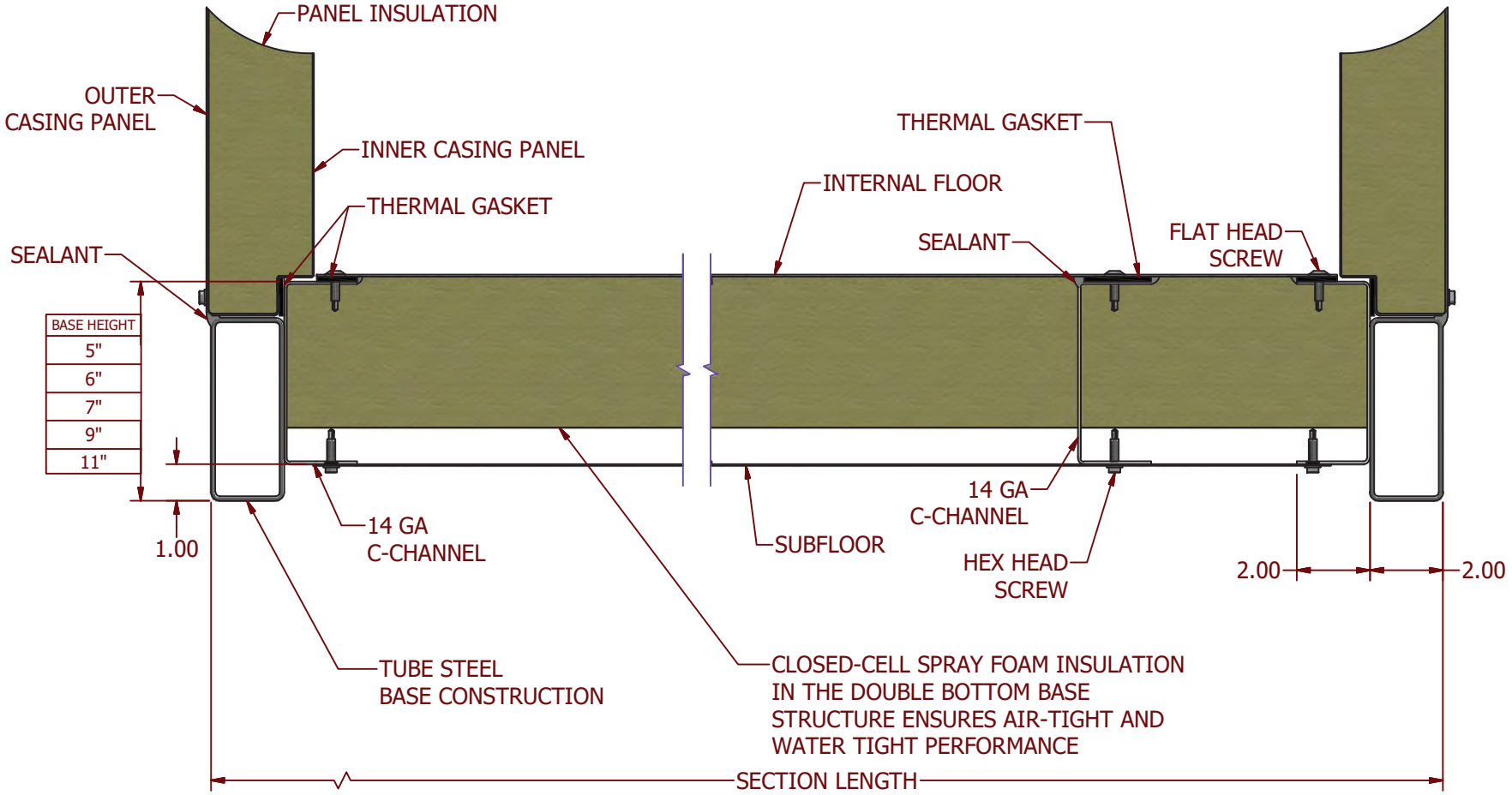


DEMOUNT SIDE

DEMOUNT

NOTES

1. DOCUMENT PREVIOUSLY RELEASED AS 221.00075



NORTEK AIR SOLUTIONS

106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:

DETAIL, BASE, 3IN CASING, ITF

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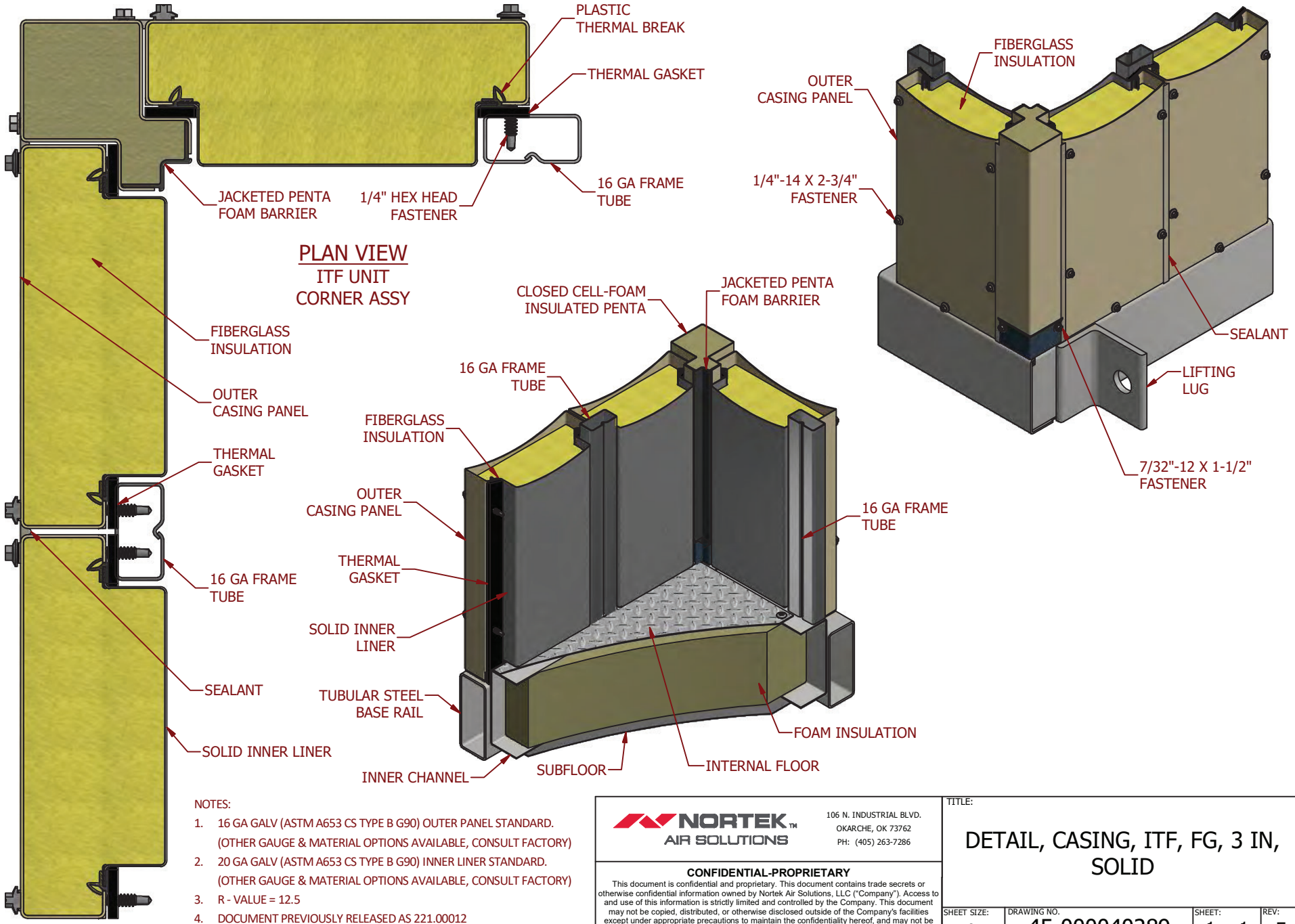


NOTES:

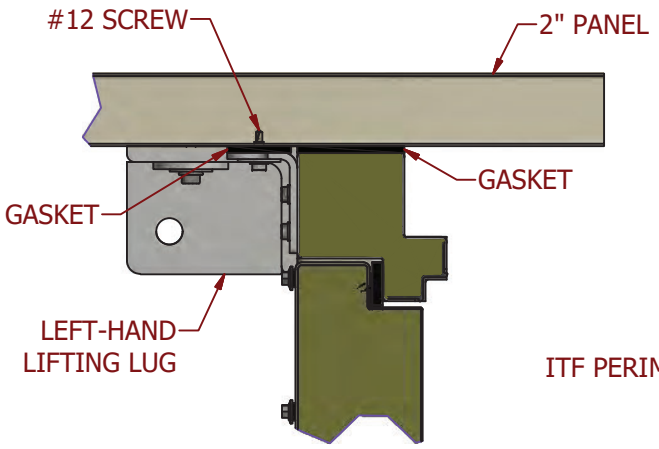
1. 16 GA GALV (ASTM A653 CS TYPE B G90) OUTER PANEL STANDARD. (OTHER GAUGE & MATERIAL OPTIONS AVAILABLE, CONSULT FACTORY)
2. 20 GA GALV (ASTM A653 CS TYPE B G90) INNER LINER STANDARD. (OTHER GAUGE & MATERIAL OPTIONS AVAILABLE, CONSULT FACTORY)
3. R - VALUE = 12.5
4. DOCUMENT PREVIOUSLY RELEASED AS 221.00012

NORTEK™ AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

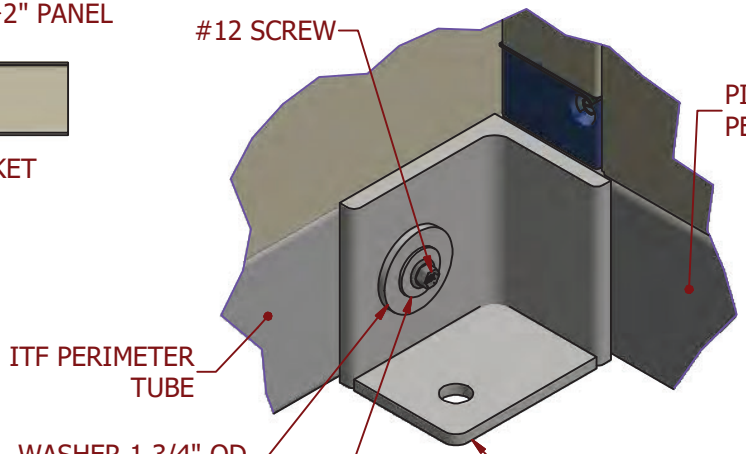
TITLE:

DETAIL, CASING, ITF, FG, 3 IN, SOLID

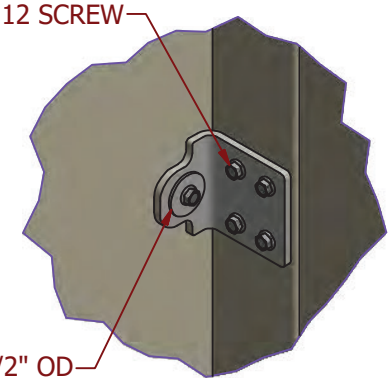
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000040289	1 OF 1	E



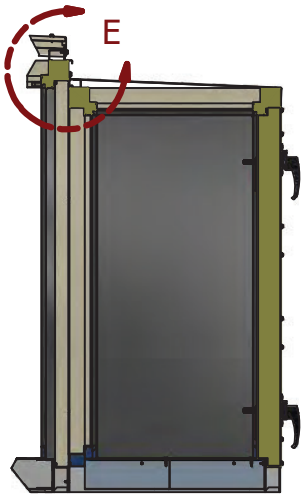
SECTION C-C



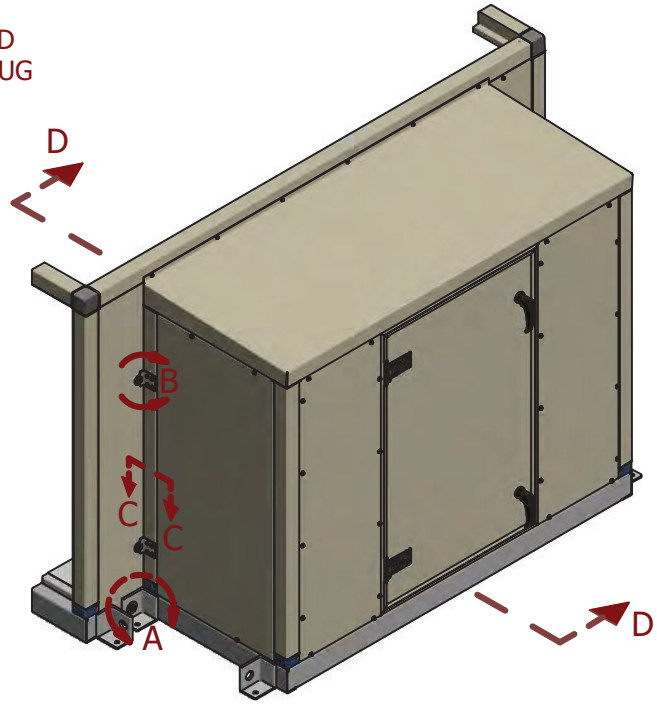
DETAIL A

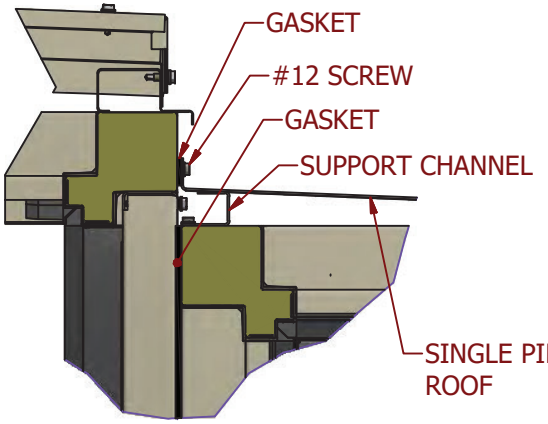


DETAIL B



SECTION D-D





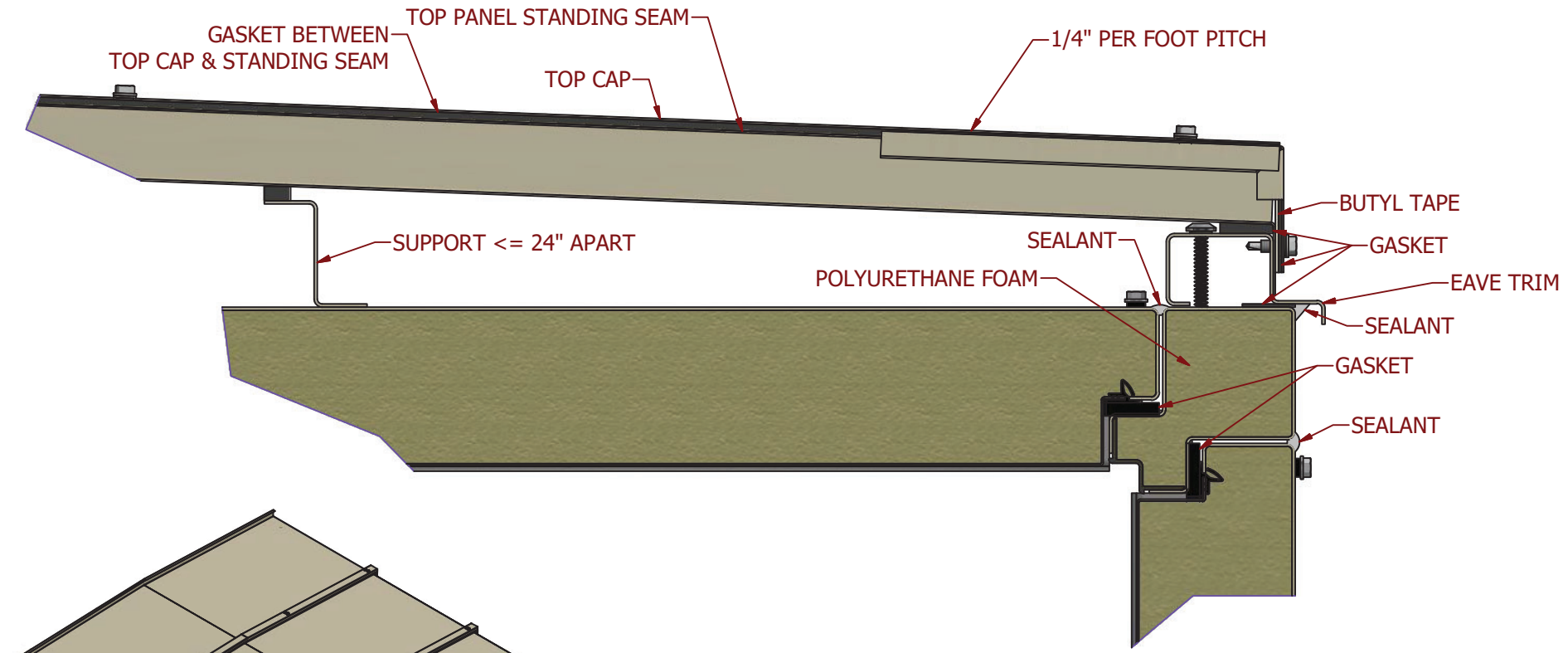
DETAIL E

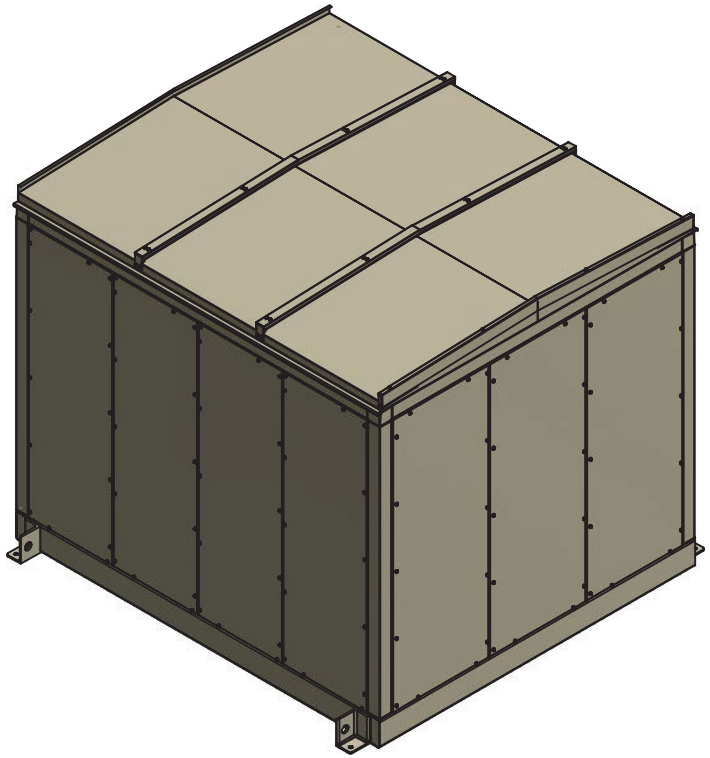
NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:

DETAIL, PENTA PIPE HOUSE, ITF

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000016635	1 OF 1	





NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

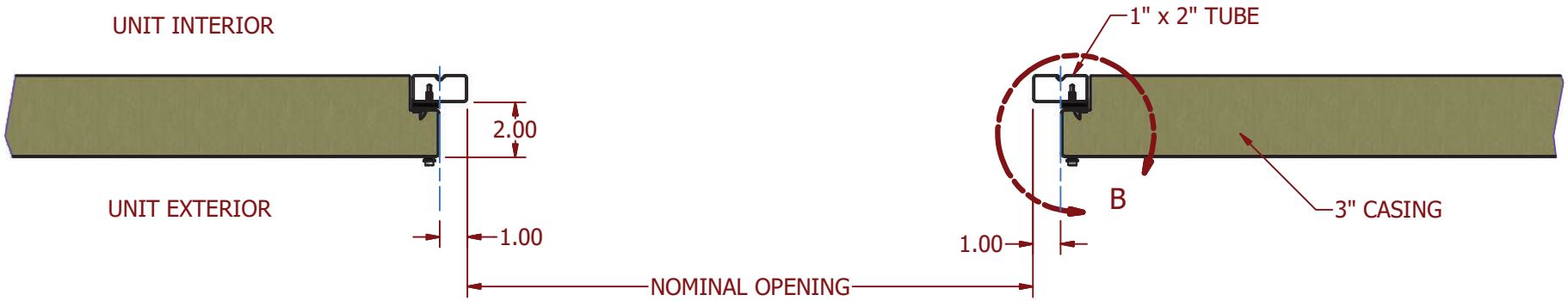
TITLE:

DETAIL, SECTION, ROOF, ITF

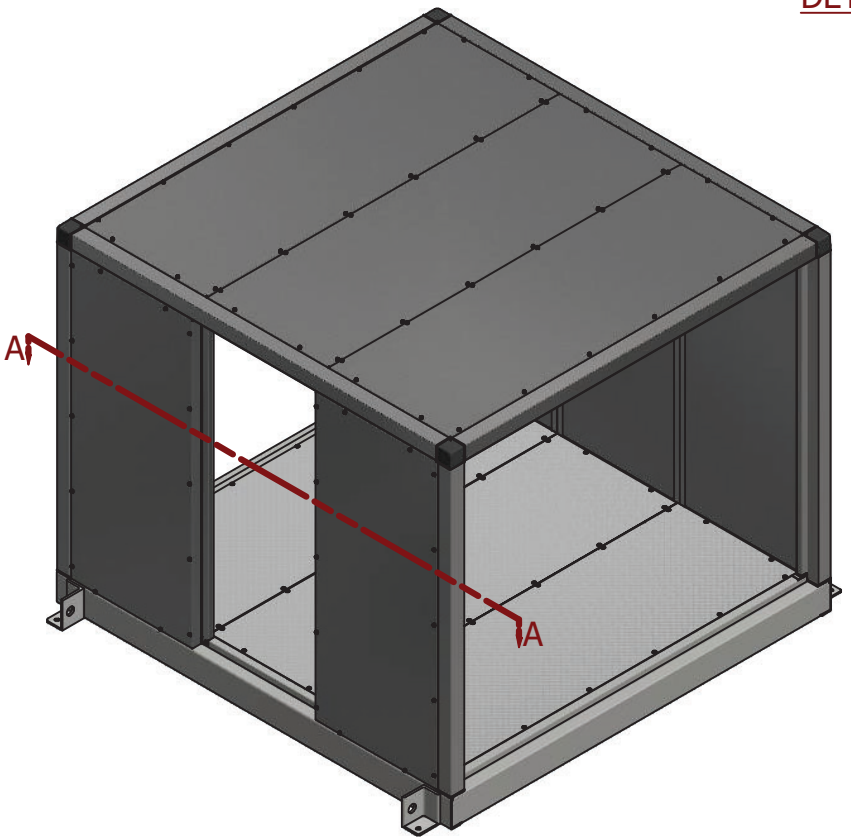
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000013450	1 OF 1	C

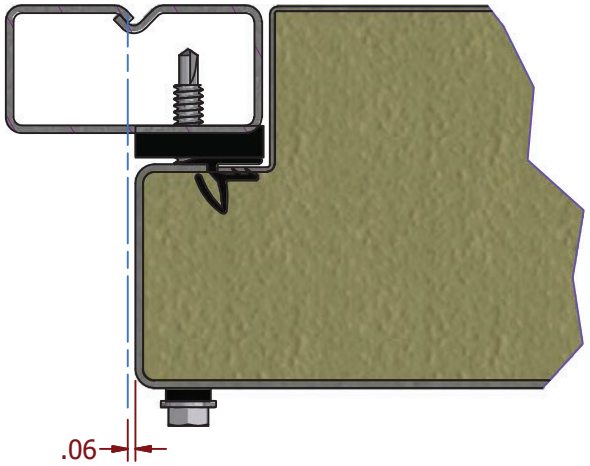
NOTE:

1. THIS DOCUMENT REPLACES 221.00165 WHICH IS OBSOLETE.



DETAIL A-A





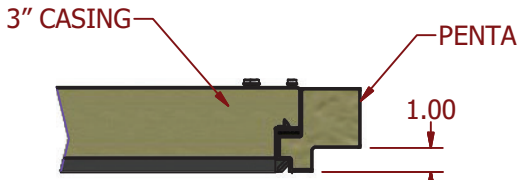
DETAIL B

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:

DETAIL
OPENING, CASING, ITF

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000020518	1 OF 5	

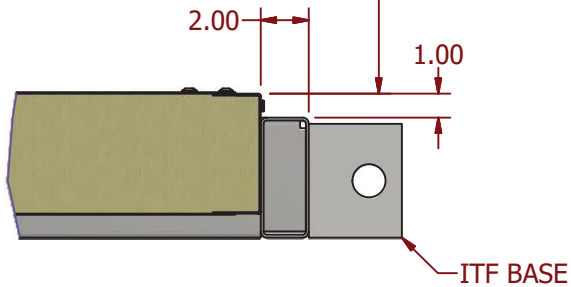


1.00

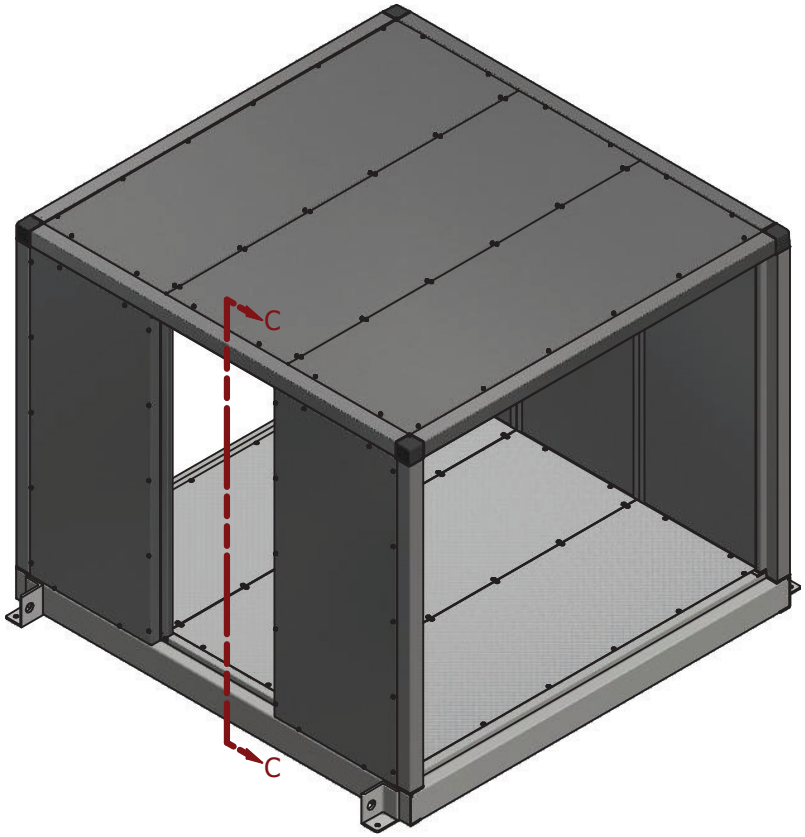
UNIT INTERIOR

UNIT EXTERIOR

NOMINAL OPENING



DETAIL C-C



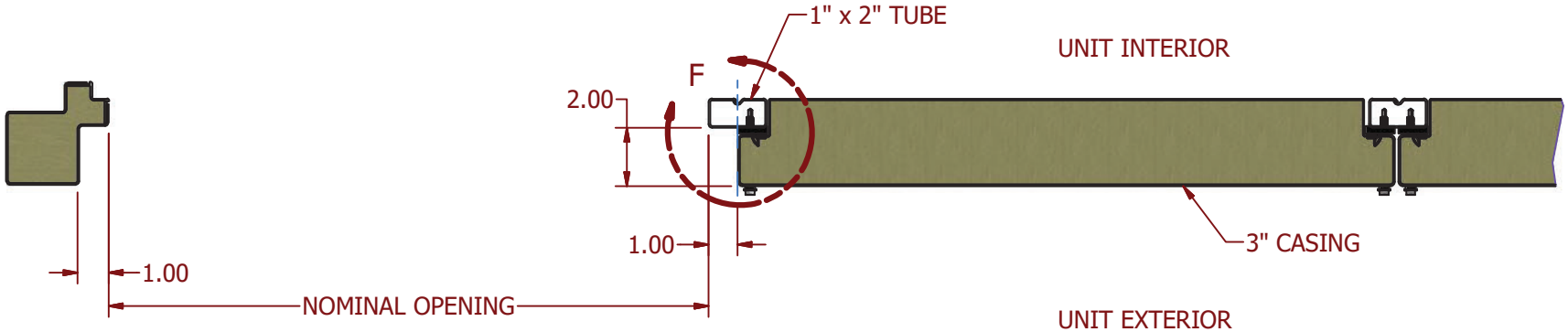
NORTEK AIR SOLUTIONS

106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

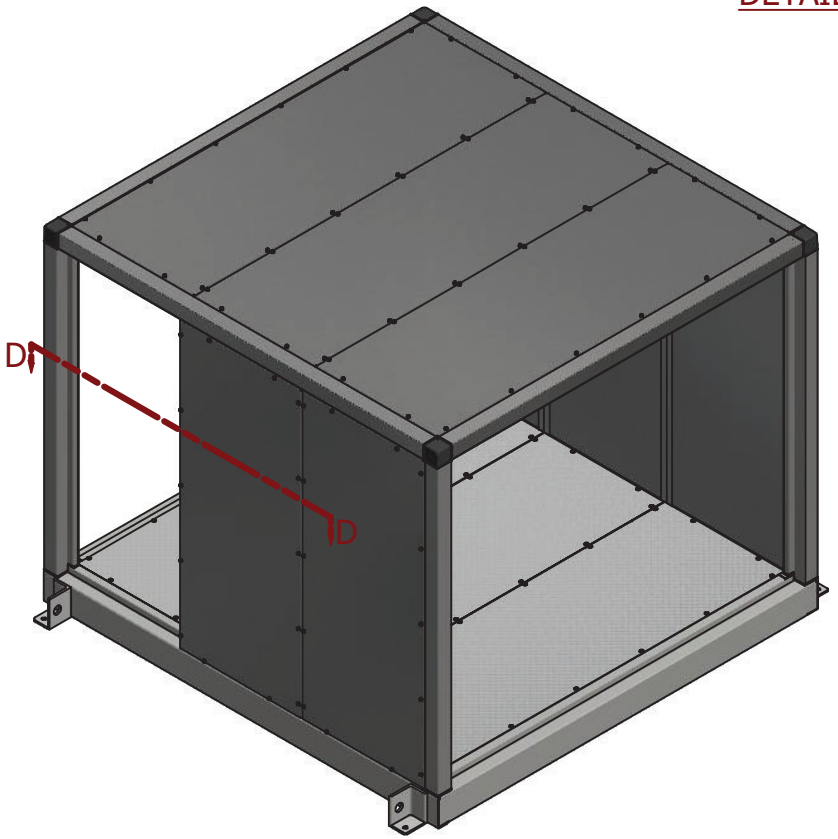
TITLE:

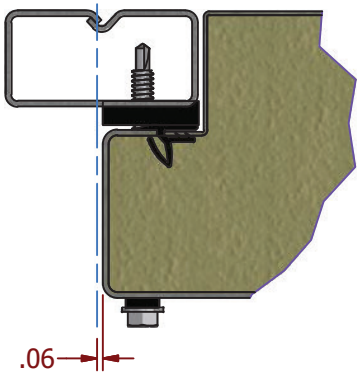
DETAIL
OPENING, CASING, ITF

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000020518	2 OF 5	



DETAIL D-D



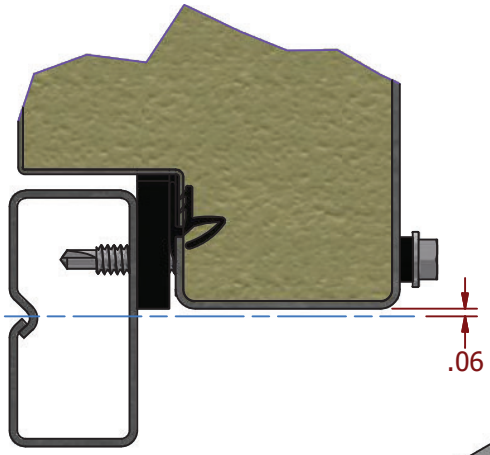


DETAIL F

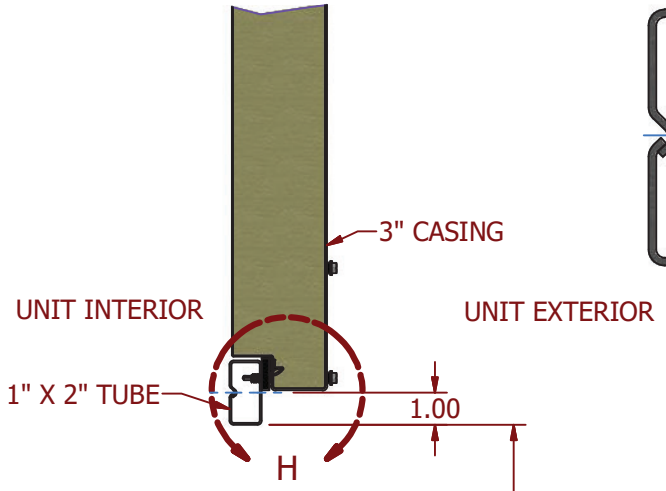
NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

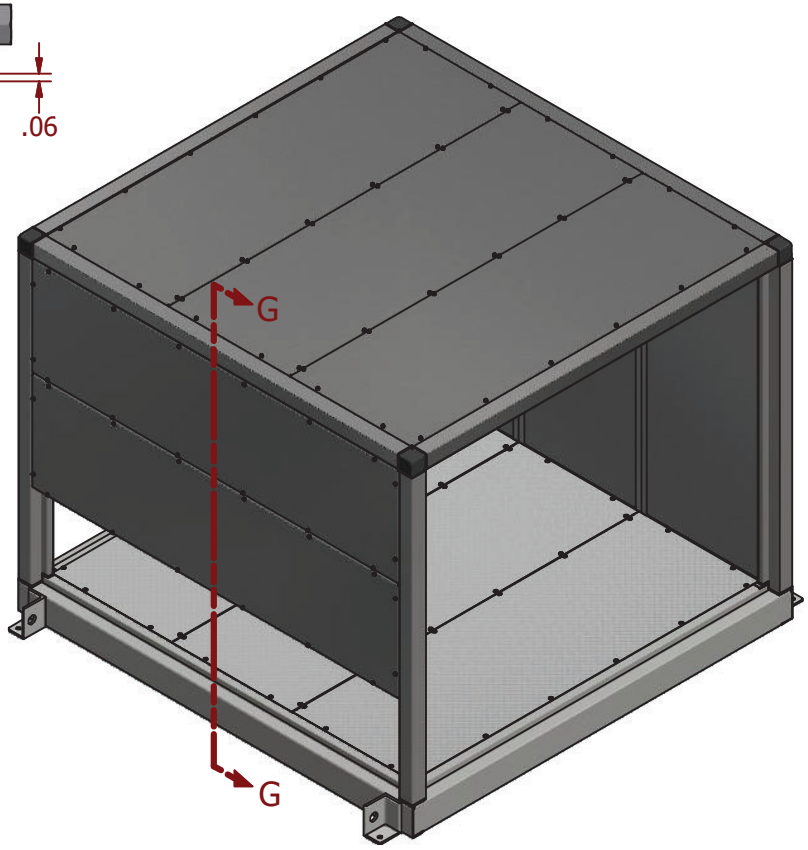
TITLE:
DETAIL
OPENING, CASING, ITF

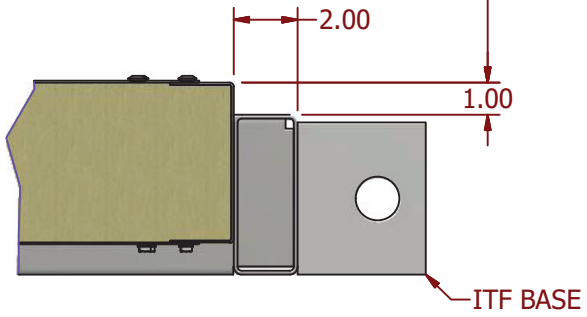
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000020518	3 OF 5	



DETAIL H







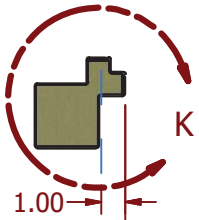
DETAIL G-G

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

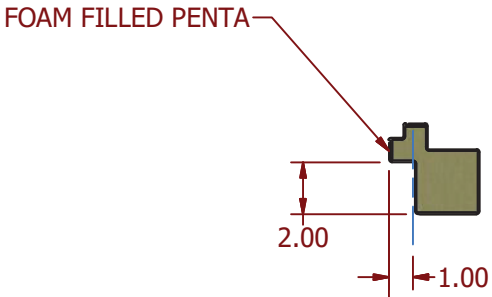
TITLE:

DETAIL
OPENING, CASING, ITF

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000020518	4 OF 5	



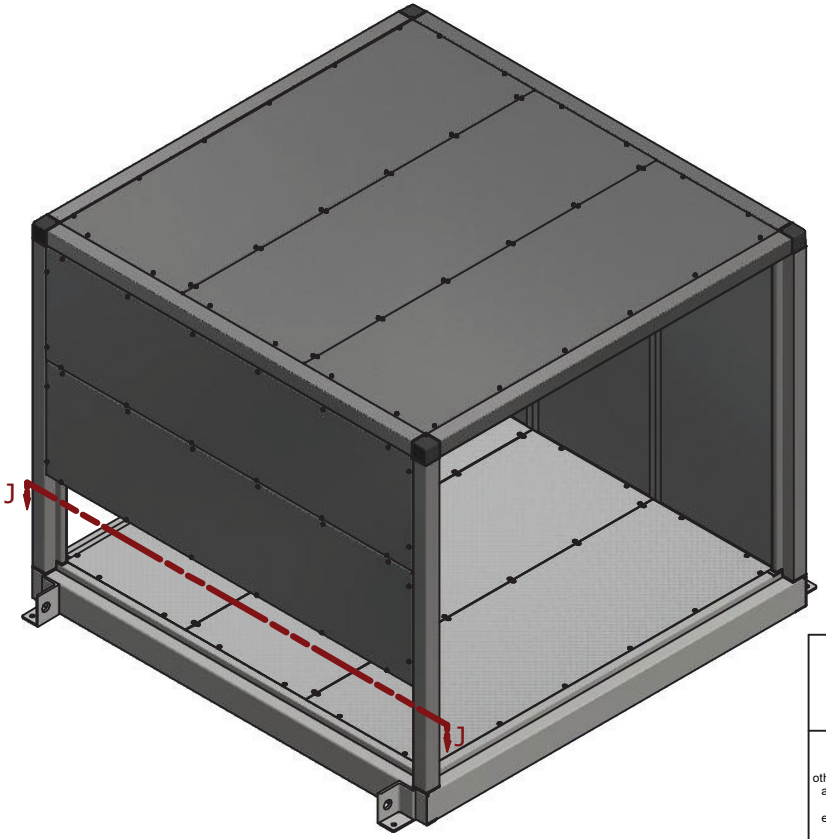
UNIT INTERIOR

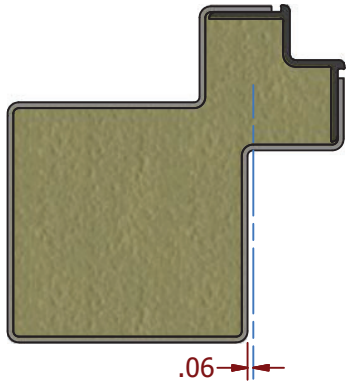


NOMINAL OPENING

UNIT EXTERIOR

DETAIL J-J





DETAIL K

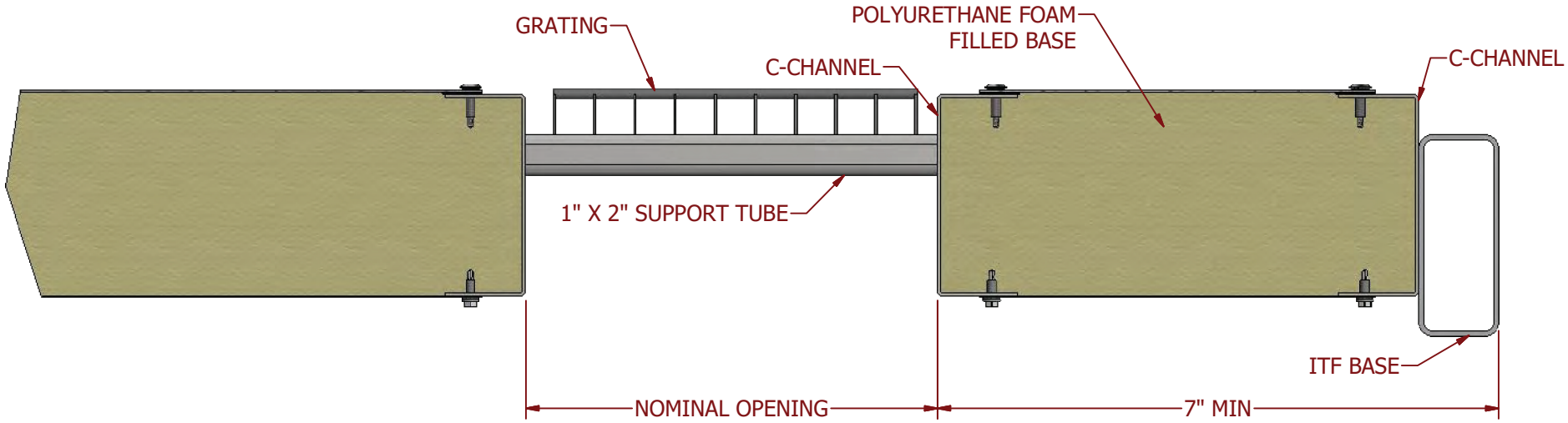
NORTEK AIR SOLUTIONS

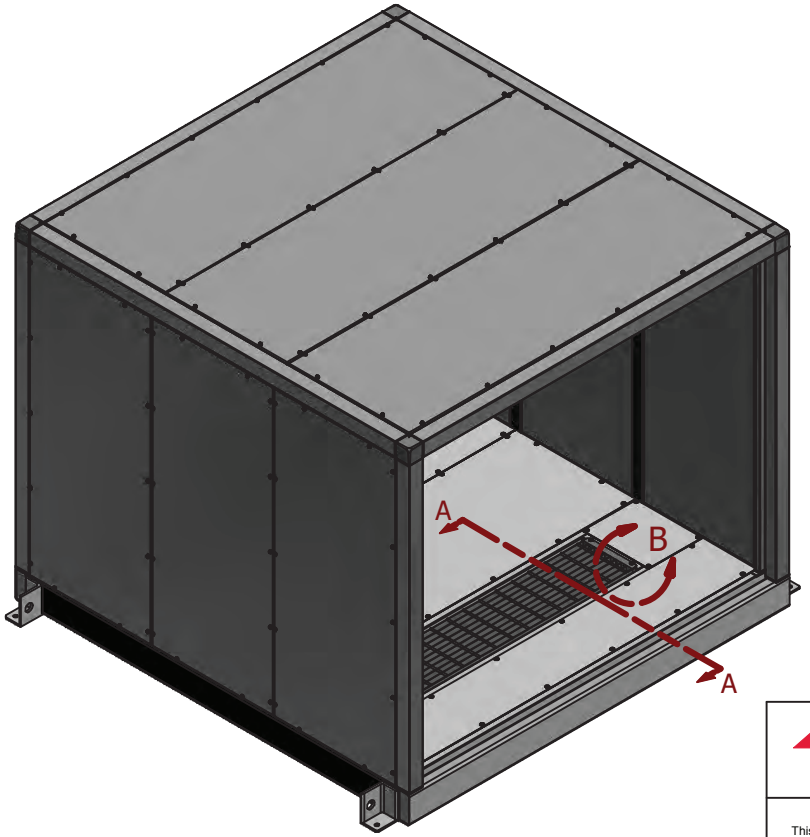
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:

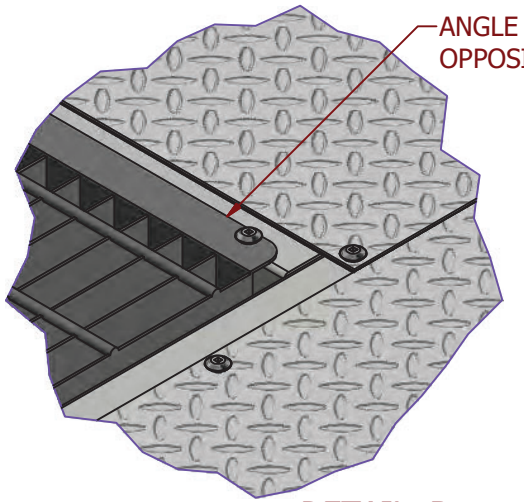
DETAIL
OPENING, CASING, ITF

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000020518	5 OF 5	





SECTION A-A



DETAIL B

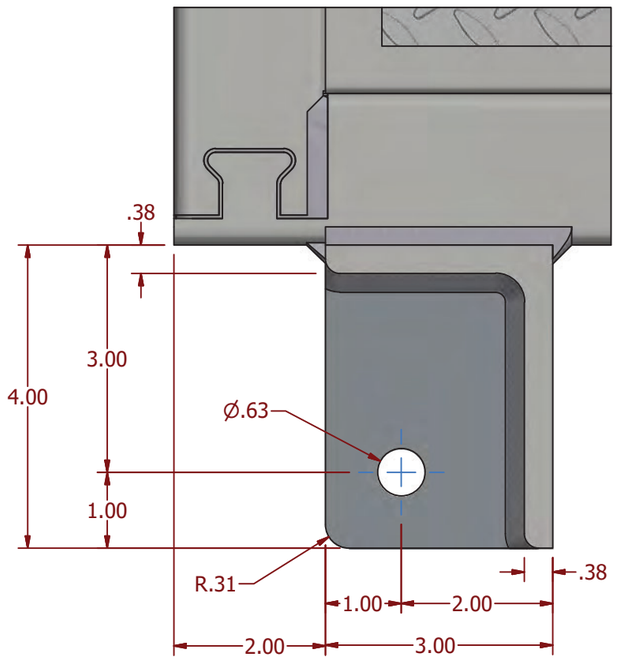
NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE: DETAIL, OPENING, BASE, ITF

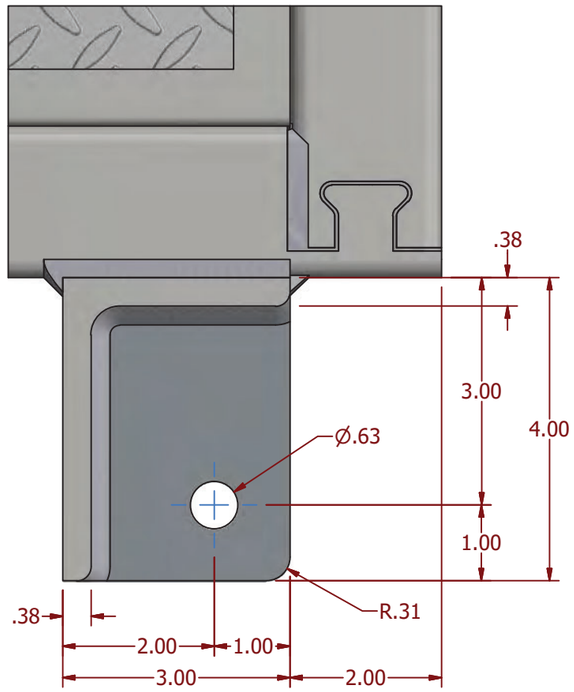
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000013770	1 OF 1	A

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312
QUOTE #	23-1950

Lifting Lugs

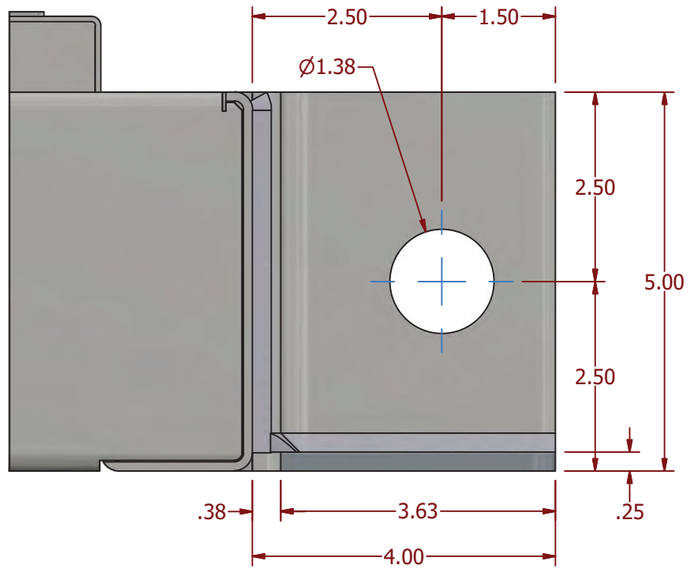


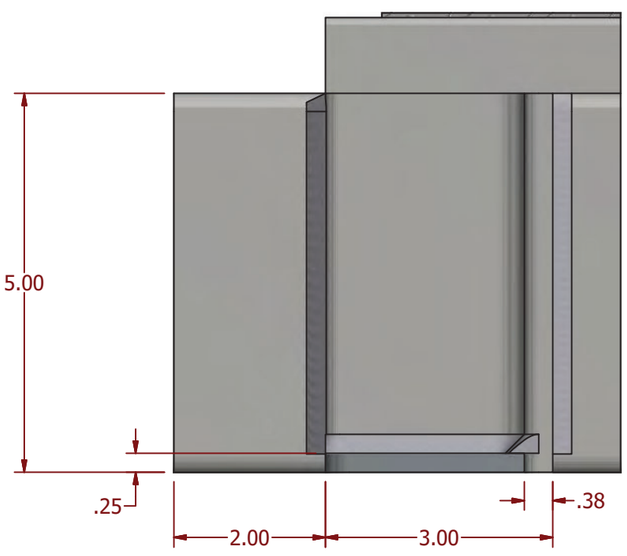
TOP VIEW
RIGHT HAND



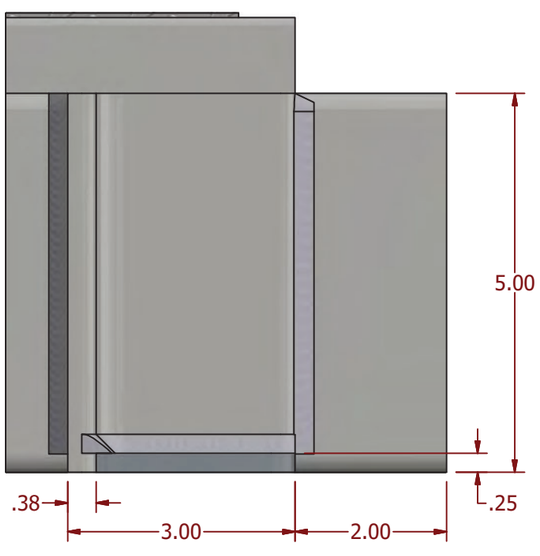
TOP VIEW
LEFT HAND

DEMOUNTED UNITS

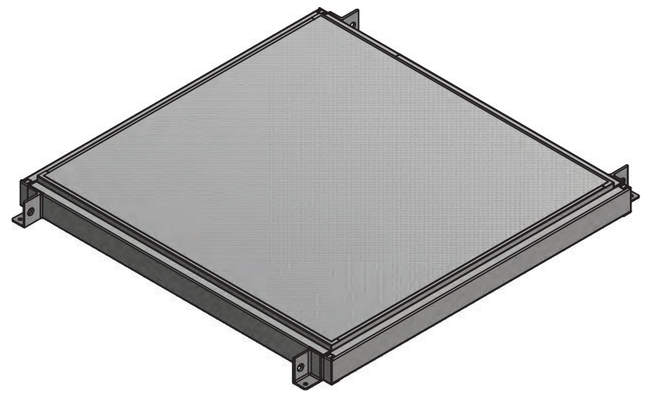




FRONT VIEW
RIGHT HAND



FRONT VIEW
LEFT HAND



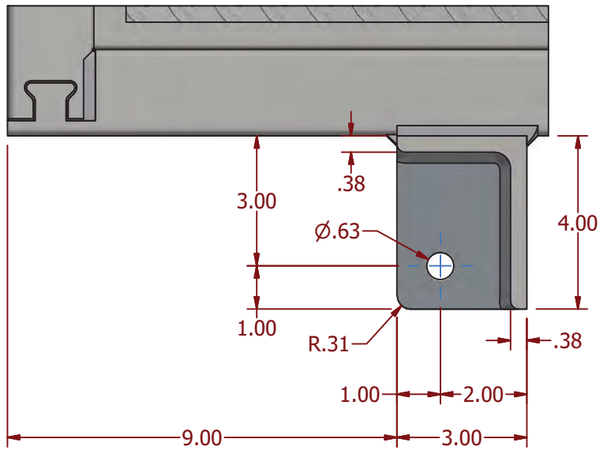
NOTE:

1. THIS DOCUMENT REPLACES 221.00212 WHICH IS OBSOLETE.

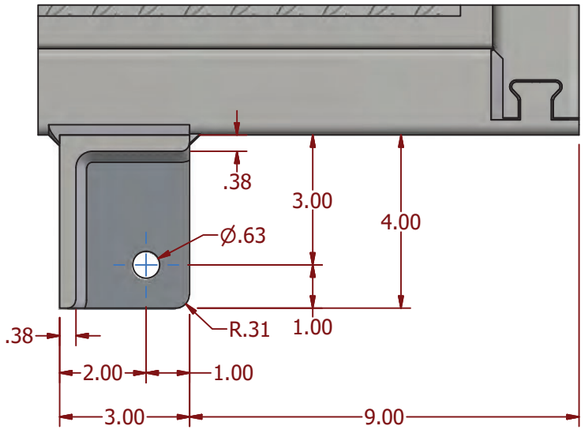
NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE: DETAIL, LIFTING LUG LOCATION, ITF

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
B	45-000018383	1 OF 2	-

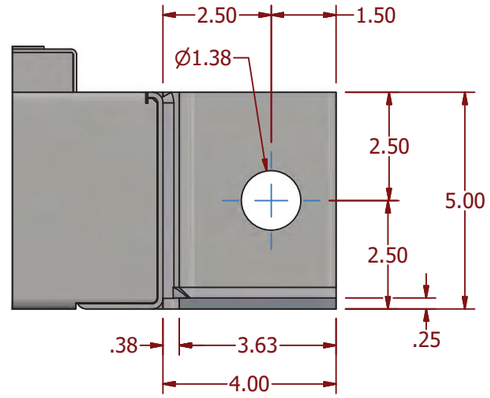


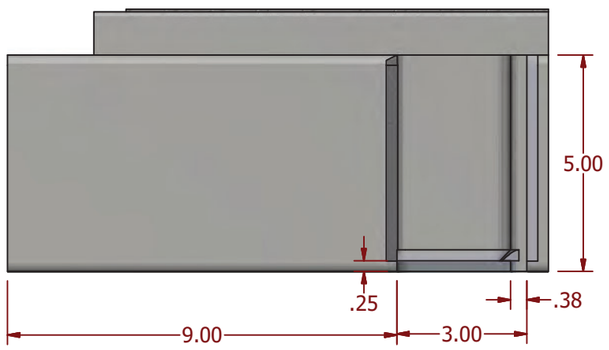
TOP VIEW
RIGHT HAND



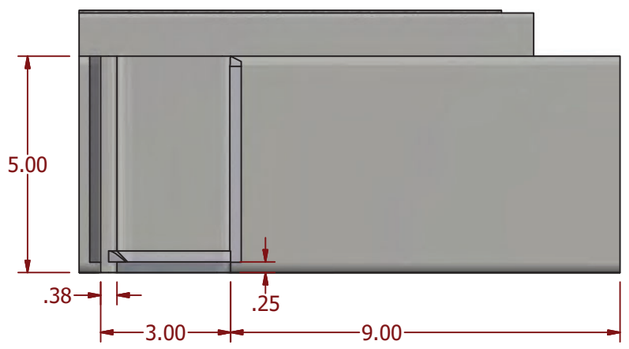
TOP VIEW
LEFT HAND

SINGLE PIECE UNIT

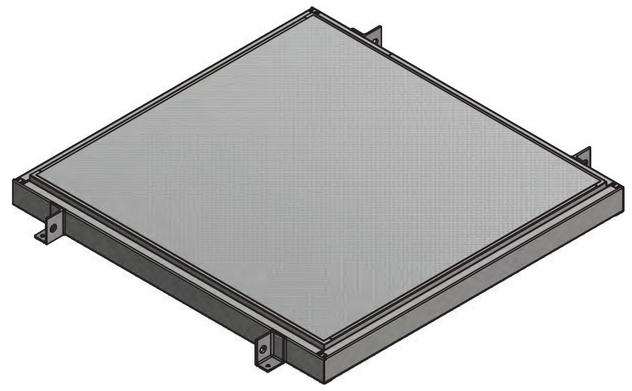




FRONT VIEW
RIGHT HAND



FRONT VIEW
LEFT HAND



NORTEK AIR SOLUTIONS™
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

CONFIDENTIAL-PROPRIETARY

TITLE:

DETAIL, LIFTING LUG LOCATION, ITF

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
B	45-000018383	2 OF 2	-

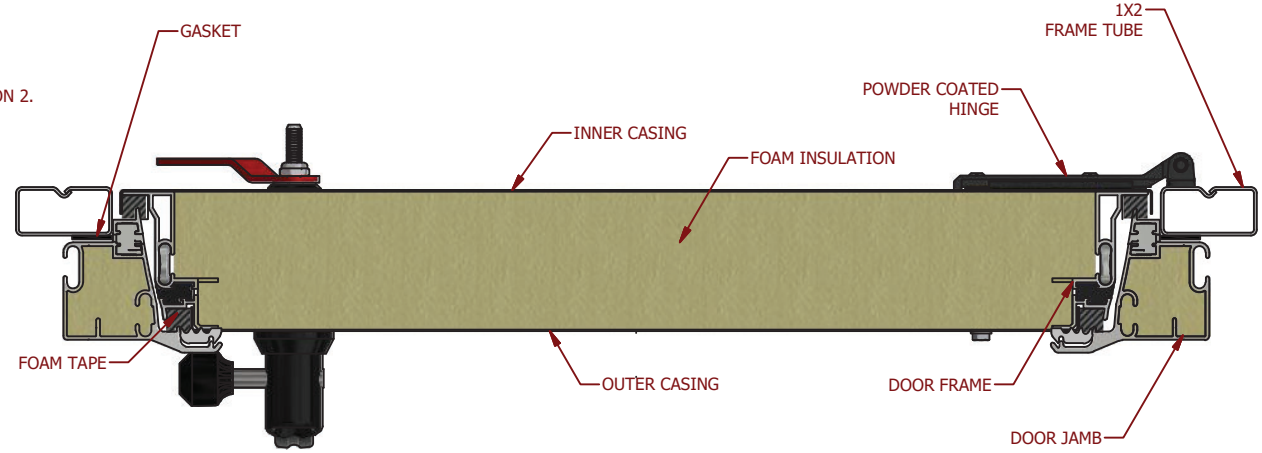
NORTEK AIR SOLUTIONS TEMTROL

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312
QUOTE #	23-1950

Component Details

AVAILABLE OPTIONS:

1.) DUAL THERMAL PANE, UV RATED SAFETY GLASS OR FACTORY FABRICATED LOUVER. REFER TO UNIT DRAWING IF SPECIFIED.
2.) TEST PORT.
3.) PREVIOUSLY RELEASED AS 221.00044

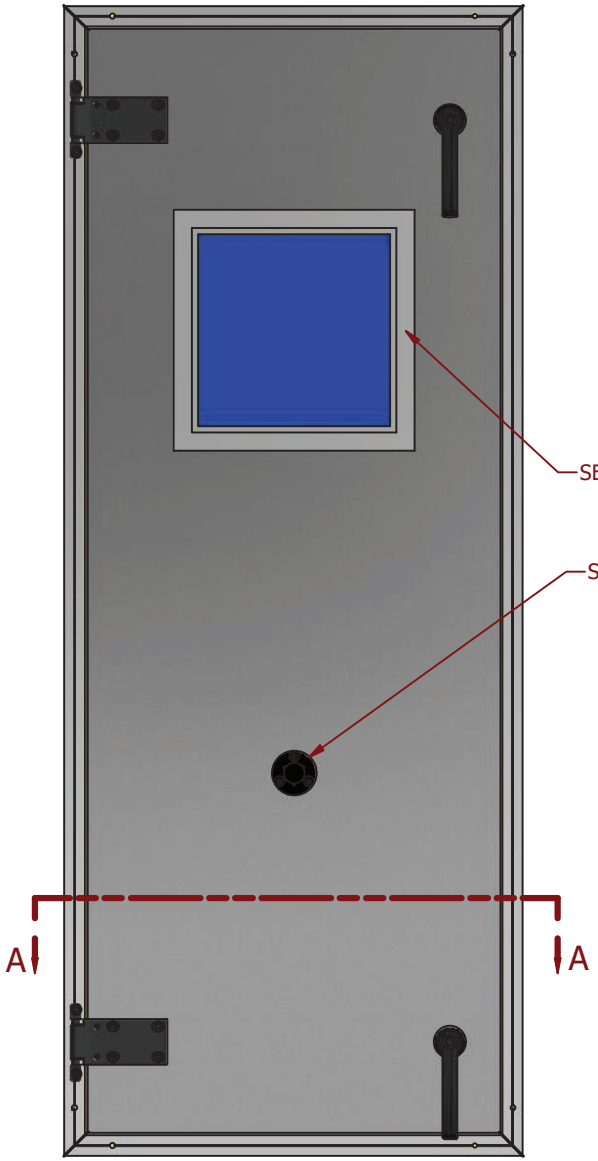


SECTION A-A

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

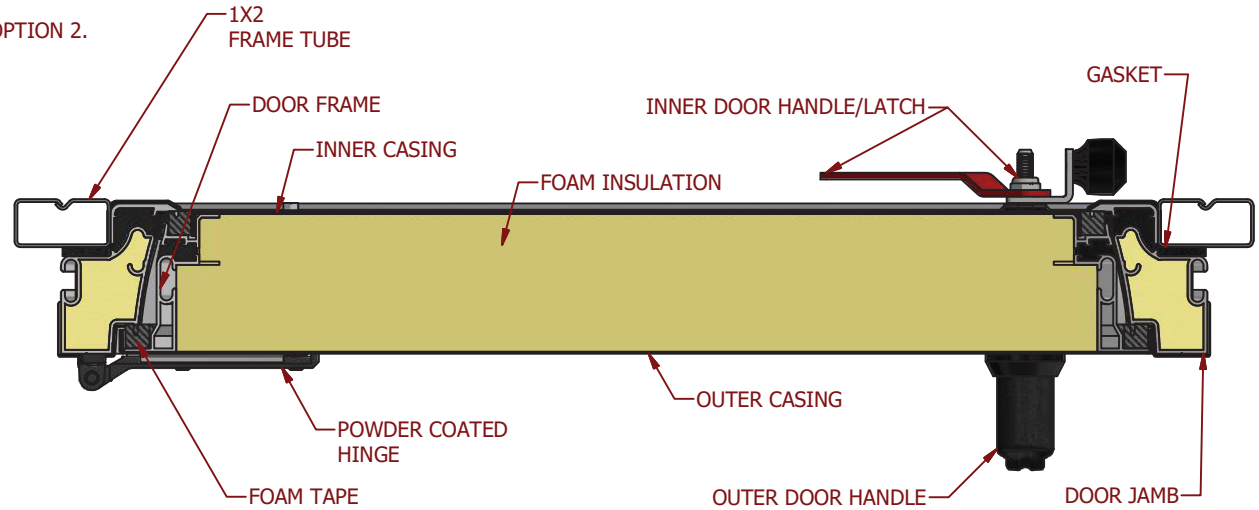
TITLE: DETAIL ACCESS DOOR, FOAM, IS, 3 INCH

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000012406	1 OF 1	-



AVAILABLE OPTIONS:

1. DUAL THERMAL PANE, UV RATED SAFETY GLASS OR FACTORY FABRICATED LOUVER. REFER TO UNIT DRAWING IF SPECIFIED.
2. TEST PORT.

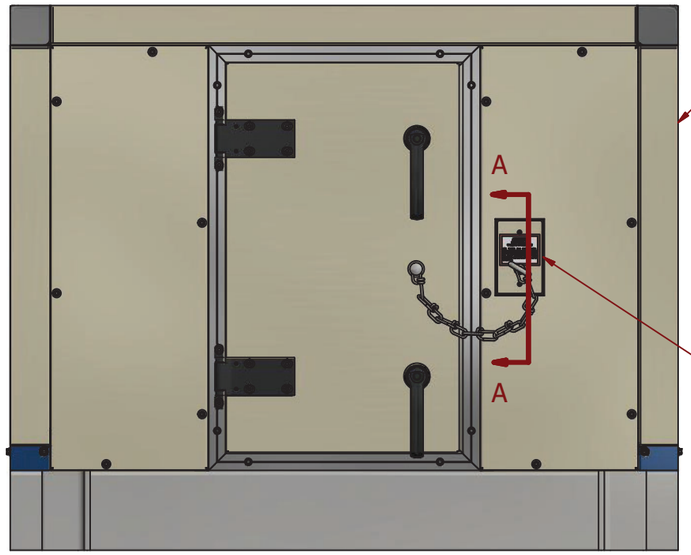


NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

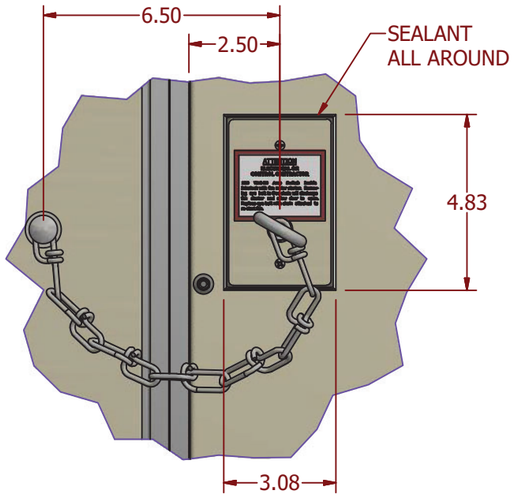
TITLE:

DETAIL, ACCESS DOOR, FOAM, OS, 3 INCH

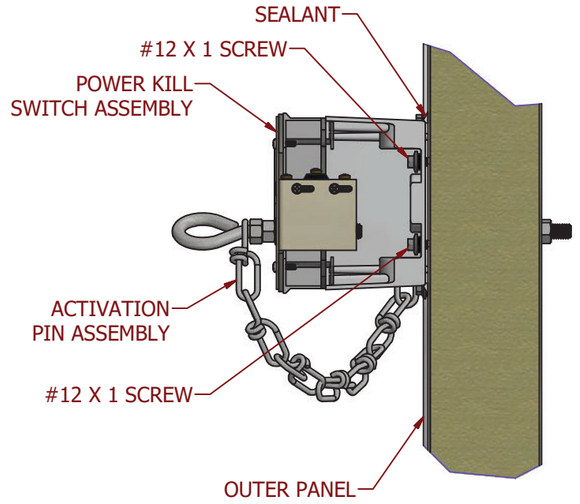
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000010325	1 OF 1	-



OUT-SWING DOOR CONFIGURATION

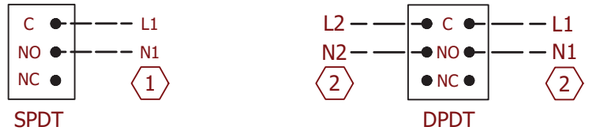


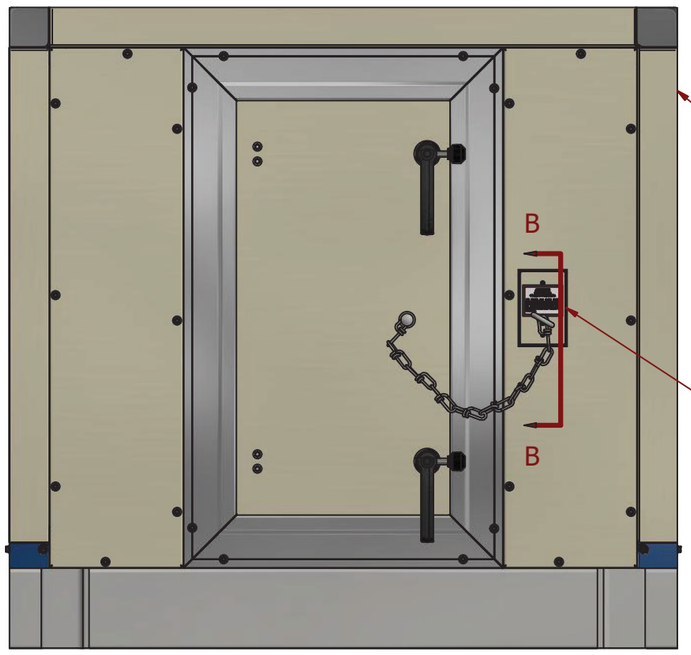
OUT-SWING DOOR



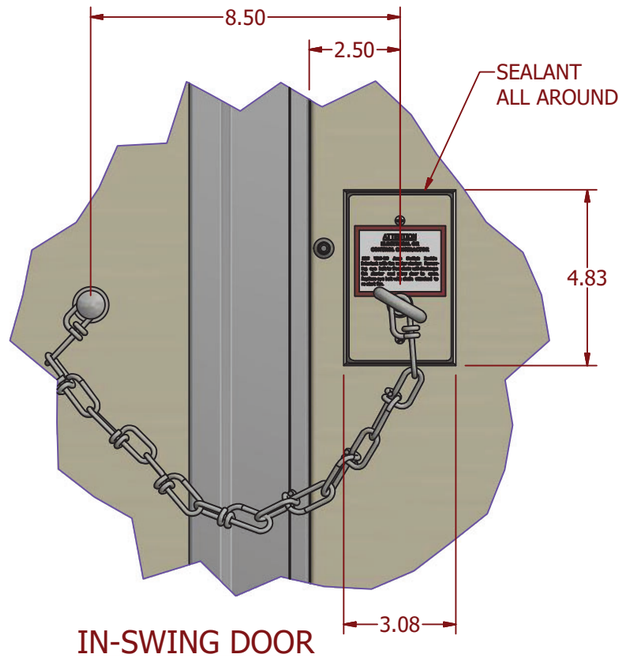
SECTION A-A/B-B

SPDT AND DPDT MICRO SWITCH ELECTRICAL DIAGRAM:





IN-SWING DOOR CONFIGURATION



IN-SWING DOOR

MICRO SWITCH SPECIFICATIONS:

SPDT MICRO SWITCH RATING:	DPDT MICRO SWITCH RATING:
20A @ 125, 250, OR 480VAC	10A @ 125 OR 250VAC
10A @ 125VAC (TUNGSTEN)	2A @ 480VAC
1/2A @ 125VDC/1 HP @ 125VAC	1/2A @ 125VDC/1/8 HP @ 125VAC
1/4A @ 250VDC/2 HP @ 250VAC	1/4A @ 250VDC/1/4 HP @ 250VAC

(1) SINGLE MOTOR CONTROL CIRCUIT OR SINGLE POWER SUPPLY CIRCUIT

(2) DUAL MOTOR CONTROL CIRCUIT OR DUAL POWER SUPPLY CIRCUIT

MECHANICAL PROTECTION REQUIREMENTS:

UL 1995, SECTION 11 REQUIRES ALL MOVING PARTS CAPABLE OF CAUSING BODILY INJURY TO BE GUARDED. ACCEPTABLE MEANS FOR PROTECTION INCLUDE:

- ENCLOSURES ACCESSIBLE ONLY WITH THE USE OF TOOLS SUCH AS UNIT CABINET EQUIPPED WITH TOOLED OPERATED DOOR LATCHES.
- INTERLOCKING MECHANISM TO DE-ENERGIZE DRIVE MOTOR POWER IF ACCESS IS OPENED.
- SCREEN REQUIRING TOOLS FOR REMOVAL OR PERMANENTLY ATTACHED.

AIR HANDLERS MANUFACTURED BY TEMTROL/GOVERNAIR/VENTROL ARE ETL LISTED AND ARE THEREFORE IN COMPLIANCE WITH UL 1995, SECTION 11.

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
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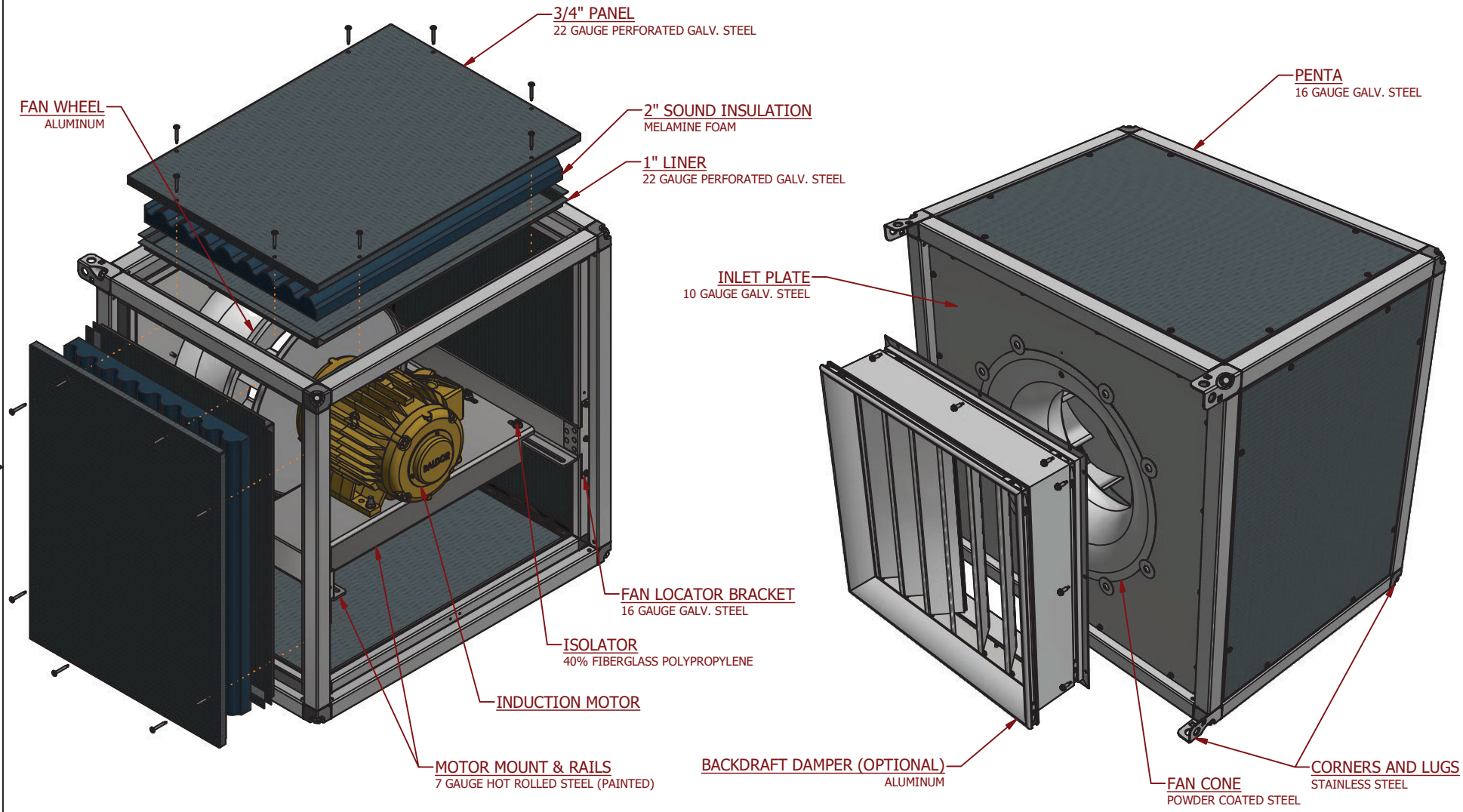
TITLE: DETAIL, ACCESS DOOR WITH POWER KILL SWITCH (PKS)

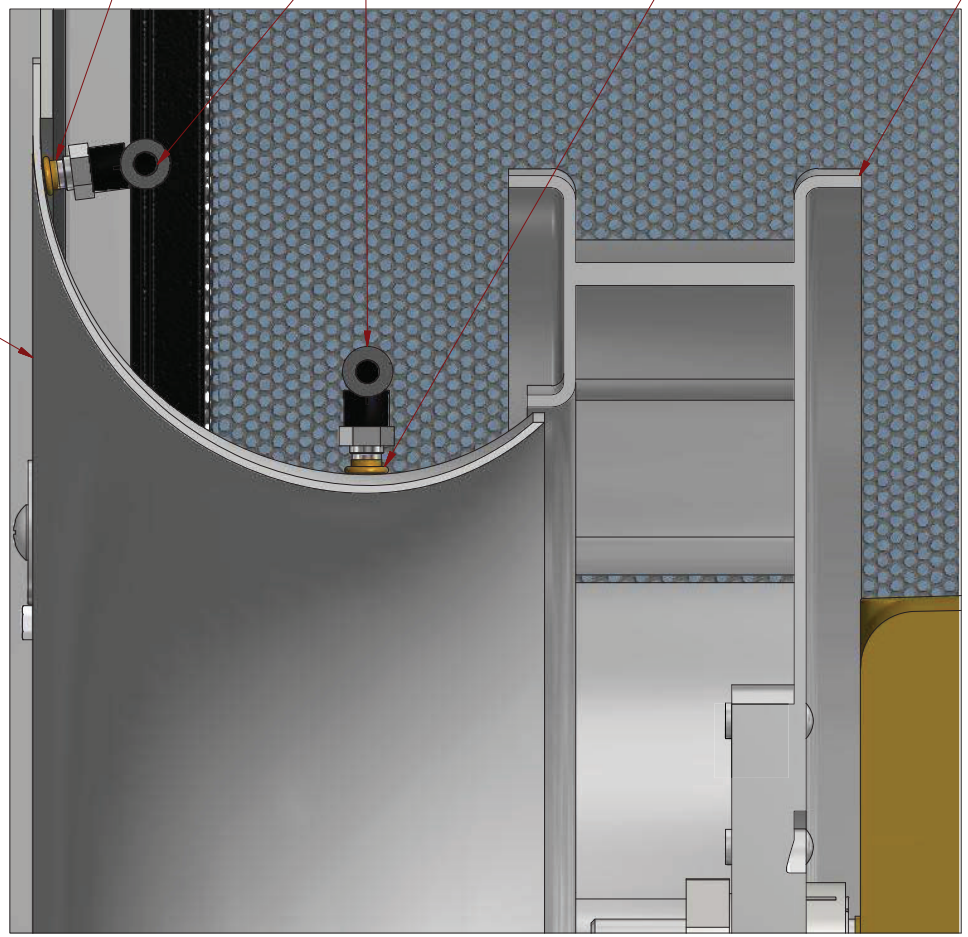
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
B	45-000017550	1 OF 1	



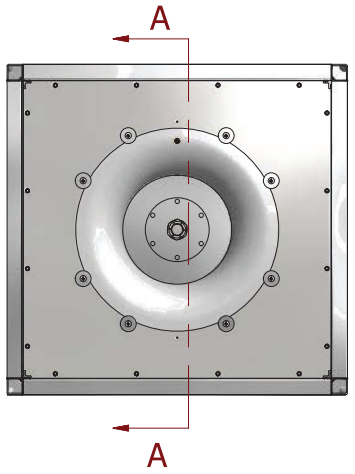
NORTEK™ AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:
DETAIL, FANCELL, STANDARD CONSTRUCTION, ALUMINUM WHEEL, INDUCTION MOTOR

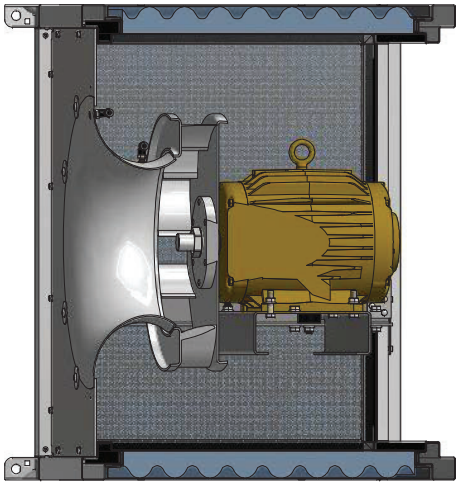
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000013390	1 OF 1	



SECTION A-A



FRONT VIEW



NORTEK AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

File Saved: 11:09am 01-16-2014

Title:

DETAIL, INLET CONE AIR MONITOR, ALUMINUM WHEEL, FANWALL

DRAWING NO.

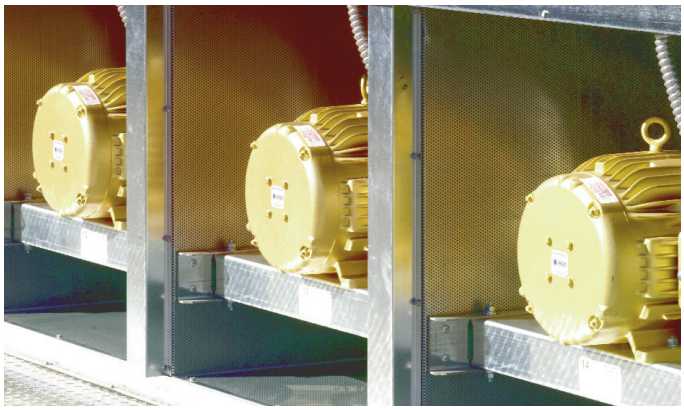
221.00185

Backdraft Damper for Air Handlers with FANWALL TECHNOLOGY®

Model FBD

Delivering Quality One Unit at a Time

New Backdraft Control Device



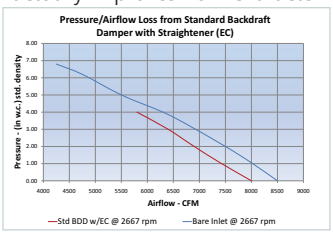
Why Temtrol

Since 1955, Temtrol, LLC. has earned a reputation for the manufacturing of innovative custom air handling equipment of the highest quality for commercial, institutional, and industrial applications. When you seek a manufacturer with flexibility in construction, products designed for long life, and one that delivers performance without compromise, specify Temtrol®.

Revolutionary Backflow Control Device

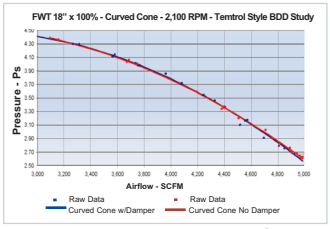
Air handlers are critical components in a building's air conditioning system. The redundancy of fan components in a multi-fan array adds to an air-handling unit's reliability. If you were to disable a fan or fans in a FANWALL® system during operation, how would you handle the backflow of air that would occur? The answer is the new patent pending model FBD backdraft damper.

The model FBD backdraft damper has a revolutionary new blade profile that laminarizes incoming air and actually improves flow characteristics. To illustrate this advantage, Graph 1 shows the significant system effect penalty associated with the addition of typical backdraft dampers (blue top line represents without damper, red bottom line represents with damper).



Graph 1 - Traditional backdraft damper system effect impact shown in red line.

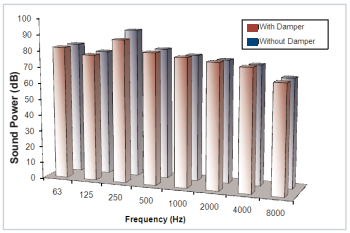
In striking contrast, Graph 2 illustrates the model FBD backdraft damper, which amazingly imposes near ZERO net effect on the system. The resulting performance of this remarkable new innovation is truly nothing short of revolutionary!



Graph 2 - Model FBD backdraft damper performance showing near zero system effect impact.

Acoustical Benefits

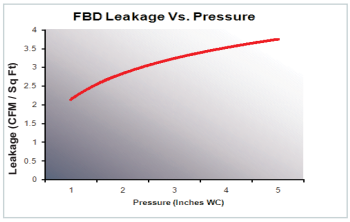
This laminarizing effect has a significant impact on the acoustical performance of the system as well. Graph 3 shows the acoustical comparison between a FANWALL cube using a FBD backdraft damper and again with a conventional backdraft damper. The acoustical performance is either essentially identical or significantly **improved** in every band.



Graph 3 - Sound comparison, by octave band, of FANWALL cube with model FBD backdraft damper (red front bars) and without backdraft damper (blue back bars).

Low Leakage Performance

The new model FBD backdraft damper has a "world class" low leakage rate of only two cfm/sq. ft. at one-inch of static pressure. This far exceeds requirements for a 1A class rating for control dampers. It is also nearly **nine times** less than the industry standard backdraft damper, which has a reported leakage of 17.5 cfm/sq. ft. at the same static pressure!

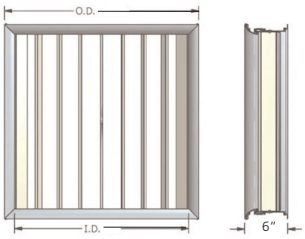


Graph 4 - Model FBD leakage rate test showing low leakage.

Important Features

- Non-corrosive extruded aluminum frame and blades
- Santoprene blade seals
- Low friction sealed metal ball bearings for long life and continuous operation

Three Sizes Cover Every Application

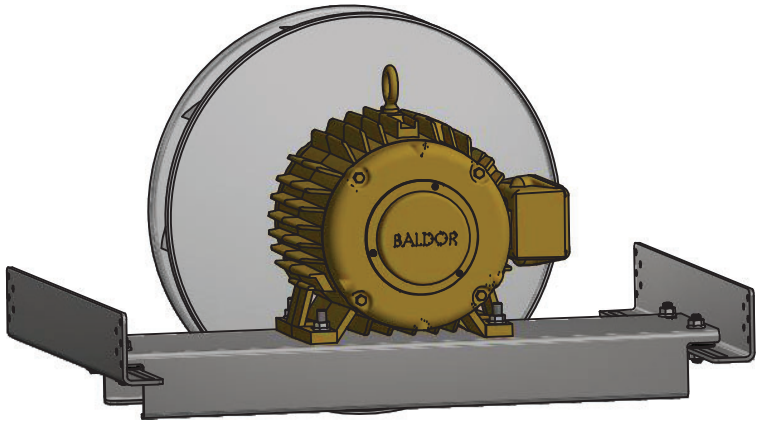


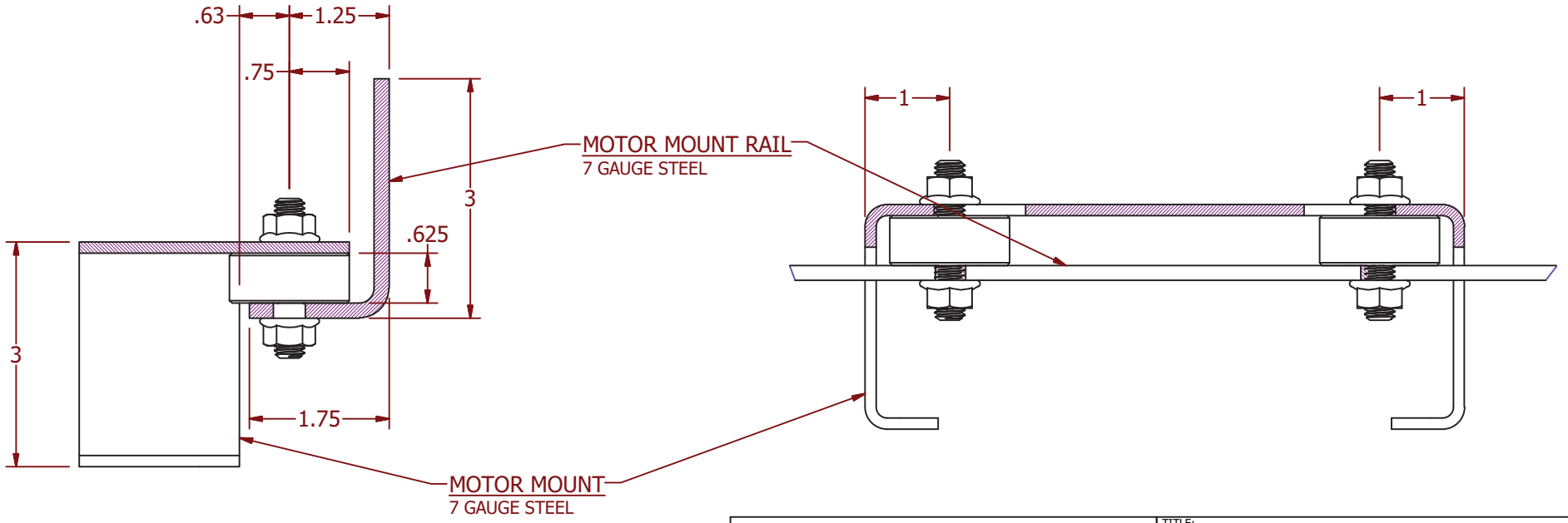
Model	Wheel / Cone Size							O.D.	I.D.	MAX TSP
	10"	12"	14"	16"	18"	20"	22"			
FBD-4	X							14.75	12"	12"
FBD-6		X	X	X				20.75	18"	12"
FBD-8					X	X	X	26.75	24"	12"

Contact your local CES Group Representative to learn more about the model FBD backdraft damper.

Temtrol®
A CES Group® Company

www.temtrol.com
temtrol@temtrol.com



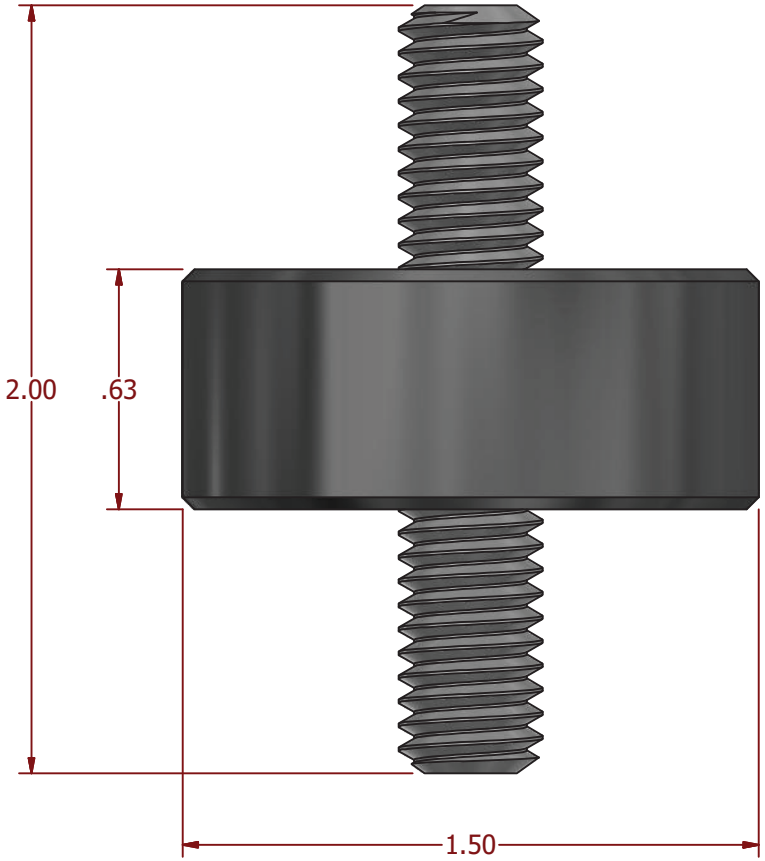


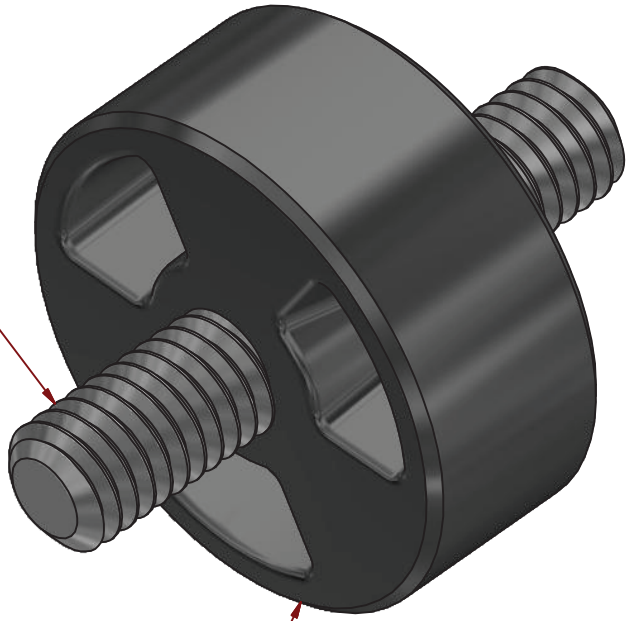
NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:

DETAIL, FANWALL MOTOR ISOLATION

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000064052	1 OF 1	-





NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:

DETAIL, ISOLATOR, MOTOR MOUNT, FANWALL

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000064041	1 OF 1	-

Chilled or Hot Water Coil

Type WC

Primary Surface

Round seamless copper tubes are mechanically expanded into the fin collars of the secondary surface. The mechanical expansion provides a permanent metal-to-metal bond for efficient heat transfer. Tubes are staggered in the direction of airflow.

Secondary Surface

Corrugated aluminum or copper plate type fin that is die-formed. Fin collars are full-drawn to provide accurate control of fin spacing and maximum contact with tubes.

Headers

Seamless copper with die-formed holes that provide a parallel surface to the coil tube for strong brazing joints. Standard 1/8" brass female pipe thread (FPT) vent and drain with optional 1/2" or 3/4". All circuiting is designed to gravity-drain with the coil mounted vertically and tubes running horizontally.

Connections

Red Brass Schedule 40 male pipe thread (MPT) std. with optional copper female pipe thread (FPT), sweat and Victaulic Red Brass available.

Casing

Casing is die-formed with 1½" flanges to permit easy stacking and mounting. Intermediate tube supports are supplied on coils over 44" fin length with an additional support every 42".

Testing and Performance

All coil assemblies are leak tested under water with nitrogen at 315 PSIG. Standard construction is suitable for 250 PSIG and up to 300 degrees F.

Performance is AHRI Certified™ to Air-Cooling and Air-Heating Coils AHRI Standard 410. Coil performance ratings are calculated using Temtrol AHRI Certified™ selection software.

Coil Options

Rows	Fin Height	Fin Length	Fin Spacing	Fin Thickness ALUMINUM	Fin Thickness COPPER	Tube O.D.Tube Thickness	Tube Spacing Face x Row	Casing	Max. Std. Operating Conditions
1,2, 3,4,5, 6,8, 10,12	6" to 60"	12" to 240"	1/2" 8 to 14 fins per inch 5/8" 6 to 14 fins per inch	1/2" 0.006" 5/8" 0.008" 0.010"	1/2" 0.006" 5/8" 0.006" 0.008" 0.010"	1/2" 0.017" 0.025" 5/8" 0.020" 0.025" 0.035" 0.049"	1/2" 1.25"x1.083" 5/8" 1.50"x1.299"	16 or 14 GA Galvanized Steel 304, 316 Stainless Steel	250 PSIG 300° F

AHRI CERTIFIED™ www.ahridirectory.org Air-Cooling and Air-Heating Coils AHRI Standard 410

NORTEK™ AIR SOLUTIONS TEMTROL

Specifications and illustrations subject to change without notice and without incurring obligation.

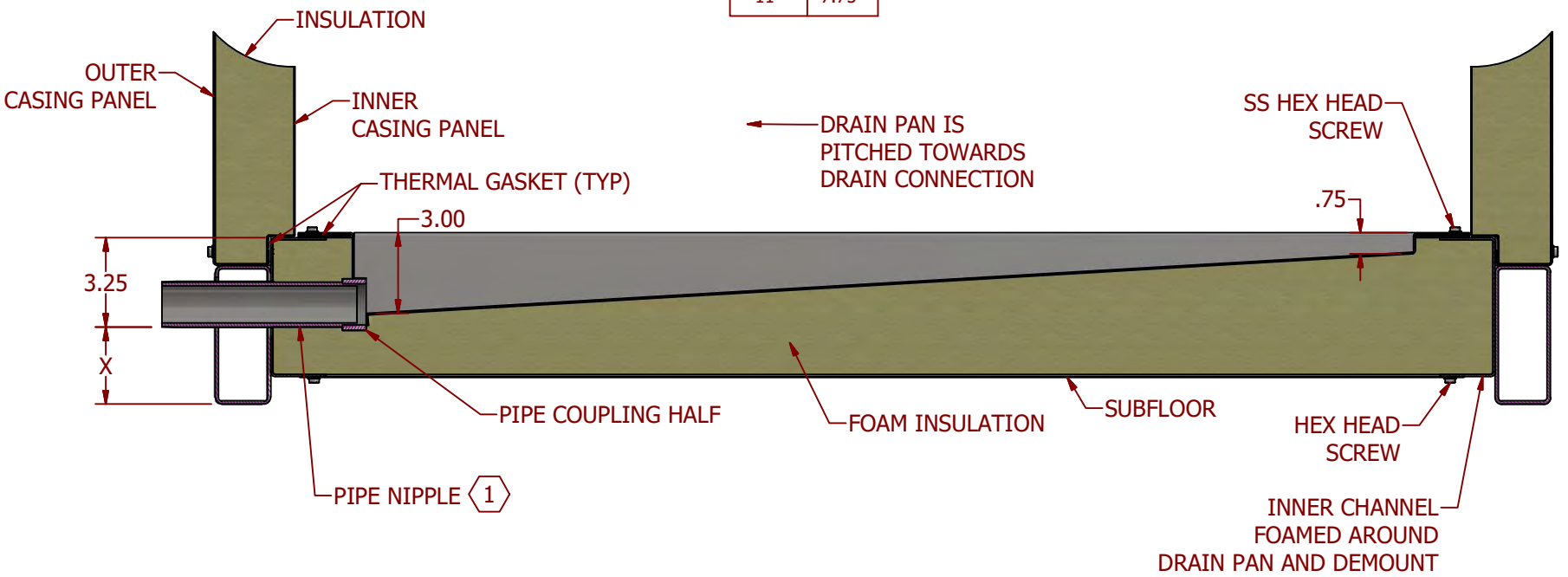
www.nortekair.com
nortekairinfo@nortek.com

172F-0519 (Replaces 172F-0418)

NOTES

1. 304/304L STAINLESS STEEL PIPE WITH HIGH CORROSION PROTECTION.
2. DOCUMENT PREVIOUSLY RELEASED AS 221.00071

BASE	X
5"	1.75"
6"	2.75"
7"	3.75"
□	5.75"
11"	7.75"



NORTEK AIR SOLUTIONS
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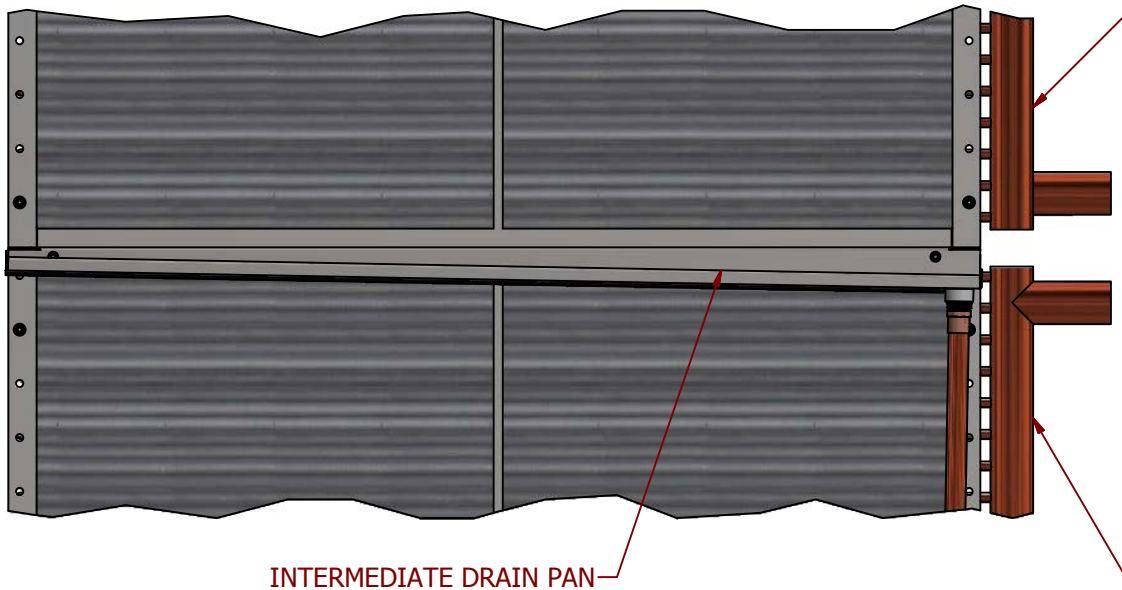
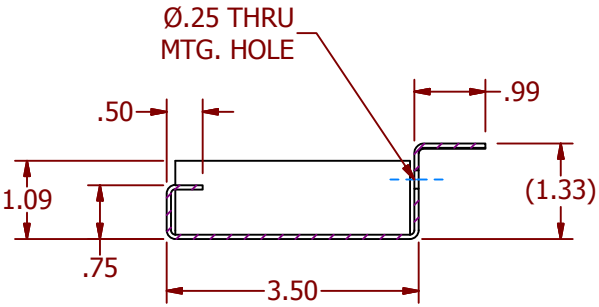
OKARCHE, OK 73762
PH: (405) 263-7286

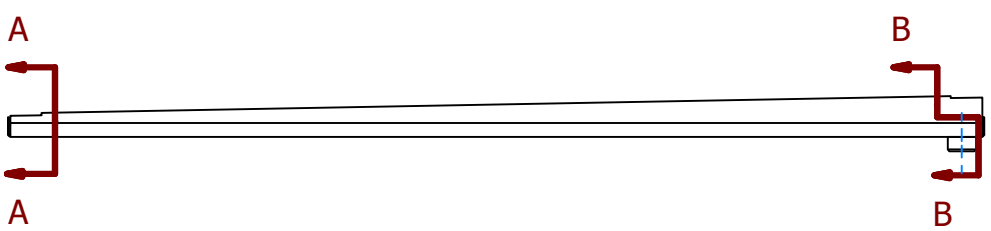
TITLE: DETAIL, DRAIN PAN, .75 IN TO 3 IN, BASE, ITF

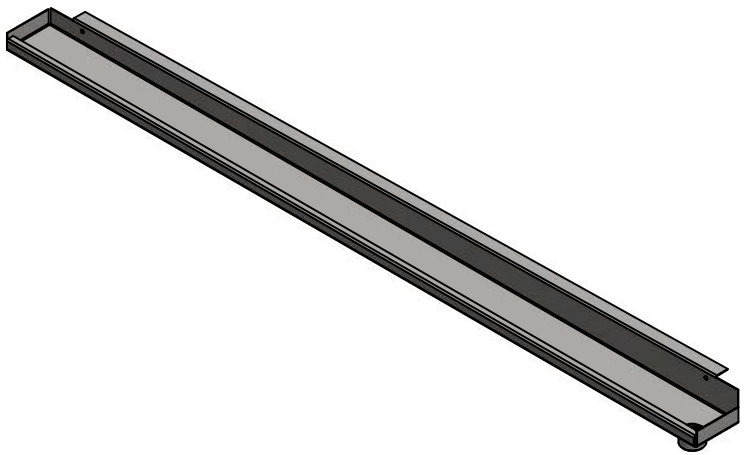
SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000040□76	1 OF 1	-

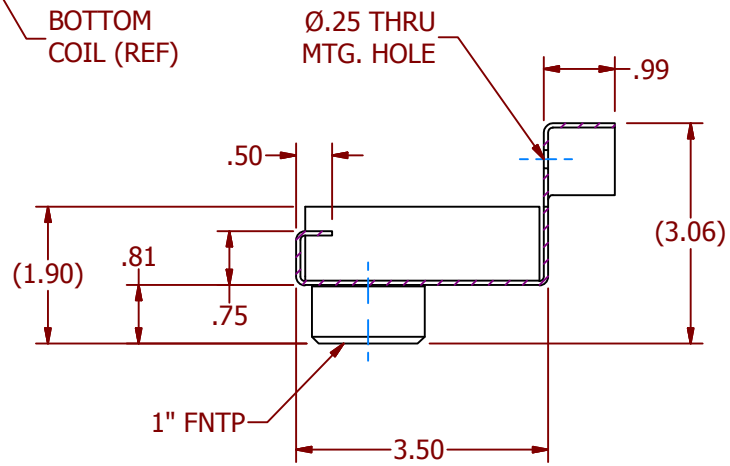




SECTION A-A







SECTION B-B

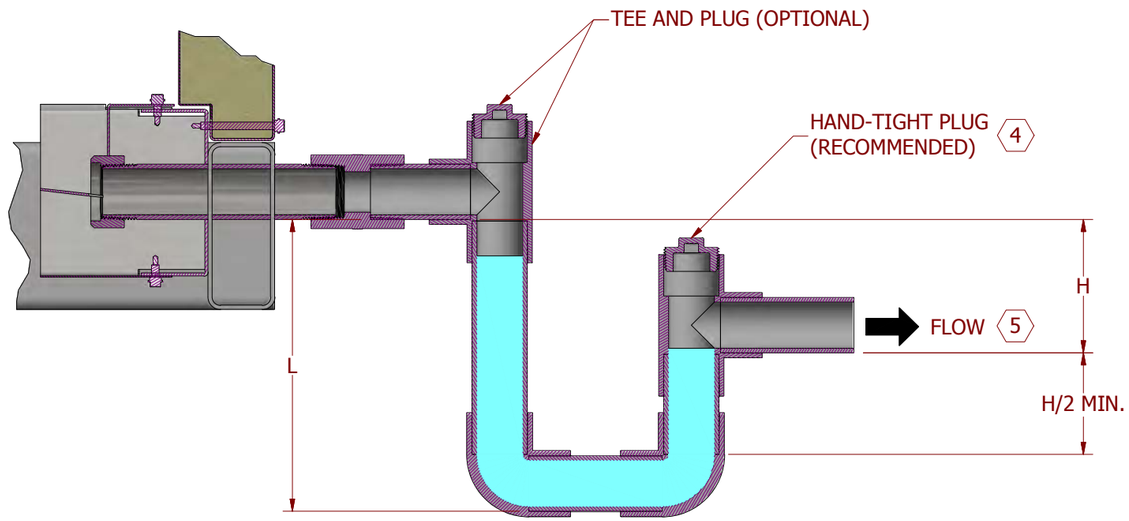
NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

TITLE:

DETAIL, DRAIN PAN, INTERMEDIATE, 3.5" WIDE

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
A	45-000024148	1 OF 1	B

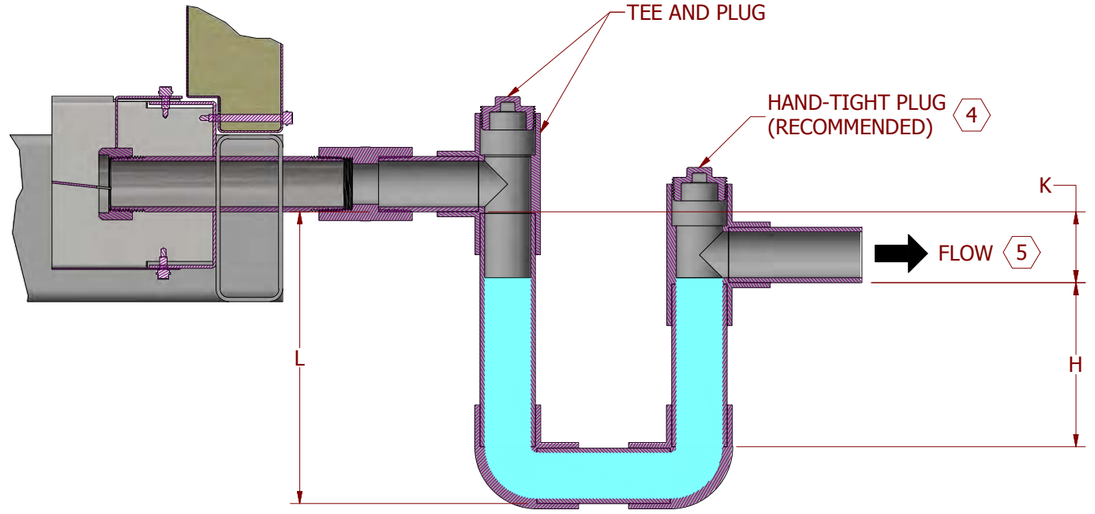
NEGATIVE (-) STATIC PRESSURE



L = H + H/2 + PIPE DIAMETER

H = STATIC PRESSURE IN DRAIN PAN SECTION (in. W.C.) + 1 INCH

POSITIVE (+) STATIC PRESSURE



L = H + K + PIPE DIAMETER

K = 1/2 INCH (MIN)

H = STATIC PRESSURE IN DRAIN PAN SECTION (in. W.C.) + 1/2 in (MIN)

1. ALL UNIT DRAIN CONNECTIONS TO BE TRAPPED SEPARATELY.
2. ALL CONDENSATE AND FLOOR DRAIN TRAP COMPONENTS TO BE FIELD SUPPLIED BY OTHERS AND CONSTRUCTED IN THE FIELD BY OTHERS.
3. IMPROPERLY TRAPPED DRAINS WILL RESULT IN FLOODING OF DRAIN PANS AND FLOOR DRAINS CAUSING POTENTIAL WATER DAMAGE TO AIR HANDLING UNIT AND OTHER BUILDING FACILITIES.
4. TRAPS TO BE PRIMED (WATER ADDED TO DOWN-STREAM SIDE OF TRAP) PRIOR TO UNIT START-UP. LIQUID SEAL TO BE MAINTAINED DURING UNIT OPERATION.
5. CONSULT LOCAL CODES FOR AIR GAP REQUIREMENTS.

REV	ECN #	DESCRIPTION	BY	APPVD	DATE
-					

REVISION HISTORY

DESCRIPTION	NUMBER

DOCUMENT REFERENCE

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
BENDS UTILIZE STANDARD BEND ALLOWANCE
TOLERANCES PER BELOW

MECHANICAL	SHEET METAL		
	FLAT		FINISHED
.X = ±.05	.X = ± .031	±	.125
.XX = ±.01	.XX = ± .015	±	.093
.XXX = ±.005	.XXX = ± .005	±	.060
ANGLES = ±1°			

FRACTIONS = ± 1/32" ANGLES = ± 1°
125 √ SURFACE FINISH BREAK ALL SHARP CORNERS

File Saved: 14:23:39 5/5/2016

NORTEK AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

	BY	DATE
DRAWN:	REYJ	4/15/2016
CHECKED:	WHEM	5/6/2016
APPROVED:	KRIM	5/9/2016

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

SCALE:

TITLE:

DESIGN STANDARD, TRAP, CONDENSATE AND FLOOR DRAINS

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
B	310.00082	1 OF 1	-

RUSKIN®

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

CD60

AMCA CLASS 1A LEAKAGE RATED, HIGH PERFORMANCE CONTROL DAMPER

APPLICATION

Ruskin model CD60 incorporates an exclusive one-piece steel frame construction, making it the engineer's preferred frame design with no fasteners required. Frame corners are internally braced and machine staked. Exclusive one-piece aerodynamic dual skin airfoil blades are suitable for medium and high pressure velocity applications. Blade edge seals are mechanically fastened to ensure years of sustainable performance and reliability. Frame and blade construction, in concert with compression type chambered jamb seals, ensures leakage performance on par with requirements of the International Energy Conservation Code (IECC). Factory mounted and commissioned actuators are among the available options.

STANDARD CONSTRUCTION

FRAME
5" x 1" x 16 gauge (127 x 25 x 1.6) hot dipped galvanized steel hat channel reinforced with corner braces.

BLADES
Galvanized steel, one piece airfoil shaped, construction of 14 gauge (2.0) equivalent thickness, typically 6" (152) wide, maximum 8 5/8" wide. Opposed blade action standard, parallel blade action optional.

AXLES
1/2" (13) plated steel hex.

BEARINGS
Oil impregnated, self-lubricating, stainless steel sleeve.

BLADE SEALS
Ruskiprene blade edge seals mechanically fastened to blades.

JAMB SEALS
300 Series stainless steel cambered compression type.

LINKAGE
Shake proof Swedgelock™ plated steel assembly, concealed out of airstream.

CONTROL SHAFT
1/2" (13) dia. x 6" (152) long plated steel shaft on single section units.
1/2" (13) dia. jackshaft on multi-section assemblies up to 12 1/2 ft² (1.16 m²) and 1" (25) dia. jackshaft multi-section assemblies over 12 1/2 ft² (1.16 m²)

MAX PRESSURE
Up to 13 inches w.g. (see Performance Data on page 2).

MAX VELOCITY
Up to 6000 FPM (see Performance Data on page 2).

LEAKAGE
Class 1A (see Performance Data on page 2).

TEMPERATURE LIMITS
-72°F (-58°C) minimum and +275°F (+135°C) maximum.

MINIMUM SIZE
Single blade – 8"w x 6"h (203 x 152).
Two blades, opposed or parallel action: 8"w x 10"h (203 x 254).

MAXIMUM SIZE
Single section – 60"w x 72"h (1524 x 1829).
Multiple section assembly – Unlimited size.
(Units over 60"w or 72"h (1524 x 1829) are built in multiple equal size sections)

ESTIMATED SHIPPING WEIGHT
7 lbs. (3.2kg) per square foot.

CERTIFICATE NUMBER AJA07/11923

FEATURES

- One-piece airfoil blade for low pressure drop.
- One-piece interlocking frame design to reduce racking.
- Positive lock axles, noncorrosive bearings and shake proof linkage for low maintenance operation.

VARIATIONS

Ruskin model CD60 is available with the following variations at additional charge.

- Factory mounted and commissioned electric and pneumatic actuators, chain pull devices and manual locking handles.
- Front, rear or double flange frame with or without bolt holes.
- Stainless steel axles and linkage.
- SP100 switch package to remotely indicate damper blade position.
- Factory mounted sleeves with optional round or oval transitions.
- Enamel and epoxy finishes.
- Silicone blade edge seals.

NOTES

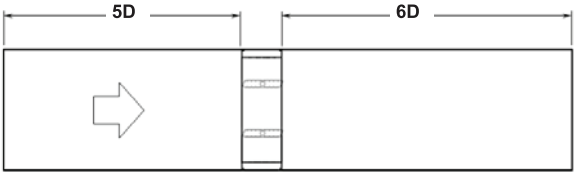
* Value shown in parenthesis ( ) are millimeters unless otherwise indicated.
* Units furnished approximately 1/4" (6) smaller than given opening dimensions.

AMCA LICENSED PERFORMANCE DATA

Pressure Drop Data

CD60 air performance testing is performed in accordance with AMCA Standard 500-D configuration 5.3 as illustrated below. All data are corrected to standard air density of .075 lb/ft³ (1.201 kg/m³).

$$D = \sqrt{\frac{4\,(W)\,(H)}{3.14}}$$



AMCA figure 5.3 was established to represent a fully ducted damper with straight duct upstream and downstream. With entrance and exit losses minimized by this straight duct arrangement, this configuration has the lowest pressure drop of all three configurations.

12" x 12" (305 x 305)		24" x 24" (610 x 610)		36" x 36" (914 x 914)		12" x 48" (305 x 1219)		48" x 12" (1219 x 305)	
Velocity (fpm)	Pressure Drop (in.wg)	Velocity (fpm)	Pressure Drop (in.wg)	Velocity (fpm)	Pressure Drop (in.wg)	Velocity (fpm)	Pressure Drop (in.wg)	Velocity (fpm)	Pressure Drop (in.wg)
499	0.02	506	0.005	517	0.005	508	0.005	509	0.01
869	0.06	998	0.03	1007	0.02	1002	0.03	1005	0.04
1417	0.17	1514	0.06	1404	0.03	1519	0.06	1523	0.08
1980	0.34	2012	0.11	1949	0.05	2019	0.10	2024	0.16
2986	0.79	2867	0.22	3004	0.12	2883	0.21	2884	0.32

Leakage Data

Air Leakage testing is performed in accordance with ANSI/AMCA Standard 500-D, figure 5.5.

Data are based on a torque of 7 in-lbs/ft² (.56 N.m./m²) applied to close and seat the damper during the test.

Air Leakage is based on operation between 32°F - 120°F (0°C - 49°C).

CD60	LEAKAGE CLASS*			
Maximum Damper Width	1" w.g. (0.25 kPa)	4" w.g. (1 kPa)	8" w.g. (2 kPa)	10" w.g. (2.5 kPa)
60" (1524)	1A	1	NA	NA

*** Leakage Class Definitions**

As defined by AMCA, the maximum allowable leakage is as follows:

Leakage Class 1A (is only defined @ 1" wg)
- 3 cfm/ft² (.92 cmm/m²) @ 1" wg (0.25 kPa)

Leakage Class 1
- 4 cfm/ft² (1.22 cmm/m²) @ 1" wg (0.25 kPa)
- 8 cfm/ft² (2.44 cmm/m²) @ 4" wg (1 kPa)
- 11.3 cfm/ft² (3.45 cmm/m²) @ 8" wg (2 kPa)
- 12.6 cfm/ft² (3.85 cmm/m²) @ 10" wg (2.5 kPa)

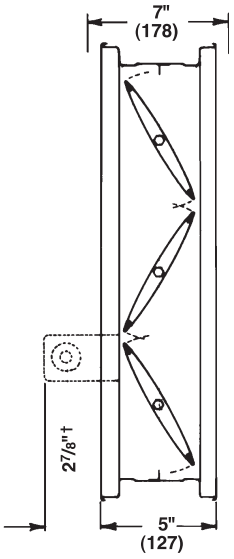
Maximum System Velocity and Pressure

The CD60 may be used in systems with total pressures exceeding 3.5" w.g. (.09 kPA) and velocities exceeding 3000 fpm (15.2 m/s) by reducing damper section width as indicated below:

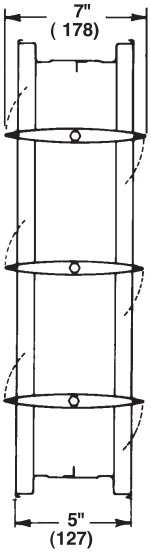
VELOCITY AND PRESSURE DATA		
DAMPER WIDTH INCHES	MAXIMUM SYSTEM PRESSURE In. wg (kPa)	MAXIMUM SYSTEM VELOCITY FPM (m/s)
60" (1524)	3.5" (0.9)	3000 (15.2)
48" (1219)	6.2" (1.5)	4000 (20.3)
36" (914)	8.5" (2.1)	4000 (20.3)
24" (610)	10.8" (2.7)	5000 (25.4)
12" (305)	13.0" (3.25)	6000 (30.5)

Ruskin Company certifies that model CD60 shown herein is licensed to bear the AMCA seal. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program.

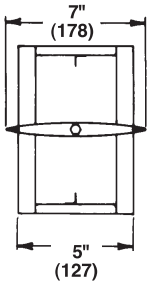
DIMENSIONAL INFORMATION



OPPOSED BLADE



PARALLEL BLADE



Low profile frame illustrated is typical for units under 12" (305) high.

CD60 SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans, or in accordance with schedules AMCA certified, low leakage airfoil control dampers meeting the following minimum construction standards. Control dampers shall be produced in an ISO9001 certified factory. Frame shall be one-piece uniframe construction of 16 ga. (1.6) galvanized steel roll formed hat channel structurally equivalent to a minimum 13 ga. (2.4) frame. Blades shall be 14 ga. (2.0) equivalent galvanized steel, roll-formed airfoil type for low pressure drop and low noise generation. Blade edge seals shall be Ruskiprene™ TPV type or equivalent mechanically locked into the blade edge. Adhesive or clip-on type seals are unacceptable. Jamb seals shall be stainless steel chambered compression type to prevent leakage between blade end and damper frame. Blade end overlapping frame is unacceptable. Multiple section dampers must have factory installed jackshafts unless clearly eliminated by engineer. Bearings shall be 304 stainless steel, oil impregnated, and self-lubricating sleeve type with a 450 pound (204 kg) minimum radial crush load. Bearings shall turn in extruded holes in the damper frame. Axles shall be hexagonal positively locked into the damper blade. Linkage shall be concealed out of airstream, within the damper frame to reduce pressure drop and noise. Temperature limits shall be -72°(-58°C) to +275°F (+135°C). Submittal must include leakage, maximum air flow and maximum pressure ratings based on AMCA Publication 500. Damper shall be tested and licensed in accordance with AMCA 511 for Air Performance and Air Leakage. Damper widths from 12" to 60" (305 to 1524) wide shall not leak any greater than 3 cfm/sq.ft. at 1" w.g. (15.2 l/s-m^2 at .25 kPa). Dampers shall be equivalent in all respects to Ruskin Model CD60.

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AMS050
AIR MEASURING STATION WITH INTEGRAL DAMPER

APPLICATION

The AMCA certified AMS050 combines an air measuring station with an ultra low-leak, high performance control damper. The complete assembly is tested to provide effective setpoint monitoring and adjustment. The unit is class 1A leakage and performance rated and includes a honeycomb airflow straightener, pressure sensing station and a high performance glass-on-silicone pressure transducer. The sensing blades are extruded aluminum with a clear anodize finish. The AMS050 can be used with any building automation system. Multiple control options are available.

STANDARD CONSTRUCTION

SLEEVE
15" (381mm) long x 16 gauge (1.6) galv. G60 (for slip-fit duct connection).

AIR FLOW STRAIGHTENER
.50" (13mm) Honeycomb Cell x 3" (76mm) 3000 series aluminum alloy.

SENSOR BLADE
6063T6 extruded aluminum, clear anodize finish.

SENSOR PORT FITTINGS
Brass.

PRESSURE TRANSDUCER:
RU-274-R2-VDC, 0-5 or 0-10 VDC output (field selectable).
Output signal is proportional to flow.

ACCURACY
3% Deviation Average Across Measurement Range.

POWER REQUIREMENTS
12-40 VDC or 12-35 VAC.

DAMPER BLADES
6" (152mm) wide, 6063T6 extruded aluminum, airfoil shape.

SEALS
Ruskiprene blade edge seals and stainless jamb seals.

BEARINGS
Molded synthetic.

LINKAGE
Plated steel, concealed in frame.

AXLES
.50" (13mm) plated steel hex.

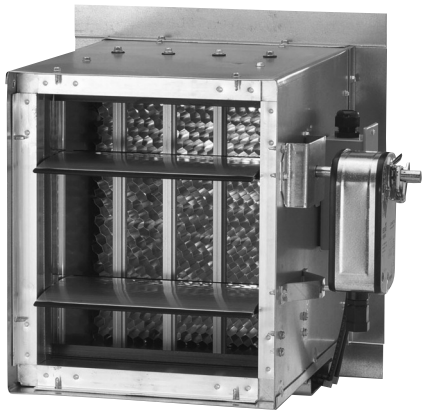
MINIMUM SIZE
Single-6"w x 6"h (152mm x 152mm).

MAXIMUM SIZE
Single section - 60"w x 72"h (1524mm x 1829mm).
Multiple section assembly - unlimited.

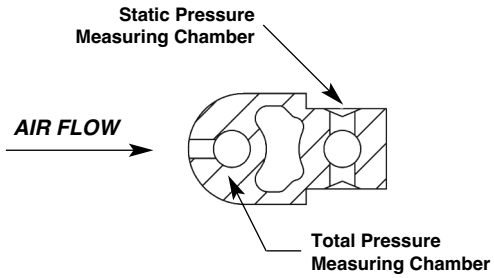
VELOCITY REQUIREMENTS
Product Range - 300 to 5000 FPM (1.5 to 25 m/s).
Operating Range - 300 to 2,000 FPM (1.5 to 10.2 m/s).
-Standard units with RU274-R2-VDC (1.5 to 25 m/s).
Operating Range - 300 to 5,000 FPM.
-Units with Ruskin's VAFB24-BAC RAMS Air Measurement BACnet actuator/controller and/or AMS810 or AMS810 (high pressure) transducer.

OPERATING TEMPERATURE
-22° F to +140° F standard (-30°C to 60°C).

Ruskin Company certifies that the AMS050 Air Monitoring Station shown herein is licensed to bear the AMCA Certified Rating Seal - Airflow Measuring Station Performance. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 611 and comply with requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to airflow measurement performance only.



AMS050 shown with External Right Hand Construction (Standard)



FEATURES

- Low-leak Class 1A Damper
- Honeycomb airflow straightener
- Anodized aluminum sensing blades
- Factory piped low pressure transducer with 0-10 VDC output

Ruskin AMS050 helps satisfy the requirements for minimum outside air as required by the following.
- ASHRAE 62.1, 90.1 and 189.1.
- California Title 24
- International Mechanical Code (IMC)
- International Energy Conservation Code (IECC)

VARIATIONS

The AMS050 is available with several options to fit your specific application.
- Stainless steel axle bearings
- Stainless steel linkage (includes axles, tie bars & control arms)
- Special material, flanged or extended sleeve
- AMS810 pressure transducer with LCD display
- Ruskin's VAFB24-BAC RAMS Air Measurement BACnet actuator/controller

Package includes factory calibration of control module and air measurng station in a complete turnkey assembly (reference VAFB24-BAC RAMS data sheet)

Notes:

1. Values shown in ( ) indicate metric units.
2. Refer to installation manual for additional details
3. To order, send completed Order Process Sheet with purchase order.

AIR PERFORMANCE

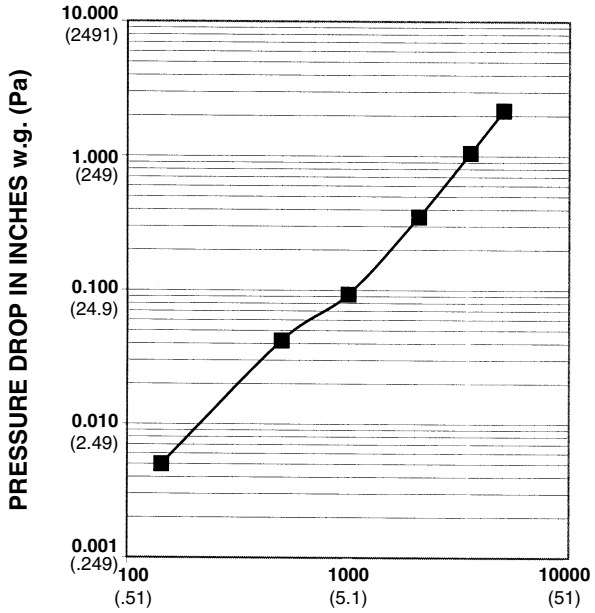
AMCA TEST FIGURE 1									AMCA TEST FIGURE 2								
PAMS		Reference Volume		Reference Velocity		Indicated Volume		% Deviation Average = 2.09%	PAMS		Reference Volume		Reference Velocity		Indicated Volume		% Deviation Average = 2.09%
In. W.G.	Kpa	CFM	l/s	FPM	m/s	CFM	l/s	2.09%	In. W.G.	Kpa	CFM	l/s	FPM	m/s	CFM	l/s	-0.759%
AIR PERFORMANCE SIZE 12" x 12" (305mm x 305mm)																	
4.190	1.004	5,070	2,393	5,070	25.76	5,199	2,454	2.55%	4.040	1.006	5,008	2,364	5,008	25.44	5,104	2,049	1.93%
2.010	0.501	3,563	1,682	3,563	18.10	3,585	1692	0.62%	2.260	0.563	3,791	1,789	3,791	19.26	3,804	1,795	0.35%
0.650	0.162	2,074	979	2,074	10.54	2,025	956	-2.37%	0.670	0.167	2,163	1,021	2,163	10.99	2,056	970	-4.94%
0.150	0.037	995	470	995	5.05	964	455	-3.12%	0.190	0.047	1,085	512	1,085	5.51	1,087	513	0.14%
0.045	0.011	498	235	498	2.53	524	247	5.25%	0.040	0.010	548	25	548	2.78	494	233	-9.89%
0.005	0.001	143	67	143	0.73	172	81	20.55%	0.005	0.001	143	67	143	0.73	172	81	20.6%
AIR PERFORMANCE SIZE 24" x 24" (610mm x 610mm)																	
4.070	1.014	20,030	9,453	5,008	25.44	20,669	9,755	3.19%	3.75	0.934	20,174	9,521	5,044	25.62	19,924	9,403	-1.24%
1.905	0.475	13,888	6,554	3,472	17.64	13,902	9,894	0.10%	1.77	0.441	14,094	6,652	3,524	17.90	13,659	6,446	-3.09%
0.610	0.152	7,925	3,740	1,981	10.06	7,669	3,619	-3.23%	0.54	0.135	8,056	3,802	2,014	10.23	7,518	3,518	-6.67%
0.170	0.042	4,017	1,896	1,004	5.10	3,934	1,857	-2.06%	0.14	0.035	4,006	1,891	1,002	5.09	3,813	1,800	-4.81%
0.100	0.025	3,004	1,418	751	3.82	2,982	1,407	-0.74%	0.13	0.032	3,983	1,880	996	5.06	3,674	1,734	-7.77%
0.018	0.004	1,183	558	296	1.50	1,217	574	2.90%	0.04	0.0101	1,996	942	499	2.53	2,031	959	1.75%
AIR PERFORMANCE SIZE 36" x 36" (914mm x 914mm)																	
3.790	0.944	45,485	21,467	5,054	25.67	48,031	22,668	5.60%	0.894	1.006	45,100	21,285	5,011	25.46	46,707	22,043	3.56%
1.780	0443	31,557	14,893	3,506	17.81	32,532	15,353	3.09%	0.428	0.563	31,650	14,937	3,517	17.87	31,962	1,5084	0.99%
0.570	0.142	18,158	8,570	2,018	10.25	18,086	8,536	-0.40%	0.135	0.167	18,193	8,586	2,021	10.27	17,589	8,301	-3.32%
0.150	0.037	9,052	4,272	1,006	5.11	9,087	4,289	0.39%	0.032	0.047	8,774	4,141	975	495	8,441	3,984	-3.79%
0.140	0.05	8,757	4,133	973	4.94	8,770	4,139	0.15%	0.010	0.010	4,491	2,120	499	2.53	4,597	2,170	2.37%
0.015	0.004	2760	1,303	307	1.56	2,773	1309	0.46%	0.004	0.001	2,763	1,304	307	1.56	2,773	1,309	0.35%

Pressure Drop		VolumeCFM		Velocity	
in WG	Pa	CFM	l/s	FPM	m/s
AIR FLOW RESISTANCE 12" x 12" (305mm x 305mm)					
2.174	541.5	5,040	2,378	5,040	25.60
1.052	148.2	3,562	1,681	3,562	18.10
0.352	51.1	2,082	982	2,082	10.58
0.093	17.4	1,000	472	1,000	5.08
0.042	10.0	500	236	500	2.54
0.005	2.5	144	68	144	0.73
AIR FLOW RESISTANCE 24" x 24" (610mm x 610mm)					
1.235	307.6	20,762	9,799	5,191	26.37
0.595	148.2	14,173	6,689	3,543	18.00
0.205	51.1	7,994	3,773	1,999	10.15
0.070	17.4	4,204	1,984	1,051	5.34
0.040	10.0	3,220	1,520	805	4.09
0.010	2.5	1,359	641	339	1.73
AIR FLOW RESISTANCE 36" x 36" (914mm x 914mm)					
0.643	160.2	45,176	21,320	5,020	25.50
0.307	76.5	31,469	14,851	3,497	17.76
0.113	28.	18,153	8,567	2,017	10.25
0.036	9.0	9,051	4,272	1,006	5.11
0.031	7.7	8,763	4,136	974	4.95
0.010	2.5	4,486	2,117	498	2.53
0.005	1.2	2,760.	1,303	307	1.56
0.000	0.0	1,372	647	152	0.77

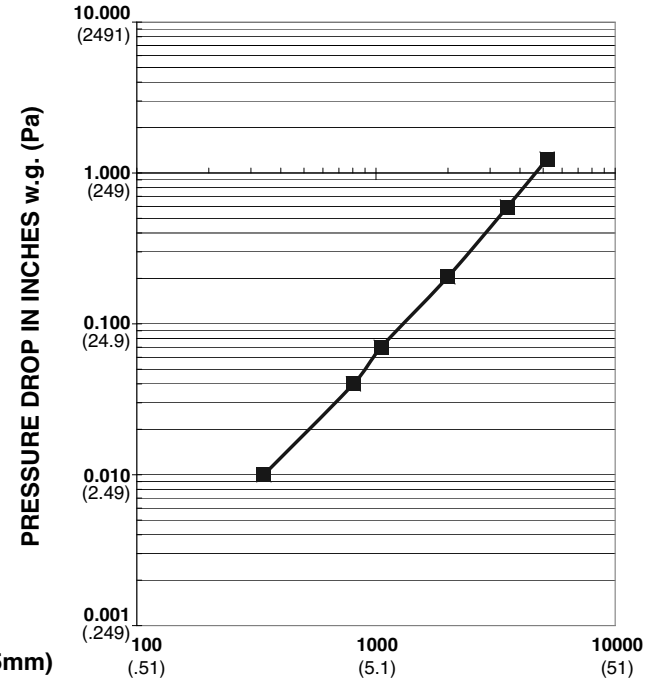
CFM = (K) x (PAMS^M)		
SIZE	**K**	**M**
12" x 12" (304mm x 305mm)	2518 (784.05)	0.5061
24" x 24" (610mm x 610mm)	9928 (2825.5)	0.5224
36" x 36" (914mm x 914mm)	24166 (7142.2)	0.51555

Ruskin Company certifies that the AMS050 Air Monitoring Station shown herein is licensed to bear the AMCA Certified Rating Seal - Airflow Measuring Station Performance. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 611 and comply with requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to airflow measurement performance only.

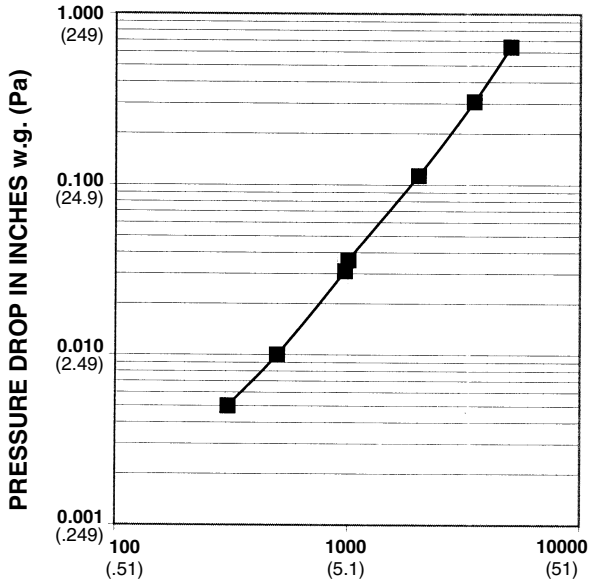
AIR PERFORMANCE



FACE VELOCITY - FEET MINUTE (m/s)
PRESSURE DROP of AMS050 SIZE 12" x 12" (305mm x 305mm)



FACE VELOCITY - FEET MINUTE (m/s)
PRESSURE DROP of AMS050
SIZE 24" x 24" (610mm x 610mm)



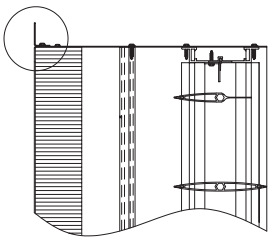
FACE VELOCITY - FEET MINUTE (m/s)
PRESSURE DROP of AMS050 SIZE 36" x 36" (305mm x 305mm)

Ruskin Company certifies that the AMS050 Air Monitoring Station shown herein is licensed to bear the AMCA Certified Rating Seal - Airflow Measuring Station Performance. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 611 and comply with requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to airflow measurement performance only.

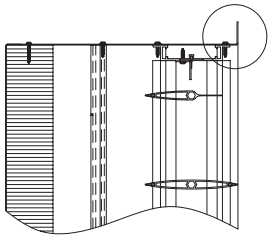
NOTES

1. Ratings are based on AMCA Standard 610-93 Test Setup figure 1 using differential pressure output.
2. Performance of the AMS050 will be ±3% of curve shown for AMCA 610-93 Test Fig. 1 applications.
3. Size and shape tested include 12" x 12", 24" x 24" (305mm x 305mm, 610mm x 610mm) and 36" x 36" (914mm x 914mm) rectangular. Rated sizes from .5 square feet to 18 square feet ($1.67m^2$).
4. Indicated volumes = *(K) (PAMS^M)*

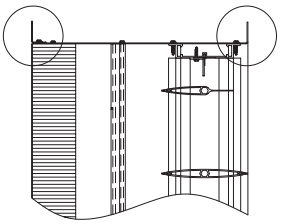
MOUNTING FLANGE OPTIONS



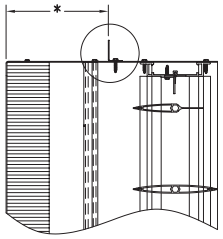
FRONT FLANGE



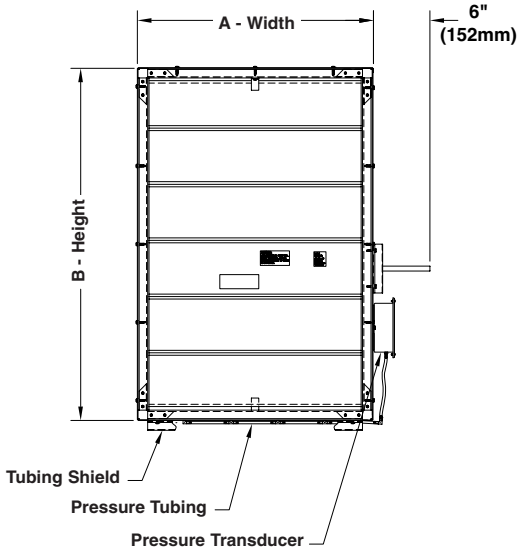
REAR FLANGE

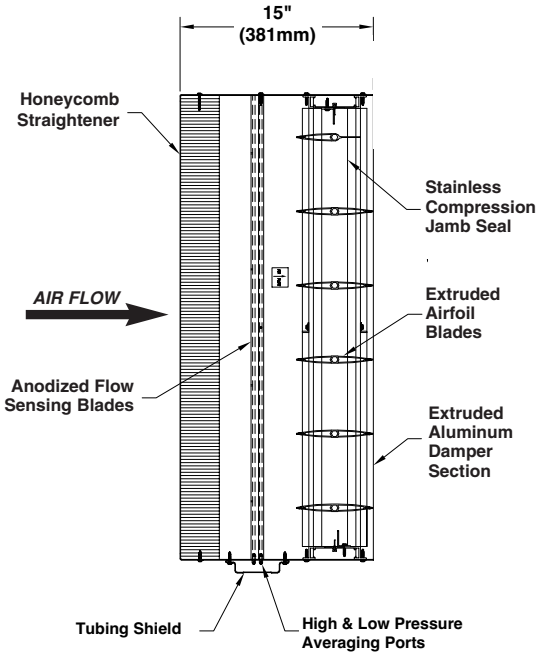


DOUBLE (FRONT & REAR) FLANGE



OFFSET FLANGE
Specify Dimensions





SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans or as in accordance with schedules, an air measuring station with integral pressure transducer and class 1a leakage extruded aluminum control damper. The complete air measuring package shall be factory assembled into one turnkey product and calibrated for the specific job requirements. Unit shall have a measuring range from 300 to 2,000 FPM (1.5 to 10.2 m/s). The Air measuring station shall consist of .50" x 3" (13mm x 76mm) 3000 series aluminum alloy honeycomb, 6063T6 extruded aluminum sensing blades with anodized finish and a glass-on-silicone GL-Si capacitance sensor pressure transducer capable of measuring up to six field selectable pressure ranges up to 1" water column (249 Pa). The transducer shall be accurate to ±1% of full scale and be contained in a NEMA 4 (IP-65) painted steel enclosure.

Transducer shall be factory mounted and piped to high and low brass pressure fittings from the sensor averaging ports. All sensor tubing shall terminate in solid brass barbed fittings. Tubing and associated fittings to be contained in a formed steel protective tubing shield to protect pressure station during transit. The damper section shall consist of 6063T6 extruded aluminum frame and blades. Blade edge seals shall be extruded TPR double edge design with inflatable pocket to enable air pressure to assist in seal-off and shall be mechanically locked in extruded blade slots. Adhesive or clip-on type seals are not acceptable. Axle bearings shall be non-corrosive molded synthetic and shall be molded to fit the hexagonal damper shaft to reduce leakage. Linkage shall be concealed in a linkage chase with dust cover to prevent collection of airborne particles to accumulate on the mechanical parts. Complete assembly shall be constructed, piped and commissioned in an ISO 9001 certified facility. Air Measuring Stations accuracy shall be 3% deviation average across the entire range. The damper and measuring station assembly shall be tested as a complete assembly and shall be licensed to bear the AMCA Certified Ratings Seal for Airflow Measurement Stations. Turnkey assembly shall be, in all respects, equivalent to Ruskin Model AMS050.

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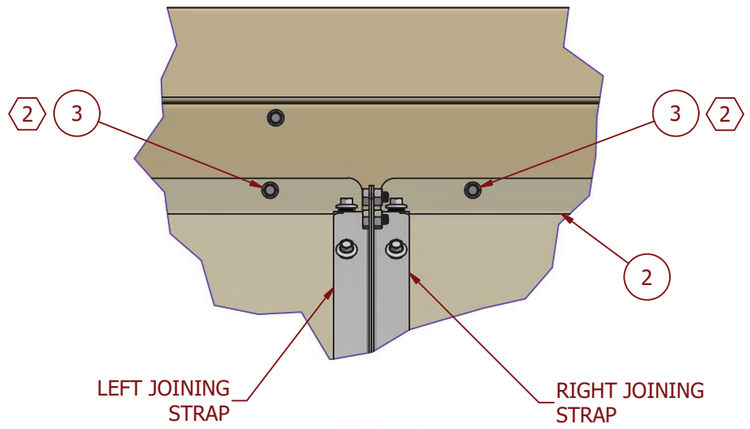
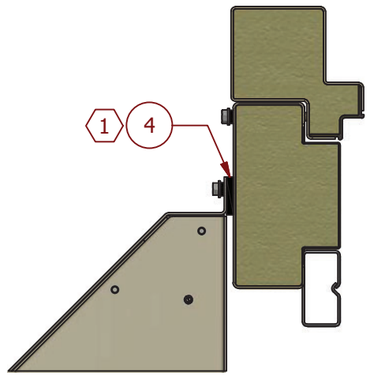
PARTS LIST					
QTY	NO.	ITEM NUMBER	DESCRIPTION	MATERIAL/REFERENCE	REMARKS
	1		ASSEMBLY, UNIT SECTION WALL		
2	2		ASSEMBLY, SIDE BY SIDE, HOOD	200.00103	
AR	3	FNSC0031	SCREW, HEX HEAD, RUBBER WASHER, TEK #12-14 X 1", SELF-DRILL, SELF-TAP		SEE NOTE 2
AR	4	GKFM0185	TAPE, FOAM, 1/4" X 1", TEM 25, SCE41		SEE NOTE 1

NOTES:

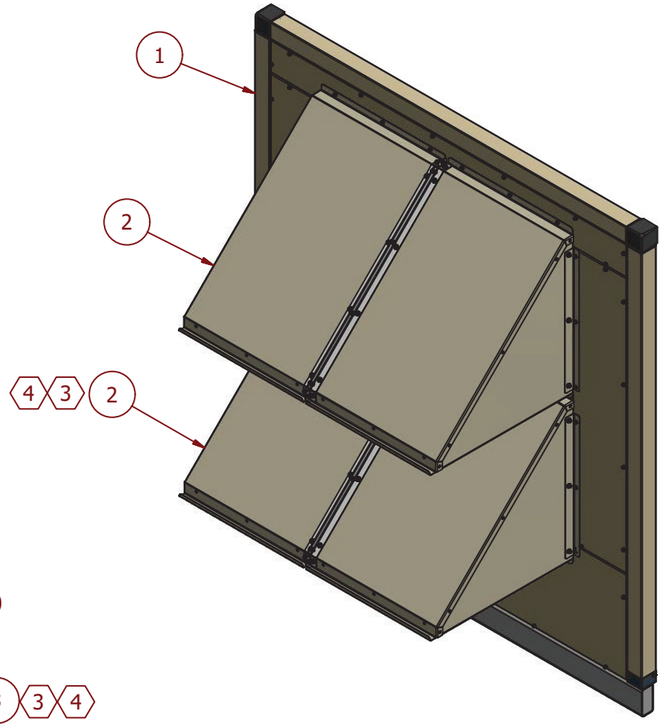
1. MOUNTING BRACKETS TO BE MASKED WITH FOAM TAPE (ITEM 4) PRIOR TO INSTALLING HOODS.
2. TO MOUNT MULTIPLE HOODS TO BE MOUNTED TO UNIT SECTION USING HEAD HEX SCREWS (ITEM 3) AS SHOWN
3. BOTTOM HOOD TO BE INSTALLED FIRST IN MULTIPLE HOOD CONFIGURATION
4. IF TOP AND BOTTOM HOOD ASSEMBLIES ARE DIFFERENT SIZES, SMALLER HOOD ASSEMBLY IS ALWAYS INSTALLED ON THE BOTTOM

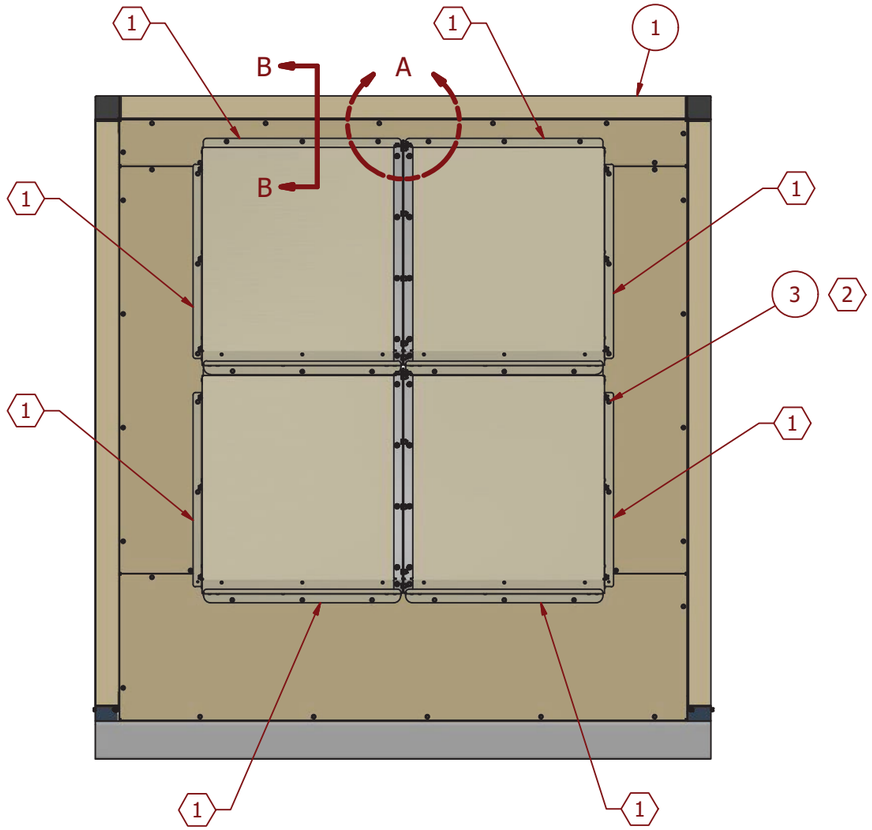


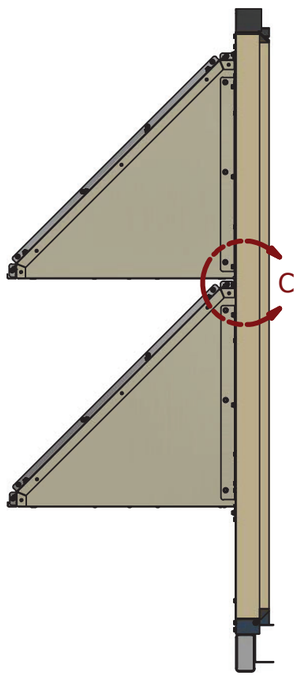
DETAIL A

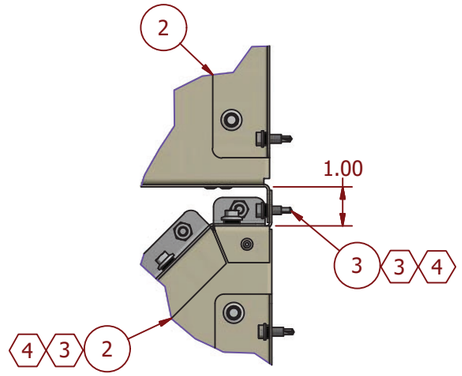


SECTION B-B









DETAIL C

C		ITEM 3 WAS FNSC0035.	REYJ	KRIM	6/2/17	DESIGN STANDARD, HOOD, MULTIPLE	310.00078
REV	ECN #	DESCRIPTION	BY	APPVD	DATE	DESCRIPTION	NUMBER
REVISION HISTORY						DOCUMENT REFERENCE	

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
BENDS UTILIZE STANDARD BEND ALLOWANCE
TOLERANCES PER BELOW

MECHANICAL	SHEET METAL	
.X = ±.05	FLAT	FINISHED
.XX = ±.01	.X = ± .031	± .125
.XXX = ±.005	.XX = ± .015	± .093
ANGLES = ±1°	.XXX = ± .005	± .060

FRACTIONS = ± 1/32" ANGLES = ± 1°
125 √ SURFACE FINISH BREAK ALL SHARP CORNERS

File Saved: 08:42:06 10/19/2022

NORTEK AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

	BY	DATE
DRAWN:	REYJ	5/20/2016
CHECKED:	WHEM	7/1/2016
APPROVED:	KRIM	7/8/2016

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING | SCALE: -

TITLE: INSTALLATION, HOOD, MULTIPLE

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
B	251.00012	1 OF 1	C

Better Air is Our Business®

AmericanAirFilter®
Type A-8 Filter Holding Frames and Latches

Type A-8 Filter Holding Frames

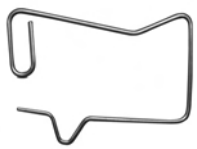
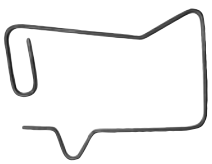
Type A-8 Filter Holding Frames

The Type A-8 filter holding frame comes in seven standard sizes that can be used individually or may be combined to fit virtually any size filter bank. Each frame includes closed cell gaskets to ensure a proper seal between the frame and filter to minimize dirty air bypass. Frames are also available without gaskets or with dovetail gaskets. Also available are Type A-8 latches designed to hold the filter in place and create a positive seal. Type A-8 frames are constructed of galvanized steel and 304 stainless steel, and also available in 316 stainless steel.

Size	Part Number 16 ga. Galv	Part Number 18 ga. 304SS
12 x 24 x 3	312-600-600	312-600-100
16 x 20 x 3	312-600-001	316-600-101
16 x 25 x 3	312-600-002	316-600-102
20 x 20 x 3	312-600-003	312-600-103
20 x 24 x 3	312-600-004	312-600-104
20 x 25 x 3	312-600-005	312-600-105
24 x 24 x 3	312-600-606	312-600-106

Type A-8 Latches

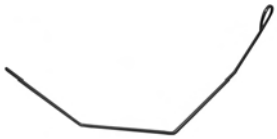
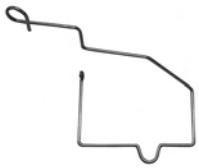
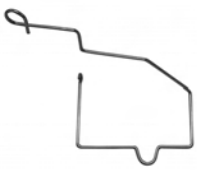
AAF offers a variety of Type A-8 latches to secure disposable panel filters or 12" box style high efficiency filters (with or without a prefilter) into a Type A-8 filter holding frame. The Type A-8 latches attach to one of two sets of knockouts on the Type A-8 frame. Simply attach the appropriate latch that best fits the depth of the filter. It is recommended to use 4 latches per frame.

AAF Part Number	Material	Application	Farr Model	Picture
315-004-000	Galvanized Steel	Secures a 4" filter, or a 2" filter with a single header filter in an A-8 frame	C-86	
315-004-100	Stainless Steel	Secures a 4" filter, or a 2" filter with a single header filter in an A-8 frame	C-86S	
315-004-001	Galvanized Steel	12" spring latch with 7/8" Tang to secure 12" deep double header AAF filter	C-80	

Continued on back page

AmericanAirFilter®

Type A-8 Filter Holding Frames and Latches

AAF Part Number	Material	Application	Farr Model	Picture
315-004-101	Stainless Steel	12" spring latch with 7/8" Tang to secure 12" deep double header AAF filter	C-80S	
315-004-002	Galvanized Steel	6" spring latch with 7/8" Tang to secure 6" deep double header AAF filter	C-90	
315-004-003	Stainless Steel	Secures a 1" or 2" prefilter or a single header filter in an A-8 frame	C-70S	
315-004-006	Galvanized Steel	Secures a 4" prefilter in same frame with a single header filter	C-89	
315-004-106	Stainless Steel	Secures a 4" prefilter in same frame with a single header filter	C-89S	
315-004-007	Galvanized Steel	2" deep filter as a prefilter to a single header filter	C-77	
315-004-107	Stainless Steel	2" deep filter as a prefilter to a single header filter	C-77S	
315-003-002	Galvanized Steel	Holds a 2" prefilter on the face of a double header AAF filter	N/A	
315-003-004	Galvanized Steel	Holds a 4" prefilter on the face of a double header AAF filter	N/A	

AAF® INTERNATIONAL
10300 Ormsby Park Place Suite 600
Louisville, Kentucky 40223-6169

www.aafintl.com
Customer Service 888.AAF.2003
Fax 888.223.6500

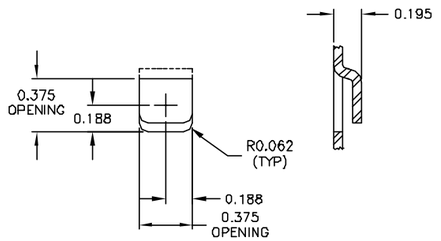
AFP-1-171 APR '09

AAF has a policy of continuous product research and improvement and reserves the right to change design and specifications without notice.

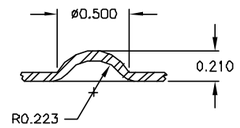
ISO Certified Firm

U105-3013588 A

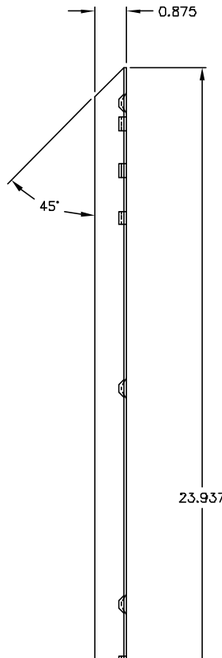
LTR.	CHANGE	CK'D	DATE	APPR	DATE
A	SLOT CHANGED; WAS .50 x .375				
	GAC 3AUG04	R.L.S.	3AUG04		

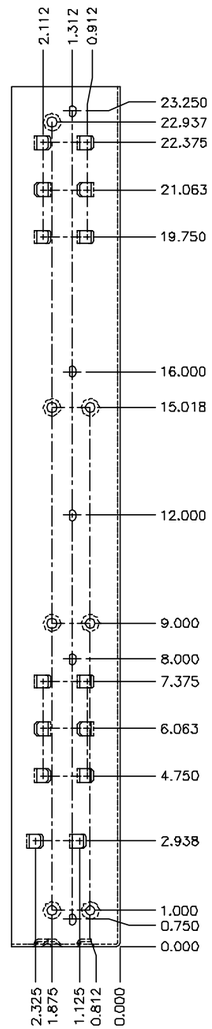


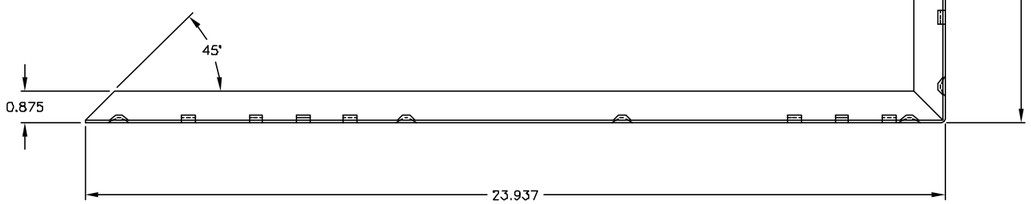
TAB DETAIL
(TYPICAL 28 PLACES)

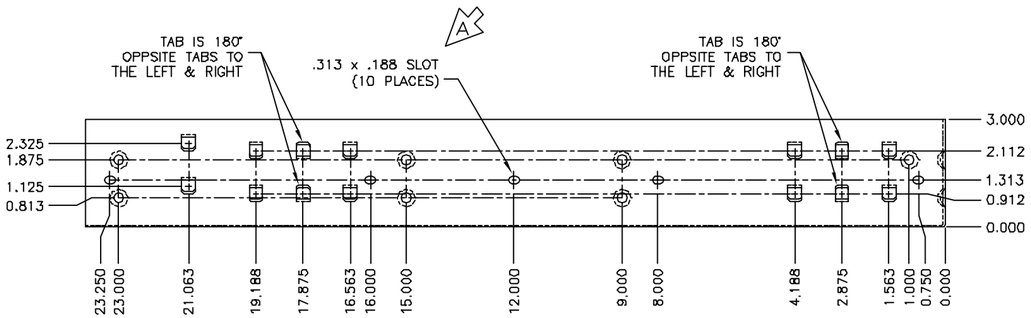


DIMPLE DETAIL
(TYPICAL 14 PLACES)









NOTE:

1. MATERIAL: #16 GA (.0635) GALVANNEALED STEEL

Tolerance Unless Otherwise Specified ±1/32	Material NOTED; Finish —; Chkd. R.L.S. Date 20JUL04; Dwn. GAC Date 20JUL04; Appr. — Date —	Confidential Property of AAF International P.O. Box 35690 Louisville, Ky. 40232-5690	NEXT ASSEMBLY
FRAME, LEG FILTER (24 x 24 x 3)		SHEET SIZE D	SECTION NO. U105 3013588

FORM 1250 REV 7/00

Dwyer

SERIES 2000

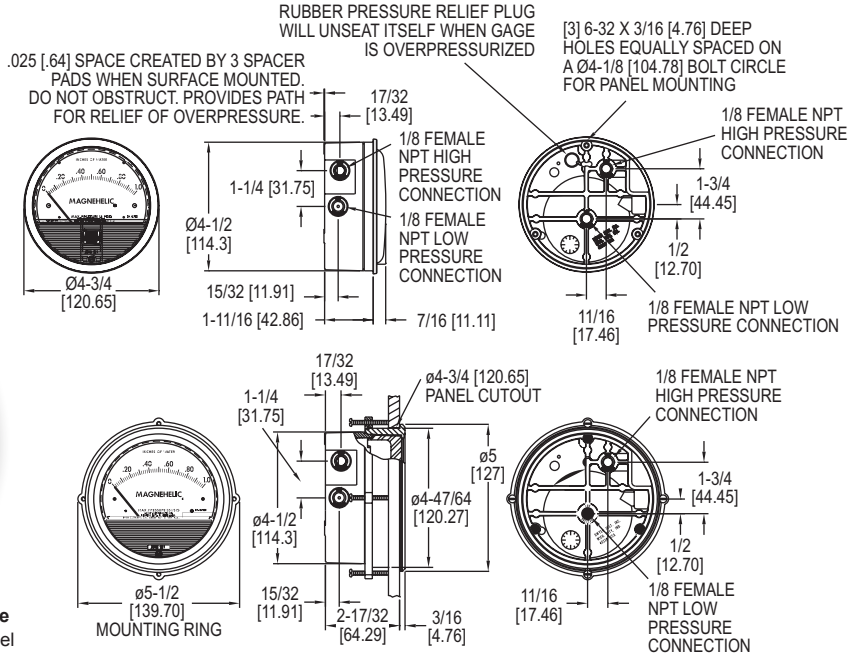
MAGNEHELIC® DIFFERENTIAL PRESSURE GAGES

Indicate Positive, Negative or Differential, Accurate within 1%

5 YEAR LIMITED WARRANTY

Standard Magnehelic® Gage

High Accuracy Magnehelic® Gage
Note: Shown with optional -SS bezel



VIDEO ONLINE

Select the **SERIES 2000** Magnehelic® Gage for a versatile low differential pressure gage with a wide choice of 81 models and 27 options to choose from. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates air or non-corrosive gas pressures--either positive, negative (vacuum) or differential. The design resists shock, vibration, over-pressures and is weatherproof to IP67.
Select the –HA High Accuracy Magnehelic® gage option for an accuracy within 1% of full scale. Also included with the –HA option at no extra cost are a mirrored scale overlay and a 6 point calibration certificate.

FEATURES/BENEFITS

- Easy to read gage through undistorted plastic face permits viewing from far away
- Patented design provides quick response to pressure changes means no delay in assessing critical situations
- Durable and rugged housing and high-quality components combine to provide long-service life and minimized down-time
- High accuracy option is twice as accurate as the standard Magnehelic® gage

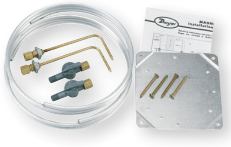
APPLICATIONS

- Filter monitoring
- Air velocity with Dwyer pitot tube
- Blower vacuum monitoring
- Fan pressure indication
- Duct, room or building pressures
- Clean room positive pressure indication

ACCESSORIES	
Model	**Description**
A-432	Portable kit; combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16″ ID rubber tubing, standhang bracket and terminal tube with holder
A-605	Air filter gage accessory kit; adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing, two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves
A-605B	Air filter gage accessory kit; air filter kit with two plastic open/close valves, two 4″ steel static tips, plastic tubing and mounting flange
A-605C	Air filter gage accessory kit; air filter kit with two plastic open/close valves, two plastic static tips, plastic tubing and mounting flange

SPECIFICATIONS	
Service: Air and non-combustible, compatible gases (natural gas option available). **Note:** May be used with hydrogen. Order a Buna-N diaphragm. Pressures must be less than 35 psi. **Wetted Materials:** Consult factory. **Housing:** Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test. **Accuracy:** ±2% (-HA model ±1) of FS (±3% (-HA ±1.5%) on -0, -100PA, -125PA, -10MM and ±4% (-HA ±2%) on -00, -60PA, -6MM ranges), throughout range at 70°F (21.1°C). **Pressure Limits:** -20 in Hg to 15 psig (-0.677 to 1.034 bar); MP option: 35 psig (2.41 bar); HP option: 80 psig (5.52 bar). **Enclosure Rating:** IP67. **Overpressure:** Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.❶	**Temperature Limits:** 20 to 140°F* (-6.67 to 60°C). -20°F (-28°C) with low temperature option. **Size:** 4″ (101.6 mm) diameter dial face. **Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations. **Process Connections:** 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back. **Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g). **Standard Accessories:** Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapter, and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for three adapters in MP & HP gage accessories.) **Agency Approvals:** Meets the technical requirements of EU Directive 2011/65/EU (RoHS II). **Note:** -SP models not RoHS approved.
Note: For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.	
*Low temperature models available as special options.	

A-432



A-605

❶Over Protection Note: See page 21 (Series 2000)

Dwyer

SERIES 2000

MAGNEHELIC® DIFFERENTIAL PRESSURE GAGES

Indicate Positive, Negative or Differential, Accurate within 1%

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

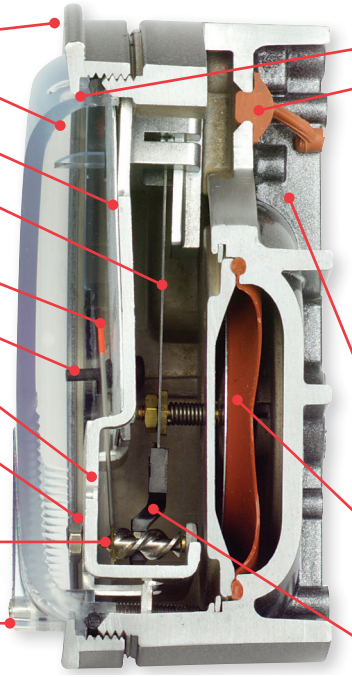
Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



O-ring seal for cover assures pressure integrity of case.

OVERPRESSURE PROTECTION
Blowout plug is comprised of a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (1.7 bar). To provide a free path for pressure relief, there are four spacer pads which maintain 0.023″ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.
The blowout plug is not used on models above 180″ of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
The blowout plug should not be used as a system overpressure control. High supply pressures may still cause the gage to fail due to over pressurization, resulting in property damage or serious injury. Good engineering practices should be utilized to prevent your system from exceeding the ratings of any component.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

MODEL CHART

Model	Range, Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2012	0-12
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2120	0-120
2150	0-150
2160	0-160
2180*	0-180
2250*	0-250
Zero Center Ranges	
2300-00†••	0.125-0-0.125
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model	Range, PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

Model	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

Model	Range, MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-15MM	0-15
2000-25MM	0-25
2000-30MM	0-30
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
2000-125MM	0-125
2000-150MM	0-150
2000-200MM	0-200
2000-250MM	0-250
2000-300MM	0-300
Zero Center Ranges	
2300-6MM†••	3-0-3
2300-10MM†•	5-0-5
2300-20MM†•	10-0-10

Model	Range, Pa
2000-60NPA†••	10-0-50
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
2000-1000PA	0-1000
Zero Center Ranges	
Model	**Range, Pa**
2300-60PA†••	30-0-30
2300-100PA†•	50-0-50
2300-120PA	60-0-60
2300-200PA	100-0-100
2300-250PA	125-0-125
2300-300PA	150-0-150
2300-500PA	250-0-250
2300-1000PA	500-0-500

Model	Range, kPa
2000-0.5KPA	0-0.5
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-2.5KPA	0-2.5
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-2KPA	1-0-1
2300-2.5KPA	1.25-0-1.25
2300-3KPA	1.5-0-1.5

Dual Scale Air Velocity Units
For use with pitot tube

Model	Range, in w.c./ Velocity F.P.M.
2000-00AV†••	0-.25/ 300-2000
2000-0AV†•	0-.50/ 500-2800
2001AV	0-1.0/ 500-4000
2002AV	0-2.0/ 1000-5600
2005AV	0-5.0/ 2000-8800
2010AV	0-10/ 2000-12500

Dual Scale English/Metric Models

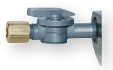
Model	Range, in w.c.	Range, Pa or kPa
2000-00D†••	0-.25	0-62 Pa
2000-0D†•	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2005D	0-5.0	0-1.25 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa
2015D	0-15	0-3.7 kPa
2020D	0-20	0-5 kPa
2025D	0-25	0-6.2 kPa
2050D	0-50	0-12.4 kPa
2060D	0-60	0-15 kPa

†These ranges calibrated for vertical scale position • Accuracy ±3% •• Accuracy ±4% *MP option standard **HP option standard

VELOCITY AND VOLUMETRIC FLOW UNITS
Scales are available on the Magnehelic® gage that read in velocity units (FPM, m/s) or volumetric flow units (SCFM, m^3/s, m^3/h). Stocked velocity units with dual range scales in inches w.c. and feet per minute are shown above. For other ranges contact the factory.
When ordering volumetric flow scales please specify the maximum flow rate and its corresponding pressure.
Example: 0.5 in w.c. = 16,000 CFM.

ACCESSORIES

Model	Description
A-321	Safety relief valve
A-448	3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-135	Rubber gasket for panel mounting
A-401	Plastic carry case
A-310A	3-way vent valves. In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

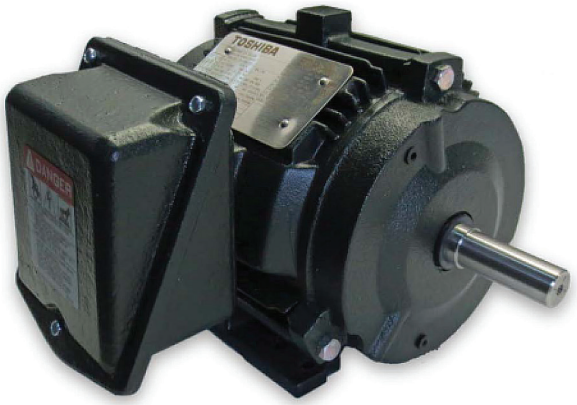


A-310A

TOSHIBA EQP Global™ SD

With Hybrid Ceramic Bearings (208, 230, 460 Volt)

Efficiency, Quality & Performance (EQP)



The TOSHIBA EQP Global SD premium efficient motor are suited for the FANWALL® applications. Motors are balanced to vibration levels at half the allowable NEMA limits. The totally enclosed air over (TEAO) design runs quiet, is very compact and is a superior enclosure for any application, including dirty or wet environments.

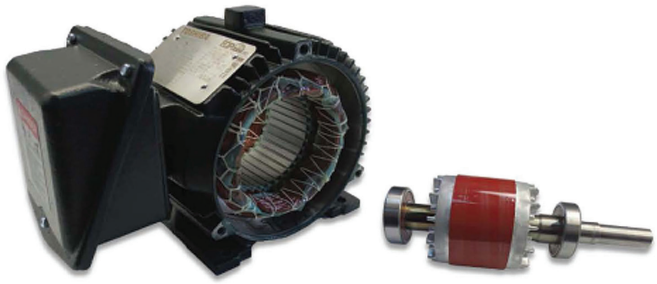
The insulation system in a motor is designed to handle the sum of three temperatures: an ambient design temperature 40°C / 104°F; the temperature rise in the motor under load; and a 10°C hot spot allowance. For example, a NEMA Class B rated motor can have a maximum motor temperature rise during operation of 80°C. This results in a total motor temperature rating of 130°C (40°C ambient temp. + 80°C motor temp. rise + 10°C hot spot temp.). A NEMA Class F rating allows for a motor temperature rise of 105°C yielding a total motor temperature rating of 155°C. A NEMA Class F ratings allows for a 125°C motor temperature rise for a total motor temperature rating of 180°C. Additionally, NEMA allows the motor temperature rating limit to increase by 10°C for motors rated with a 1.15 service factor. TOSHIBA EQP motors provided for FANWALL systems incorporate Class F rated wire and Class F rated varnish as part of the insulation system.

Testing: Through manufacturers testing the TOSHIBA EQP motors are suitable for continuous duty in ambient temperatures from –25°C to 40°C in 100% humidity. The increased airflow over the motor fins, produced by the Coplanar Silencer® design in FANWALL systems, helps to keep the motor windings cooler and well below a Class F 180°C [356°F] rating. This unique cooling design makes available a significantly greater number of motor horsepower increments that can be selected to more closely match brake horsepower requirements. These incremental horsepower motors carry a full factory warranty, maintain a 1.15 service factor, are constructed for 120 Hz continuous operation, and are readily available from Nortek Air Solutions LLC stock inventory.

Frame mounting dimensions are industry standard for readily available replacement. The motors utilize an insulation system which meets the requirements of NEMA MG1 Part 31.4.4.2 for VFD use, and is considered inverter ready. Cast iron motor construction is rigid, durable and quiet. The motors have double sealed hybrid ceramic ball bearings that exceed a L-10 life of 150,000 hours in direct coupled applications. These hybrid ceramic bearings prevent electrical arcing that damages traditional bearings.

The TOSHIBA motors are in accordance with the latest revisions of the applicable sections of the NEMA MG1, NEC, CSA, UL, IEEE and CE standards. The nominal efficiency is stamped on the nameplate of the motor. The nameplate and fasteners surpass a 720 hour salt spray (fog) test for corrosion resistance per ASTM B117/IEEE 841 A.4.

All efficiency testing and labeling are done in accordance with the NEMA MG1 standard. The motors are dynamically balanced to 0.10 inches per second peak velocity and vibration testing is per NEMA MG1 Part 7. All motors are painted with a corrosion-resistance, severe duty, alkyd resin primer paint with an acrylic enamel finish.



NORTEK™ AIR SOLUTIONS

TOSHIBA EQP Global™ SD With Hybrid Ceramic Bearings (208, 230, 460 Volt)

Efficiency, Quality & Performance (EQP) 1800 RPM MOTORS

1800 RPM Motors										
						FLA				
HP	Part #	Toshiba Spec #	RPM @ 60Hz with slip	FRAME	EFF	460V	230V	208V	LBS	Max RPM
1	200.0789	4OA001L1ZVS210	1760	143T	85.5	1.7	3.4	3.3	53	3600
1.5			1745			2.1	4.2			
2	200.0790	4OA002L1ZVS210	1750	145T	86.5	3.0	6.0	6.1	58	3600
2.5			1730		84.0	3.5	7.0			2700
3	200.0791	4OA003L1ZVS210	1760	182T	89.5	4.0	8.0	8.6	92	3600
3.5			1750		88.5	4.5	9.0			3150
4			1740		87.5	5.1	10.2			2700
4.5			1735		87.5	5.7	11.4			2400
5	200.0792	4OA005L1ZVS210	1755	184T	89.5	6.4	12.8	13.8	104	3600
5.5			1750		88.5	6.9	13.8			3300
6			1745		88.5	7.5	15.0			3000
6.5			1740		87.5	8.1	16.2			2850
7			1735		87.5	8.8	17.6			2700
7.5	200.0793	4OAY75L1ZVS210	1760	213T	91.7	9.8	19.6	21.0	175	3600
8			1760		91.0	10.1	20.2			3450
8.5			1760		91.0	10.7	21.4			3300
9			1760		91.0	11.2	22.4			3000
9.5			1755		91.0	11.8	23.6			2850
10	200.0794	4OA010L1ZVS210	1760	215T	91.7	13.0	26.0	28.0	190	3600
10.5			1760		91.0	13.3	26.6			3000
11			1760		91.0	13.9	27.8			2850
11.5			1760		91.0	14.5	29.0			2700
12			1755		91.0	15.1	30.2			2250
15	200.0795	4OA015L1ZVS210	1770	254T	92.4	19.0	38.0	42.0	289	3600
20	200.0796	4OA020L1ZVS210	1770	256T	93.0	25.0	50.0	55.0	331	2550

TOSHIBA EQP Global™ SD With Hybrid Ceramic Bearings (208, 230, 460 Volt)

Efficiency, Quality & Performance (EQP) 3600 RPM MOTORS

3600 RPM Motors										
						FLA				
HP	Part #	Toshiba Spec #	RPM @ 60Hz with slip	FRAME	EFF	460V	230V	208V	LBS	Max RPM
1	200.0797	2OAY15L1ZVS210	3525	143T	82.5	1.5	3.0		50	4800
1.5			3490		84.0	2.0	4.0	4.4		
2	200.0798	2OA002L1ZVS210	3490	145T	85.5	2.6	5.2	5.7	53	4800
2.5			3455		82.5	3.1	6.2			
3	200.0799	2OA003L1ZVS210	3500	182T	86.5	3.7	7.4	8.0	80	4800
3.5			3480		85.5	4.2	8.4			
4			3460		84.0	4.8	9.6			
4.5			3440		82.5	5.5	11.0			
5	200.0800	2OA005L1ZVS210	3500	184T	88.5	5.8	11.6	13.0	95	4800
5.5			3480		87.5	6.3	12.6			
6			3465		86.5	6.9	13.8			
6.5			3455		86.5	7.6	15.2			
7			3440		85.5	8.2	16.4			
7.5	200.0801	2OAY75L1ZVS210	3500	213T	89.5	9.0	18.0	20.0	159	4800
8			3490		89.5	9.4	18.8			
8.5			3485		89.5	10.0	20.0			
9			3475		88.5	10.6	21.2			
9.5			3470		88.5	11.2	22.4			
10	200.0802	2OA010L1ZVS210	3510	215T	90.2	11.8	24.0	26.0	177	4800
10.5			3500		89.5	12.3	24.6			
11			3495		89.5	12.9	25.8			
11.5			3490		88.5	13.4	26.8			
12			3485		88.5	14.1	28.2			
15	200.0803	2OA015L1ZVS210	3530	254T	91.0	18.0	36.0	40.0	274	4800
20	200.0804	2OA020L1ZVS210	3520	256T	91.0	24.0	48.0	53.0	292	4800

Specifications and illustrations subject to change without notice and without incurring obligation.

503F-0521 (Replaces 503F-0919)

Please recycle

NORTEK™
AIR SOLUTIONS

www.nortekair.com
nortekairinfo@nortek.com

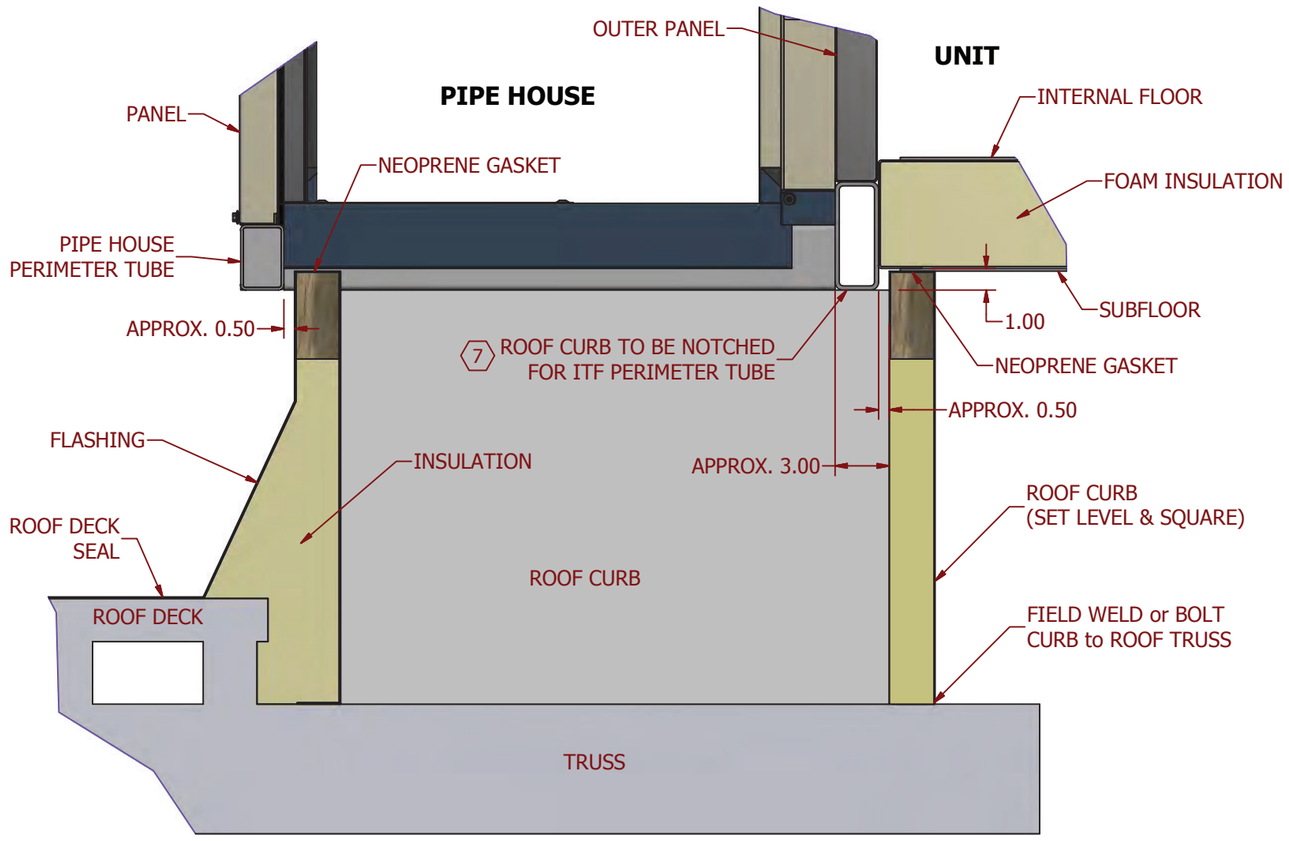
NORTEK AIR SOLUTIONS TEMTROL

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312
QUOTE #	23-1950

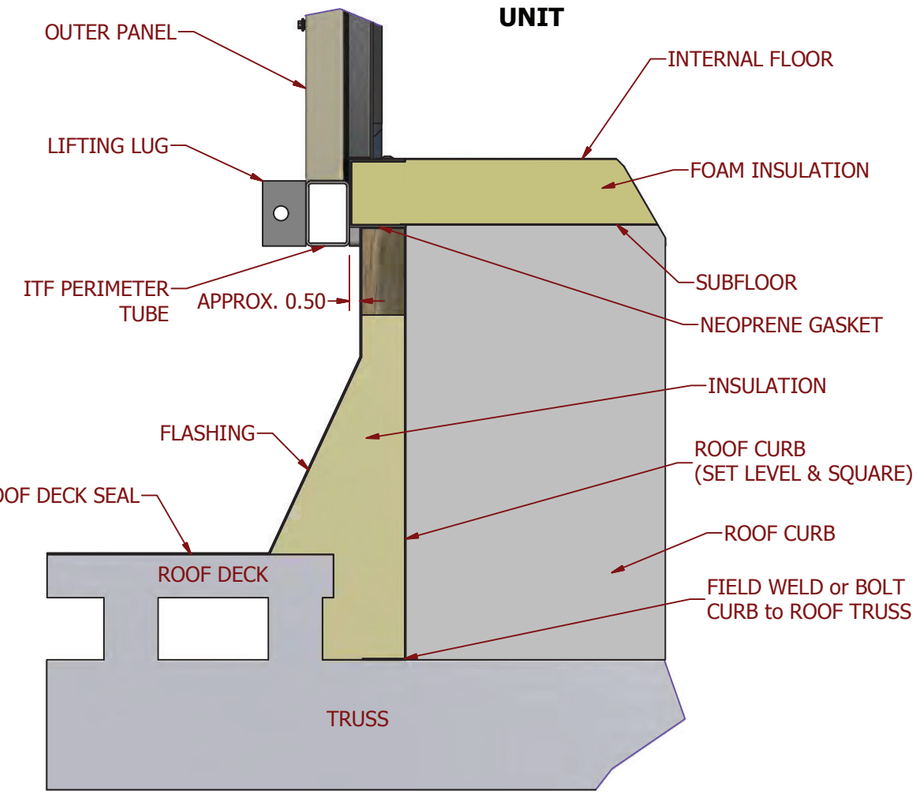
Roof Curb Sizing

NOTES:

1. ROOF CURB LENGTH/WIDTH = UNIT LENGTH/WIDTH - 5" (NON INSULATED CURB)
2. ROOF CURB LENGTH/WIDTH = UNIT LENGTH/WIDTH -6" (INSULATED CURB)
3. ROOF CURB PIPE HOUSE LENGTH = PIPE HOUSE LENGTH - 5" (INSULATED OR NON INSULATED CURB)
4. ROOF CURB PIPE HOUSE DEPTH = PIPE HOUSE DEPTH (NON INSULATED CURB)
5. ROOF CURB PIPE HOUSE DEPTH = PIPE HOUSE DEPTH + .5" (INSULATED CURB)
6. FLOORING AVAILABLE FOR VFD COMPARTMENTS AND LARGER PIPE HOUSES. CONSULT FACTORY.
7. NOTCH FOR PIPE HOUSE = 3" WIDE X 1" DEEP
8. ROOF CURB IS TO FULLY SUPPORT EACH SECTIONS PERIMETER TUBE. THIS INCLUDES ALL DEMOUNTS.



ITF DETAIL W/ PIPE HOUSE
ROOF CURB ASSEMBLED AT JOBSITE



ITF DETAIL
ROOF CURB ASSEMBLED AT JOBSITE

REV	ECO #	DESCRIPTION	REV APPRV DATE
A	000396	ADDED NOTE 8; UPDATED TITLE	12/10/2018

REVISION HISTORY

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
.X = ±0.1
.XX = ±0.03
.XXX = ±0.010
(.XX) = REFERENCE
FRACTIONS = ± 1/32"
ANGLES = ± 0.5°

NORTEK AIR SOLUTIONS
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

	BY	DATE
DRAWN:	JONC	12/29/2015
CHECKED:	WHEM	2/11/2016
APPROVED:	KRIM	2/11/2016

THIRD ANGLE PROJECTION

TITLE: DESIGN STANDARD, UNIT ROOF CURB, SIZING, ATTACHMENT, ITF

PART NO.

DRAWING NOT TO SCALE

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
B	45-000029212	1 OF 1	A

NORTEK AIR SOLUTIONS TEMTROL

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312
QUOTE #	23-1950

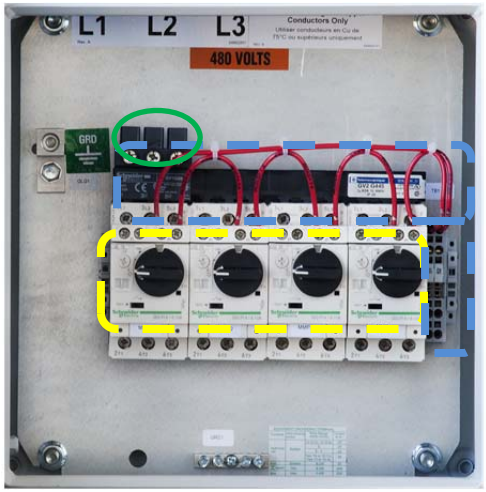
Electrical

Motors for FANWALL® systems are wired to a factory furnished manual starter overload panel as a standard for individual motor overload protection

Motor Overload Panel with Aux Contacts

NEMA 4, UL listed enclosure is constructed of cold rolled 16 gauge steel (14 gauge if 36"H x 30"W or larger) that is dip-coated primed and powder coated.

Panel is provided with carbon steel hinges, foamed in place gasket and zinc plated back plate.



- Power block for VFD output wiring.
- Auxiliary contacts wired in series for optional field wiring to a remote powered pilot light or alarm. (Terminals 51 & 52)
- IECC manual starters with rotary type operator.

CATALOG

ABB drives for HVAC

ACH580 series
Leading the way in HVAC drives

Comfort. It's something we take for granted in the buildings we live and work in. But comfort requires efficient systems to control heating, ventilation, and air conditioning (HVAC) to ensure the air we breathe is pure and the temperature is comfortable. We also need to ensure air quality and safety in the most energy-efficient and cost-effective way in both normal and mission-critical situations.

For half a century, ABB has been leading the way in optimizing HVAC systems using drive control to ensure that you can take comfort for granted. The new ACH580 series of variable-frequency drives (VFDs) provides the quality, reliability, and energy savings you expect, and are easy to use and safe to maintain. All you need to do is to set the drive up, and then focus on what counts.

Contents

The next step in HVAC drives

The new ACH580 drives come with a range of advanced features, such as a new primary settings menu that makes commissioning the drives much easier and faster. Optional Bluetooth connectivity offers improved accessibility for drives in remote areas and increases safety by letting users stay out of arc flash zones.

Simple to select, install and use
All the essentials – such as chokes, EMC filters, cabling clamps, certified BACnet communication, and enclosures from UL (NEMA) Type 1 to UL (NEMA) Type 12 – are a standard part of the drive, simplifying selection, installation, and commissioning.

Safe maintenance
The packaged disconnect solution provides a main disconnect switch, further increasing safety for people working on air-handling units.

Motor control options to meet your application needs
ACH580 drives can be integrated with several types of AC motors, even high-efficiency permanent magnet (PM) and synchronous reluctance (SynRM) motors. Using these motors can reduce your energy costs even more.

Additional I/O options
Take advantage of the added flexibility and accessibility – never be without back-up I/O points at the job site again.

ACH580 drives are ideal for HVAC fans, pumps, compressors, air-handling units, and chillers. These are used in hospitals, data centers, shopping centers, tunnel ventilation, factories, office buildings, and more.

Intuitive control panel
The drive's HVAC-specific software, intuitive control panel with customizable text, and menu-driven programming simplify setup and operation of even the most complex applications. You can customize the view so that it only shows the information you need, and it automatically saves a backup of your most recent configuration so that it's always available.

Optional Bluetooth® capability
ABB's new HVAC Bluetooth control panel lets you commission the drive remotely, safely outside the arc flash boundary. The Drivetune smartphone app allows you to commission and tune the drive from a distance, giving you access to the same primary settings and other menus available on the drive's HVAC control panel.

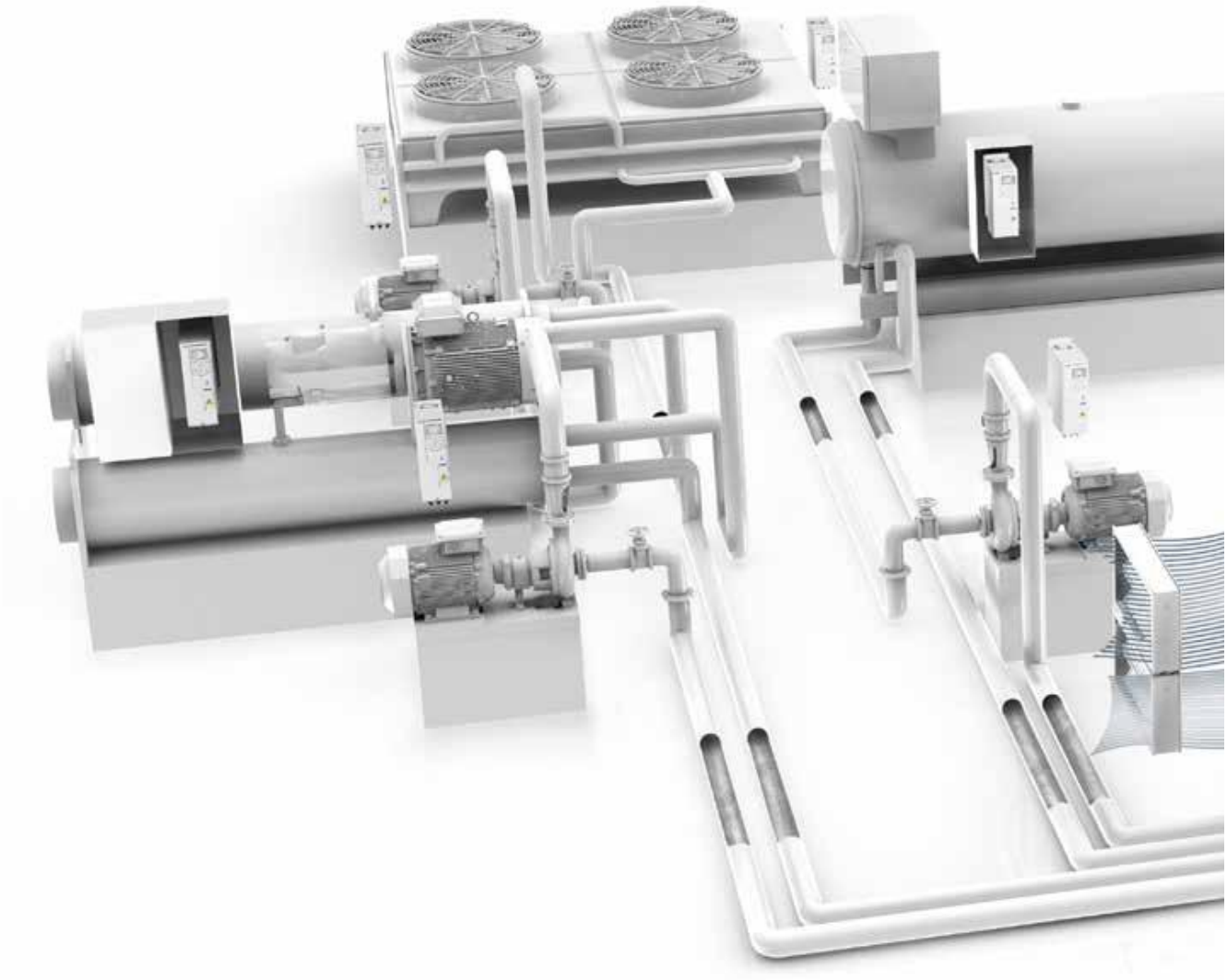
Reliable communication
BACnet MS/TP, Modbus RTU and Johnson Controls N2 are embedded in every ACH580. In addition, a wide range of optional fieldbus adapters are available to enable connectivity with all major building automation and control systems.

Harmonic mitigation
The drive provides reduced harmonics with built-in, optimized DC choke in a small and lightweight design.

Ultra-low harmonic (ULH) drive for a clean network
The revolutionary ACH580 ultra-low harmonic drive is designed specifically for the HVAC market, minimizing the effect of harmonics on your system. This all-in-one solution is fully integrated within the ACH580 platform and leverages the same programming tools, user settings, options, and functions, while providing superior harmonic performance.

Premier air handling

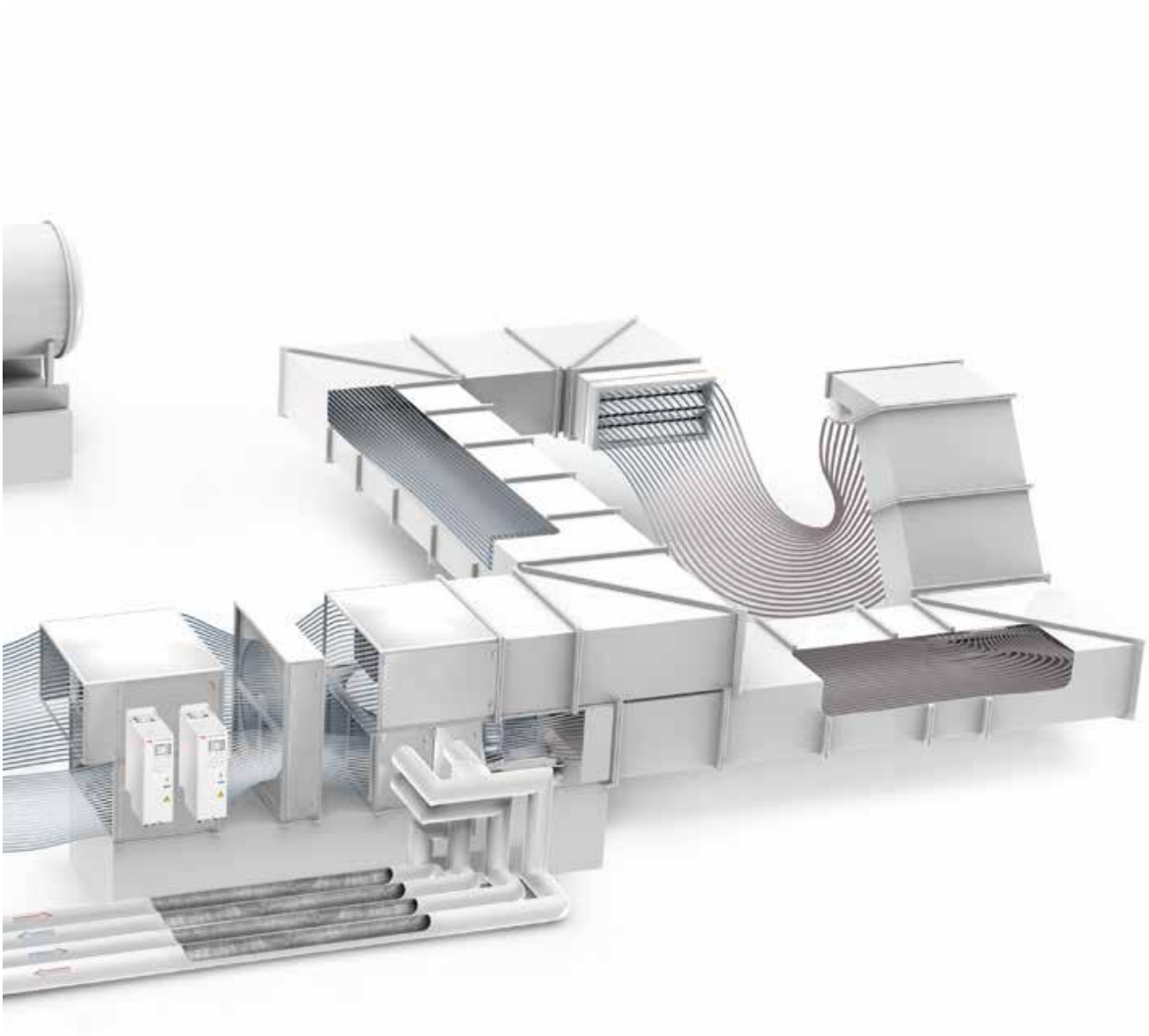
We understand the complexity of air handling systems and the need to produce high levels of comfort, control, and safety. Regardless of the season or external conditions, we help make your system efficient, safe, and informative.



Effortless system startup
The ACH580 ensures a smooth, coordinated start to your HVAC system. Embedded interlock logic enables the drive to confirm that equipment such as dampers are in the right position and sensors are showing the correct status before operations begin. The control panel's Primary Settings menu and built-in assistants streamline commissioning, allowing basic setup to be completed in minutes. The Drive Composer PC tool simplifies the customization of the drive.

Increased energy savings
Increase energy savings by using the appropriate motor and drive combination. The ACH580 drive works with a variety of motors, such as induction, PM, or SynRM, enabling high efficiencies.

Improved safety
Built-in safety functionality, such as override mode, enables your system to override all non-essential faults during emergencies to maintain air quality in the fire exit paths.



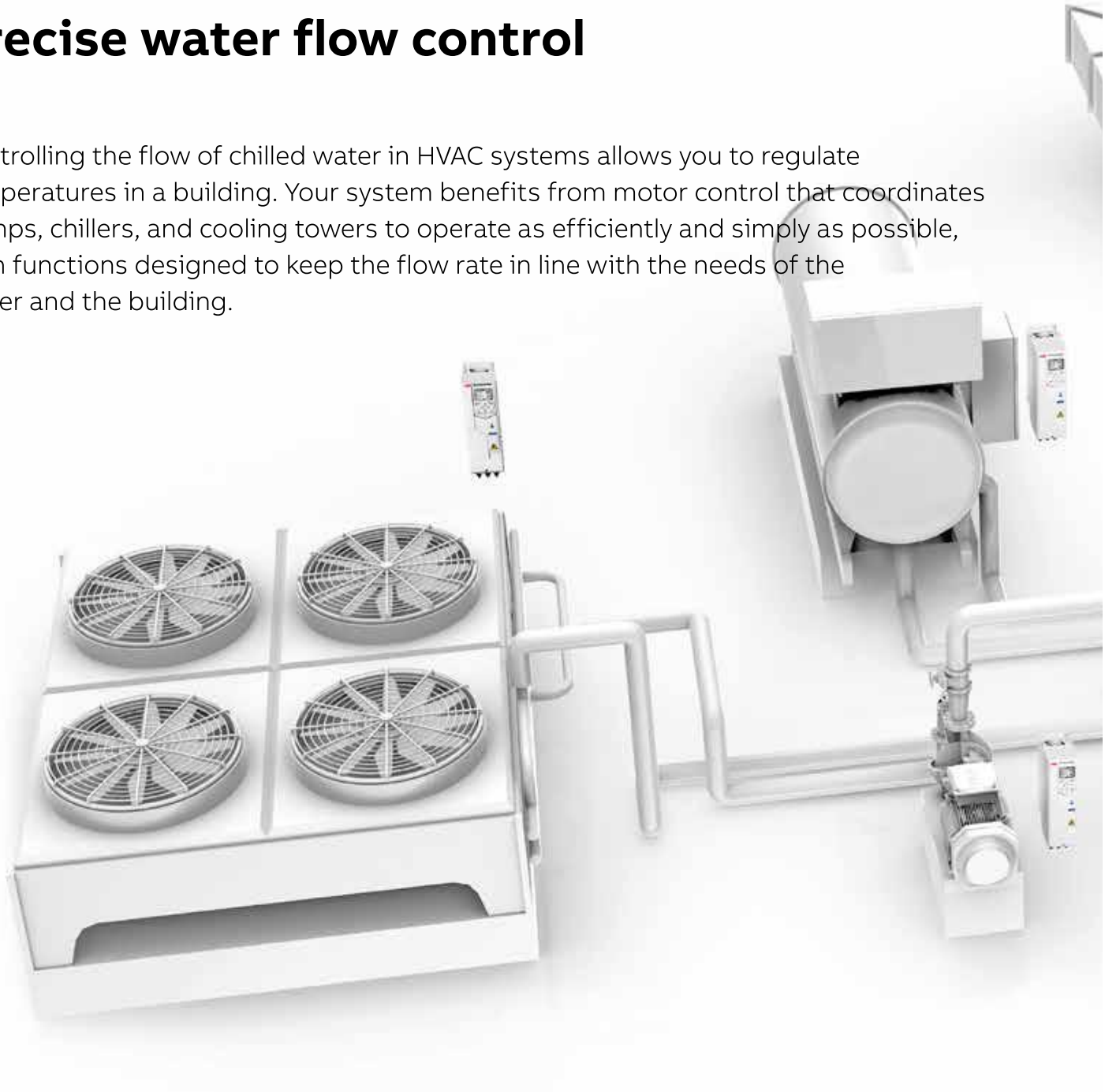
The control panel's optional Bluetooth capability provides an extra level of safety for commissioning and troubleshooting.

Reduced costs
The ACH580 reduces costs by eliminating dependencies on external controllers. The drive can use its internal PID loops to maintain a pressure setpoint by checking the active pressure and adjusting the fan speed accordingly.

Improved monitoring and maintenance
Leverage advanced system monitoring, giving you access to data on all aspects of the operation. Use this information to plan maintenance based on the actual needs of the application. With built-in monitoring, the drive lets you know when it’s time to take action if a fan stalls, a belt breaks, a filter clogs, and more.

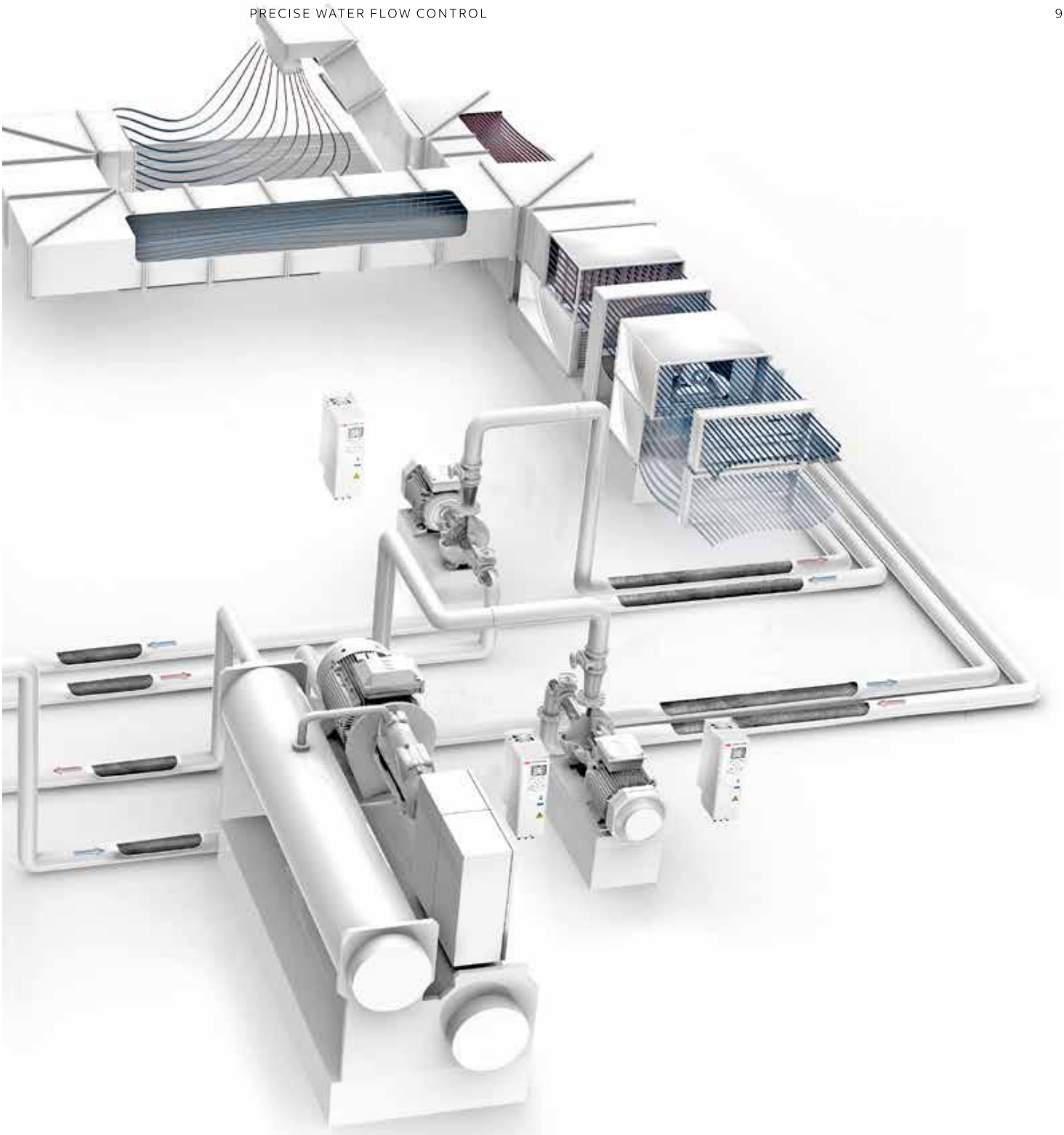
Precise water flow control

Controlling the flow of chilled water in HVAC systems allows you to regulate temperatures in a building. Your system benefits from motor control that coordinates pumps, chillers, and cooling towers to operate as efficiently and simply as possible, with functions designed to keep the flow rate in line with the needs of the chiller and the building.



Motor monitoring prevents problems
Protect your investment with onboard monitoring. Monitor and show trends of key attributes for preventative maintenance.

Protect your equipment
Extend the life of your pipes, motors, valves, and pumps with intelligent motor control. By starting the pumping system smoothly and precisely managing flow and pressure, you protect the system from pressure surges.



Energy savings through intelligent control
Intelligent motor control replaces throttle and bypass valves, enabling better control of flow, and resulting in energy savings. In addition, fewer mechanical parts means minimal wear and tear on the system.

System optimization
As demand fluctuates during the day, the system automatically adjusts. The ACH580 provides optimal pressure when needed, and goes into sleep mode when it's not.

ACH580 drives offering

All ACH580 drives offer ease of use, scalability, and reliability and comes in a variety of packages. They can be equipped with an intuitive Bluetooth control panel, allowing the drive to be configured directly via the control panel or via the Drivetune app. A robust HVAC firmware package provides drive, motor, and application protection features. The drive includes BACnet MS/TP, Modbus RTU, and Johnson Controls N2. Additional protocols, such as BACnet/IP and LonWorks, are available with optional fieldbus adapters.

Wall-mounted drives, ACH580-01
ACH580-01 wall-mounted drives are available in UL (NEMA) Type 1 to UL (NEMA) Type 12 protection class with a power range up to 350 hp and offer side-by-side, flange, and horizontal mounting options. The UL (NEMA) Type 12 variants are designed for applications exposed to dust, moisture, vibration, and other harsh conditions. The ACH580-01 is a six-pulse drive that includes an optimized DC link choke for harmonic mitigation.

Ultra-low harmonic drives, ACH580-31
ACH580-31 ultra-low harmonic drives help to keep the power network clean. The ACH580 ultra-low harmonic (ULH) drive provides an unprecedented compact design that delivers unity power factor with a 3% or less THDi. By meeting the most stringent requirements of the IEEE519 recommendations, the ACH580 ULH drive reduces any risk of electrical disturbance when operating on a back-up generator.

E-Clipse bypass drive, ACH580-VCR, ACH580-VDR, ACH580-BCR, ACH580-BDR
The ACH580 with ABB E-Clipse bypass has an integrated UL (NEMA) Type 1, 12 or 3R enclosure with a bypass motor starter and is available from 1 to 350 hp at 230/460/575 V. The ACH580 with ABB E-Clipse bypass provides an input disconnect switch or circuit breaker with door mounted and interlocked switch (padlockable in the OFF position), a bypass starter, electronic motor overload protection, a door mounted control panel with graphical display for local control, provisions for external control connections, and serial communications capability.

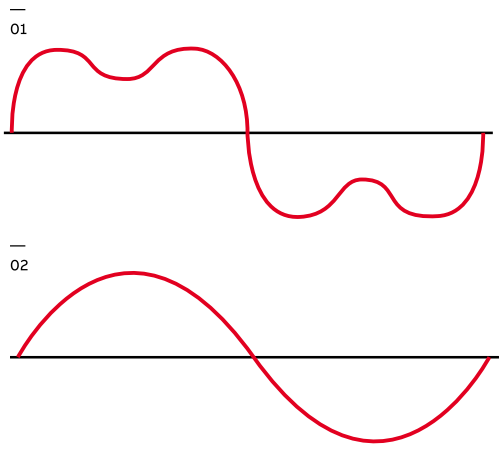
Packaged drive with disconnect means, ACH580-PCR, ACH580-PDR
The ACH580 Packaged Drive includes an ACH580 drive in a UL (NEMA) Type 1, 12 or 3R enclosure with either an input disconnect switch and fast acting fuses or an input circuit breaker. It is available from 1 to 350 hp at 230/460/575 V. The ACH580 Packaged Drive provides a door-mounted input disconnect switch (padlockable in the OFF position), electronic motor overload protection, a door mounted control panel with graphical display for local control, provisions for external control connections, and serial communications capability.

The entire ACH580 product family provides a consistent user interface and features, making it easy for you to install, commission and use throughout your facility.

ACH580 ultra-low harmonic (ULH) drive

What are harmonics?
In an ideal case the current in an AC grid is a pure sine wave and does not contain harmonics. In reality the current deviates from this pure sine wave and contains harmonics. Harmonics are typically measured as a percentage value, called total harmonic distortion (THD).

Harmonics can cause damage to sensitive electronic equipment, interference to communication equipment, tripping of circuit breakers, blowing of fuses and capacitor failures. The effects can also include overheating of cables, light ballast, motors, overloading of transformers, generator failure and power factor capacitor damage.



01
Diode supply

02
Active supply

Complete HVAC functionality
The ACH580 ULH 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. 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 Controls N2 as standard.

Savings in total cost of ownership
Installation costs are reduce with the simple 3 wires in and 3 wires out design. Maintenance costs are lowered as compared to other harmonic mitigation solutions like passive filters, multi-pulse and active filters there are less components to maintain and stock as spares.

Using the ACH580 ULH allows your engineer to design your electrical system and backup generators to the right size and not oversizing for the harmonics in the network.

Reliability for your building
Harmonics in the network could cause problems with other electrical equipment in the same electrical network. In the worst case it might cause your sensitive electrical equipment to fail.

Harmonics can cause problems also in retrofit projects. In such projects, a transformer might not be able to meet the harmonic levels caused by non-linear loads such as standard 6-pulse drives, so there is a risk of overloading the transformer.

In addition to problems caused by harmonics, also weak network can cause troubles to your systems. Weak electrical networks that have sags in line voltage may cause motors to overheat, trip or fail.

The ACH580 ULH drive offers a reliable solution to overcome these challenges as it is able to lower the harmonic content so that sensitive equipment stay running and transformers or generators don't fail. Also the ACH580 ULH can boost output voltage so that motor always runs with nominal voltage despite the fluctuations in line voltage.

Optimized size and performance
ACH580 ULH has all the harmonic mitigation technology in the drive. With a THDi of 3% or less, there is no need for external components to install with the drive for reducing harmonics, this drive doesn't create the harmonics to fix.

ACH580 ultra-low harmonic packaged drives with disconnect
The ACH580 ultra-low harmonic (ULH) packaged drive is an ACH580 ULH variable frequency drive enclosed with either an input disconnect switch and fast acting fuses (ACH580-3PDR) or an input circuit breaker (ACH580-3PCR). The ACH580 packaged drive provides a door-mounted input disconnect operator (padlockable in the OFF position), electronic motor overload protection, a door mounted control panel with graphical display for local control, provisions for external control connections, and serial communications capability.

ACH580 ultra-low harmonic drive E-Clipse bypass
The ACH580 ultra-low harmonic (ULH) drive with ABB E-Clipse bypass is an ACH580 HVAC drive in an integrated UL (NEMA) Type 1, 12 or 3R enclosure with a bypass motor starter. The ACH580 ULH drive with ABB E-Clipse bypass provides an input disconnect switch or circuit breaker with door mounted and interlocked operator (padlockable in the OFF position), a bypass starter, electronic motor overload protection, a door mounted control panel with graphical display for local control, provisions for external control connections, and serial communications capability. Configurations with the +F267 option include a drive service switch.

Technical details and documentation
PDF, BIM, CAD Drawings and 3D models are available for planning your building.

Common characteristics of the ACH580 drives family

ACH580 series

HVAC control panel with primary settings
- Primary settings makes commissioning the drive easier than ever before
- The optional Bluetooth-enabled control panel allows easy smartphone connection and remote support capability
- Easily available USB interface for PC and tool connection
- Help button for problem-solving

HVAC communication protocols
- The most common HVAC communication protocols – BACnet MS/TP, Johnson Controls N2 and Modbus RTU – are standard
- BACnet/IP with optional fieldbus adapter

Ingress protection
- ACH580 drives are available in multiple different UL/NEMA classes. Check the details at the end of this catalog.

Suitable for various HVAC applications
- Suitable not only for variable-torque applications like fans and pumps, but also for basic constant-torque applications like compressors
- Support for induction, premanent magnet and synchronous reluctance motors

Reliability and quality
- All units are tested under full load at maximum allowed ambient temperature to verify quality
- Printed circuit boards have an extra coating to protect against humid and harsh environments

Harmonic mitigation options
- The ACH580-01 has optimized DC chokes standard for harmonic mitigation.
- Compliant with IEC/EN61000-3-12
- The ACH580-31 ultra-low harmonic drive results in harmonic current as low as 3 percent at the input terminals of the drive, meeting even the most stringent IEEE519 requirements.

Shared features of the ABB all-compatible drives portfolio

Drivetune smartphone app
- The Drivetune smartphone app together with the Bluetooth-enabled control panel allow you to set up and commission the drive remotely from a safe and comfortable location, using the same primary settings menu that is available on the control panel on the drive.

Energy efficiency calculators
- Optimize energy efficiency with features that help you to save and manage energy. You can monitor the hourly, daily cumulative, last hour, last day and last month energy consumption via kWh counters.

Diagnostic menu
- Analyze and resolve issues with the control panel's diagnostics menu. You can quickly analyze why the drive is performing as it is; running, stopped or running at the present speed.

Embedded load analyzers
- Analyze and optimize the application with the load profile log, which shows how the drive has been operating.

EMC/RFI category C2
- The EMC category C2 level design allows installation in commercial and residental buildings.

Reduced motor noise
- User-selectable switching frequencies to manage audible noise.

Integrated process control
- Reduce costs with built-in PID controllers, allowing drives to self-govern, limiting the need for external controllers.

Flexibility in programming
- Align the drive to the needs of your application and users with customized home screens and adaptive programming.

Extensive I/O capabilities
- ABB HVAC drives have an extensive number of I/O terminals in standard configuration
- Color-coded terminals and clear terminal marking significantly ease drive wiring process
- I/O status can be monitored via the I/O menu
- I/O can be forced on or off to verify the drive's programming

Same PC tools for ABB all-compatible drives
- Drive composer entry available for free at www.abb.com
- Same parameter structure makes the all-compatible platform easy to use

Connectivity
- ABB's F-series fieldbus adapters can be used throughout the all-compatible platform
- Fieldbus settings are made easy with the Primary Settings menu
- Bluetooth connectivity to apple and android devices

Technical data for the ACH580-01 and ACH580-31

Product compliance (complete list on following page)	
ACH580-01, ACH580-31	CE, UL, cUL, and EAC
Supply connection	
Input voltage (U_1)	
ACH580-xx-xxxA-2	208/240V
ACH580-xx-xxxA-4	480V
ACH580-xx-xxxA-6	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 φ) 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 Automatic fold back in case of overload
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
Input Updating Time	2 ms
3 relay outputs	Maximum switching voltage 250 V AC/30 V DC. Maximum continuous current 2 A rms. Programmable, Form C
Contact material	Silver Tin Oxide ($AgSnO_2$)
PTC, PT100 and PT1000	Any of the analog inputs, or digital input 6, are configurable for PTC with up to 6 sensors.
Adjustable filters on analog inputs and outputs	
All control inputs isolated from ground and power	
Operation	
Air temperature	-15 to +50 °C (5 to 122 °F). -15 to 0 °C (5 to 32 °F): No frost allowed. Output derated above +40 °C (104 °F)
Installation site altitude	0 to 4000 m (13123 ft) above sea level Output derated above 1000 m (3281 ft)
Relative humidity	5 to 95%: No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Atmospheric pressure	70 to 106 kPa (10.2 to 15.4 PSI) 0.7 to 1.05 atmospheres
Vibration	Risk category IV Certified (IBC 2018)

Environmental protections	
Chemical Gasses	Class 3C2
Solid Particles	Class 3S2 No conductive dust allowed
Pollution degree (IEC/EN 61800-5-1)	Pollution degree 2
Product compliance	
Standards and directives	Low Voltage Directive 2006/95/EC EMC Directive 2004/108/EC 60721-3-3: 2002 60721-3-1:1997 Quality assurance system ISO 9001 and Environmental system ISO 14001 CE, UL, cUL, and EAC approvals Galvanic isolation according to PELV RoHS2 (Restriction of Hazardous Substances) EN 61800-5-1: 2007; IEC/EN 61000-3-12; EN61800-3: 2017 + A1: 2012 Category C2 (1st environment restricted distribution); Safe torque off (EN 61800-5-2) BACnet Testing Laboratory (BTL) Seismic (IBC, OSHPD) Plenum rated
EMC (according to EN61800-3)	ACH580-01 and ACH580-31 class C2 (1st environment restricted distribution)
Storage (in Protective Shipping Package)	
Air Temperature	-40 to +70 °C (-40 to +158 °F)
Relative Humidity	Less than 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Chemical Gasses	Class 1C2
Solid Particles	Class 1S2 Contact ABB regarding Class 1S3
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres
Vibration (ISTA)	
R1…R4	In accordance with ISTA 1A
R5…R9	In accordance with ISTA 3E

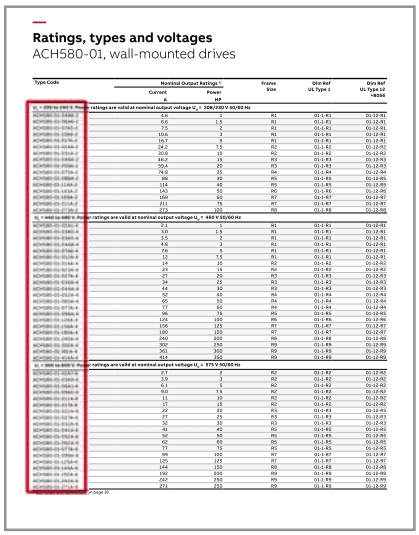
Transportation (in Protective Shipping Package)	
Air Temperature	-40° to 70°C (-40° to 158°F)
Relative Humidity	Less than 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Atmospheric Pressure	60 to 106 kPa (8.7 to 15.4 PSI) 0.6 to 1.05 atmospheres
Free Fall	R1: 76 cm (30 in) R2: 61 cm (24 in) R3: 46 cm (18 in) R4: 31 cm (12 in) R5: 25 cm (10 in)
Chemical Gasses	Class 2C2
Solid Particles	Class 2S2
Shock/ Drop (ISTA)	
R1…R4	In accordance with ISTA 1A
R5…R9	In accordance with ISTA 3E
Vibration (ISTA)	
R1…R4	In accordance with ISTA 1A
R5…R9	In accordance with ISTA 3E

How to select a drive

This is how you build up your own ordering code using the type designation key.

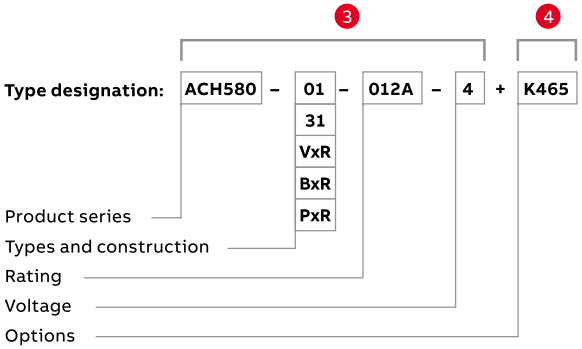
Start by identifying your supply voltage.
This tells you what rating table to use.
See pages 19-26.

Select your drive's order code from the rating table based on the nominal current rating of your motor.

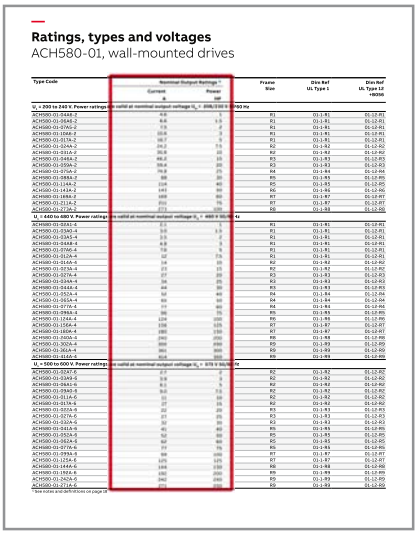

Ratings, types and voltages
ACH580-01, wall-mounted drives

Pages 19-26

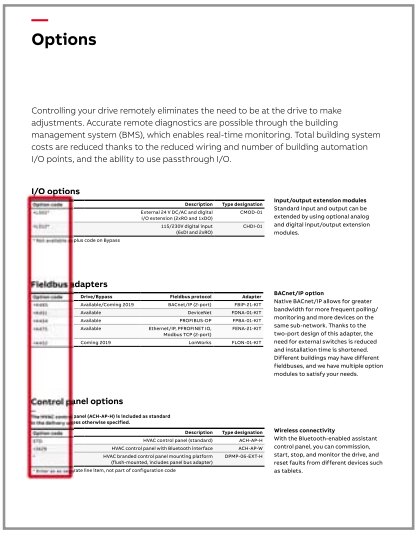
Choose your options (on page 36) and add the option codes to the drive's order code. Remember to use a "+" sign before each option code.



Choose the power and current rating of your motor from the ratings tables on pages 19-26.


Ratings, types and voltages
ACH580-01, wall-mounted drives

Pages 19-26


Options

Controlling your drive remotely eliminates the need to be at the drive to make adjustments. Accurate remote diagnostics are possible through the building management system (BMS), which enables real-time monitoring. Total building system costs are reduced thanks to the reduced wiring and number of building automation I/O points, and the ability to use passthrough I/O.

I/O options

Input/output extension modules
Standard input and output can be extended by using optional analog and digital input/output extension modules.

Fieldbus adapters

BACnet/IP option
Native BACnet/IP allows for greater bandwidth for more frequent polling/monitoring and more devices on the same sub-network. Thanks to the two-port design of this adapter, the need for external switches is reduced and installation time is shortened. Different buildings may have different fieldbuses, and we have multiple option modules to satisfy your needs.

Control panel options

Wireless connectivity
With the Bluetooth-enabled assistant control panel, you can commission, start, stop, and monitor the drive, and reset faults from different devices such as tablets.

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Note: Ratings apply at an ambient temperature of 40°C (104°F) unless otherwise noted.
To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current.

Definitions:
I Continuous rms output current allowing 110% overload for 1 minute every 10 minutes.
P Typical motor power
U_N Nominal output voltage of the drive
U_1 Input voltage range

Ratings, types and voltages
ACH580-01, wall-mounted drives

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type 1	Dim Ref UL Type 12 +B056
	Current A	Power HP			
U_1 = 200 to 240 V. Power ratings are valid at nominal output voltage U_N = 208/230 V 60 Hz					
ACH580-01-04A6-2	4.6	1	R1	01-1-R1	01-12-R1
ACH580-01-06A6-2	6.6	1.5	R1	01-1-R1	01-12-R1
ACH580-01-07A5-2	7.5	2	R1	01-1-R1	01-12-R1
ACH580-01-10A6-2	10.6	3	R1	01-1-R1	01-12-R1
ACH580-01-017A-2	16.7	5	R1	01-1-R1	01-12-R1
ACH580-01-024A-2	24.2	7.5	R2	01-1-R2	01-12-R2
ACH580-01-031A-2	30.8	10	R2	01-1-R2	01-12-R2
ACH580-01-046A-2	46.2	15	R3	01-1-R3	01-12-R3
ACH580-01-059A-2	59.4	20	R3	01-1-R3	01-12-R3
ACH580-01-075A-2	74.8	25	R4	01-1-R4	01-12-R4
ACH580-01-088A-2	88	30	R5	01-1-R5	01-12-R5
ACH580-01-114A-2	114	40	R5	01-1-R5	01-12-R5
ACH580-01-143A-2	143	50	R6	01-1-R6	01-12-R6
ACH580-01-169A-2	169	60	R7	01-1-R7	01-12-R7
ACH580-01-211A-2	211	75	R7	01-1-R7	01-12-R7
ACH580-01-273A-2	273	100	R8	01-1-R8	01-12-R8
U_1 = 440 to 480 V. Power ratings are valid at nominal output voltage U_N = 460 V 60 Hz					
ACH580-01-02A1-4	2.1	1	R1	01-1-R1	01-12-R1
ACH580-01-03A0-4	3.0	1.5	R1	01-1-R1	01-12-R1
ACH580-01-03A5-4	3.5	2	R1	01-1-R1	01-12-R1
ACH580-01-04A8-4	4.8	3	R1	01-1-R1	01-12-R1
ACH580-01-07A6-4	7.6	5	R1	01-1-R1	01-12-R1
ACH580-01-012A-4	12	7.5	R1	01-1-R1	01-12-R1
ACH580-01-014A-4	14	10	R2	01-1-R2	01-12-R2
ACH580-01-023A-4	23	15	R2	01-1-R2	01-12-R2
ACH580-01-027A-4	27	20	R3	01-1-R3	01-12-R3
ACH580-01-034A-4	34	25	R3	01-1-R3	01-12-R3
ACH580-01-044A-4	44	30	R3	01-1-R3	01-12-R3
ACH580-01-052A-4	52	40	R4	01-1-R4	01-12-R4
ACH580-01-065A-4	65	50	R4	01-1-R4	01-12-R4
ACH580-01-077A-4	77	60	R4	01-1-R4	01-12-R4
ACH580-01-096A-4	96	75	R5	01-1-R5	01-12-R5
ACH580-01-124A-4	124	100	R6	01-1-R6	01-12-R6
ACH580-01-156A-4	156	125	R7	01-1-R7	01-12-R7
ACH580-01-180A-4	180	150	R7	01-1-R7	01-12-R7
ACH580-01-240A-4	240	200	R8	01-1-R8	01-12-R8
ACH580-01-302A-4	302	250	R9	01-1-R9	01-12-R9
ACH580-01-361A-4	361	300	R9	01-1-R9	01-12-R9
ACH580-01-414A-4	414	350	R9	01-1-R9	01-12-R9
U_1 = 500 to 600 V. Power ratings are valid at nominal output voltage U_N = 575 V 60 Hz					
ACH580-01-02A7-6	2.7	2	R2	01-1-R2	01-12-R2
ACH580-01-03A9-6	3.9	3	R2	01-1-R2	01-12-R2
ACH580-01-06A1-6	6.1	5	R2	01-1-R2	01-12-R2
ACH580-01-09A0-6	9.0	7.5	R2	01-1-R2	01-12-R2
ACH580-01-011A-6	11	10	R2	01-1-R2	01-12-R2
ACH580-01-017A-6	17	15	R2	01-1-R2	01-12-R2
ACH580-01-022A-6	22	20	R3	01-1-R3	01-12-R3
ACH580-01-027A-6	27	25	R3	01-1-R3	01-12-R3
ACH580-01-032A-6	32	30	R3	01-1-R3	01-12-R3
ACH580-01-041A-6	41	40	R5	01-1-R5	01-12-R5
ACH580-01-052A-6	52	50	R5	01-1-R5	01-12-R5
ACH580-01-062A-6	62	60	R5	01-1-R5	01-12-R5
ACH580-01-077A-6	77	75	R5	01-1-R5	01-12-R5
ACH580-01-099A-6	99	100	R7	01-1-R7	01-12-R7
ACH580-01-125A-6	125	125	R7	01-1-R7	01-12-R7
ACH580-01-144A-6	144	150	R8	01-1-R8	01-12-R8
ACH580-01-192A-6	192	200	R9	01-1-R9	01-12-R9
ACH580-01-242A-6	242	250	R9	01-1-R9	01-12-R9
ACH580-01-271A-6	271	250	R9	01-1-R9	01-12-R9

[1] See notes and definitions on page 18.

Ratings, types and voltages

ACH580-VCR, vertical E-Clipse bypass drive with circuit breaker

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type1
	Drive Current A	Package Power HP		
U_1 = 200 to 240 V. Power ratings are valid at nominal output voltage U_N = 208/230 V 60 Hz				
ACH580-VCR-04A6-2	4.6	1	R1	Vx1-1
ACH580-VCR-06A6-2	6.6	1.5	R1	Vx1-1
ACH580-VCR-07A5-2	7.5	2	R1	Vx1-1
ACH580-VCR-10A6-2	10.6	3	R1	Vx1-1
ACH580-VCR-017A-2	16.7	5	R1	Vx1-1
ACH580-VCR-024A-2	24.2	7.5	R2	Vx1-2
ACH580-VCR-031A-2	30.8	10	R2	Vx1-3
ACH580-VCR-046A-2	46.2	15	R3	Vx1-4
ACH580-VCR-059A-2	59.4	20	R3	Vx1-4
ACH580-VCR-075A-2	74.8	25	R4	Vx1-4
U_1 = 440 to 480 V. Power ratings are valid at nominal output voltage U_N = 460 V 60 Hz				
ACH580-VCR-02A1-4	2.1	1	R1	Vx1-1
ACH580-VCR-03A0-4	3.0	1.5	R1	Vx1-1
ACH580-VCR-03A5-4	3.5	2	R1	Vx1-1
ACH580-VCR-04A8-4	4.8	3	R1	Vx1-1
ACH580-VCR-07A6-4	7.6	5	R1	Vx1-1
ACH580-VCR-012A-4	12	7.5	R1	Vx1-1
ACH580-VCR-014A-4	14	10	R2	Vx1-2
ACH580-VCR-023A-4	23	15	R2	Vx1-2
ACH580-VCR-027A-4	27	20	R3	Vx1-3
ACH580-VCR-034A-4	34	25	R3	Vx1-3
ACH580-VCR-044A-4	44	30	R3	Vx1-3
ACH580-VCR-052A-4	52	40	R4	Vx1-4
ACH580-VCR-065A-4	65	50	R4	Vx1-4
ACH580-VCR-077A-4	77	60	R4	Vx1-4
U_1 = 500 to 600 V. Power ratings are valid at nominal output voltage U_N = 575 V 60 Hz				
ACH580-VCR-02A7-6	2.7	2	R2	Vx1-2
ACH580-VCR-03A9-6	3.9	3	R2	Vx1-2
ACH580-VCR-06A1-6	6.1	5	R2	Vx1-2
ACH580-VCR-09A0-6	9.0	7.5	R2	Vx1-2
ACH580-VCR-011A-6	11	10	R2	Vx1-2
ACH580-VCR-017A-6	17	15	R2	Vx1-2
ACH580-VCR-022A-6	22	20	R3	Vx1-3
ACH580-VCR-027A-6	27	25	R3	Vx1-3
ACH580-VCR-032A-6	32	30	R3	Vx1-3

[1] See notes and definitions on page 18.

Ratings, types and voltages

ACH580-VDR, vertical E-Clipse bypass drive with non-fused disconnect switch

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type 1
	Drive Current A	Package Power HP		
U_1 = 200 to 240 V. Power ratings are valid at nominal output voltage U_N = 208/230 V 60 Hz				
ACH580-VDR-04A6-2	4.6	1	R1	Vx1-1
ACH580-VDR-06A6-2	6.6	1.5	R1	Vx1-1
ACH580-VDR-07A5-2	7.5	2	R1	Vx1-1
ACH580-VDR-10A6-2	10.6	3	R1	Vx1-1
ACH580-VDR-017A-2	16.7	5	R1	Vx1-1
ACH580-VDR-024A-2	24.2	7.5	R2	Vx1-2
ACH580-VDR-031A-2	30.8	10	R2	Vx1-3
ACH580-VDR-046A-2	46.2	15	R3	Vx1-4
ACH580-VDR-059A-2	59.4	20	R3	Vx1-4
ACH580-VDR-075A-2	74.8	25	R4	Vx1-4
U_1 = 440 to 480 V. Power ratings are valid at nominal output voltage U_N = 460 V 60 Hz				
ACH580-VDR-02A1-4	2.1	1	R1	Vx1-1
ACH580-VDR-03A0-4	3.0	1.5	R1	Vx1-1
ACH580-VDR-03A5-4	3.5	2	R1	Vx1-1
ACH580-VDR-04A8-4	4.8	3	R1	Vx1-1
ACH580-VDR-07A6-4	7.6	5	R1	Vx1-1
ACH580-VDR-012A-4	12	7.5	R1	Vx1-1
ACH580-VDR-014A-4	14	10	R2	Vx1-2
ACH580-VDR-023A-4	23	15	R2	Vx1-2
ACH580-VDR-027A-4	27	20	R3	Vx1-3
ACH580-VDR-034A-4	34	25	R3	Vx1-3
ACH580-VDR-044A-4	44	30	R3	Vx1-3
ACH580-VDR-052A-4	52	40	R4	Vx1-4
ACH580-VDR-065A-4	65	50	R4	Vx1-4
ACH580-VDR-077A-4	77	60	R4	Vx1-4
U_1 = 500 to 600 V. Power ratings are valid at nominal output voltage U_N = 575 V 60 Hz				
ACH580-VDR-02A7-6	2.7	2	R2	Vx1-2
ACH580-VDR-03A9-6	3.9	3	R2	Vx1-2
ACH580-VDR-06A1-6	6.1	5	R2	Vx1-2
ACH580-VDR-09A0-6	9.0	7.5	R2	Vx1-2
ACH580-VDR-011A-6	11	10	R2	Vx1-2
ACH580-VDR-017A-6	17	15	R2	Vx1-2
ACH580-VDR-022A-6	22	20	R3	Vx1-3
ACH580-VDR-027A-6	27	25	R3	Vx1-3
ACH580-VDR-032A-6	32	30	R3	Vx1-3

[1] See notes and definitions on page 18.

Ratings, types and voltages

ACH580-BCR, E-Clipse bypass drive with circuit breaker

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type 1	Dim Ref UL Type 12 +B056	Dim Ref NEMA 3R +B058
	Drive Current A	Package Power HP				
U_1 = 200 to 240 V. Power ratings are valid at nominal output voltage U_N = 208/230 V 60 Hz						
ACH580-BCR-04A6-2	4.6	1	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-06A6-2	6.6	1.5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-07A5-2	7.5	2	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-10A6-2	10.6	3	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-017A-2	16.7	5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-024A-2	24.2	7.5	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-031A-2	30.8	10	R2	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-046A-2	46.2	15	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-059A-2	59.4	20	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-075A-2	74.8	25	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-088A-2	88.0	30	R5	Bx1-3	Bx12-3	Bx3R-3
ACH580-BCR-114A-2	114	40	R5	Bx1-3	Bx12-3	Bx3R-3
ACH580-BCR-143A-2	143	50	R6	Bx1-3	Bx12-3	Bx3R-4
ACH580-BCR-169A-2	169	60	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BCR-211A-2	211	75	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BCR-248A-2	248	100[2]	R8	Bx1-3	Bx12-3	Bx3R-5
U_1 = 440 to 480 V. Power ratings are valid at nominal output voltage U_N = 460 V 60 Hz						
ACH580-BCR-02A1-4	2.1	1	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-03A0-4	3.0	1.5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-03A5-4	3.5	2	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-04A8-4	4.8	3	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-07A6-4	7.6	5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-012A-4	12	7.5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-014A-4	14	10	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-023A-4	23	15	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-027A-4	27	20	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-034A-4	34	25	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-044A-4	44	30	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-052A-4	52	40	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-065A-4	65	50	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-077A-4	77	60	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-096A-4	96	75	R5	Bx1-3	Bx12-3	Bx3R-3
ACH580-BCR-124A-4	124	100	R6	Bx1-3	Bx12-3	Bx3R-4
ACH580-BCR-156A-4	156	125	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BCR-180A-4	180	150	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BCR-240A-4	240	200	R8	Bx1-3	Bx12-3	Bx3R-5
ACH580-BCR-302A-4	302	250	R9	Bx1-6	Bx12-6	Bx3R-6
ACH580-BCR-361A-4	361	300	R9	Bx1-6	Bx12-6	Bx3R-6
ACH580-BCR-414A-4	414	350	R9	Bx1-6	Bx12-6	Bx3R-6
U_1 = 500 to 600 V. Power ratings are valid at nominal output voltage U_N = 575 V 60 Hz						
ACH580-BCR-02A7-6	2.7	2	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-03A9-6	3.9	3	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-06A1-6	6.1	5	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-09A0-6	9.0	7.5	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-011A-6	11	10	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-017A-6	17	15	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BCR-022A-6	22	20	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-027A-6	27	25	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-032A-6	32	30	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BCR-041A-6	41	40	R5	Bx1-3	Bx12-3	-
ACH580-BCR-052A-6	52	50	R5	Bx1-3	Bx12-3	-
ACH580-BCR-062A-6	62	60	R5	Bx1-3	Bx12-3	-
ACH580-BCR-077A-6	77	75	R5	Bx1-3	Bx12-3	-
ACH580-BCR-099A-6	99	100	R7	Bx1-3	Bx12-3	-
ACH580-BCR-125A-6	125	125	R7	Bx1-3	Bx12-3	-
ACH580-BCR-144A-6	144	150	R8	Bx1-3	Bx12-3	-

[1] See notes and definitions on page 18.

[2] 100 HP at 230 V

Ratings, types and voltages

ACH580-BDR, E-Clipse bypass drive with non-fused disconnect switch

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type 1	Dim Ref UL Type 12 +B056	Dim Ref NEMA 3R +B058
	Drive Current A	Package Power HP				
U_1 = 200 to 240 V. Power ratings are valid at nominal output voltage U_N = 208/230 V 60 Hz						
ACH580-BDR-04A6-2	4.6	1	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-06A6-2	6.6	1.5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-07A5-2	7.5	2	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-10A6-2	10.6	3	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-017A-2	16.7	5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-024A-2	24.2	7.5	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-031A-2	30.8	10	R2	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-046A-2	46.2	15	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-059A-2	59.4	20	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-075A-2	74.8	25	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-088A-2	88.0	30	R5	Bx1-3	Bx12-3	Bx3R-3
ACH580-BDR-114A-2	114	40	R5	Bx1-3	Bx12-3	Bx3R-3
ACH580-BDR-143A-2	143	50	R6	Bx1-3	Bx12-3	Bx3R-4
ACH580-BDR-169A-2	169	60	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BDR-211A-2	211	75	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BDR-248A-2	248	100[2]	R8	Bx1-3	Bx12-3	Bx3R-5
U_1 = 440 to 480 V. Power ratings are valid at nominal output voltage U_N = 460 V 60 Hz						
ACH580-BDR-02A1-4	2.1	1	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-03A0-4	3.0	1.5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-03A5-4	3.5	2	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-04A8-4	4.8	3	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-07A6-4	7.6	5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-012A-4	12	7.5	R1	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-014A-4	14	10	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-023A-4	23	15	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-027A-4	27	20	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-034A-4	34	25	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-044A-4	44	30	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-052A-4	52	40	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-065A-4	65	50	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-077A-4	77	60	R4	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-096A-4	96	75	R5	Bx1-3	Bx12-3	Bx3R-3
ACH580-BDR-124A-4	124	100	R6	Bx1-3	Bx12-3	Bx3R-4
ACH580-BDR-156A-4	156	125	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BDR-180A-4	180	150	R7	Bx1-3	Bx12-3	Bx3R-4
ACH580-BDR-240A-4	240	200	R8	Bx1-3	Bx12-3	Bx3R-5
ACH580-BDR-302A-4	302	250	R9	Bx1-6	Bx12-6	Bx3R-6
ACH580-BDR-361A-4	361	300	R9	Bx1-6	Bx12-6	Bx3R-6
ACH580-BDR-414A-4	414	350	R9	Bx1-6	Bx12-6	Bx3R-6
U_1 = 500 to 600 V. Power ratings are valid at nominal output voltage U_N = 575 V 60 Hz						
ACH580-BDR-02A7-6	2.7	2	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-03A9-6	3.9	3	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-06A1-6	6.1	5	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-09A0-6	9.0	7.5	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-011A-6	11	10	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-017A-6	17	15	R2	Bx1-1	Bx12-1	Bx3R-1
ACH580-BDR-022A-6	22	20	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-027A-6	27	25	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-032A-6	32	30	R3	Bx1-2	Bx12-2	Bx3R-2
ACH580-BDR-041A-6	41	40	R5	Bx1-3	Bx12-3	-
ACH580-BDR-052A-6	52	50	R5	Bx1-3	Bx12-3	-
ACH580-BDR-062A-6	62	60	R5	Bx1-3	Bx12-3	-
ACH580-BDR-077A-6	77	75	R5	Bx1-3	Bx12-3	-
ACH580-BDR-099A-6	99	100	R7	Bx1-3	Bx12-3	-
ACH580-BDR-125A-6	125	125	R7	Bx1-3	Bx12-3	-
ACH580-BDR-144A-6	144	150	R8	Bx1-3	Bx12-3	

[1] See notes and definitions on page 18.

[2] 100 HP at 230 V

Ratings, types and voltages

ACH580-PCR, packaged drive with disconnect means with circuit breaker

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type 1	Dim Ref UL Type 12 +B056	Dim Ref NEMA 3R +B058
	Current A	Power HP				
U_1 = 200 to 240 V. Power ratings are valid at nominal output voltage U_N = 208/230 V 60 Hz						
ACH580-PCR-04A6-2	4.6	1	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-06A6-2	6.6	1.5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-07A5-2	7.5	2	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-10A6-2	10.6	3	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-017A-2	16.7	5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-024A-2	24.2	7.5	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-031A-2	30.8	10	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-046A-2	46.2	15	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-059A-2	59.4	20	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-075A-2	74.8	25	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PCR-088A-2	88.0	30	R5	PxB1-3	PxB12-3	PxB3R-3
ACH580-PCR-114A-2	114	40	R6	PxB1-3	PxB12-3	PxB3R-3
ACH580-PCR-143A-2	143	50	R6	PxB1-3	PxB12-3	PxB3R-4
ACH580-PCR-169A-2	169	60	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PCR-211A-2	211	75	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PCR-248A-2	248	100[2]	R8	PxB1-3	PxB12-3	PxB3R-4
U_1 = 380 to 480 V. Power ratings are valid at nominal output voltage U_N = 460 V 60 Hz						
ACH580-PCR-02A1-4	2.1	1	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-03A0-4	3.0	1.5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-03A5-4	3.5	2	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-04A8-4	4.8	3	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-07A6-4	7.6	5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-012A-4	12	7.5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PCR-014A-4	14	10	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-023A-4	23	15	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-027A-4	27	20	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-034A-4	34	25	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-044A-4	44	30	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-052A-4	52	40	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PCR-065A-4	65	50	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PCR-077A-4	77	60	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PCR-096A-4	96	75	R5	PxB1-3	PxB12-3	PxB3R-3
ACH580-PCR-124A-4	124	100	R6	PxB1-3	PxB12-3	PxB3R-4
ACH580-PCR-156A-4	156	125	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PCR-180A-4	180	150	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PCR-240A-4	240	200	R8	PxB1-3	PxB12-3	PxB3R-4
ACH580-PCR-302A-4	302	250	R9	PxB1-6	PxB12-6	PxB3R-5
ACH580-PCR-361A-4	361	300	R9	PxB1-6	PxB12-6	PxB3R-5
ACH580-PCR-414A-4	414	350	R9	PxB1-6	PxB12-6	PxB3R-5
U_1 = 500 to 600 V. Power ratings are valid at nominal output voltage U_N = 575 V 60 Hz						
ACH580-PCR-02A7-6	2.7	2	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-03A9-6	3.9	3	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-06A1-6	6.1	5	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-09A0-6	9.0	7.5	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-011A-6	11	10	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-017A-6	17	15	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PCR-022A-6	22	20	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-027A-6	27	25	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-032A-6	32	30	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PCR-041A-6	41	40	R5	PxB1-3	PxB12-3	-
ACH580-PCR-052A-6	52	50	R5	PxB1-3	PxB12-3	-
ACH580-PCR-062A-6	62	60	R5	PxB1-3	PxB12-3	-
ACH580-PCR-077A-6	77	75	R5	PxB1-3	PxB12-3	-
ACH580-PCR-099A-6	99	100	R7	PxB1-3	PxB12-3	-
ACH580-PCR-125A-6	125	125	R7	PxB1-3	PxB12-3	-
ACH580-PCR-144A-6	144	150	R8	PxB1-3	PxB12-3	-

[1] See notes and definitions on page 18.

[2] 100 HP at 230 V

Ratings, types and voltages

ACH580-PDR, packaged drive with disconnect means with non-fused disconnect switch

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type 1	Dim Ref UL Type 12 +B056	Dim Ref NEMA 3R +B058
	Current A	Power HP				
U_1 = 200 to 240 V. Power ratings are valid at nominal output voltage U_N = 208/230 V 60 Hz						
ACH580-PDR-04A6-2	4.6	1	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-06A6-2	6.6	1.5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-07A5-2	7.5	2	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-10A6-2	10.6	3	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-017A-2	16.7	5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-024A-2	24.2	7.5	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-031A-2	30.8	10	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-046A-2	46.2	15	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-059A-2	59.4	20	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-075A-2	74.8	25	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PDR-088A-2	88.0	30	R5	PxB1-3	PxB12-3	PxB3R-3
ACH580-PDR-114A-2	114	40	R5	PxB1-3	PxB12-3	PxB3R-3
ACH580-PDR-143A-2	143	50	R6	PxB1-3	PxB12-3	PxB3R-4
ACH580-PDR-169A-2	169	60	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PDR-211A-2	211	75	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PDR-248A-2	248	100[2]	R8	PxB1-3	PxB12-3	PxB3R-4
U_1 =380 to 480 V. Power ratings are valid at nominal output voltage U_N = 460 V 60 Hz						
ACH580-PDR-02A1-4	2.1	1	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-03A0-4	3.0	1.5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-03A5-4	3.5	2	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-04A8-4	4.8	3	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-07A6-4	7.6	5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-012A-4	12	7.5	R1	Px1-1	Px12-1	PxB3R-1
ACH580-PDR-014A-4	14	10	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-023A-4	23	15	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-027A-4	27	20	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-034A-4	34	25	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-044A-4	44	30	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-052A-4	52	40	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PDR-065A-4	65	50	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PDR-077A-4	77	60	R4	Px1-4	Px12-4	PxB3R-2
ACH580-PDR-096A-4	96	75	R5	PxB1-3	PxB12-3	PxB3R-3
ACH580-PDR-124A-4	124	100	R6	PxB1-3	PxB12-3	PxB3R-4
ACH580-PDR-156A-4	156	125	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PDR-180A-4	180	150	R7	PxB1-3	PxB12-3	PxB3R-4
ACH580-PDR-240A-4	240	200	R8	PxB1-3	PxB12-3	PxB3R-4
ACH580-PDR-302A-4	302	250	R9	PxB1-6	PxB12-6	PxB3R-5
ACH580-PDR-361A-4	361	300	R9	PxB1-6	PxB12-6	PxB3R-5
ACH580-PDR-414A-4	414	350	R9	PxB1-6	PxB12-6	PxB3R-5
U_1 = 500 to 600 V. Power ratings are valid at nominal output voltage U_N = 575 V 60 Hz						
ACH580-PDR-02A7-6	2.7	2	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-03A9-6	3.9	3	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-06A1-6	6.1	5	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-09A0-6	9.0	7.5	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-011A-6	11	10	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-017A-6	17	15	R2	Px1-2	Px12-2	PxB3R-1
ACH580-PDR-022A-6	22	20	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-027A-6	27	25	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-032A-6	32	30	R3	Px1-3	Px12-3	PxB3R-2
ACH580-PDR-041A-6	41	40	R5	PxB1-3	PxB12-3	-
ACH580-PDR-052A-6	52	50	R5	PxB1-3	PxB12-3	-
ACH580-PDR-062A-6	62	60	R5	PxB1-3	PxB12-3	-
ACH580-PDR-077A-6	77	75	R5	PxB1-3	PxB12-3	-
ACH580-PDR-099A-6	99	100	R7	PxB1-3	PxB12-3	-
ACH580-PDR-125A-6	125	125	R7	PxB1-3	PxB12-3	-
ACH580-PDR-144A-6	144	150	R8	PxB1-3	PxB12-3	-

[1] See notes and definitions on page 18.

[2] 100 HP at 230 V

Ratings, types and voltages
ACH580-31, ultra-low harmonic drives

Type Code	Nominal Output Ratings [1]		Frame Size	Dim Ref UL Type 1	Dim Ref UL Type 12 +B056
	Current A	Power HP			
U_1 = 380 to 480 V. Power ratings are valid at nominal output voltage 460 V 60 Hz					
ACH580-31-07A6-4	7.6	5	R3	31-1-R3	31-12-R3
ACH580-31-012A-4	12	7.5	R3	31-1-R3	31-12-R3
ACH580-31-014A-4	14	10	R3	31-1-R3	31-12-R3
ACH580-31-023A-4	23	15	R3	31-1-R3	31-12-R3
ACH580-31-027A-4	27	20	R6	31-1-R6	31-12-R6
ACH580-31-034A-4	34	25	R6	31-1-R6	31-12-R6
ACH580-31-044A-4	44	30	R6	31-1-R6	31-12-R6
ACH580-31-052A-4	52	40	R6	31-1-R6	31-12-R6
ACH580-31-065A-4	65	50	R6	31-1-R6	31-12-R6
ACH580-31-077A-4	77	60	R6	31-1-R6	31-12-R6

[1] See notes and definitions on page 18.

Option compatibility
Descriptions

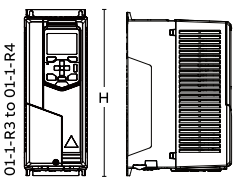
Constructions												Option	Option Code	Description
01	VCR	VDR	BCR	BDR	PCR	PDR	31	3BCR	3BDR	3PCR	3PDR			
•	•	•	•	•	•	•	•	•	•	•	•	UL (NEMA) Type 1	-	Indoor use primarily to provide a degree of protection against limited amounts of falling dirt.
•			•	•	•	•	•	•	•	•	•	UL (NEMA) Type 12	+B056	Indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping non-corrosive liquids. Does not protect against contamination from salt-laden air
			•	•	•	•		•	•	•	•	UL (NEMA) Type 3R	+B058	Either indoor or outdoor use to provide a degree of protection against falling dirt, rain, sleet, and snow; and that will be undamaged by the external formation of ice on the enclosure.
			•	•	•	•		•	•	•	•	UL (NEMA) Type 3R Stainless Steel	+B058+C165	Either indoor or outdoor use to provide a degree of protection against falling dirt, rain, sleet, and snow; and that will be undamaged by the external formation of ice on the enclosure. Enclosure is made of Stainless Steel grade 304. Internal heating strips and cooling fans regulate the internal temperature of the enclosure.
			•	•	•	•		•	•	•	•	UL (NEMA) Type 4	+B057	Either indoor or outdoor use to provide a degree of protection against falling dirt, windblown dust, rain, sleet, snow, splashing water, and hose-directed water; and that will be undamaged by the external formation of ice on the enclosure. Enclosure is made of powder coated galvanized steel. An air conditioner is mounted on the side of the enclosure for cooling of the VFD.
			•	•	•	•		•	•	•	•	UL (NEMA) Type 4X	+B063+C165	Either indoor or outdoor use to provide a degree of protection against falling dirt, windblown dust, rain, sleet, snow, splashing water, and hose-directed water; and that will be undamaged by the external formation of ice on the enclosure. Enclosure is made of Stainless Steel grade 304. A stainless steel air conditioner made of 304 grade steel is mounted on the side of the enclosure for cooling of the VFD.
	•	•	•	•				•	•			Service Switch	+F267	Provides a means to manually disconnect power to the drive.
			•	•	•	•						Line Reactor	+E213	A line reactor provides additional line side impedance for power conditioning. In some applications the line reactor will prevent nuisance drive trips and slightly reduce overall harmonic current.
			•	•	•	•						Passive Filter	+E211	A passive harmonic filter (inductive-capacitive) style is installed and wired in series with the drive. For power factor control, the contactor drops out the tuning reactor and capacitors during light loading. This filter is designed to limit current distortion to less than 5%.
			•	•				•	•			Softstart Bypass	+G390	The Softstarter is installed in the bypass circuit ahead of the Bypass Contactor power contacts. Softstarter operation is initiated by means of a control circuit interlock contact on the Bypass Contactor. Softstarter UP-TO-SPEED and FAULT signals (contact closures) are available at the Softstarter terminal block.
					•	•						Redundant	+C170	The redundant drive control option has two drives installed into a single enclosure to act as a backup for critical applications. The control scheme automatically switches from selected Lead Drive to secondary drive upon a fault on the selected Lead Drive. Each drive equipped with Drive Fuses and electrically interlocked drive output contactors.
			•	•	•	•						MMPs	+xG405+M6xx	Control multiple motors with a single drive. Size the drive based on the combined power rating of all of the loads that will be controlled by the drive. ABB Manual Motor Protectors (MMPs) are sized based on each individual load are installed on the output of the VFD.

Adding these options may change the dimensions of the enclosure.
Contact ABB for available configuration requirements.

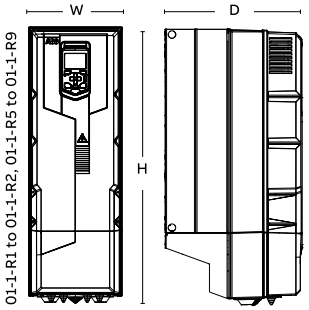
Dimensions
ACH580-01

ACH580-01, wall-mounted UL Type 1

Dim Ref	Height		Width		Depth		Weight	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(lb)	(kg)
01-1-R1	14.69	373	4.92	125	8.78	223	10.1	4.6
01-1-R2	18.62	473	4.92	125	9.02	229	14.6	6.6
01-1-R3	19.29	490	7.99	203	9.02	229	26.0	11.8
01-1-R4	25.04	636	7.99	203	10.12	257	41.9	19.0
01-1-R5	28.82	732	7.99	203	11.61	295	62.4	28.3
01-1-R6	28.62	727	9.92	252	14.53	369	93.5	42.4
01-1-R7	34.65	880	11.18	284	14.57	370	119.1	54.0
01-1-R8	37.99	965	11.81	300	15.47	393	152.2	69.0
01-1-R9	37.60	955	14.96	380	16.46	418	213.9	97.0



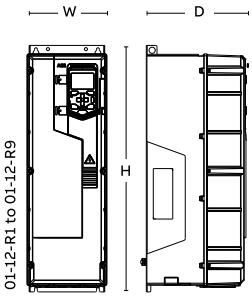
ACH580-01 with integrated conduit box (R3-R4)



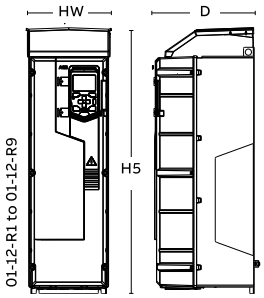
ACH580-01 with removeable conduit box (R1-R2, R5-R9)

ACH580-01, wall-mounted UL Type 12 (option +B056)

Dim Ref	Height		Height (H5)		Width (W)		Width (HW)		Depth (D)		Weight	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(lb)	(kg)
01-12-R1	15.87	403	17.78	452	5.04	128	5.09	129	9.17	233	10.6	4.8
01-12-R2	19.80	503	21.49	546	5.04	128	5.10	130	9.41	239	15.0	6.8
01-12-R3	19.29	490	20.93	532	8.11	206	8.16	207	9.33	237	28.7	13.0
01-12-R4	25.04	636	27.03	686	7.99	203	8.59	218	10.43	265	44.1	20.0
01-12-R5	28.82	732	32.01	813	7.99	203	8.58	218	12.60	320	63.9	29.0
01-12-R6	28.62	727	34.81	884	9.92	252	11.46	291	14.96	380	94.8	43.0
01-12-R7	34.65	880	40.86	1038	11.18	284	13.00	330	15.00	381	123.5	56.0
01-12-R8	37.99	965	44.23	1123	11.81	300	13.80	351	17.80	452	169.8	77.0
01-12-R9	37.60	955	46.75	1188	14.96	380	16.95	431	18.78	477	227.1	103.0



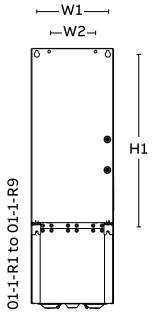
ACH580-01 without hood with integrated conduit box (R1-R9)



ACH580-01 with hood with integrated conduit box (R1-R9)

ACH580-01, mounting dimensions UL Type 1 and UL Type 12

Dim Ref	Height (H1)		Width (W1)		Width (W2)	
	(in)	(mm)	(in)	(mm)	(in)	(mm)
01-1-R1/01-12-R1	12.48	317	3.86	98	-	-
01-1-R2/01-12-R2	16.42	417	3.86	98	-	-
01-1-R3/01-12-R3	18.62	473	6.30	160	-	-
01-1-R4/01-12-R4	24.37	619	6.30	160	3.86	98
01-1-R5/01-12-R5	22.87	581	6.30	160	3.86	98
01-1-R6/01-12-R6	20.91	531	8.37	213	6.30	160
01-1-R7/01-12-R7	22.95	583	9.65	245	6.30	160
01-1-R8/01-12-R8	25.91	658	10.33	263	8.43	214
01-1-R9/01-12-R9	25.91	658	13.58	345	7.87	200

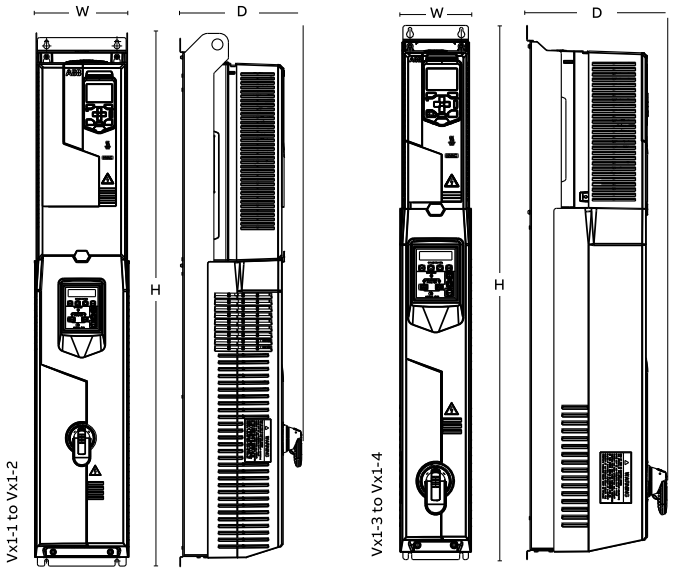


Standard configuration dimensions for reference only.

Dimensions
ACH580-VCR and ACH580-VDR

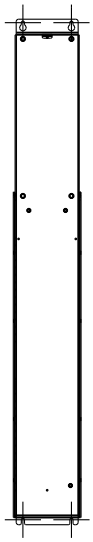
ACH580-VCR and ACH580-VDR, vertical
E-Clipse bypass drives UL Type 1

Dim Ref	Height		Width		Depth		Weight	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(lb)	(kg)
Vx1-1	40.18	1021	5.39	137	10.55	268	30.0	13.6
Vx1-2	44.10	1120	5.39	137	10.77	274	50.7	23.0
Vx1-3	47.70	1212	8.44	214	10.90	277	59.5	27.0
Vx1-4	56.82	1443	8.44	214	12.00	305	86.0	39.0



ACH580-VCR and ACH580-VDR, vertical
E-Clipse bypass drives UL Type 1, mounting dimensions

Dim Ref	Height (H1)		Width (W1)		Width (W2)	
	(in)	(mm)	(in)	(mm)	(in)	(mm)
Vx1-1	39.51	1004	4.93	125	3.86	98
Vx1-2	43.43	1103	4.93	125	3.86	98
Vx1-3	46.47	1180	8.19	208	6.30	160
Vx1-4	55.70	1415	8.19	208	6.30	160



Standard configuration dimensions for reference only.

Dwyer

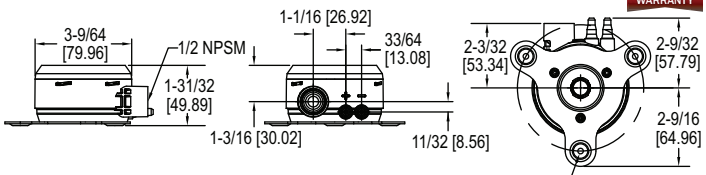
SERIES MSX

MAGNESENSE® DIFFERENTIAL PRESSURE TRANSMITTER

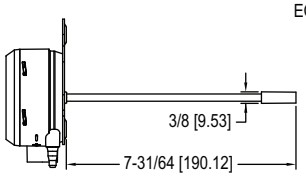
Monitors Differential Pressure, Air Velocity, and Volumetric Flow

5 YEAR LIMITED WARRANTY

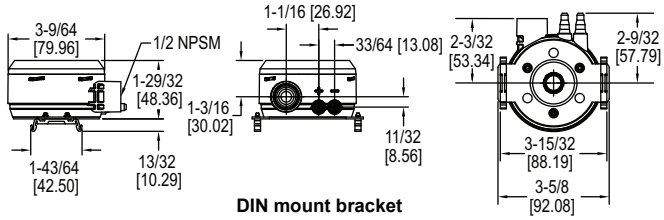
VIDEO ONLINE



Wall mount bracket



Duct mount bracket



DIN mount bracket

The **Series MSX Magnesense® Differential Pressure Transmitter** combines the stability and versatility of the original Series MS2 Magnesense® II transmitter for use in building control applications. The MSX simplifies the ordering process to deliver the desired configuration, which reduces product setup time. Pressure ranges are available in Pa, mm w.c., and in w.c. All pressure ranges can be configured in unidirectional or bidirectional modes, providing a total of 32 ranges. The MSX transmitter can provide a linear pressure output or a linear velocity output with the square root extraction from the transmitter. Additional parameters have been included to expand the square root capability for calculating flow. Dual voltage and milliamp output signals can be used to provide both control and equipment output signal verification.

BENEFITS/FEATURES

- Read LCD values easier with rotatable 180° display
- Quick and easy wiring via the optional toolless terminal block
- Add safety to variety of applications with UL94 V-0 and plenum ratings

APPLICATIONS

- Filter monitoring in air handler units
- Building pressure in pharmaceutical/semiconductor clean rooms
- Duct static pressure in commercial buildings
- Air velocity/flow in VAV systems

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±1% FSO.
Stability: ±1% FSO/year.
Temperature Limits: -4 to 158°F (-20 to 70°C).
Pressure Limits: Ranges 0 and 1: 3.6 psi max operation, 6 psi burst; Ranges 2, 3 and 4: 6 psi max operation, 6 psi burst.
Power Requirements: 10-36 VDC (2-wire), 17-36 VDC or isolated 21.6-33 VAC (3-wire).
Output Signals: 4-20 mA (2-wire); 0-10 V or 0-5 V selectable (3-wire).
Response Time: Instantaneous (default) or 3 s (selectable).
Zero and Span Adjustments: Digital push-button.
Loop Resistance: Current output: 0-1250 Ω max; Voltage output: min. load resistance 1 kΩ.
Current Consumption: 21 mA max continuous.
Electrical Connections: 4-wire removable European style terminal block for 16 to 26 AWG.
Electrical Entry: 1/2″ NPS thread.
Display (optional): 4 digit LCD.
Process Connections: 1/8″, 3/16″, 1/4″, 5 mm, and 6 mm ID flexible tubing.
Enclosure Rating: NEMA 4X (IP66), UL 2043 (Plenum), UL94 V-0.
Mounting Orientation: Pressure sensor measurement unaffected by orientation.
Weight: 8.0 oz (230 g).
Compliance: CE.

OPTIONS

Range	in w.c.	Pa low	Pa high	mm w.c.
Range 0	0.1 0.15 0.25 0.5*	25 30 40 50	60 75 100 125*	2.5 5 10 12*
Range 1	0.1 0.25 0.5 1*	25 40 50 60	100 150 160 250*	2.5 5 10 25*
Range 2	1 2 3 5*	250 300 400 500	600 750 1000 1250*	25 50 100 125*
Range 3	10 15 25 28*	1000 1500 2000 2500	3000 4000 5000 7000*	250 350 500 700*
Range 4	1 5 10 15*	250 300 400 500	1000 2000 3000 4000*	25 125 250 400*

*Indicated values are the positive full-scale output values per range.
Note: Ranges indicated in the table are the high end of the set range. All ranges have a low end pressure value of 0.

MODEL CHART

Example	MSX	-W	1	3	-IN	-LCD	MSX-W13-IN-LCD
Series	MSX						Magnesense® differential pressure transmitter
Mounting		W U N					Wall mount Universal (wall or duct) mount DIN rail mount
Direction			1 2				Unidirectional Bidirectional
Range				0 1 2 3 4			.5 in w.c., 125 Pa, 12.5 mm w.c. 1 in w.c., 250 Pa, 25 mm w.c. 5 in w.c., 1250 Pa, 125 mm w.c. 28 in w.c., 7000 Pa, 700 mm w.c. 15 in w.c., 4000 Pa, 400 mm w.c.
Pressure Unit					IN PA MM		Inches water column Pascal Millimeters water column
Options						A481 COM FC FP GLD LCD NIST STX TT WO	Installer kit, includes 2 plastic static pressure tips and 7 ft (2.1m) of PVC tubing BACnet/Modbus® communications Factory calibration certificate Filtered pickup with barb Liquid tight cable gland fitting Liquid crystal display NIST traceable calibration certificate Two (2) plastic static pressure tips Toolless terminal block LCD cover without LCD display

ACCESSORIES

Model	Description
A-480	Plastic static pressure tip
A-481	Installer kit, includes 2 plastic static pressure tips and 7 ft (2.1 m) of PVC tubing
A-MSX-LCD	Replacement display for the Series MSX

Modbus® is a registered trademark of Schneider Electric USA, Inc.

SINCE 1945 KEYSTONE LIGHT MADE EASY®

ESSENTIAL SERIES
GENERAL PURPOSE LED BULBS

KT-LED14A19-O-8XX-ND-CS
REPLACEMENT LAMP

DESCRIPTION
14W A19 Lamp | 2700–5000K | ≤80 CRI | Omni-Directional

RoHS Compliant | 3 YEAR WARRANTY

- **LAMP TYPE:** A19
- **BASE TYPE:** E26 (Medium)
- **WATTAGE:** 14W
- **COLOR TEMPERATURE:** 2700–5000K
- **COLOR RENDERING INDEX (CRI):** ≤80
- **WARRANTY:** 3 Years
- **RATED LIFE:** L70 (11,000 Hours)

TYPICAL APPLICATIONS
- Table, Desk, and Floor Lamps
- Wall Sconces
- Surface Mount Ceiling Fixtures
- General Lighting
- Pendant Lights

PRODUCT FEATURES
- Energy Efficient, 80%+ Energy Savings over Legacy Equivalents
- Lower Heat Generation than Legacy Equivalents
- PF >0.50
- Complies with Part 15 of FCC
- Durable Plastic housing lowers the risk for breakage
- ANSI compliant construction ensures fitment for intended applications
- Operating temperature range –4°F/–20°C to 95°F/35°C
- Long Life minimizes replacement and maintenance costs
- UL Listed
- Smooth diffused lens for comfortable glare free performance
- Rated for open, recessed, and enclosed fixtures
- Non-dimming
- Suitable for damp locations

ELECTRICAL AND PERFORMANCE SPECIFICATIONS

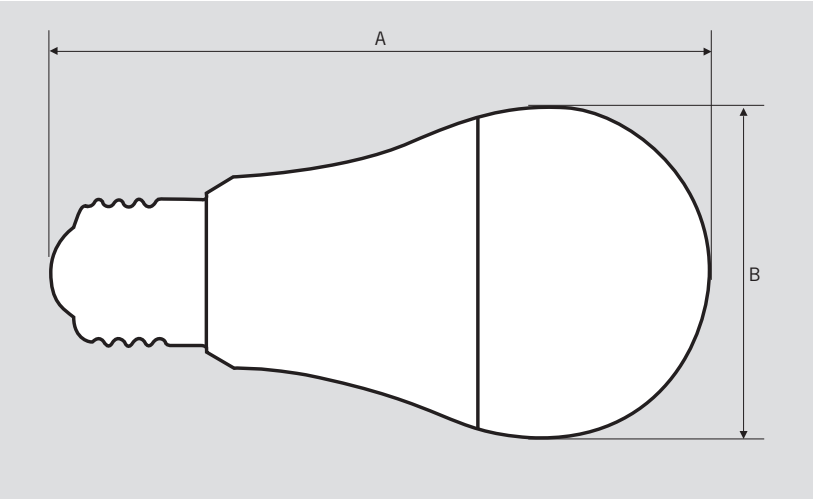
Keystone Catalog Number	Description	Color Temp	Input Voltage	Rated Lamp Wattage	Legacy Equivalent Wattage	Base Type	Lumens	CRI	Beam Angle	Dimmable	Efficacy
KT-LED14A19-O-827-ND-CS	A19 bulb. Omni-Directional, non-dimmable	2700K	120V	14W	100W	E26	1500	≤80	200°	No	114 lm/W
KT-LED14A19-O-830-ND-CS	A19 bulb. Omni-Directional, non-dimmable	3000K	120V	14W	100W	E26	1500	≤80	200°	No	114 lm/W
KT-LED14A19-O-835-ND-CS	A19 bulb. Omni-Directional, non-dimmable	3500K	120V	14W	100W	E26	1500	≤80	200°	No	114 lm/W
KT-LED14A19-O-840-ND-CS	A19 bulb. Omni-Directional, non-dimmable	4000K	120V	14W	100W	E26	1500	≤80	200°	No	114 lm/W
KT-LED14A19-O-850-ND-CS	A19 bulb. Omni-Directional, non-dimmable	5000K	120V	14W	100W	E26	1500	≤80	200°	No	114 lm/W

KEYSTONE SINCE 1945 LIGHT MADE EASY®

ESSENTIAL SERIES
GENERAL PURPOSE LED BULBS

KT-LED14A19-O-8XX-ND-CS
REPLACEMENT LAMP

PHYSICAL CHARACTERISTICS



PACKAGING

Carton Quantity	60 pcs
Carton Dimensions	24.61" × 14.76" × 5.31"
Carton Weight	9.74 lbs

LAMP DIMENSIONS

A (Length)	4.57"
B (Diameter)	2.36"

BASE TYPE: E26 (Medium)

ORDERING INFORMATION

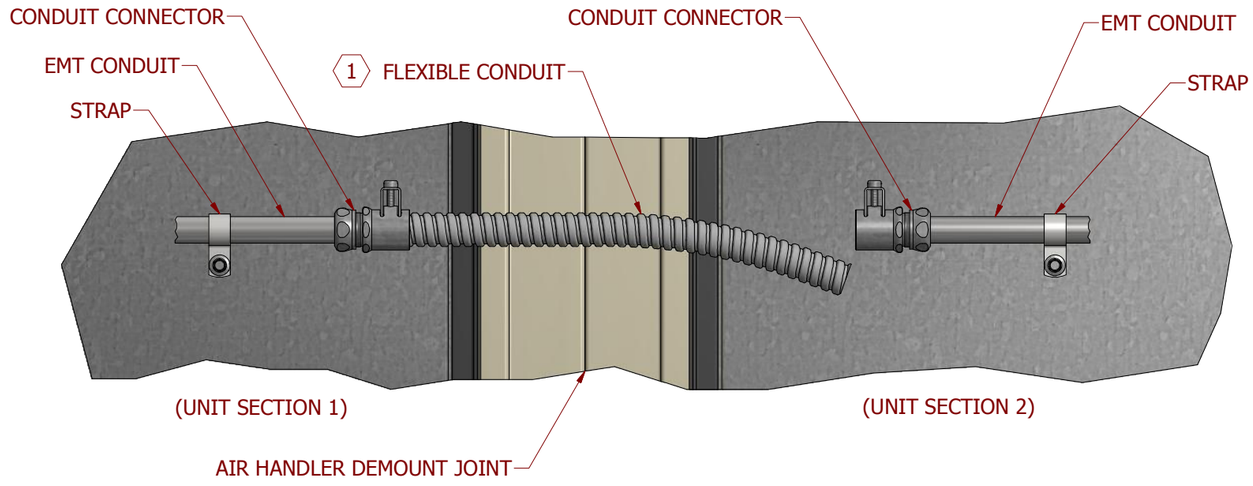
CATALOG NUMBER	CARTON QUANTITY	EASY CODE	UPC
KT-LED14A19-O-827-ND-CS	60 pcs	VDT-15	843654130095
KT-LED14A19-O-830-ND-CS	60 pcs	NVC-18	843654130101
KT-LED14A19-O-835-ND-CS	60 pcs	UIP-05	843654130118
KT-LED14A19-O-840-ND-CS	60 pcs	DZA-55	843654130125
KT-LED14A19-O-850-ND-CS	60 pcs	SPB-77	843654130132

CATALOG NUMBER BREAKDOWN

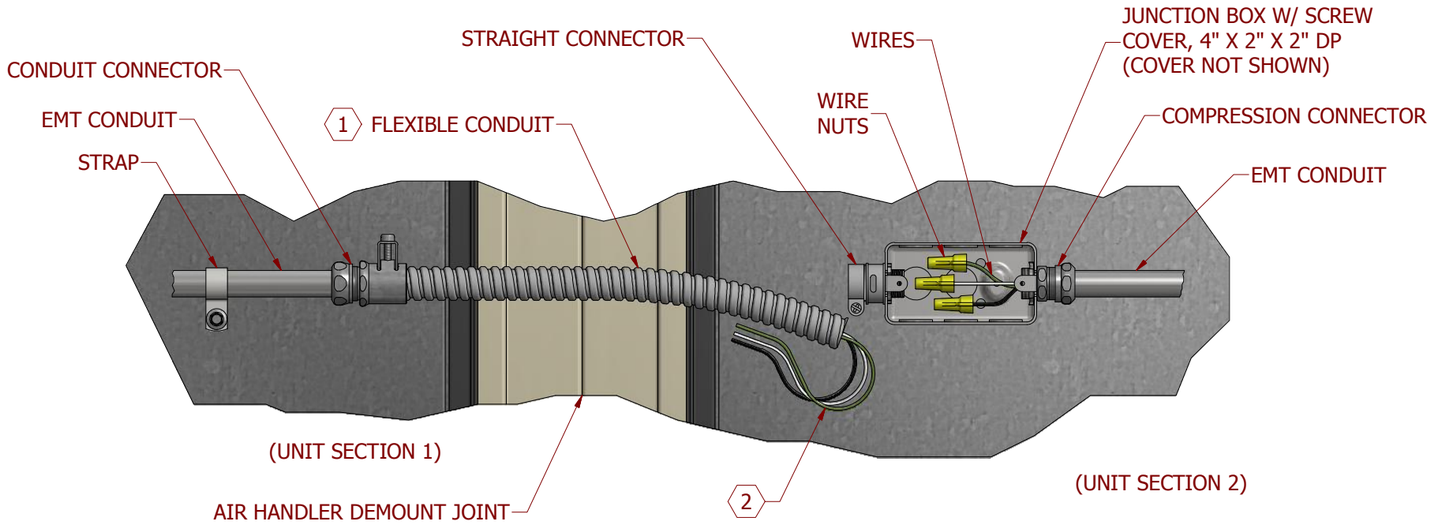
KT-LED14A19-O-8XX-ND-CS

1 2 3 4 5 6 7 8 9

1 **Keystone Technologies**
2 **LED Lamp**
3 **Wattage**
4 **Lamp Shape**
5 **Omni-Directional**
6 **800 Series**
7 **Color Temperature**
8 **Non Dimming**
9 **Contractor Series**



EMPTY CONDUIT RUN DETAIL
CONDUIT 1/2" DIA



WIRE SPLIT DETAIL
120VAC / ≤ 16A
CONDUIT 1/2" DIA

INSTALLATION INSTRUCTIONS:

1. FOR SHIPPING PURPOSES, FLEXIBLE METAL CONDUIT MAY HAVE BEEN SECURED TO UNIT CASING WITH A CONDUIT STRAP. REMOVE AND DISCARD STRAP TO FREE CONDUIT.
2. REMOVE ELECTRICAL TAPE, CUT WIRES TO LENGTH NEEDED AND STRIP INSULATION 1/2 INCH.
3. REMOVE ELECTRICAL TAPE, CUT WIRES TO LENGTH NEEDED AND STRIP INSULATION 3/8 INCH.
4. REMOVE ELECTRICAL TAPE, CUT WIRES TO LENGTH NEEDED AND STRIP INSULATION PER TABLE.
5. IF WIRE CONNECTOR IS "IT" MODEL, REMOVE RUBBER PLUGS TO ACCESS SET SCREWS. ONCE WIRE IS INSERTED, TORQUE SET SCREW PER TABLE. INSTALL RUBBER ACCESS PLUGS AND SECURE WITH ELECTRICAL TAPE (SEE CONNECTOR TORQUE CHART).

5 CONNECTOR TORQUE (INCH-POUND)

CONNECTOR MODEL		IT-4	IT-1/0	IT-3/0	IT-250
4 WIRE STRIP LENGTH		11/16"	7/8"	1"	1-1/4"
WIRE SIZES	#14 - #10	35	35	---	---
	#8	40	75	---	---
	#6 - #4	45	110	110	110
	#1 - #3	---	150	150	150
	1/0	---	180	180	180
	2/0	---	---	180	180
	3/0	---	---	250	250
	4/0	---	---	---	250
	250	---	---	---	360

WIRES MUST BE TORQUED AND INSULATION STRIPPED AS SHOWN. WIRE INSULATION ON A PROPERLY INSTALLED WIRE MUST BE INSIDE INSULATED CONNECTOR CONDUCTOR PORT NO LESS THAN 3/8 INCH. INSTALL ACCESS PLUGS AND SECURE PLUGS WITH AT LEAST TWO WRAPS OF ELECTRICAL TAPE ACROSS PLUGS AND AROUND CONNECTOR BODY.

NOTES:

TRADES DOING INSTALLATION OR RE-CONNECTIONS SHALL BE IN COMPLIANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS. FOR FURTHER INFORMATION, PLEASE CONTACT LOCAL AUTHORITIES FOR CLARIFICATION AND REQUIREMENTS WHERE EQUIPMENT IS TO BE INSTALLED AND OPERATED.

REV	ECN #	DESCRIPTION	BY	APPVD	DATE
-					

REVISION HISTORY

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
BENDS UTILIZE STANDARD BEND ALLOWANCE
TOLERANCES PER BELOW

MECHANICAL	SHEET METAL	
	FLAT	FINISHED
.X = ±.05	.X = ± .031	± .125
.XX = ±.01	.XX = ± .015	± .093
.XXX = ±.005	.XXX = ± .005	± .060
ANGLES = ±1°		

FRACTIONS = ± 1/32" ANGLES = ± 1°
125 √ SURFACE FINISH BREAK ALL SHARP CORNERS
File Saved: 08:54:01 11/11/2016

NORTEK AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

	BY	DATE
DRAWN:	REYJ	9/2/2016
CHECKED:	WHEM	11/11/2016
APPROVED:	KRIM	11/17/2016

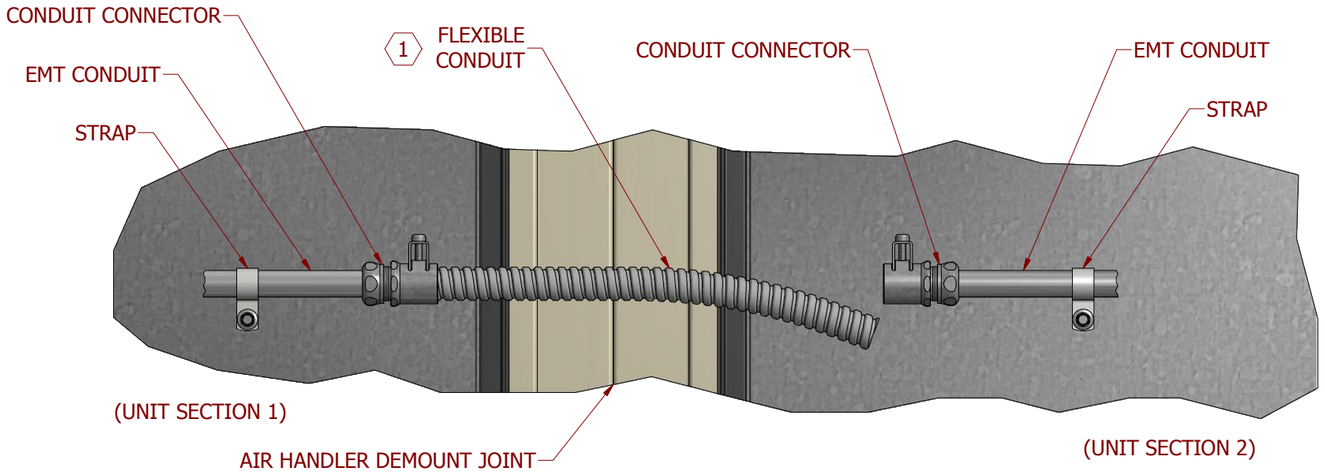
THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING | SCALE: 1/4 | SHEET SIZE: B | DRAWING NO. 251.00013 | SHEET: 1 OF 5 | REV: -

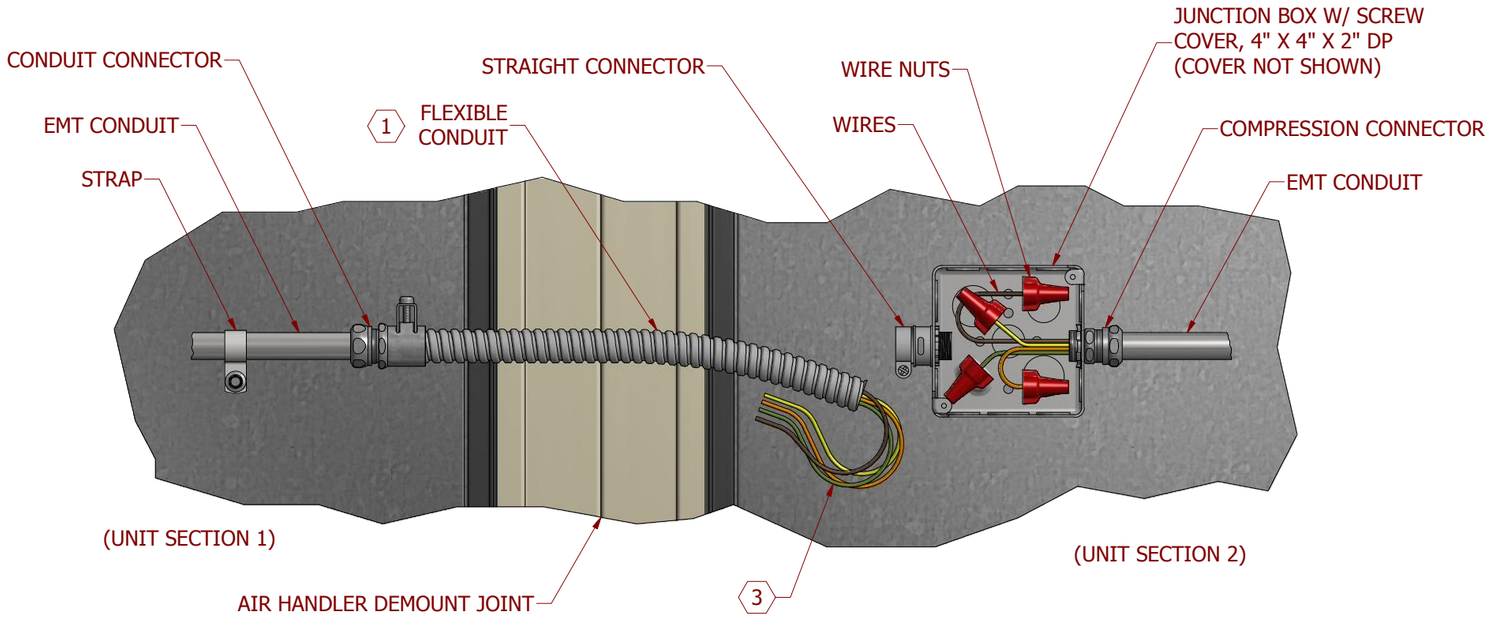
INST. DEMOUNTED ELECT. CONNECTIONS	250.00078
DESCRIPTION	NUMBER
DOCUMENT REFERENCE	

TITLE:

INSTALLATION, DEMOUNTED ELECTRICAL CONNECTIONS



EMPTY CONDUIT RUN DETAIL
CONDUIT 1/2" DIA



WIRE SPLIT DETAIL
208-230-460VAC / ≤ 24A
CONDUIT 1/2" DIA

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
BENDS UTILIZE STANDARD BEND ALLOWANCE
TOLERANCES PER BELOW

MECHANICAL	SHEET METAL	
	FLAT	FINISHED
.X = ±.05	.X = ± .031	± .125
.XX = ±.01	.XX = ± .015	± .093
.XXX = ±.005	.XXX = ± .005	± .060
ANGLES = ±1°		

FRACTIONS = ± 1/32" ANGLES = ± 1°
125 √ SURFACE FINISH BREAK ALL SHARP CORNERS
File Saved: 08:54:01 11/11/2016

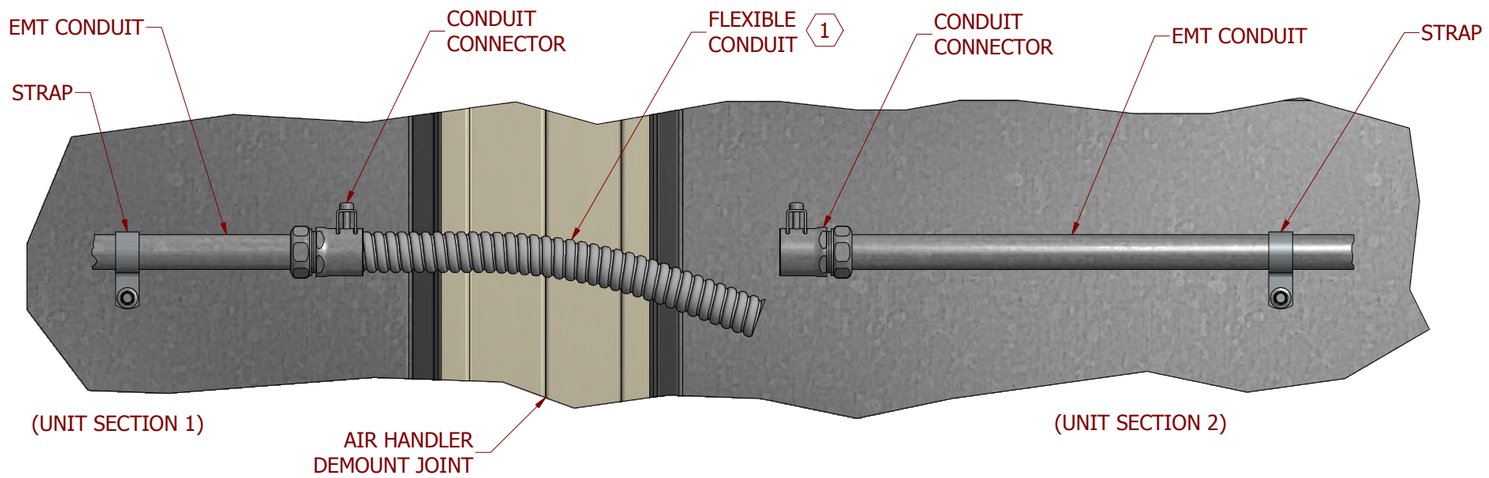
NORTEK™ AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

	BY	DATE
DRAWN:	REYJ	9/2/2016
CHECKED:	WHEM	11/11/2016
APPROVED:	KRIM	11/17/2016

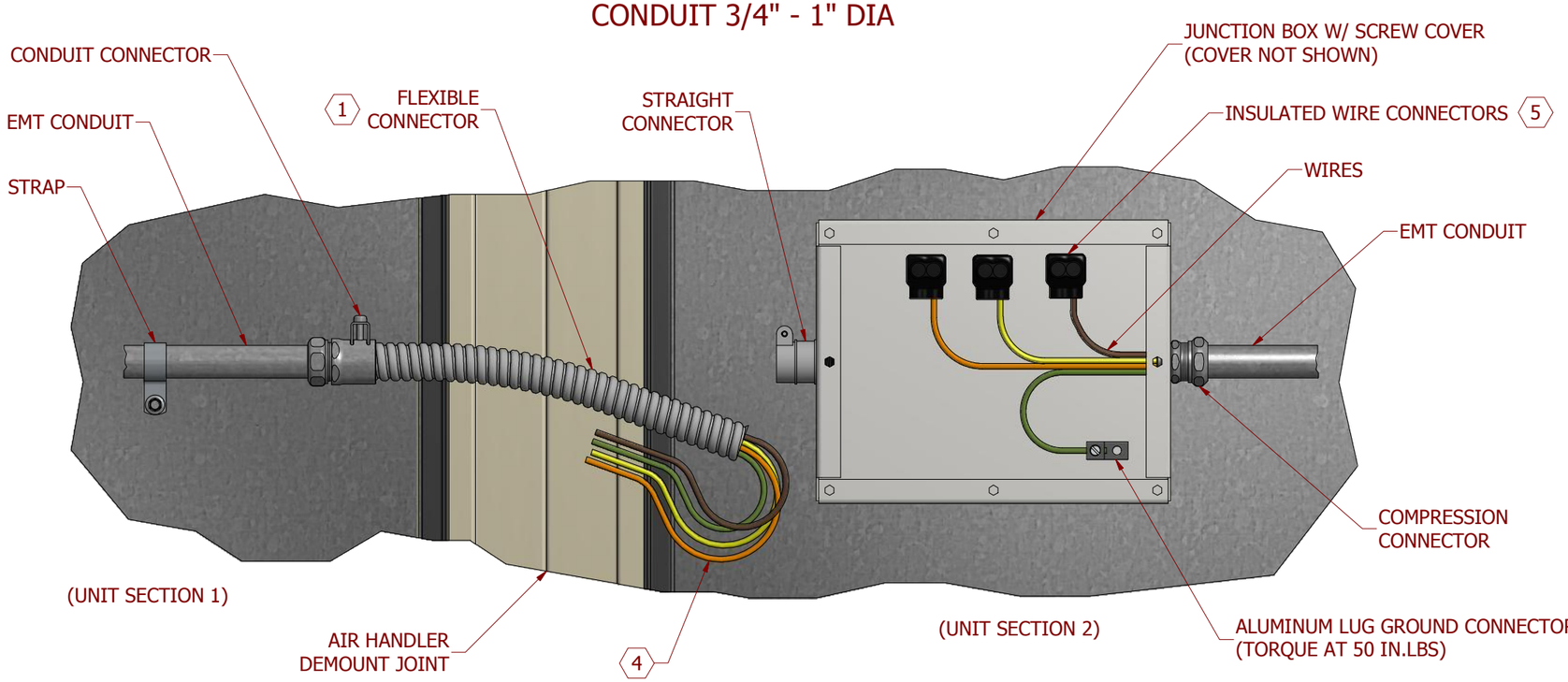
THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING | SCALE: 1/4 | SHEET SIZE: B | DRAWING NO. 251.00013 | SHEET: 2 OF 5 | REV: -

TITLE: INSTALLATION, DEMOUNTED ELECTRICAL CONNECTIONS



EMPTY CONDUIT RUN DETAIL
CONDUIT 3/4" - 1" DIA



WIRE SPLIT DETAIL
208-230-460VAC / 25A-68A
CONDUIT 3/4" - 1" DIA

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
BENDS UTILIZE STANDARD BEND ALLOWANCE
TOLERANCES PER BELOW

MECHANICAL	SHEET METAL	
	FLAT	FINISHED
.X = ±.05	.X = ± .031	± .125
.XX = ±.01	.XX = ± .015	± .093
.XXX = ±.005	.XXX = ± .005	± .060
ANGLES = ±1°		

FRACTIONS = ± 1/32" ANGLES = ± 1°
125 √ SURFACE FINISH BREAK ALL SHARP CORNERS
File Saved: 08:54:01 11/11/2016

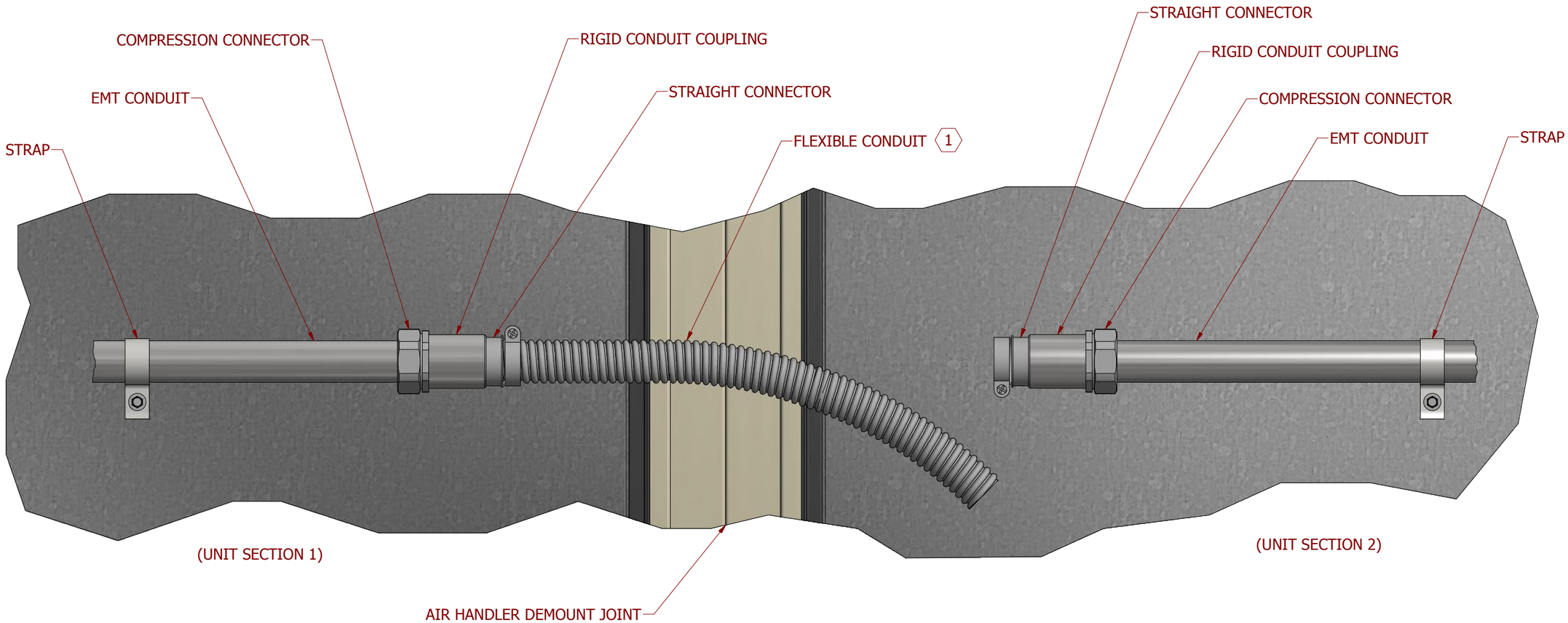
NORTEK AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

	BY	DATE
DRAWN:	REYJ	9/2/2016
CHECKED:	WHEM	11/11/2016
APPROVED:	KRIM	11/17/2016

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING | SCALE: 1/4 | SHEET SIZE: B | DRAWING NO. 251.00013 | SHEET: 3 OF 5 | REV: -

TITLE: INSTALLATION, DEMOUNTED ELECTRICAL CONNECTIONS



EMPTY CONDUIT RUN DETAIL
CONDUIT ≥ 1-1/4" DIA

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
BENDS UTILIZE STANDARD BEND ALLOWANCE
TOLERANCES PER BELOW

MECHANICAL	SHEET METAL	
	FLAT	FINISHED
.X = ±.05	.X = ± .031	± .125
.XX = ±.01	.XX = ± .015	± .093
.XXX = ±.005	.XXX = ± .005	± .060
ANGLES = ±1°		

FRACTIONS = ± 1/32" ANGLES = ± 1°
125 √ SURFACE FINISH BREAK ALL SHARP CORNERS
File Saved: 08:54:01 11/11/2016

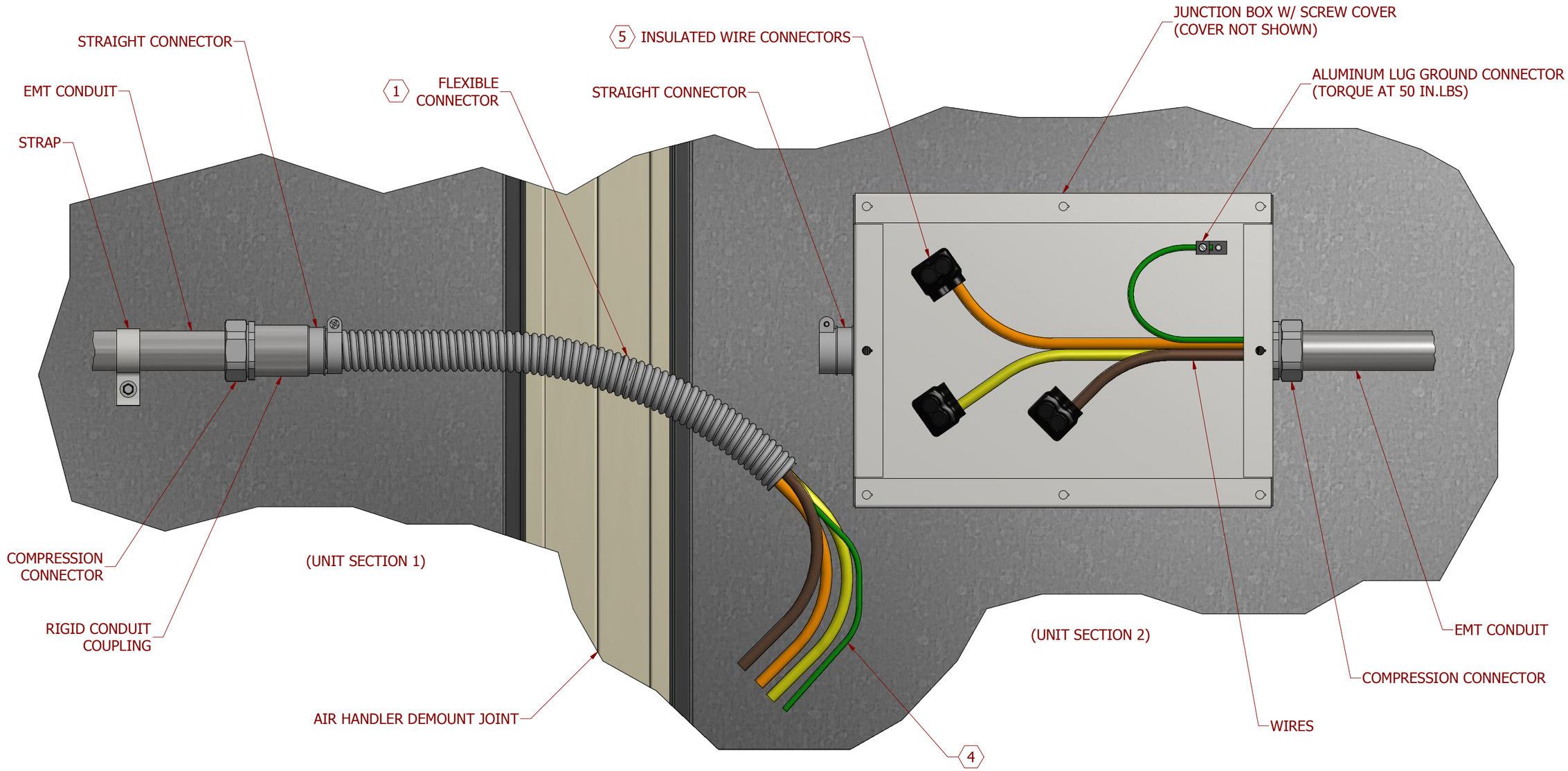
NORTEK™ AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

	BY	DATE
DRAWN:	REYJ	9/2/2016
CHECKED:	WHEM	11/11/2016
APPROVED:	KRIM	11/17/2016

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING | SCALE: 1/4 | SHEET SIZE: B | DRAWING NO. 251.00013 | SHEET: 4 OF 5 | REV: -

TITLE: INSTALLATION, DEMOUNTED ELECTRICAL CONNECTIONS



WIRE SPLIT DETAIL
208-230-460VAC / ≥ 69A
CONDUIT ≥ 1-1/4" DIA

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
BENDS UTILIZE STANDARD BEND ALLOWANCE
TOLERANCES PER BELOW

MECHANICAL	SHEET METAL	
	FLAT	FINISHED
.X = ±.05	.X = ± .031	± .125
.XX = ±.01	.XX = ± .015	± .093
.XXX = ±.005	.XXX = ± .005	± .060
ANGLES = ±1°		

FRACTIONS = ± 1/32" ANGLES = ± 1°
125 √ SURFACE FINISH BREAK ALL SHARP CORNERS
File Saved: 08:54:01 11/11/2016

NORTEK™ AIR SOLUTIONS
Temtrol GOVERNAIR Ventrol
106 N. INDUSTRIAL BLVD. OKARCHE, OK 73762
PH: (405) 263-7286 FAX: (405) 263-4924

	BY	DATE
DRAWN:	REYJ	9/2/2016
CHECKED:	WHEM	11/11/2016
APPROVED:	KRIM	11/17/2016

THIRD ANGLE PROJECTION

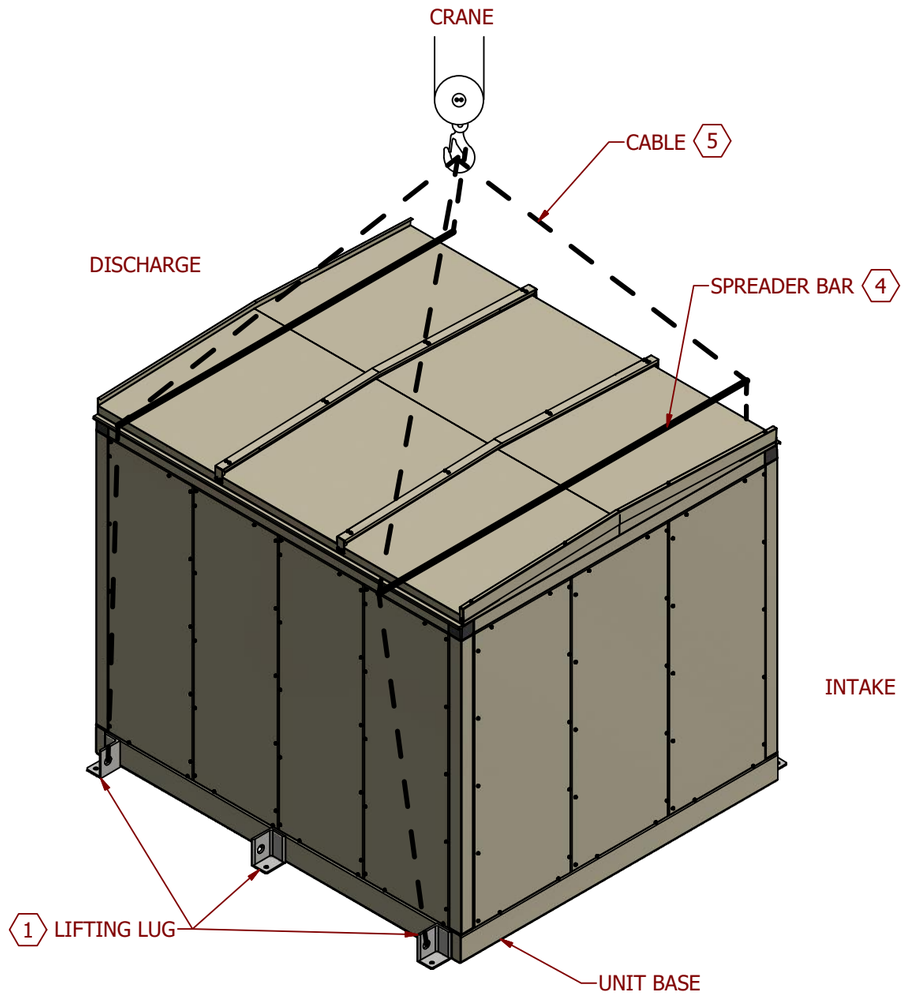
TITLE: INSTALLATION, DEMOUNTED ELECTRICAL CONNECTIONS

DO NOT SCALE DRAWING	SCALE: 1/4	SHEET SIZE: B	DRAWING NO. 251.00013	SHEET: 5 OF 5	REV: -

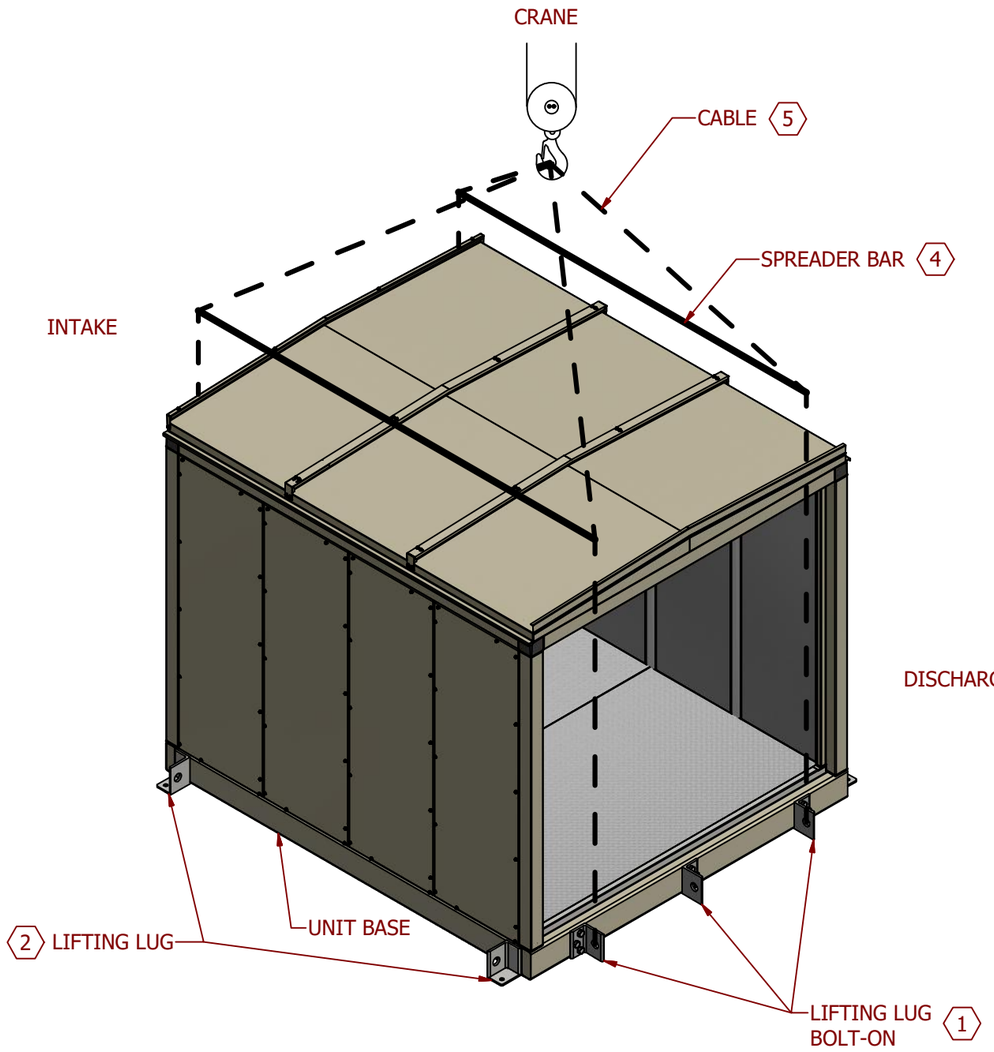
NORTEK AIR SOLUTIONS TEMTROL

PROJECT	UCA Snow Fine Arts
SALES ORDER #	N003312
QUOTE #	23-1950

Lifting and Rigging



SINGLE SECTION ≤ 140" WIDE



SINGLE SECTION > 140" WIDE

1. ALL LIFTING LUGS MUST BE USED WHEN RIGGING/LIFTING UNIT.
   CENTER LUG IS ONLY PRESENT WHEN DISTANCE BETWEEN LUGS BECOME GREATER THAN 144"
2. LIFTING LUGS FOR SECTION JOINING ONLY. NOT TO BE USED TO LIFT SECTION
3. CABLE TENSION/LEVELING MAY REQUIRE USE OF CHAIN FALL EQUIPMENT (FURNISHED BY OTHERS IN THE FIELD).
4. LOAD SPREADING EQUIPMENT (FURNISHED BY OTHERS IN THE FIELD) REQUIRED TO PREVENT UNIT CASING DAMAGE.
5. CAUTION: TO PREVENT DAMAGE, CABLE/CHAINS MUST NOT CONTACT DOOR HANDLES, ELECTRICAL PANELS, FILTER GAUGES, HOODS, ETC.
6. DOCUMENT PREVIOUSLY RELEASED AS 221.00251

MATERIAL NO.:

MATERIAL:

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
.X = ±0.1
.XX = ±0.03
.XXX = ±0.010
(.XX) = REFERENCE
FRACTIONS = ± 1/32"
ANGLES = ± 0.5°

NORTEK AIR SOLUTIONS™
106 N. INDUSTRIAL BLVD.
OKARCHE, OK 73762
PH: (405) 263-7286

	BY	DATE
DRAWN:	STOT	5/1/2017
CHECKED:	WHEM	5/15/2017
APPROVED:	KRIM	5/24/2017

THIRD ANGLE PROJECTION

DRAWING NOT TO SCALE

TITLE: DETAIL
LIFTING AND RIGGING, UNIT

PART NO.

SHEET SIZE:	DRAWING NO.	SHEET:	REV:
B	45-000017456	1 OF 1	C