TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE	CONTRACT NO. W9127S26CA009	PAGE 1 of 1

PROJECT TITLE F35 Special Access Program Facility	DATE	TRANSMITTAL NO.
LOCATION	10/13/2026	23 30 00-1

Item	Description	Variation	QA Code
12	Air Handling Units	No	A
29	Air Handling Units	No	A

SECTION III - GOVERNMENT REVIEW REMARKS

No remarks

B.L. Harbert International, LLC
820 SHADES CREEK PKWY. SUITE 3000
BIRMINGHAM, AL 35209
P: (205) 802-2800 F: (205) 802-2801

Submittal

Project: F-35: SPECIAL ACCESS PROGRAM FACILITY Ebbing (ANG)

Spec Section:	23 00 00	**Responsible Contractor:**	BL Harbert		
Submittal Number:	1	**SD Number:**	03.10		
Submittal Title:	HANDLING UNITS	**"N"**	**Yes** ☐	**No** ☑	
Revision No:		**Variance Requested :**	**Yes** ☐	**No** ☑	

Specification Items included in Submittal:

23 30 00 SD-03, AIR HANDLING UNITS 2.10 (G)

23 30 00 SD-10 AIR HANDLING UNITS 2.10 (G)

Notes:

Contractor:
B.L. Harbert International, LLC

Contractor's Stamp

B.L HARBERT INTERNATIONAL, LLC

THIS REVIEW DOES NOT RELIVE THE SUBCONTRACTOR OR SUPPLIER OF ITS RESPONSIBILITY TO COMPLY WITH THE CONTRACT DOCUMENTS.

- ☑ REVIEWED
- ☐ REVIEWED AS NOTED
- ☐ REVISE AND RESUBMIT
- ☐ REJECTED
- ☐ FOR INFORMATION ONLY

BY: A Ledbetter DATE: 9/29/26

COMFORT SYSTEMS USA

Quality People. Building Solutions.

Comfort Systems USA (Arkansas), Inc.
P.O. Box 16620
Little Rock, AR 72231
Phone 501-834-3320
Fax 501-834-5416

Date:	09/28/2026
Return Request:	Normal
Project:	EBBING F35 SAPF
Supplier:	Comfort Systems USA
Manufacturer:	Pace
Submittal:	Air Handling Units
Submittal Number:	23 30 00-2.10
Drawing # and Installation:	Mechanical

ARCHITECT
Burns and McDonnell
Kansas City, MO 64114

ENGINEER
Byron Edward K. Fonseca

GENERAL CONTRACTOR
BL Harbert International

MECHANICAL SUBCONTRACTOR
Comfort Systems USA (Arkansas), Inc.
116 Commercial Ave.
Lowell, AR 72745
(479) 770.8992

NOTES:

CSUSA PROJECT NO.
26-5039
jzuber@comfortar.com

CREATING CUSTOMERS FOR LIFE

POWERS

SUBMITTAL

F-35: Special Access Program Facility - Air Handling Units

Submittal	
LOCATION	Fort Smith, Arkansas
DATE	September 16, 2026
PRODUCTS	Register - Other Air Handling Units - (AHU-101-102, DOAS-101-102) - Pace Spec - Other Schedule - Other

CREATING CUSTOMERS FOR LIFE
POWERS

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Product 1/4

Submittal

JOB NAME	F-35: Special Access Program Facility - Air Handling Units
PRODUCT	Register
MANUFACTURER	Other
LOCATION	Fort Smith, Arkansas
DATE	September 16, 2026
ENGINEER	US Army Corp of Engineers
CONTRACTOR	Comfort Systems USA
SUBMITTED BY	Joey Smith

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
Ebbing ANGB Special Access Program Facility

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
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			Data																
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Ebbing ANGB Special Access Program Facility

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SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
Ebbing ANGB Special Access Program Facility

CONTRACTOR

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Submittal

JOB NAME	F-35: Special Access Program Facility - Air Handling Units
PRODUCT	Air Handling Units - (AHU-101-102, DOAS-101-102)
MANUFACTURER	Pace
LOCATION	Fort Smith, Arkansas
DATE	September 16, 2026
SPECIFICATION	23 30 00
ENGINEER	US Army Corp of Engineers
CONTRACTOR	Comfort Systems USA
SUBMITTED BY	Joey Smith

SUBMITTAL DATE: 16/09/2026

SITE ADDRESS:

EQUIPMENT SUBMITTAL FOR APPROVAL REVISION (0)

PROJECT NAME: F35 Special Access Program Facility Ebbing ANGB
Specification Section:####

ITEM	QTY	TAG	ITEM DESCRIPTIONS
I	1	AHU-101	Air Handling Units Semi-Custom
II	1	AHU-102	Air Handling Units Semi-Custom
III	1	DOAS-101	Air Handling Units Semi-Custom
IV	1	DOAS-102	Air Handling Units Semi-Custom

SOLD TO:

CONSULTING ENGINEER:

PREPARED BY:

Chad Fisher
Powers of Arkansas Inc
1219 Wagon Wheel Road, Springdale, Arkansas, United States, 72764

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Project Coordination Release for Fabrication

PROJECT COORDINATION

Release for Fabrication Notes

Release for Fabrication Requirements:

1. **Purchase Order (scanned or hard copy).** Document must state "Purchase Order". Purchase Requisition, Purchase Request, and other similar documents which do not reflect "Purchase Order" will not be considered.
2. **Approved Submittals.** Stamped on the submittal or sent through email. Verbal and text message approvals will not be considered.
3. **Release Confirmation.** Stamped on the submittal or sent through email formalizing the release of equipment. Verbal and text message release confirmation will not be considered.
    a. Any **"SUBMITTAL NOTES"** or **"EQUIPMENT RELEASE APPROVAL FORM"** page(s) must be filled out.
    b. Any **HANDING COORDINATION** documents must be confirmed and filled out.
    c. Any **DRAWINGS** or **PERFORMANCE** sheets needs to be verified and signed off.

Lead times do not start until release requirements are met.

Revisions After Release:

1. Equipment will be ordered and manufactured based on the approved submittal.
2. Any **revisions AFTER release** will have to be approved by the corresponding JCI factory.
3. Revision approval will **solely depend on the JCI factory**. The local JCI office does not have the authority to approve any revisions AFTER release.
4. Revisions AFTER release **may incur additional costs for approval**. These costs are not part of the original contract price and will be processed as a Change Order.
5. Revisions AFTER release **may affect lead time**. This impact will be relayed to the customer prior to revision approval. Any lead time estimates/promises made before the revision will be null and void.
6. Revisions AFTER release that require additional costs will not be processed unless a Change Order for the revision is submitted to JCI.
7. Revisions AFTER release include, but are not limited to the following:
    a. Project name change.
    b. Unit(s) tag number change.
    c. Unit(s) performance revisions (includes changes in input parameters such as CFM, temperatures, gpm, capacity, electrical ratings, OSHPD/seismic certifications, etc.)
    d. Unit(s) drawing revisions (includes changes in nozzle configurations, intake/discharge orientations, dimension modifications, weight reduction, OSHPD/seismic certifications, etc.)
    e. Change in BOM (includes, scope of work, warranty, items provided, items excluded, quantity, etc.)

Long Term Storage

If the equipment is not planned to be started before six (6) months from the date of shipment, or if the area they are going to be stored in will be subject to unusual atmospheric conditions (including within 5 miles of salt water/shipped over salt water). If these conditions exist, please contact your JCI representative for JCI's long term storage recommendations and a quote for delayed startup to maintain unit(s) warranty.

Units not started up within 6 months will nothave warranty, unless notified by customer of needing this requirement prior to 6 monthsfrom shipment.

Installation, Operation, & Maintenance Manuals

One physical copy of IOMs for detailed information on shipping and receiving ships with unit. Additional digital copies are available upon request.

Shipping & Receiving

Shipping

JCI consolidates loads and non-standard shipments aren't part of JCI scope, unless specifically included in the quote. All non-standard shipments will require a change order. Non-standard shipment include but are not limited to:

- Shipping units or sections in a certain order
- Shipping 1 unit per truck
- Shipping units by floor

Receiving

It is the installing contractor's responsibility to verify the following prior to signing the bill of lading presented by the transportation company:

- Ensure everything on the bill of lading was delivered
- Visually perform a thorough inspection of all equipment for any signs of shipping damage

Any short-shipments or shipping damage must be noted on the bill of lading prior to signing.

Loose Items Shipment Notes (If Included with Order, See Bill of Materials)

Look inside cabinets, base rails, etc for ship loose items that the ship with units. Certain ship loose items may not arrive at the same time as units.

AHUs:

- Filters shipped separately to the units. Customers to direct where and when to ship filters at least 2 weeks prior to unit(s)' shipment. Spare filters ship at the same time as the first set of filters.

Start-up and other Included Service Tasks

Our Service department needs **at least 10 business days** to schedule any quoted service work. For start-ups, a technician will not be dispatched until the completed pre-startup checklist is received by our Service department. The preferred and most efficient way to request start-up is via the **TrueContext Forms app** (see *Startup* section later in the submittal). If the equipment is not ready for start-up when the technician is on the site, a trip charge will be invoiced.

- Any included startup/field work/training must be performed during normal working business hours 7am-3pm (Mon-Fri) and excluding any holidays. Start-up/field work/training requested outside of normal business hours are subject to a change order.
- Any quoted training are NOT videotaped unless explicitly mentioned.

BOM Data

BILL OF MATERIAL

ITEM	QTY	TAG	ITEM DESCRIPTIONS
I	1	AHU-101	PAI-54x78
II	1	AHU-102	PAI-54x78
III	1	DOAS-101	PAI-36x51
IV	1	DOAS-102	PAI-36x51

Johnson Controls' standard warranty for chillers and air-handlers begin upon startup or 6 months after shipment, whichever occurs first. If unit startup will occur more than 6 months after shipment, long term storage preparation and periodic inspections may be required at additional cost to the buyer. If these procedures are not followed, the warranty will be voided. Please contact your JCI representative for more details.

Quantity: 1 PAI-54x78

Unit Tag: AHU-101

Unit Details

- 18 Month Parts Only Warranty (From Shipment)
- #N/A
- Exterior Material: 18 Ga. G90 Galvanized Steel
- Interior Liner Material: 22 Ga. G90 Galvanized Steel
- FLoor Material: 20 Ga. G90 Galvanized Steel
- Doors with same construction as unit. Doors provided with View Ports and Thermal Break Design.
- 8 " High Formed Steel Base
- Unit Voltage/Phase/Hertz: 460/3/60
- VFD (Location: FS Serves: Supply Fan)
- Fused Disconnect (NEMA 1 Enclosure)
- 120V Wiring Type: SJO Cable
- High Voltage Wiring Type: Motor Cable
- Integral LED light(s) wired to single switch on FS segment.

Filter Mixing Box Segment

- Side Load Filter Bank
- 2 in. Pleated MERV 8 Filters
- Qty 2 set(s) of spare filters; 2 in. Pleated MERV 8 Filters
- Magnehelic With Flag filter gauge (Gauge Range: 0 To 5.0 in. w.g.)
- Return Air opening (Top)
- Return Air Damper Ruskin - CD60 (Galvanized) Parallel Blade

Rigid Filter Segment

- Side Load Filter Bank
- 12 in. Rigid MERV 13 Filters
- #N/A
- Magnehelic With Flag filter gauge (Gauge Range: 0 To 5.0 in. w.g.)

Cooling Coil Segment

- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Left
- 4 Row 12 FPI Cooling Coil with 0.008 " Aluminum fins
- 5/8" Tube Diameter with 0.020" Tubewall Thickness with Turbulators
- Brazed Return Bends with 0.020" Tubewall Thickness
- Galvanized Casing
- Copper Header; Steel MPT 1.5 " Connection
- IAQ Drain Pan with 304 Stainless Steel Liner

Supply Fan Segment

- Interior Liner Material: 22 Ga. Galvanized Steel Perf - 1/8" Hole Size
- Galvanized Steel Bulkhead

- 1x1 Single Fan with Lau Size 222 Model DDPG2 9 blade Direct Drive SWSI Plenum Fan; Class 2
- Isolation: 2" Springs
- Air Flow Measuring: Piezo Ring (transducer not included)
- 20 HP ODP (1800 RPM) Motor with Shaft Grounding Ring
- Supply Air opening (Top)

Items Not Included:

- Hauling, Unloading, Rigging, Installation and Re-Assembly of Equipment
- Taxes, Delayed Shipment, Expedited Freight, and Long Term Storage
- Extended Warranties beyond length of time shown above
- Any DDC Controls, End Devices, Sensors Actuators, Control Values, etc.
- Power Wiring to Lights and Outlets (Unless specified above)
- Single-Point Power Connection (Unless specified above)
- Factory or Field Leakage and Deflection Testing (Unless specified above); Factory Perfomance Testing (Units are AHRI Certified) (Unless specified above)
- Outdoor Airflow Measuring Stations
- Installation of Ship Loose Filters (filters ship loose for installation by others in factory installed racks)
- Smoke Detectors
- Smoke Dampers and/or Fire/Smoke Dampers
- Connecting Wiring between Shipping Splits
- Long Term Storage Maintenance (required if AHU not started up within 6 months of shipment)
- Anything not listed above

Quantity: 1 PAI-54x78

Unit Tag: AHU-102

Unit Details

- 18 Month Parts Only Warranty (From Shipment)
- #N/A
- Exterior Material: 18 Ga. G90 Galvanized Steel
- Interior Liner Material: 22 Ga. G90 Galvanized Steel
- FLoor Material: 20 Ga. G90 Galvanized Steel
- Doors with same construction as unit. Doors provided with View Ports and Thermal Break Design.
- 8 " High Formed Steel Base
- Unit Voltage/Phase/Hertz: 460/3/60
- VFD (Location: FS Serves: Supply Fan)
- Fused Disconnect (NEMA 1 Enclosure)
- 120V Wiring Type: SJO Cable
- High Voltage Wiring Type: Motor Cable
- Integral LED light(s) wired to single switch on FS segment.

Filter Mixing Box Segment

- Side Load Filter Bank
- 2 in. Pleated MERV 8 Filters
- Qty 2 set(s) of spare filters; 2 in. Pleated MERV 8 Filters
- Magnehelic With Flag filter gauge (Gauge Range: 0 To 5.0 in. w.g.)
- Return Air opening (Top)
- Return Air Damper Ruskin - CD60 (Galvanized) Parallel Blade

Rigid Filter Segment

- Side Load Filter Bank
- 12 in. Rigid MERV 13 Filters
- #N/A
- Magnehelic With Flag filter gauge (Gauge Range: 0 To 5.0 in. w.g.)

Cooling Coil Segment

- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Right
- 4 Row 12 FPI Cooling Coil with 0.01 " Aluminum fins
- 5/8" Tube Diameter with 0.020" Tubewall Thickness with Turbulators
- Brazed Return Bends with 0.020" Tubewall Thickness
- Galvanized Casing

- Copper Header; Steel MPT 1.5 " Connection
- IAQ Drain Pan with 304 Stainless Steel Liner

Supply Fan Segment

- Interior Liner Material: 22 Ga. Galvanized Steel Perf - 1/8" Hole Size
- Galvanized Steel Bulkhead
- 1x1 Single Fan with Lau Size 245 Model DDPG2 9 blade Direct Drive SWSI Plenum Fan; Class 2
- Isolation: 2" Springs
- Air Flow Measuring: Piezo Ring (transducer not included)
- 20 HP ODP (1800 RPM) Motor with Shaft Grounding Ring
- Supply Air opening (Top)

Items Not Included:

- Hauling, Unloading, Rigging, Installation and Re-Assembly of Equipment
- Taxes, Delayed Shipment, Expedited Freight, and Long Term Storage
- Extended Warranties beyond length of time shown above
- Any DDC Controls, End Devices, Sensors Actuators, Control Values, etc.
- Power Wiring to Lights and Outlets (Unless specified above)
- Single-Point Power Connection (Unless specified above)
- Factory or Field Leakage and Deflection Testing (Unless specified above); Factory Perfomance Testing (Units are AHRI Certified) (Unless specified above)
- Outdoor Airflow Measuring Stations
- Installation of Ship Loose Filters (filters ship loose for installation by others in factory installed racks)
- Smoke Detectors
- Smoke Dampers and/or Fire/Smoke Dampers
- Connecting Wiring between Shipping Splits
- Long Term Storage Maintenance (required if AHU not started up within 6 months of shipment)
- Anything not listed above

Quantity: 1 PAI-36x51

Unit Tag: DOAS-101

Unit Details

- 18 Month Parts Only Warranty (From Shipment)
- 2" thick Foam Insulated (R16) panels with Enhanced Thermal Performance
- Exterior Material: 20 Ga. G90 Galvanized Steel
- Interior Liner Material: 22 Ga. G90 Galvanized Steel
- FLoor Material: 20 Ga. G90 Galvanized Steel
- Doors with same construction as unit. Doors provided with View Ports and Thermal Break Design.
- 8 " High Formed Steel Base
- Unit Voltage/Phase/Hertz: 460/3/60
- VFD (Location: HW Serves: Supply Fan)
- Fused Disconnect (NEMA 1 Enclosure)
- 120V Wiring Type: SJO Cable
- High Voltage Wiring Type: Motor Cable
- Integral LED light(s) wired to single switch on FS segment.

Mixing Box Segment

- Return Air opening (Rear)
- Return Air Damper Ruskin - CD60 (Galvanized) Parallel Blade

Flat Filter Segment

- Side Load Filter Bank
- 2 in. Pleated MERV 8 Filters
- Qty 2 set(s) of spare filters; 2 in. Pleated MERV 8 Filters
- Magnehelic With Flag filter gauge (Gauge Range: 0 To 2.0 in. w.g.)

Heat Wheel Segment

- Doors with same construction as unit. Doors provided with Thermal Break Design.
- AirXChange Enthalpy Wheel with Polymer Media and Silica Gel Coating
- Heat Wheel Model: ERC-3628C
- Outside Air Damper Ruskin - CD60 (Galvanized) Parallel Blade
- Exhaust Air Damper Ruskin - CD60 (Galvanized) Parallel Blade

Access Segment (XA-3)

Exhaust Fan Segment

- Galvanized Steel Bulkhead
- 1x1 Single Fan with Lau Size 135 Model DDPG2 9 blade Direct Drive SWSI Plenum Fan; Class 2
- Isolation: 2" Springs
- Air Flow Measuring: Piezo Ring (transducer not included)
- 1.5 HP ODP (1800 RPM) Motor with Shaft Grounding Ring
- Exhaust Air opening (Front)

Inlet Plenum Segment

- Inlet Air opening (Front)

Rigid Filter Segment

- Side Load Filter Bank
- Magnehelic With Flag (Combined Gauge Range: 0 To 2.0 in. w.g.)
- 2 in. Pleated MERV 8 Filters
- Qty 2 set(s) of spare filters; 2 in. Pleated MERV 8 Filters
- 4 in. MiniPleat MERV 13 Filters
- Qty 2 set(s) of spare filters; 4 in. MiniPleat MERV 13 Filters

Heating Coil Segment (HC-1)

- Doors with same construction as unit. Doors provided with Thermal Break Design.
- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Right
- 1 Row 12 FPI Heating Coil with 0.008 " Aluminum fins
- 1/2" Tube Diameter with 0.016" Tubewall Thickness
- Standard Return Bends with 0.016" Tubewall Thickness
- Galvanized Casing
- Copper Header; Steel MPT 1.5 " Connection

Access Segment (XA-1)

- Doors with same construction as unit. Doors provided with Thermal Break Design.

Cooling Coil Segment

- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Right
- 6 Row 10 FPI Cooling Coil with 0.008 " Aluminum fins
- 1/2" Tube Diameter with 0.016" Tubewall Thickness
- Standard Return Bends with 0.016" Tubewall Thickness
- Galvanized Casing
- Copper Header; Steel MPT 1.5 " Connection
- IAQ Drain Pan with 304 Stainless Steel Liner

Heating Coil Segment (HC-2)

- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Right
- 1 Row 10 FPI Heating Coil with 0.008 " Aluminum fins
- 1/2" Tube Diameter with 0.016" Tubewall Thickness
- Standard Return Bends with 0.016" Tubewall Thickness
- Galvanized Casing
- Copper Header; Steel MPT 1.5 " Connection

Access Segment (XA-2)

Supply Fan Segment

- Galvanized Steel Bulkhead
- 1x1 Single Fan with Lau Size 165 Model DDPG2 9 blade Direct Drive SWSI Plenum Fan; Class 2
- Isolation: 2" Springs
- Air Flow Measuring: Piezo Ring (transducer not included)
- 5 HP ODP (1800 RPM) Motor with Shaft Grounding Ring
- Supply Air opening (Top)

Items Not Included:

- Hauling, Unloading, Rigging, Installation and Re-Assembly of Equipment
- Taxes, Delayed Shipment, Expedited Freight, and Long Term Storage
- Extended Warranties beyond length of time shown above
- Any DDC Controls, End Devices, Sensors Actuators, Control Values, etc.
- Power Wiring to Lights and Outlets (Unless specified above)

- Single-Point Power Connection (Unless specified above)
- Factory or Field Leakage and Deflection Testing (Unless specified above); Factory Perfomance Testing (Units are AHRI Certified) (Unless specified above)
- Outdoor Airflow Measuring Stations
- Installation of Ship Loose Filters (filters ship loose for installation by others in factory installed racks)
- Smoke Detectors
- Smoke Dampers and/or Fire/Smoke Dampers
- Connecting Wiring between Shipping Splits
- Long Term Storage Maintenance (required if AHU not started up within 6 months of shipment)
- Anything not listed above

Quantity: 1 PAI-36x51

Unit Tag: DOAS-102

Unit Details

- 18 Month Parts Only Warranty (From Shipment)
- 2" thick Foam Insulated (R16) panels with Enhanced Thermal Performance
- Exterior Material: 20 Ga. G90 Galvanized Steel
- Interior Liner Material: 22 Ga. G90 Galvanized Steel
- FLoor Material: 20 Ga. G90 Galvanized Steel
- Doors with same construction as unit. Doors provided with View Ports and Thermal Break Design.
- 8 " High Formed Steel Base
- Unit Voltage/Phase/Hertz: 460/3/60
- VFD (Location: HW Serves: Supply Fan)
- Fused Disconnect (NEMA 1 Enclosure)
- 120V Wiring Type: SJO Cable
- High Voltage Wiring Type: Motor Cable
- Integral LED light(s) wired to single switch on FS segment.

Mixing Box Segment

- Return Air opening (Rear)
- Return Air Damper Ruskin - CD60 (Galvanized) Parallel Blade

Flat Filter Segment

- Side Load Filter Bank
- 2 in. Pleated MERV 8 Filters
- Qty 2 set(s) of spare filters; 2 in. Pleated MERV 8 Filters
- Magnehelic With Flag filter gauge (Gauge Range: 0 To 2.0 in. w.g.)

Heat Wheel Segment

- Doors with same construction as unit. Doors provided with Thermal Break Design.
- AirXChange Enthalpy Wheel with Polymer Media and Silica Gel Coating
- Heat Wheel Model: ERC-3628C
- Outside Air Damper Ruskin - CD60 (Galvanized) Parallel Blade
- Exhaust Air Damper Ruskin - CD60 (Galvanized) Parallel Blade

Access Segment (XA-3)

Exhaust Fan Segment

- Galvanized Steel Bulkhead
- 1x1 Single Fan with Lau Size 135 Model DDPG2 9 blade Direct Drive SWSI Plenum Fan; Class 2
- Isolation: 2" Springs
- Air Flow Measuring: Piezo Ring (transducer not included)
- 1.5 HP ODP (1800 RPM) Motor with Shaft Grounding Ring
- Exhaust Air opening (Front)

Inlet Plenum Segment

- Inlet Air opening (Front)

Rigid Filter Segment

- Side Load Filter Bank
- Magnehelic With Flag (Combined Gauge Range: 0 To 2.0 in. w.g.)
- 2 in. Pleated MERV 8 Filters
- Qty 2 set(s) of spare filters; 2 in. Pleated MERV 8 Filters
- 4 in. MiniPleat MERV 13 Filters
- Qty 2 set(s) of spare filters; 4 in. MiniPleat MERV 13 Filters

Heating Coil Segment (HC-1)

- Doors with same construction as unit. Doors provided with Thermal Break Design.
- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Right
- 1 Row 12 FPI Heating Coil with 0.008 " Aluminum fins
- 1/2" Tube Diameter with 0.016" Tubewall Thickness
- Standard Return Bends with 0.016" Tubewall Thickness
- Galvanized Casing
- Copper Header; Steel MPT 1.5 " Connection

Access Segment (XA-1)

- Doors with same construction as unit. Doors provided with Thermal Break Design.

Cooling Coil Segment

- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Right
- 6 Row 10 FPI Cooling Coil with 0.008 " Aluminum fins
- 1/2" Tube Diameter with 0.016" Tubewall Thickness
- Standard Return Bends with 0.016" Tubewall Thickness
- Galvanized Casing
- Copper Header; Steel MPT 1.5 " Connection
- IAQ Drain Pan with 304 Stainless Steel Liner

Heating Coil Segment (HC-2)

- Galvanized Steel Bulkhead with Galvanized Steel Coil Supports
- Coil Hand: Right
- 1 Row 10 FPI Heating Coil with 0.008 " Aluminum fins
- 1/2" Tube Diameter with 0.016" Tubewall Thickness
- Standard Return Bends with 0.016" Tubewall Thickness
- Galvanized Casing
- Copper Header; Steel MPT 1.5 " Connection

Access Segment (XA-2)

Supply Fan Segment

- Galvanized Steel Bulkhead
- 1x1 Single Fan with Lau Size 165 Model DDPG2 9 blade Direct Drive SWSI Plenum Fan; Class 2
- Isolation: 2" Springs
- Air Flow Measuring: Piezo Ring (transducer not included)
- 5 HP ODP (1800 RPM) Motor with Shaft Grounding Ring
- Supply Air opening (Top)

Items Not Included:

- Hauling, Unloading, Rigging, Installation and Re-Assembly of Equipment
- Taxes, Delayed Shipment, Expedited Freight, and Long Term Storage
- Extended Warranties beyond length of time shown above
- Any DDC Controls, End Devices, Sensors Actuators, Control Values, etc.
- Power Wiring to Lights and Outlets (Unless specified above)
- Single-Point Power Connection (Unless specified above)
- Factory or Field Leakage and Deflection Testing (Unless specified above); Factory Perfomance Testing (Units are AHRI Certified) (Unless specified above)
- Outdoor Airflow Measuring Stations
- Installation of Ship Loose Filters (filters ship loose for installation by others in factory installed racks)
- Smoke Detectors
- Smoke Dampers and/or Fire/Smoke Dampers
- Connecting Wiring between Shipping Splits
- Long Term Storage Maintenance (required if AHU not started up within 6 months of shipment)
- Anything not listed above

Performance Ratings

Air Handling Unit Performance Report

Job Summary

Project Name:	F35 Special Access Program Facility Ebbing ANGB		
Unit Tag(s):	AHU-101		
Quantity:	1	**Environment:**	Indoor



Unit Overview

Model	Airflow (CFM)	Altitude (ft)	Operating Weight (lbs)
PAI-54x78	9,500	449	3,278

Segment Sequence

(FS CC RF FM)

Unit Construction

Casing Details

Segment(s)	Thickness (in)	Exterior Paint	Exterior Gauge and Material	Interior Gauge and Material	Insulation Thickness and Material	Mylar Lining	Thermal Break	Bulkhead Material
FS	2"	None	18 Ga. G-90 Galvanized	22 Ga. G-90 Galvanized (Perf.)	1" Foam + 1" Fiberglass	-	-	Galvanized Steel
FM, RF, CC	2"	None	18 Ga. G-90 Galvanized	Standard Ga. G-90 Galvanized	2" Foam	-	-	Galvanized Steel

Base Details

Segment(s)	Material	Paint
FM, RF, CC, FS	8" Formed Steel	None

Floor Details

Segment(s)	Gauge and Material	Paint	Insulation	Thermal Break	Attachment	Sub-Floor Gauge and Material
FM, RF, CC, FS	Standard Ga. G-90 Galvanized	None	2"	-	Screw Down	None

Unit Electrical

Circuit Details

#	Component(s)	V/Ph/Hz	Full Load Amps (FLA)	Minimum Current Ampacity (MCA)	Maximum Overcurrent Protection (MOP)
1	FS Variable Frequency Drive - 1-1 (on FS)	460/3/60	24.96	31.2	50
2	Light Switch (on FS)	120/1/60	NaN	-	15

Electrical Details

Minimum Unit SCCR	100 kA rms Symmetrical	**ETL Label (UL1995/NEC-2002)**	Yes

Unit Light Type	Light Switch Enclosure
LED	Indoor

Hyperlinked

Supply Fan(s)

Performance Details

Fan Manufacturer	Model	# Blades	Class	Size	% Wheel Width	% Wheel Diameter	Quantity	Airflow per Fan (CFM)	Altitude (ft)	TSP (in w.g)	ESP (in w.g)	Fan Speed (RPM)	Fan Power (BHP)
Lau	DDPG2	9	II	222	120	100	1	9,500	449	6.68	3.50	2,253	14.38

Max RPM	Wheel Type	Blade Type	Wheel Material	Base Material	Fan Flow Isolation	AirFlow Monitoring	Inverter Drive Balancing	Isolation Type	Thrust Restraints
2,454	SWSI	Airfoil	Aluminum	Galvanized Steel	None	Yes (K=2649.00)	-	2" Spring	Yes

Drive Type	FEI	FEP (KW)	Inlet Screen	Fan Cage	Fan Stand	Motor Removal Rail	Seismic Snubber
Direct Drive	1.28	11.88	-	-	-	-	-

Motor Details

Type / MFG	Motor Power (HP)	V/Ph/Hz	Quantity	Insulation Class	RPM	Frame Size	FLA (Amps)	Efficiency	Location	SGR
ODP / Baldor	20.0	460/3/60	1	H	1,800	256T	24.96	Premium	Left	Yes

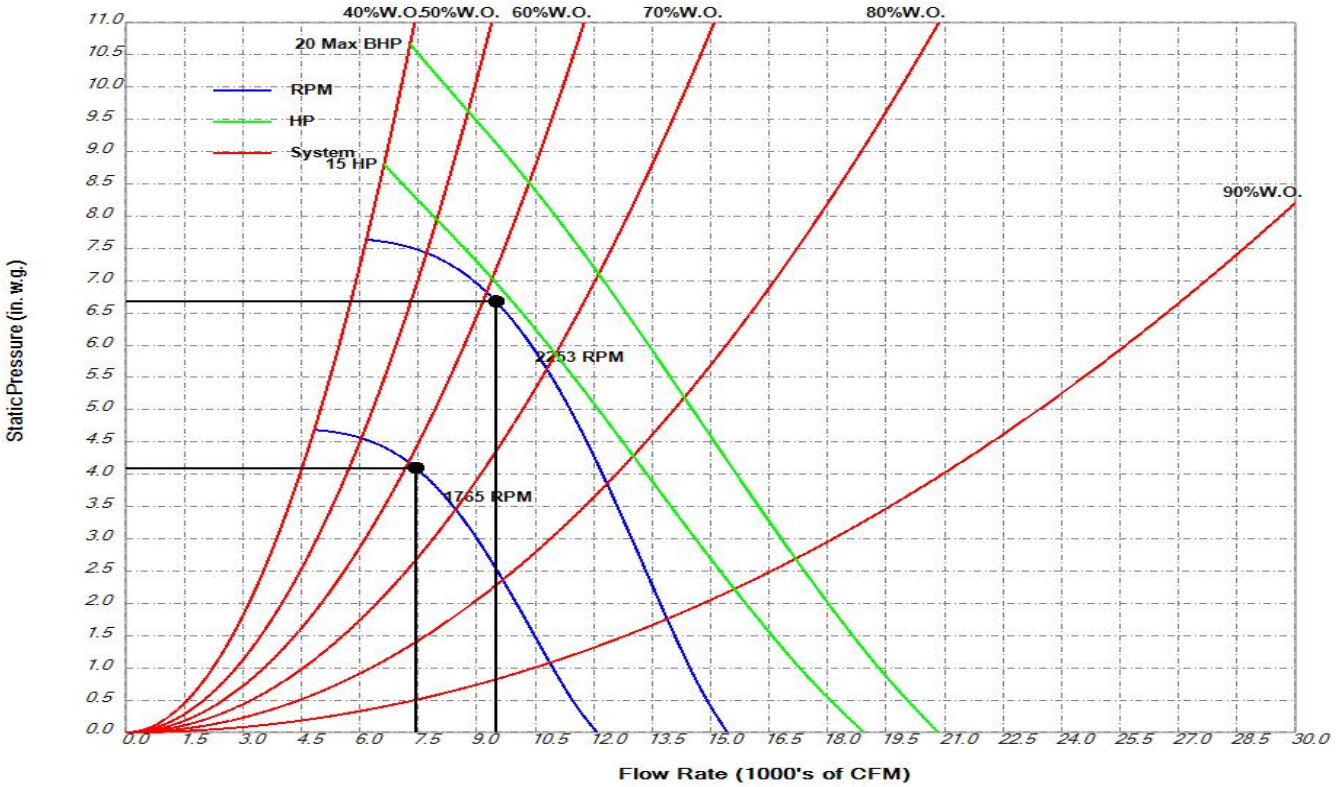
At Motor Synchronous Details

TSP (in w.g.)	Total Air Flow (CFM)	Fan Speed (RPM)	Fan Power (BHP)
4.10	7,442	1,765	6.91

Notes

Certified by the AHRI Central Station Air-Handling Unit (AHU) Certification Program, based on AHRI Standard 430/431. AHRI certified units are subject to rigorous and continuous testing, have performance ratings independently measured and are third-party verified. Certified units may be found in the AHRI Directory at www.ahridirectory.org

Per California Energy Code (C.E.C.), Title 20, the selected fan ratings are only approved for use in equipment outside the state of California. Buyer assumes all liability for non-compliance of the noted regulation.



Water Coil(s)

Performance[1] Details

Coil	Fluid Type	Rows	Fin Spacing (FPI)	TPC	TMBH	SMBH	EAT (°F)		LAT (°F)		Airflow (CFM)	FV (ft/min)	APD	Flow (GPM)	EWT (°F)	LWT (°F)	Fluid Vel. (ft/s)	WPD	Alt. (ft)
							DB	WB	DB	WB									
CC	Water	4	12	4	299	253	78.0	62.3	52.9	50.9	9,500	465	0.59	39.4	42.0	57.1	1.5	6.4	449

Construction Details

Coil	Location		Offset (in)	Connection Material[3]	Connection Rotation (degrees)	Connection Type	Supply Connection (Per Coil)		Return Connection (Per Coil)		Coil Stack Rack
	Coil Index[2]	Connection					Qty	Size (in)	Qty	Size (in)	
CC	1	Left	0	Steel	0	MPT	1	1.5	1	1.5	-

Coil	# of Coils High	Face Type	Total Fin Height (in)	Fin Length (in)	Coil Face Area (ft^2)	Fin Material	Fin Thickness (in)	Fin Type	Tube Diameter (in)	Tube Material	Tube Wall Thickness (in)
CC	1	Full	45.25	65.0	20.4	Aluminum	0.008	Sine	0.625	Copper	0.020

Coil	Coil Coating	Dry Weight (lbs)	Fluid Weight (lbs)	Fluid Volume (ft^3)	Header Material	Casing Material	Intermediate Drain Pan Material	Fouling Factor ($hr.ft^2.°F/BTU$)
CC	None	295	93	1.5	Copper	Galvanized	-	-

Notes

- Performance is shown for the entire coil bank. Performance is not per coil.
- Coil index indicates position in segment. Example: CC-1, index 1; Spacer, index 2; CC-1, index 3
- Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.
- All Coils: Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.
- CC[1]: AHRI Certified:No.Coil is NOT certified by AHRI. Coil is within the scope of AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program.
- CC[1]: AHRI Certified:No.Coils with Turbulator option are not AHRI Certified.
- AHRI Certified: No
- All Coils: CDW Tube Spacing: 1.50 x 1.30
- All Coils: Coil Dll Version: 8.14
- CC[1]: Note: When Conditions that produce condensate exist, coil face velocities above 550 fpm may result in condensate carryover.

Drain(s)

Details

Segment	Drain Pan		
	Liner Material	Connection Location	Liner Coating
CC	Stainless Steel, 304	Left	None

Filter(s)

Details							
Segment	**Type**	**Depth**	**Filter Loading**	**Media/MERV**	**# of Spares**	**Spare Filter Media**	**Frame Material**
FM	Primary Filter	2"	Side	Pleated 30% Efficiency (MERV 8)	2	Pleated 30% Efficiency (MERV 8)	Galvanized Steel
RF	Primary Filter	12"	Side	Rigid 80% Efficiency (MERV 13)	2	Rigid 80% Efficiency (MERV 13)	Galvanized Steel

Sizes						Filter Gauge Details		
Segment	**Filter**	**1st Filter Size H x W (in)**	**1st Qty**	**2nd Filter Size H x W (in)**	**2nd Qty**	**Location**	**Type**	**Range (in w.g)**
FM	Primary Filter	20x24	8	20x16	4	Door	Magnehelic with Flag	0 - 5.0
RF	Primary Filter	20x24	4	20x20	2	Door	Magnehelic with Flag	0 - 5.0

Damper(s)

Details											
Segment	**Air Path**	**H x W (in)**	**Qty**	**Total Face Velocity (ft/min)**	**Face Area (ft^2)**	**Airflow (CFM)**	**Min Airflow Measurement (CFM)**	**Type**	**Config**	**Model**	**Material**	**Blade Orientation**
FM	Return Air	15.25 x 52.00	1	1,725	5.5	9,500	-	Control	100%	CD60	Galvanized	Parallel

Door(s)

Details												
Segment(s)	**Location**	**Swing**	**Hinge Location**	**H x W x T (in)**	**View Port**	**ViewPort Wire**	**Test Port**	**Spare Gasket**	**Thermal Break**	**Fastener Type**	**Safety Latch**	**Noncontact Safety Interlock**
FM	Left	Outward	Front	48 x 28 x 2	Double Pane - 8x8	-	-	-	Yes	Plated	-	-
RF	Left	Outward	Front	48 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
CC	Left	Outward	Rear	48 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FS	Left	Outward	Rear	48 x 19 x 2	Standard Double Pane	-	-	-	Yes	Plated	Yes	-

Motor Control(s)

VFD Details									
Segment	Type	V/Ph/Hz	Input/Output Amps*	Efficiency (%)	Heat Loss (at 100% load)	Enclosure	Bypass	Disconnect Type	RFI/EMI EMC Filter
FS	AYK-580	460/3/60	27/27	98	430	NEMA 1	-	Fused	Yes

Notes (ABB VFD)
*Drives are rated for use below 3,000 ft and 104°F. Refer to the Air-Mod Engineering Guide Form 100.42-EGI (813) for additional information.
Drives are current rated devices. The HP ratings provided are for reference only and are based on typical 4-pole motors at nominal voltages (NEC Table 430-150). If full motor torque is required, ensure the drive has a continuous current rating equal to, or greater than, the full load amp rating of the motor.
Storage Temperature: -40°F to 158°F (-40°C to 70°C).
Ambient Operating Temperature: Temperate 5°F to 104°F (-15°C to 40°C). De-rating to operate at 122°F (50°C).
Relative Humidity: 5% to 95% non-condensing. Maximum relative humidity is 60% in the presence of corrosive gasses.
Altitude: 100% Load Capacity (No De-rating) up to 3,300 ft. (1,000 m). 1% derating for each 330 ft. above 3,300 ft. Installations above 6,600ft. (2,000 m) require review.
If 8KHZ Switching Frequency is used, de-rate output current to 80%.
Overload Current Rating: 110% for 1 minute every 10 minutes and is capable of 130% short term-overload rating for 2 seconds our of each minute.
If applicable, motor overload protection in the bypass mode is provided by a Class 20 motor overload relay.
The customer is responsible for providing either a platform/catwalk or portable means to access the VFD when the VFD is installed where the center of the handle of the disconnecting means in its uppermost position is greater than 78” above the finished floor.
Input line Impedance: 5% Equivalent Input Impedance with internal reactor(s). Patented swinging choke design for superior harmonic mitigation.
Use Copper Conductors Only. Do not use aluminum wire.

Face Velocity and Static Pressure

Summary						
Segment	Description	Face Area (ft^2)	Airflow (CFM)	Face Velocity (ft/min)	Supply Fan Static Pressure (in w.g.)	Exhaust/Return Fan Static Pressure (in w.g.)
FM	CD60 (Control Damper - Galvanized Airfoil)	5.5	9,500	1,725	0.10	0.00
FM	Return Air Opening	5.5	9,500	1,725	0.50	0.00
FM	2" Pleated 30% Efficiency (MERV 8)	35.6	9,500	267	0.12	0.00
FM	Dirty Filter Allowance	0.0		0	0.50	0.00
RF	12" Rigid 80% Efficiency (MERV 13)	18.9	9,500	503	0.38	0.00
RF	Dirty Filter Allowance	0.0		0	0.50	0.00
CC	Cooling - 4 Row - 12 Fins Per Inch	20.4	9,500	465	0.59	0.00
FS	Supply Air Opening	5.6	9,500	1,701	0.49	0.00
FS	External Static - User Entered	0.0		0	3.50	0.00
				Total	**6.68**	**0.00**

Dimensions and Weight

Details					
Segment	**Description**	**Length[1] (in)**	**Height (in)**	**Width[2] (in)**	**Weight[3] (lbs)**
FM	Filter Mixing Box	34	54	78	729
RF	Rigid Filter	18	54	78	374
CC	Cooling Coil	30	54	78	824
FS	Fan (Supply)	43	54	78	1,351
Overall		**125**			

Notes

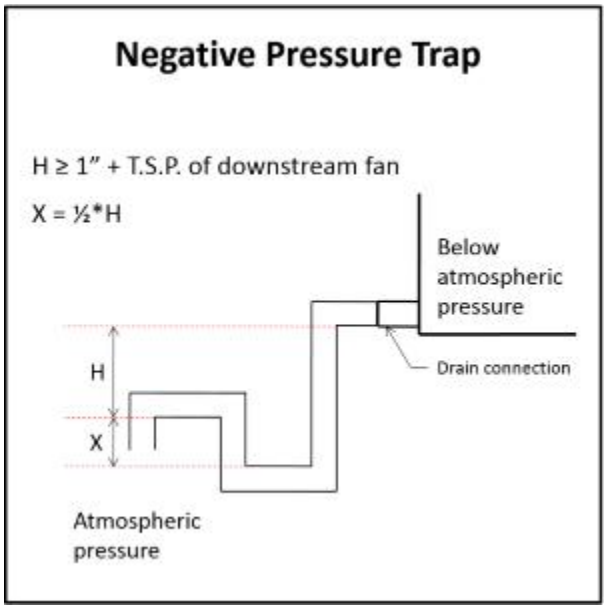
[1]The length includes bottom tier segments only.

[2]The width does not include coil connection extensions or door latches that extend beyond the unit casing. The width does not include the depth of any pipe chases.

[3]See Shipping Summary for notes on weights.

Recommended Trap Height

Details									
Segment	Applicable Fan	Fan TSP (in w.g.)	Positive or Negative	Calculated Dimensions (in)			Recommended Dimensions (in)		Base Rail Height (in)
				H	X	H + X	H	H + X	
CC	Supply Fan	6.68	Negative	7.19	3.60	10.78	7.25	10.75	8



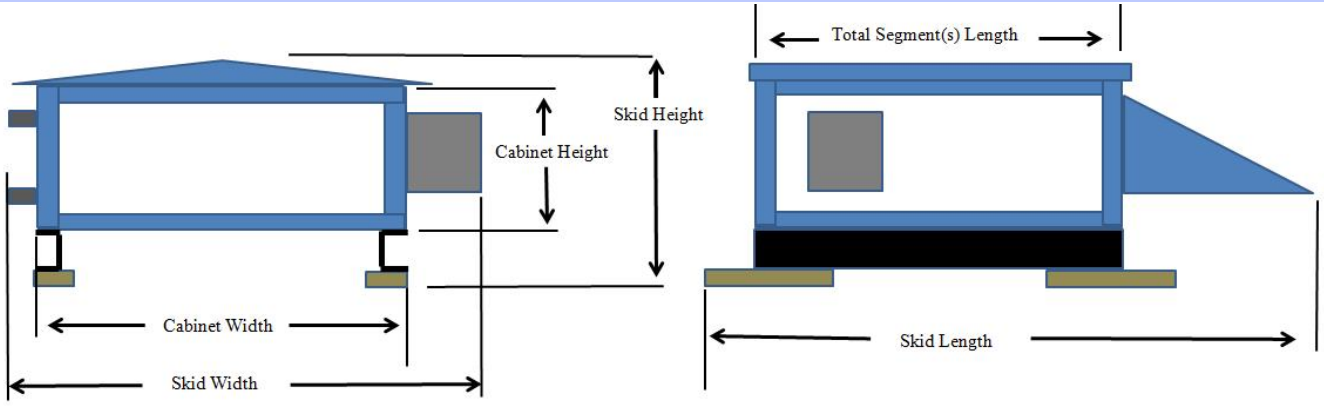
Notes
Formulas and calculations are recommendations only. Contractor shall determine actual dimensions required for each trap based on jobsite conditions, and application requirements.
Refer to the Installation Manual of the IOM for more information.

Statement of Compliance

Details
Air Handling Unit AHU's meet IBC seismic requirements for non-critical equipment (Ip = 1.0) for locations with design spectral response Sds <= 0.43. Units must be rigid mounted.
The anchorage of the unit to the ground or building structure needs to be evaluated by and is the responsibility of the engineer of record.
Specification of seismic requirements is the responsibility of the project design engineer. If formal certification is required, please contact your sales representative and/or application engineer for review. Certain application and site requirements may require additional cost and/or lead time.
Component locations are listed as Segment Hand (Unit Hand): ex. Left (Right). See Submittal Drawing for additional details.
Air handling unit parameters vary depending on conditions. Parameters such as airflows, air pressure drops, and coil capacities are shown for design conditions.

Shipping Summary

Details					
Skid	**Skid Length (in)**	**Skid Height (in)**	**Skid Width (in)**	**Shipping Weight (lbs)**	**Operating Weight (lbs)**
FS CC RF FM	125	69	94	3,181	3,278
Overall					**3,278**



Notes

Skid Width: Total width of the shipping skid, including any items that may extend beyond the cabinet (this includes any door handles, coil connections, drain connections, lifting lugs, mounted pipe-chases, electrical/control components, tie-down brackets, side dampers).

Skid Height: Total height of the shipping skid, including any items that may extend beyond the cabinet (this includes any base-rails, shipping wood-blocks, roof peak, discharge flanges, mounted gas-furnace flue pipes).

Skid Length: Total length of the shipping skid, including any items that may extend beyond the cabinet (this includes any mounted rain-hoods, discharge flanges, tie-down brackets, shipping wood-blocks, front dampers, split connectors, electrical/control components, outrigging extensions, isolation dampers, inlet baskets).

Shipping Weight: Represents the estimated shipping weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation but not any consequential shipping impact. Shipping weight does not include ship loose and/or field-installed items but does include estimate for shipping materials and/or opening covers.

Operating Weight: Represents the estimated operational weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation. Operational weight estimate includes unit shell, internal components and structure, and known ship loose and/or field-installed items (weather hoods, pipe chases, factory-provided filter media and estimated fluid weight in coils). Actual operating weight will be heaver due to additional field installed materials including but not limited to field-provided filter media, piping, control devices, and/or inertia base concrete.

Air Handling Unit Performance Report

Job Summary

Project Name:	F35 Special Access Program Facility Ebbing ANGB		
Unit Tag(s):	AHU-102		
Quantity:	1	**Environment:**	Indoor



Unit Overview

Model	Airflow (CFM)	Altitude (ft)	Operating Weight (lbs)
PAI-54x78	10,400	449	3,360

Segment Sequence

(FS CC RF FM)

Unit Construction

Casing Details

Segment(s)	Thickness (in)	Exterior Paint	Exterior Gauge and Material	Interior Gauge and Material	Insulation Thickness and Material	Mylar Lining	Thermal Break	Bulkhead Material
FS	2"	None	18 Ga. G-90 Galvanized	22 Ga. G-90 Galvanized (Perf.)	1" Foam + 1" Fiberglass	-	-	Galvanized Steel
FM, RF, CC	2"	None	18 Ga. G-90 Galvanized	Standard Ga. G-90 Galvanized	2" Foam	-	-	Galvanized Steel

Base Details

Segment(s)	Material	Paint
FM, RF, CC, FS	8" Formed Steel	None

Floor Details

Segment(s)	Gauge and Material	Paint	Insulation	Thermal Break	Attachment	Sub-Floor Gauge and Material
FM, RF, CC, FS	Standard Ga. G-90 Galvanized	None	2"	-	Screw Down	None

Unit Electrical

Circuit Details

#	Component(s)	V/Ph/Hz	Full Load Amps (FLA)	Minimum Current Ampacity (MCA)	Maximum Overcurrent Protection (MOP)
1	FS Variable Frequency Drive - 1-1 (on FS)	460/3/60	24.96	31.2	50
2	Light Switch (on FS)	120/1/60	NaN	-	15

Electrical Details

Minimum Unit SCCR	100 kA rms Symmetrical	**ETL Label (UL1995/NEC-2002)**	Yes

Unit Light Type	Light Switch Enclosure
LED	Indoor

Model Hyperlinked

Supply Fan(s)

Performance Details

Fan Manufacturer	Model	# Blades	Class	Size	% Wheel Width	% Wheel Diameter	Quantity	Airflow per Fan (CFM)	Altitude (ft)	TSP (in w.g)	ESP (in w.g)	Fan Speed (RPM)	Fan Power (BHP)
Lau	DDPG2	9	II	245	100	100	1	10,400	449	6.62	3.20	2,066	15.46

Max RPM	Wheel Type	Blade Type	Wheel Material	Base Material	Fan Flow Isolation	AirFlow Monitoring	Inverter Drive Balancing	Isolation Type	Thrust Restraints
2,269	SWSI	Airfoil	Aluminum	Galvanized Steel	None	Yes (K=3092.00)	-	2" Spring	Yes

Drive Type	FEI	FEP (KW)	Inlet Screen	Fan Cage	Fan Stand	Motor Removal Rail	Seismic Snubber
Direct Drive	1.29	12.77	-	-	-	-	-

Motor Details

Type / MFG	Motor Power (HP)	V/Ph/Hz	Quantity	Insulation Class	RPM	Frame Size	FLA (Amps)	Efficiency	Location	SGR
ODP / Baldor	20.0	460/3/60	1	H	1,800	256T	24.96	Premium	Left	Yes

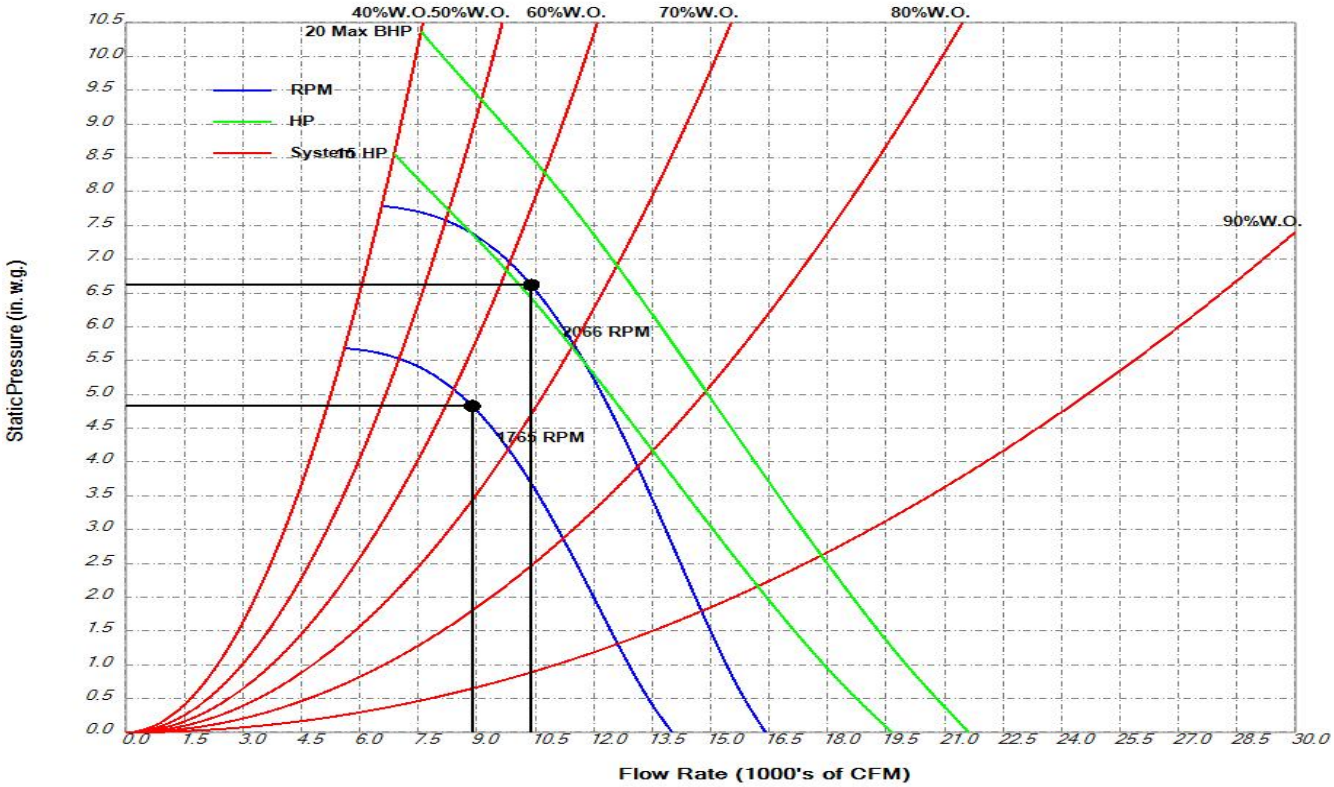
At Motor Synchronous Details

TSP (in w.g.)	Total Air Flow (CFM)	Fan Speed (RPM)	Fan Power (BHP)
4.83	8,885	1,765	9.64

Notes

Certified by the AHRI Central Station Air-Handling Unit (AHU) Certification Program, based on AHRI Standard 430/431. AHRI certified units are subject to rigorous and continuous testing, have performance ratings independently measured and are third-party verified. Certified units may be found in the AHRI Directory at www.ahridirectory.org

Per California Energy Code (C.E.C.), Title 20, the selected fan ratings are only approved for use in equipment outside the state of California. Buyer assumes all liability for non-compliance of the noted regulation.



Water Coil(s)

Performance[1] Details

Coil	Fluid Type	Rows	Fin Spacing (FPI)	TPC	TMBH	SMBH	EAT (°F)		LAT (°F)		Airflow (CFM)	FV (ft/min)	APD	Flow (GPM)	EWT (°F)	LWT (°F)	Fluid Vel. (ft/s)	WPD	Alt. (ft)
							DB	WB	DB	WB									
CC	Water	4	12	4	352	278	78.0	63.4	52.8	51.3	10,400	509	0.76	44.9	42.0	57.6	1.7	8.0	449

Construction Details

Coil	Location		Offset (in)	Connection Material[3]	Connection Rotation (degrees)	Connection Type	Supply Connection (Per Coil)		Return Connection (Per Coil)		Coil Stack Rack
	Coil Index[2]	Connection					Qty	Size (in)	Qty	Size (in)	
CC	1	Right	0	Steel	0	MPT	1	1.5	1	1.5	-

Coil	# of Coils High	Face Type	Total Fin Height (in)	Fin Length (in)	Coil Face Area (ft^2)	Fin Material	Fin Thickness (in)	Fin Type	Tube Diameter (in)	Tube Material	Tube Wall Thickness (in)
CC	1	Full	45.25	65.0	20.4	Aluminum	0.010	Sine	0.625	Copper	0.020

Coil	Coil Coating	Dry Weight (lbs)	Fluid Weight (lbs)	Fluid Volume (ft^3)	Header Material	Casing Material	Intermediate Drain Pan Material	Fouling Factor ($hr.ft^2.°F/BTU$)
CC	None	328	93	1.5	Copper	Galvanized	-	-

Notes

- Performance is shown for the entire coil bank. Performance is not per coil.
- Coil index indicates position in segment. Example: CC-1, index 1; Spacer, index 2; CC-1, index 3
- Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.
- All Coils: Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.
- CC[1]: AHRI Certified:No.Coil is NOT certified by AHRI. Coil is within the scope of AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program.
- CC[1]: AHRI Certified:No.Coils with Turbulator option are not AHRI Certified.
- AHRI Certified: No
- All Coils: CDW Tube Spacing: 1.50 x 1.30
- All Coils: Coil Dll Version: 8.14
- CC[1]: Note: When Conditions that produce condensate exist, coil face velocities above 550 fpm may result in condensate carryover.

Drain(s)

Details

Segment	Drain Pan		
	Liner Material	Connection Location	Liner Coating
CC	Stainless Steel, 304	Right	None

Filter(s)

Details							
Segment	Type	Depth	Filter Loading	Media/MERV	# of Spares	Spare Filter Media	Frame Material
FM	Primary Filter	2"	Side	Pleated 30% Efficiency (MERV 8)	2	Pleated 30% Efficiency (MERV 8)	Galvanized Steel
RF	Primary Filter	12"	Side	Rigid 80% Efficiency (MERV 13)	2	Rigid 80% Efficiency (MERV 13)	Galvanized Steel

Sizes						Filter Gauge Details		
Segment	Filter	1st Filter Size H x W (in)	1st Qty	2nd Filter Size H x W (in)	2nd Qty	Location	Type	Range (in w.g)
FM	Primary Filter	20x24	8	20x16	4	Door	Magnehelic with Flag	0 - 5.0
RF	Primary Filter	20x24	4	20x20	2	Door	Magnehelic with Flag	0 - 5.0

Damper(s)

Details											
Segment	Air Path	H x W (in)	Qty	Total Face Velocity (ft/min)	Face Area (ft^2)	Airflow (CFM)	Min Airflow Measurement (CFM)	Type	Config	Model	Material	Blade Orientation
FM	Return Air	15.25 x 57.00	1	1,723	6.0	10,400	-	Control	100%	CD60	Galvanized	Parallel

Door(s)

Details												
Segment(s)	Location	Swing	Hinge Location	H x W x T (in)	View Port	ViewPort Wire	Test Port	Spare Gasket	Thermal Break	Fastener Type	Safety Latch	Noncontact Safety Interlock
FM	Right	Outward	Front	48 x 28 x 2	Double Pane - 8x8	-	-	-	Yes	Plated	-	-
RF	Right	Outward	Front	48 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
CC	Right	Outward	Rear	48 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FS	Right	Outward	Rear	48 x 19 x 2	Standard Double Pane	-	-	-	Yes	Plated	Yes	-

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Motor Control(s)

VFD Details									
Segment	Type	V/Ph/Hz	Input/Output Amps*	Efficiency (%)	Heat Loss (at 100% load)	Enclosure	Bypass	Disconnect Type	RFI/EMI EMC Filter
FS	AYK-580	460/3/60	27/27	98	430	NEMA 1	-	Fused	Yes

Notes (ABB VFD)
*Drives are rated for use below 3,000 ft and 104°F. Refer to the Air-Mod Engineering Guide Form 100.42-EGI (813) for additional information.
Drives are current rated devices. The HP ratings provided are for reference only and are based on typical 4-pole motors at nominal voltages (NEC Table 430-150). If full motor torque is required, ensure the drive has a continuous current rating equal to, or greater than, the full load amp rating of the motor.
Storage Temperature: -40°F to 158°F (-40°C to 70°C).
Ambient Operating Temperature: Temperate 5°F to 104°F (-15°C to 40°C). De-rating to operate at 122°F (50°C).
Relative Humidity: 5% to 95% non-condensing. Maximum relative humidity is 60% in the presence of corrosive gasses.
Altitude: 100% Load Capacity (No De-rating) up to 3,300 ft. (1,000 m). 1% derating for each 330 ft. above 3,300 ft. Installations above 6,600ft. (2,000 m) require review.
If 8KHZ Switching Frequency is used, de-rate output current to 80%.
Overload Current Rating: 110% for 1 minute every 10 minutes and is capable of 130% short term-overload rating for 2 seconds our of each minute.
If applicable, motor overload protection in the bypass mode is provided by a Class 20 motor overload relay.
The customer is responsible for providing either a platform/catwalk or portable means to access the VFD when the VFD is installed where the center of the handle of the disconnecting means in its uppermost position is greater than 78” above the finished floor.
Input line Impedance: 5% Equivalent Input Impedance with internal reactor(s). Patented swinging choke design for superior harmonic mitigation.
Use Copper Conductors Only. Do not use aluminum wire.

Face Velocity and Static Pressure

Summary						
Segment	Description	Face Area (ft^2)	Airflow (CFM)	Face Velocity (ft/min)	Supply Fan Static Pressure (in w.g.)	Exhaust/Return Fan Static Pressure (in w.g.)
FM	CD60 (Control Damper - Galvanized Airfoil)	6.0	10,400	1,723	0.10	0.00
FM	Return Air Opening	6.0	10,400	1,723	0.50	0.00
FM	2" Pleated 30% Efficiency (MERV 8)	35.6	10,400	293	0.13	0.00
FM	Dirty Filter Allowance	0.0		0	0.50	0.00
RF	12" Rigid 80% Efficiency (MERV 13)	18.9	10,400	551	0.43	0.00
RF	Dirty Filter Allowance	0.0		0	0.50	0.00
CC	Cooling - 4 Row - 12 Fins Per Inch	20.4	10,400	509	0.76	0.00
FS	Supply Air Opening	6.0	10,400	1,719	0.50	0.00
FS	External Static - User Entered	0.0		0	3.20	0.00
				Total	**6.62**	**0.00**

Dimensions and Weight

Details					
Segment	**Description**	**Length[1] (in)**	**Height (in)**	**Width[2] (in)**	**Weight[3] (lbs)**
FM	Filter Mixing Box	34	54	78	734
RF	Rigid Filter	18	54	78	374
CC	Cooling Coil	30	54	78	857
FS	Fan (Supply)	44	54	78	1,395
Overall		**126**			

Notes

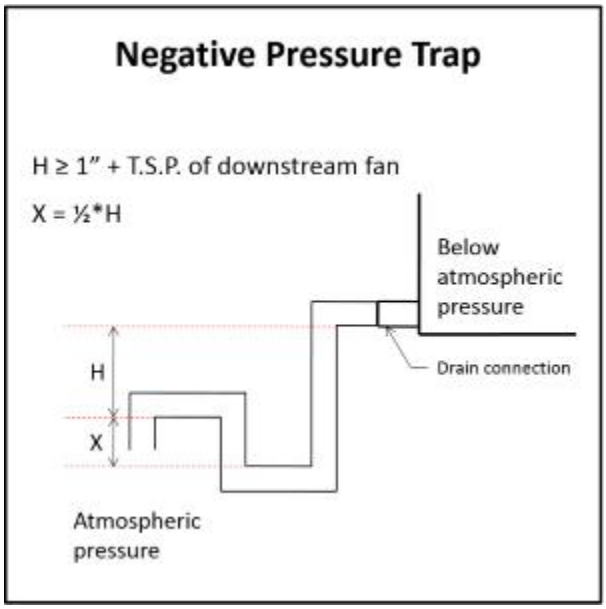
[1]The length includes bottom tier segments only.

[2]The width does not include coil connection extensions or door latches that extend beyond the unit casing. The width does not include the depth of any pipe chases.

[3]See Shipping Summary for notes on weights.

Recommended Trap Height

Details									
Segment	Applicable Fan	Fan TSP (in w.g.)	Positive or Negative	Calculated Dimensions (in)			Recommended Dimensions (in)		Base Rail Height (in)
				H	X	H + X	H	H + X	
CC	Supply Fan	6.62	Negative	7.12	3.56	10.68	7.25	10.75	8



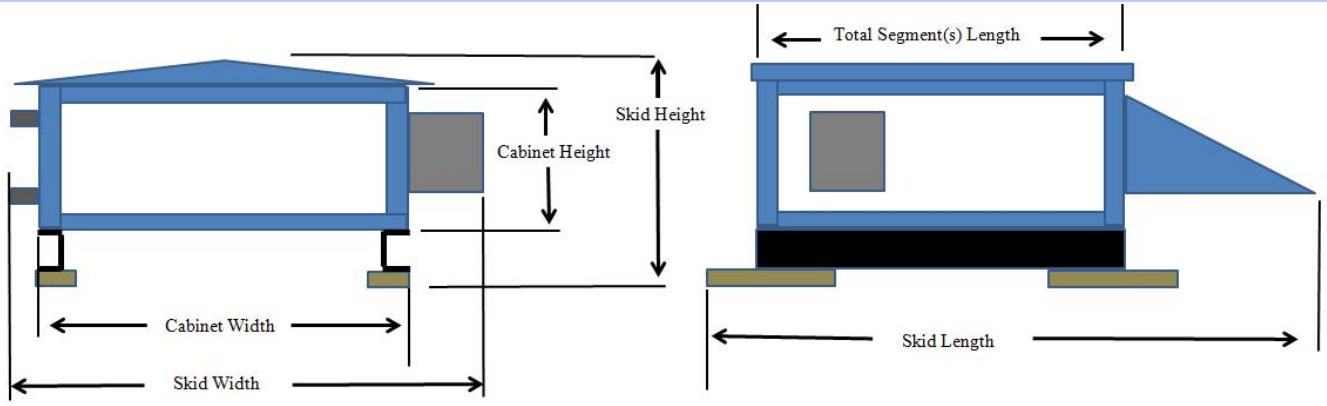
Notes
Formulas and calculations are recommendations only. Contractor shall determine actual dimensions required for each trap based on jobsite conditions, and application requirements.
Refer to the Installation Manual of the IOM for more information.

Statement of Compliance

Details
Air Handling Unit AHU's meet IBC seismic requirements for non-critical equipment (Ip = 1.0) for locations with design spectral response Sds <= 0.43. Units must be rigid mounted.
The anchorage of the unit to the ground or building structure needs to be evaluated by and is the responsibility of the engineer of record.
Specification of seismic requirements is the responsibility of the project design engineer. If formal certification is required, please contact your sales representative and/or application engineer for review. Certain application and site requirements may require additional cost and/or lead time.
Component locations are listed as Segment Hand (Unit Hand): ex. Left (Right). See Submittal Drawing for additional details.
Air handling unit parameters vary depending on conditions. Parameters such as airflows, air pressure drops, and coil capacities are shown for design conditions.

Shipping Summary

Details					
Skid	**Skid Length (in)**	**Skid Height (in)**	**Skid Width (in)**	**Shipping Weight (lbs)**	**Operating Weight (lbs)**
FS CC RF FM	126	69	94	3,263	3,360
Overall					**3,360**



Notes

Skid Width: Total width of the shipping skid, including any items that may extend beyond the cabinet (this includes any door handles, coil connections, drain connections, lifting lugs, mounted pipe-chases, electrical/control components, tie-down brackets, side dampers).

Skid Height: Total height of the shipping skid, including any items that may extend beyond the cabinet (this includes any base-rails, shipping wood-blocks, roof peak, discharge flanges, mounted gas-furnace flue pipes).

Skid Length: Total length of the shipping skid, including any items that may extend beyond the cabinet (this includes any mounted rain-hoods, discharge flanges, tie-down brackets, shipping wood-blocks, front dampers, split connectors, electrical/control components, outrigging extensions, isolation dampers, inlet baskets).

Shipping Weight: Represents the estimated shipping weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation but not any consequential shipping impact. Shipping weight does not include ship loose and/or field-installed items but does include estimate for shipping materials and/or opening covers.

Operating Weight: Represents the estimated operational weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation. Operational weight estimate includes unit shell, internal components and structure, and known ship loose and/or field-installed items (weather hoods, pipe chases, factory-provided filter media and estimated fluid weight in coils). Actual operating weight will be heaver due to additional field installed materials including but not limited to field-provided filter media, piping, control devices, and/or inertia base concrete.

Air Handling Unit Performance Report

Job Summary

Project Name:	F35 Special Access Program Facility Ebbing ANGB		
Unit Tag(s):	DOAS-101		
Quantity:	1	**Environment:**	Indoor



Unit Overview

Model	Airflow (CFM)	Altitude (ft)	Operating Weight (lbs)
PAI-36x51	2,745	449	4,904

Segment Sequence

(FS XA-2 HC-2 CC XA-1 HC-1\MB FF)/(HW)(RF IP\XA-3 FE)

Unit Construction

Casing Details

Segment(s)	Thickness (in)	Exterior Paint	Exterior Gauge and Material	Interior Gauge and Material	Insulation Thickness and Material	Mylar Lining	Thermal Break	Bulkhead Material
MB, XA-3, IP, XA-1, XA-2	2"	None	Standard Ga. G-90 Galvanized	Standard Ga. G-90 Galvanized	2" Foam	-	-	None
FF, HW, FE, RF, HC-1, CC, HC-2, FS	2"	None	Standard Ga. G-90 Galvanized	Standard Ga. G-90 Galvanized	2" Foam	-	-	Galvanized Steel

Base Details

Segment(s)	Material	Paint
HW, IP, RF, HC-1, XA-1, CC, HC-2, XA-2, FS	8" Formed Steel	None

Floor Details

Segment(s)	Gauge and Material	Paint	Insulation	Thermal Break	Attachment	Sub-Floor Gauge and Material
HW, IP, RF, HC-1, XA-1, CC, HC-2, XA-2, FS	Standard Ga. G-90 Galvanized	None	2"	-	Screw Down	None
MB, FF, XA-3, FE	Standard Ga. G-90 Galvanized	None	2" Foam	-	-	N/A

Notes

Enhanced Thermal Performance construction.

Unit Electrical

Circuit Details					
#	Component(s)	V/Ph/Hz	Full Load Amps (FLA)	Minimum Current Ampacity (MCA)	Maximum Overcurrent Protection (MOP)
1	FS Variable Frequency Drive - 1-1 (on FS)	460/3/60	6.86	8.58	15
2	FE Variable Frequency Drive - 1-1 (on FE)	460/3/60	2.39	2.99	15
3	VFD (on HW), HW Variable Frequency Drive - 1-1 (on HW)	460/3/60	0.44	0.55	15
4	Light Switch (on FS)	120/1/60	NaN	-	15

Electrical Details			
Minimum Unit SCCR	100 kA rms Symmetrical	ETL Label (UL1995/NEC-2002)	Yes
Unit Light Type		Light Switch Enclosure	
LED		Indoor	

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Supply Fan(s)

Performance Details

Fan Manufacturer	Model	# Blades	Class	Size	% Wheel Width	% Wheel Diameter	Quantity	Airflow per Fan (CFM)	Altitude (ft)	TSP (in w.g)	ESP (in w.g)	Fan Speed (RPM)	Fan Power (BHP)
Lau	DDPG2	9	II	165	80	100	1	2,745	449	4.74	1.31	2,481	2.96

Max RPM	Wheel Type	Blade Type	Wheel Material	Base Material	Fan Flow Isolation	AirFlow Monitoring	Inverter Drive Balancing	Isolation Type	Thrust Restraints
3,275	SWSI	Airfoil	Aluminum	Galvanized Steel	None	Yes (K=1441.00)	-	2" Spring	Yes

Drive Type	FEI	FEP (KW)	Inlet Screen	Fan Cage	Fan Stand	Motor Removal Rail	Seismic Snubber
Direct Drive	1.36	2.62	-	-	-	-	-

Motor Details

Type / MFG	Motor Power (HP)	V/Ph/Hz	Quantity	Insulation Class	RPM	Frame Size	FLA (Amps)	Efficiency	Location	SGR
ODP / Baldor	5.0	460/3/60	1	H	1,800	184T	6.86	Premium	Right	Yes

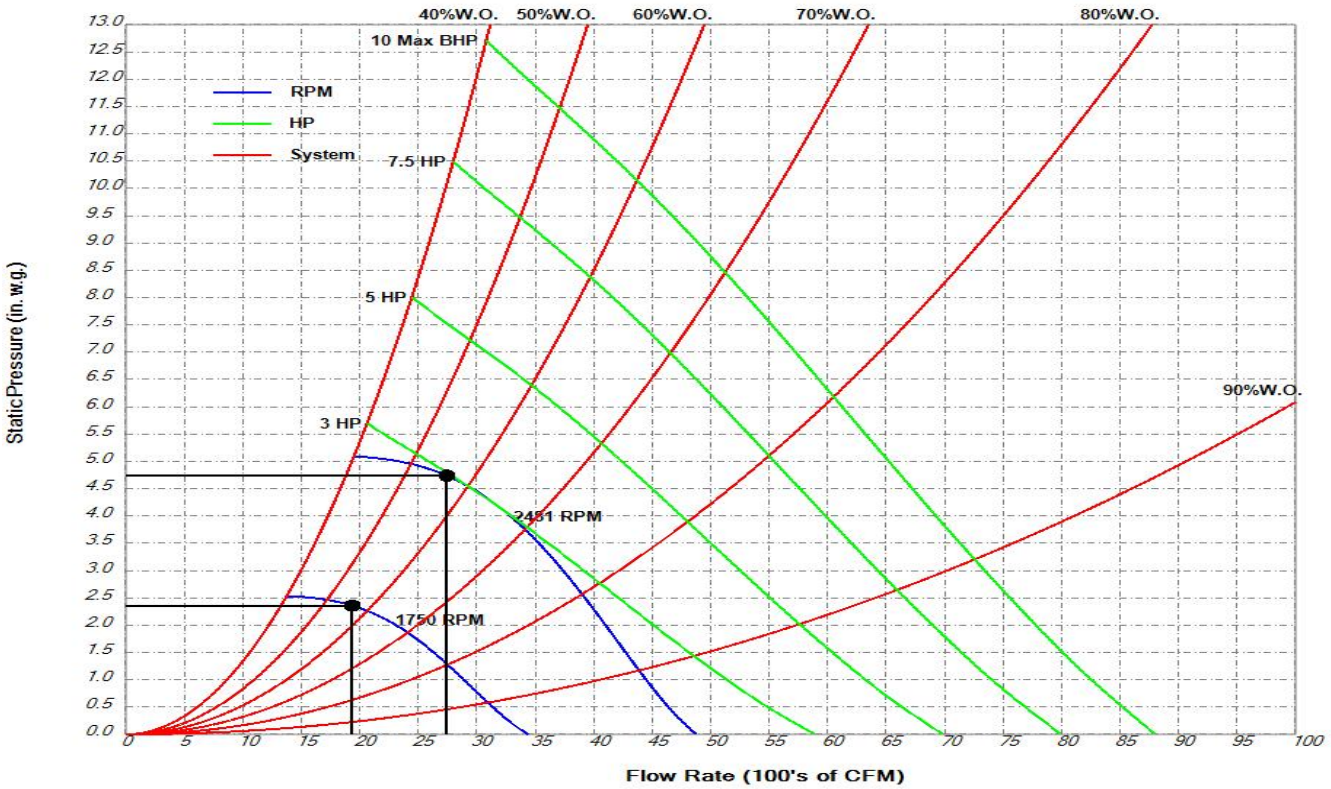
At Motor Synchronous Details

TSP (in w.g.)	Total Air Flow (CFM)	Fan Speed (RPM)	Fan Power (BHP)
2.36	1,936	1,750	1.04

Notes

Certified by the AHRI Central Station Air-Handling Unit (AHU) Certification Program, based on AHRI Standard 430/431. AHRI certified units are subject to rigorous and continuous testing, have performance ratings independently measured and are third-party verified. Certified units may be found in the AHRI Directory at www.ahridirectory.org

Per California Energy Code (C.E.C.), Title 20, the selected fan ratings are only approved for use in equipment outside the state of California. Buyer assumes all liability for non-compliance of the noted regulation.



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Exhaust Fan(s)

Performance Details

Fan Manufacturer	Model	# Blades	Class	Size	% Wheel Width	% Wheel Diameter	Quantity	Airflow per Fan (CFM)	Altitude (ft)	TSP (in w.g)	ESP (in w.g)	Fan Speed (RPM)	Fan Power (BHP)
Lau	DDPG2	9	II	135	100	100	1	1,975	449	2.87	0.86	2,428	1.27

Max RPM	Wheel Type	Blade Type	Wheel Material	Base Material	Fan Flow Isolation	AirFlow Monitoring	Inverter Drive Balancing	Isolation Type	Thrust Restraints
4,038	SWSI	Airfoil	Aluminum	Galvanized Steel	None	Yes (K=910.00)	-	2" Spring	-

Drive Type	FEI	FEP (KW)	Inlet Screen	Fan Cage	Fan Stand	Motor Removal Rail	Seismic Snubber
Direct Drive	1.50	1.18	-	-	-	-	-

Motor Details

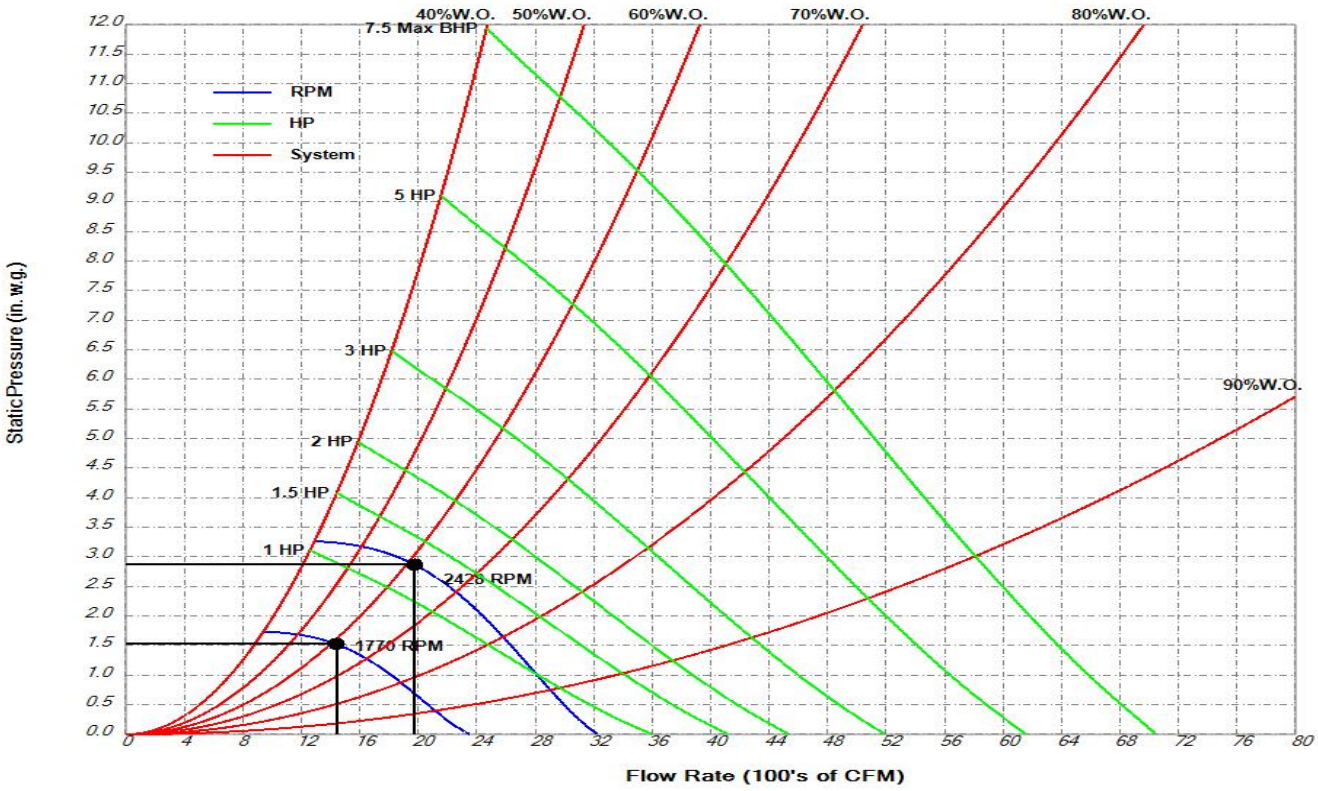
Type / MFG	Motor Power (HP)	V/Ph/Hz	Quantity	Insulation Class	RPM	Frame Size	FLA (Amps)	Efficiency	Location	SGR
ODP / Baldor	1.5	460/3/60	1	H	1,800	145T	2.39	Premium	Left	Yes

At Motor Synchronous Details

TSP (in w.g.)	Total Air Flow (CFM)	Fan Speed (RPM)	Fan Power (BHP)
1.53	1,440	1,770	0.49

Notes

Per California Energy Code (C.E.C.), Title 20, the selected fan ratings are only approved for use in equipment outside the state of California. Buyer assumes all liability for non-compliance of the noted regulation.



Water Coil(s)

Performance[1] Details

Coil	Fluid Type	Rows	Fin Spacing (FPI)	TPC	TMBH	SMBH	EAT (°F)		LAT (°F)		Airflow (CFM)	FV (ft/min)	APD	Flow (GPM)	EWT (°F)	LWT (°F)	Fluid Vel. (ft/s)	WPD	Alt. (ft)
							DB	WB	DB	WB									
HC-1	Water	1	12	2	122	122	18.0	-	55.6	-	2,745	369	0.04	8.0	150.0	119.0	1.3	0.4	449
CC	Water	6	10	12	237	96	84.8	78.0	52.4	52.1	2,745	369	0.45	31.2	42.0	57.1	4.9	17.0	449
HC-2	Water	1	10	2	47	47	53.0	-	68.7	-	2,745	369	0.03	3.0	150.0	117.8	0.5	0.1	449

Construction Details

Coil	Location		Offset (in)	Connection Material[3]	Connection Rotation (degrees)	Connection Type	Supply Connection (Per Coil)		Return Connection (Per Coil)		Coil Stack Rack
	Coil Index[2]	Connection					Qty	Size (in)	Qty	Size (in)	
HC-1	1	Right	0	Steel	0	MPT	1	1.5	1	1.5	-
CC	1	Right	0	Steel	0	MPT	1	1.5	1	1.5	-
HC-2	1	Right	0	Steel	0	MPT	1	1.5	1	1.5	-

Coil	# of Coils High	Face Type	Total Fin Height (in)	Fin Length (in)	Coil Face Area (ft^2)	Fin Material	Fin Thickness (in)	Fin Type	Tube Diameter (in)	Tube Material	Tube Wall Thickness (in)
HC-1	1	Full	27.50	39.0	7.4	Aluminum	0.008	Corrugated	0.500	Copper	0.016
CC	1	Full	27.50	39.0	7.4	Aluminum	0.008	Corrugated	0.500	Copper	0.016
HC-2	1	Full	27.50	39.0	7.4	Aluminum	0.008	Corrugated	0.500	Copper	0.016

Coil	Coil Coating	Dry Weight (lbs)	Fluid Weight (lbs)	Fluid Volume (ft^3)	Header Material	Casing Material	Intermediate Drain Pan Material	Fouling Factor ($hr.ft^2.°F/BTU$)
HC-1	None	50	11	0.2	Copper	Galvanized	-	-
CC	None	129	42	0.7	Copper	Galvanized	-	-
HC-2	None	48	11	0.2	Copper	Galvanized	-	-

Notes

- Performance is shown for the entire coil bank. Performance is not per coil.
- Coil index indicates position in segment. Example: CC-1, index 1; Spacer, index 2; CC-1, index 3
- Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.
- All Coils: Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.
- HC-1[1]: AHRI Certified:Yes.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.
- CC[1]: AHRI Certified:Yes.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.
- HC-2[1]: AHRI Certified:Yes.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.
- All Coils: BDW Tube Spacing: 1.25 x 1.08
- All Coils: Coil Dll Version: 9.0
- CC[1]: Note: When Conditions that produce condensate exist, coil face velocities above 626 fpm may result in condensate carryover.



Drain(s)

Details			
Segment	Drain Pan		
	Liner Material	Connection Location	Liner Coating
CC	Stainless Steel, 304	Right	None

Filter(s)

Details							
Segment	**Type**	**Depth**	**Filter Loading**	**Media/MERV**	**# of Spares**	**Spare Filter Media**	**Frame Material**
RF	Pre Filter	2"	Side	Pleated 30% Efficiency (MERV 8)	2	Pleated 30% Efficiency (MERV 8)	Galvanized Steel
RF	Primary Filter	4"	Side	Mini Pleat 80% Efficiency (MERV 13)	2	Mini Pleat 80% Efficiency (MERV 13)	
FF	Primary Filter	2"	Side	Pleated 30% Efficiency (MERV 8)	2	Pleated 30% Efficiency (MERV 8)	Galvanized Steel

Sizes				Filter Gauge Details		
Segment	**Filter**	**1st Filter Size H x W (in)**	**1st Qty**	**Location**	**Type**	**Range (in w.g)**
RF	Pre Filter	24x20	2	Door	Combined Magnehelic with Flag	0 - 2.0
RF	Primary Filter	24x20	2			
FF	Primary Filter	24x20	2	Door	Magnehelic with Flag	0 - 2.0

Damper(s)

Details											
Segment	**Air Path**	**H x W (in)**	**Qty**	**Total Face Velocity (ft/min)**	**Face Area (ft^2)**	**Airflow (CFM)**	**Min Airflow Measurement (CFM)**	**Type**	**Config**	**Model**	**Material**	**Blade Orientation**
MB	Return Air	9.50 x 20.00	1	1,497	1.3	1,975	-	Control	100%	CD60	Galvanized	Parallel
HW	Exhaust Air	6.00 x 37.00	1	432	1.5	925	-	Control	100%	CD60	Galvanized	Parallel
HW	Outside Air	6.00 x 37.00	1	432	1.5	925	-	Control	100%	CD60	Galvanized	Parallel

Door(s)

Details												
Segment(s)	Location	Swing	Hinge Location	H x W x T (in)	View Port	ViewPort Wire	Test Port	Spare Gasket	Thermal Break	Fastener Type	Safety Latch	Noncontact Safety Interlock
IP	Right	Outward	Front	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
RF	Right	Outward	Front	30 x 10 x 2	None	-	-	-	Yes	Plated	-	-
HW	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
HW	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
XA-1	Right	Outward	Front	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
CC	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
XA-2	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FS	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	Yes	-
MB	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FF	Right	Outward	Rear	30 x 10 x 2	None	-	-	-	Yes	Plated	-	-
XA-3	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FE	Right	Outward	Front	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	Yes	-

Model Hyperlinked

Energy Recovery Wheel(s)

Details							
MFG	Type	Model	Media	Coating	Arrangement	Purge Angle (°) / Airflow (CFM)	Bypass
AirXChange	Enthalpy	ERC-3628C	Polymer	Silica Gel	Vertical	-	Yes

Design Conditions									
OA Airflow (CFM)	EA Airflow (CFM)	Summer Outdoor		Summer Indoor		Winter Outdoor		Winter Indoor	
		DB (°F)	WB (°F)	DB (°F)	WB (°F)	DB (°F)	WB (°F)	DB (°F)	WB (°F)
2,745	1,975	84.80	78.00	78.00	64.90	18.00	16.00	68.00	56.70

Design Performance									
Net Effectiveness (%)		Sensible Effectiveness (%)		Latent Effectiveness (%)		Relative Humidity (%)		Total Recovered Load (BTU/Hr)	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
72.58	75.40	77.70	78.06	72.00	72.36	63.88	68.18	73,105.15	122,976.44

Supply Air Conditions (DB, °F)		Supply Air Conditions (WB, °F)		Leaving Exhaust Air Conditions (DB, °F)		Leaving Exhaust Air Conditions (WB, °F)	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
80.93	45.06	71.53	40.52	0.00	0.00	0.00	0.00

Motor Details						
Power (HP)	Voltage	Phase	Frequency (Hz)	FLA (Amps)	Inverter Rated Motor	Motor Control
0.2	460	3	60	0.44	Yes	VFD

Motor Control(s)

VFD Details									
Segment	Type	V/Ph/Hz	Input/Output Amps*	Efficiency (%)	Heat Loss (at 100% load)	Enclosure	Bypass	Disconnect Type	RFI/EMI EMC Filter
FE	AYK-580	460/3/60	3/3	98	55	NEMA 1	-	Fused	Yes
FS	AYK-580	460/3/60	7.6/7.6	98	133	NEMA 1	-	Fused	Yes
HW	AYK-580	460/3/60	2.1/2.1	98	45	NEMA 1	-	Fused	Yes

Notes (ABB VFD)
*Drives are rated for use below 3,000 ft and 104°F. Refer to the Air-Mod Engineering Guide Form 100.42-EGI (813) for additional information.
Drives are current rated devices. The HP ratings provided are for reference only and are based on typical 4-pole motors at nominal voltages (NEC Table 430-150). If full motor torque is required, ensure the drive has a continuous current rating equal to, or greater than, the full load amp rating of the motor.
Storage Temperature: -40°F to 158°F (-40°C to 70°C).
Ambient Operating Temperature: Temperate 5°F to 104°F (-15°C to 40°C). De-rating to operate at 122°F (50°C).
Relative Humidity: 5% to 95% non-condensing. Maximum relative humidity is 60% in the presence of corrosive gasses.
Altitude: 100% Load Capacity (No De-rating) up to 3,300 ft. (1,000 m). 1% derating for each 330 ft. above 3,300 ft. Installations above 6,600ft. (2,000 m) require review.
If 8KHZ Switching Frequency is used, de-rate output current to 80%.
Overload Current Rating: 110% for 1 minute every 10 minutes and is capable of 130% short term-overload rating for 2 seconds our of each minute.
If applicable, motor overload protection in the bypass mode is provided by a Class 20 motor overload relay.
The customer is responsible for providing either a platform/catwalk or portable means to access the VFD when the VFD is installed where the center of the handle of the disconnecting means in its uppermost position is greater than 78” above the finished floor.
Input line Impedance: 5% Equivalent Input Impedance with internal reactor(s). Patented swinging choke design for superior harmonic mitigation.
Use Copper Conductors Only. Do not use aluminum wire.

Face Velocity and Static Pressure

Summary						
Segment	Description	Face Area (ft²)	Airflow (CFM)	Face Velocity (ft/min)	Supply Fan Static Pressure (in w.g.)	Exhaust/Return Fan Static Pressure (in w.g.)
IP	Inlet Air Opening	1.8	2,745	1,520	0.39	0.00
RF	2" Pleated 30% Efficiency (MERV 8)	6.7	2,745	412	0.22	0.00
RF	Dirty Filter Allowance - Pre Filter	0.0		0	0.50	0.00
RF	4" Mini Pleat 80% Efficiency (MERV 13)	6.7	2,745	412	0.49	0.00
RF	Dirty Filter Allowance	0.0		0	0.50	0.00
HW	Energy Wheel - Supply Air	0.0	2,745	0	0.77	0.00
HC-1	Heating - 1 Row - 12 Fins Per Inch	7.4	2,745	369	0.04	0.00
CC	Cooling - 6 Row - 10 Fins Per Inch	7.4	2,745	369	0.45	0.00
HC-2	Heating - 1 Row - 10 Fins Per Inch	7.4	2,745	369	0.03	0.00
FS	Supply Air Opening	5.6	2,745	494	0.04	0.00
FS	External Static - User Entered	0.0		0	1.31	0.00
MB	CD60 (Control Damper - Galvanized Airfoil)	1.3	1,975	1,497	0.00	0.20
MB	Return Air Opening	1.3	1,975	1,497	0.00	0.38
FF	2" Pleated 30% Efficiency (MERV 8)	6.7	1,975	296	0.00	0.14
FF	Dirty Filter Allowance	0.0		0	0.00	0.50
HW	Energy Wheel - Exhaust Air	0.0	1,975	0	0.00	0.59
FE	Exhaust Air Opening	1.8	1,975	1,094	0.00	0.20
FE	External Static - User Entered	0.0		0	0.00	0.86
				Total	4.74	2.87

Dimensions and Weight

Details					
Segment	Description	Length[1] (in)	Height (in)	Width[2] (in)	Weight[3] (lbs)
MB	Mixing Box	31	36	51	336
FF	Flat Filter	16	36	51	159
HW	Heat Wheel	41	72	51	835
XA-3	Access	22	36	51	197
FE	Fan (Exhaust)	44	36	51	633
IP	Inlet Plenum	44	36	51	477
RF	Rigid Filter	22	36	51	268
HC-1	Heating Coil	16	36	51	270
XA-1	Access	18	36	51	157
CC	Cooling Coil	32	36	51	475
HC-2	Heating Coil	10	36	51	169
XA-2	Access	18	36	51	157
FS	Fan (Supply)	43	36	51	771
Overall		244			

Notes

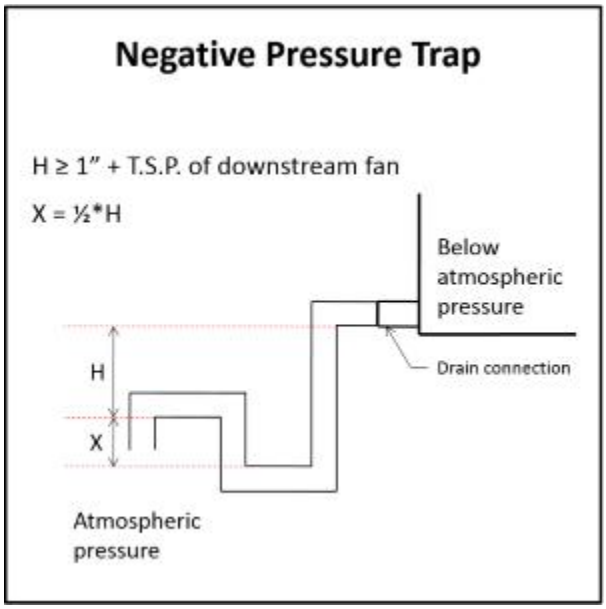
[1]The length includes bottom tier segments only.

[2]The width does not include coil connection extensions or door latches that extend beyond the unit casing. The width does not include the depth of any pipe chases.

[3]See Shipping Summary for notes on weights.

Recommended Trap Height

Details									
Segment	Applicable Fan	Fan TSP (in w.g.)	Positive or Negative	Calculated Dimensions (in)			Recommended Dimensions (in)		Base Rail Height (in)
				H	X	H + X	H	H + X	
CC	Supply Fan	4.74	Negative	5.67	2.84	8.50	5.75	8.50	8



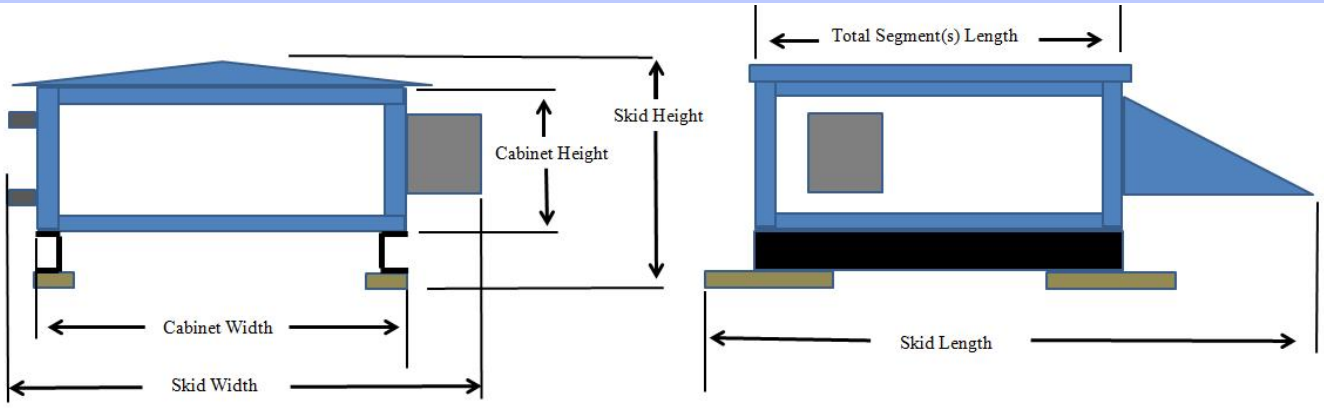
Notes
Formulas and calculations are recommendations only. Contractor shall determine actual dimensions required for each trap based on jobsite conditions, and application requirements.
Refer to the Installation Manual of the IOM for more information.

Statement of Compliance

Details
Air Handling Unit AHU's meet IBC seismic requirements for non-critical equipment (Ip = 1.0) for locations with design spectral response Sds <= 0.43. Units must be rigid mounted.
The anchorage of the unit to the ground or building structure needs to be evaluated by and is the responsibility of the engineer of record.
Specification of seismic requirements is the responsibility of the project design engineer. If formal certification is required, please contact your sales representative and/or application engineer for review. Certain application and site requirements may require additional cost and/or lead time.
Component locations are listed as Segment Hand (Unit Hand): ex. Left (Right). See Submittal Drawing for additional details.
Air handling unit parameters vary depending on conditions. Parameters such as airflows, air pressure drops, and coil capacities are shown for design conditions.

Shipping Summary

Details					
Skid	**Skid Length (in)**	**Skid Height (in)**	**Skid Width (in)**	**Shipping Weight (lbs)**	**Operating Weight (lbs)**
RF IP XA-3 FE	66	86	67	1,626	1,575
HW	41	86	67	893	835
FS XA-2 HC-2 CC XA-1 HC-1 MB FF	137	87	67	2,532	2,494
Overall					**4,904**



Notes

Skid Width: Total width of the shipping skid, including any items that may extend beyond the cabinet (this includes any door handles, coil connections, drain connections, lifting lugs, mounted pipe-chases, electrical/control components, tie-down brackets, side dampers).

Skid Height: Total height of the shipping skid, including any items that may extend beyond the cabinet (this includes any base-rails, shipping wood-blocks, roof peak, discharge flanges, mounted gas-furnace flue pipes).

Skid Length: Total length of the shipping skid, including any items that may extend beyond the cabinet (this includes any mounted rain-hoods, discharge flanges, tie-down brackets, shipping wood-blocks, front dampers, split connectors, electrical/control components, outrigging extensions, isolation dampers, inlet baskets).

Shipping Weight: Represents the estimated shipping weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation but not any consequential shipping impact. Shipping weight does not include ship loose and/or field-installed items but does include estimate for shipping materials and/or opening covers.

Operating Weight: Represents the estimated operational weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation. Operational weight estimate includes unit shell, internal components and structure, and known ship loose and/or field-installed items (weather hoods, pipe chases, factory-provided filter media and estimated fluid weight in coils). Actual operating weight will be heaver due to additional field installed materials including but not limited to field-provided filter media, piping, control devices, and/or inertia base concrete.

Air Handling Unit Performance Report

Job Summary

Project Name:	F35 Special Access Program Facility Ebbing ANGB		
Unit Tag(s):	DOAS-102		
Quantity:	1	**Environment:**	Indoor



Unit Overview

Model	Airflow (CFM)	Altitude (ft)	Operating Weight (lbs)
PAI-36x51	2,670	449	4,861

Segment Sequence

(FS XA-2 HC-2 CC XA-1 HC-1\MB FF)/(HW)(RF IP\XA-3 FE)

Unit Construction

Casing Details

Segment(s)	Thickness (in)	Exterior Paint	Exterior Gauge and Material	Interior Gauge and Material	Insulation Thickness and Material	Mylar Lining	Thermal Break	Bulkhead Material
MB, XA-3, IP, XA-1, XA-2	2"	None	Standard Ga. G-90 Galvanized	Standard Ga. G-90 Galvanized	2" Foam	-	-	None
FF, HW, FE, RF, HC-1, CC, HC-2, FS	2"	None	Standard Ga. G-90 Galvanized	Standard Ga. G-90 Galvanized	2" Foam	-	-	Galvanized Steel

Base Details

Segment(s)	Material	Paint
HW, IP, RF, HC-1, XA-1, CC, HC-2, XA-2, FS	8" Formed Steel	None

Floor Details

Segment(s)	Gauge and Material	Paint	Insulation	Thermal Break	Attachment	Sub-Floor Gauge and Material
HW, IP, RF, HC-1, XA-1, CC, HC-2, XA-2, FS	Standard Ga. G-90 Galvanized	None	2"	-	Screw Down	None
MB, FF, XA-3, FE	Standard Ga. G-90 Galvanized	None	2" Foam	-	-	N/A

Notes

Enhanced Thermal Performance construction.

Unit Electrical

Circuit Details					
#	Component(s)	V/Ph/Hz	Full Load Amps (FLA)	Minimum Current Ampacity (MCA)	Maximum Overcurrent Protection (MOP)
1	FS Variable Frequency Drive - 1-1 (on FS)	460/3/60	6.86	8.58	15
2	FE Variable Frequency Drive - 1-1 (on FE)	460/3/60	2.39	2.99	15
3	VFD (on HW), HW Variable Frequency Drive - 1-1 (on HW)	460/3/60	0.44	0.55	15
4	Light Switch (on FS)	120/1/60	NaN	-	15

Electrical Details			
Minimum Unit SCCR	100 kA rms Symmetrical	ETL Label (UL1995/NEC-2002)	Yes
Unit Light Type		Light Switch Enclosure	
LED		Indoor	

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Supply Fan(s)

Performance Details													
Fan Manufacturer	Model	# Blades	Class	Size	% Wheel Width	% Wheel Diameter	Quantity	Airflow per Fan (CFM)	Altitude (ft)	TSP (in w.g)	ESP (in w.g)	Fan Speed (RPM)	Fan Power (BHP)
Lau	DDPG2	9	II	165	80	100	1	2,670	449	4.54	1.13	2,439	2.83

Max RPM	Wheel Type	Blade Type	Wheel Material	Base Material	Fan Flow Isolation	AirFlow Monitoring	Inverter Drive Balancing	Isolation Type	Thrust Restraints
3,275	SWSI	Airfoil	Aluminum	Galvanized Steel	None	Yes (K=1441.00)	-	2" Spring	Yes

Drive Type	FEI	FEP (KW)	Inlet Screen	Fan Cage	Fan Stand	Motor Removal Rail	Seismic Snubber
Direct Drive	1.37	2.51	-	-	-	-	-

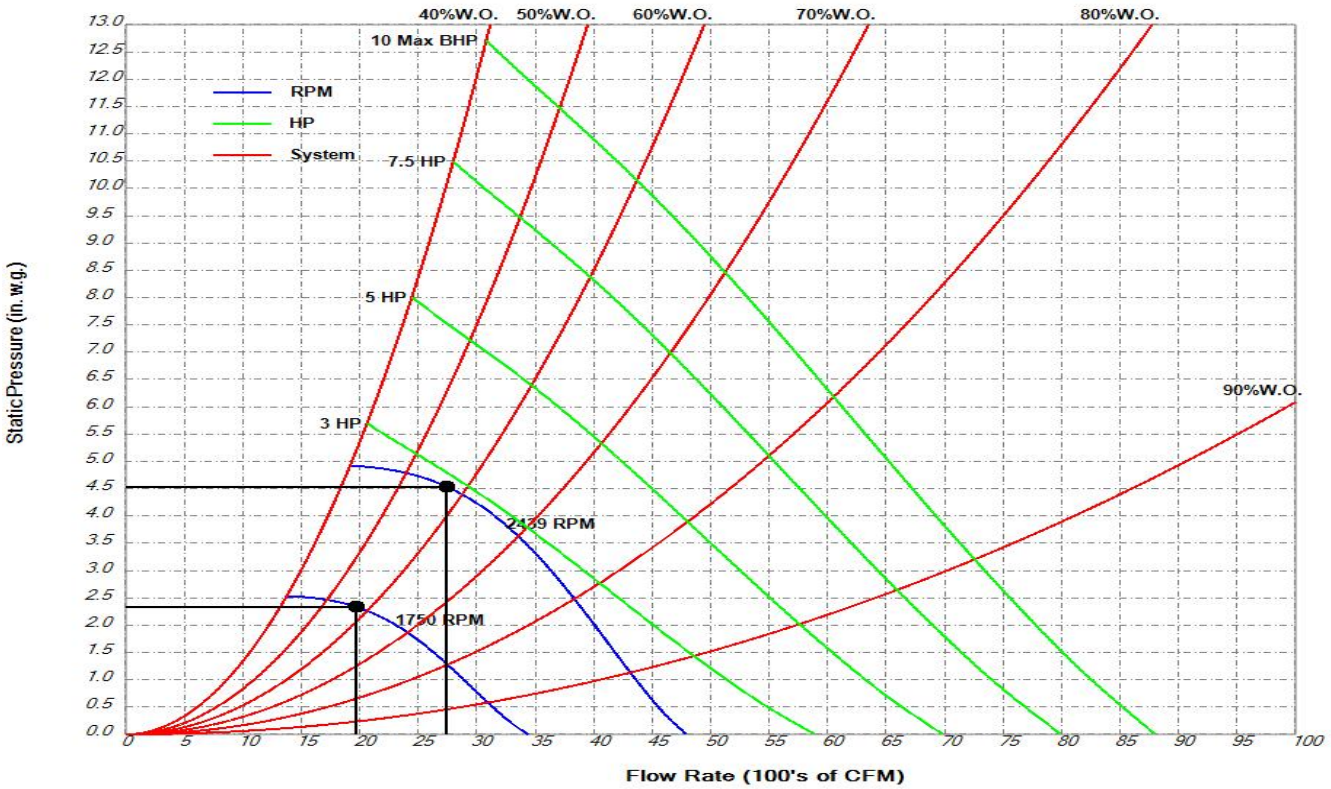
Motor Details										
Type / MFG	Motor Power (HP)	V/Ph/Hz	Quantity	Insulation Class	RPM	Frame Size	FLA (Amps)	Efficiency	Location	SGR
ODP / Baldor	5.0	460/3/60	1	H	1,800	184T	6.86	Premium	Right	Yes

At Motor Synchronous Details			
TSP (in w.g.)	Total Air Flow (CFM)	Fan Speed (RPM)	Fan Power (BHP)
2.34	1,970	1,750	1.05

Notes

Certified by the AHRI Central Station Air-Handling Unit (AHU) Certification Program, based on AHRI Standard 430/431. AHRI certified units are subject to rigorous and continuous testing, have performance ratings independently measured and are third-party verified. Certified units may be found in the AHRI Directory at www.ahridirectory.org

Per California Energy Code (C.E.C.), Title 20, the selected fan ratings are only approved for use in equipment outside the state of California. Buyer assumes all liability for non-compliance of the noted regulation.



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Exhaust Fan(s)

Performance Details													
Fan Manufacturer	Model	# Blades	Class	Size	% Wheel Width	% Wheel Diameter	Quantity	Airflow per Fan (CFM)	Altitude (ft)	TSP (in w.g)	ESP (in w.g)	Fan Speed (RPM)	Fan Power (BHP)
Lau	DDPG2	9	II	135	80	100	1	1,975	449	2.80	0.75	2,619	1.28

Max RPM	Wheel Type	Blade Type	Wheel Material	Base Material	Fan Flow Isolation	AirFlow Monitoring	Inverter Drive Balancing	Isolation Type	Thrust Restraints
4,038	SWSI	Airfoil	Aluminum	Galvanized Steel	None	Yes (K=910.00)	-	2" Spring	Yes

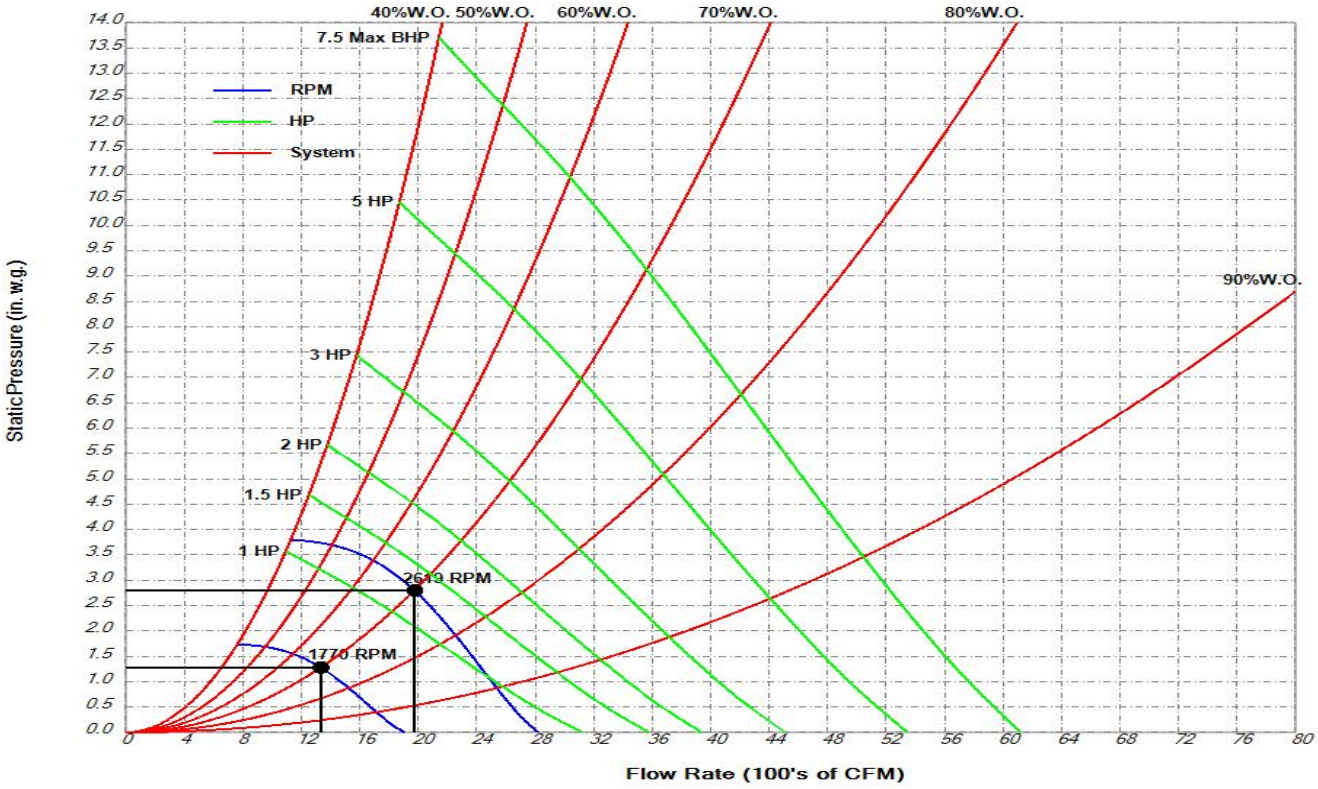
Drive Type	FEI	FEP (KW)	Inlet Screen	Fan Cage	Fan Stand	Motor Removal Rail	Seismic Snubber
Direct Drive	1.46	1.19	-	-	-	-	-

Motor Details										
Type / MFG	Motor Power (HP)	V/Ph/Hz	Quantity	Insulation Class	RPM	Frame Size	FLA (Amps)	Efficiency	Location	SGR
ODP / Baldor	1.5	460/3/60	1	H	1,800	145T	2.39	Premium	Left	Yes

At Motor Synchronous Details			
TSP (in w.g.)	Total Air Flow (CFM)	Fan Speed (RPM)	Fan Power (BHP)
1.28	1,335	1,770	0.40

Notes

Per California Energy Code (C.E.C.), Title 20, the selected fan ratings are only approved for use in equipment outside the state of California. Buyer assumes all liability for non-compliance of the noted regulation.



Water Coil(s)

Performance[1] Details

Coil	Fluid Type	Rows	Fin Spacing (FPI)	TPC	TMBH	SMBH	EAT (°F)		LAT (°F)		Airflow (CFM)	FV (ft/min)	APD	Flow (GPM)	EWT (°F)	LWT (°F)	Fluid Vel. (ft/s)	WPD	Alt. (ft)
							DB	WB	DB	WB									
HC-1	Water	1	12	2	119	119	18.0	-	56.0	-	2,670	358	0.04	7.8	150.0	118.8	1.2	0.3	449
CC	Water	6	10	12	231	94	84.8	78.0	52.2	52.0	2,670	358	0.43	30.3	42.0	57.2	4.7	16.1	449
HC-2	Water	1	10	2	47	47	53.0	-	69.0	-	2,670	358	0.03	3.0	150.0	118.0	0.5	0.1	449

Construction Details

Coil	Location		Offset (in)	Connection Material[3]	Connection Rotation (degrees)	Connection Type	Supply Connection (Per Coil)		Return Connection (Per Coil)		Coil Stack Rack
	Coil Index[2]	Connection					Qty	Size (in)	Qty	Size (in)	
HC-1	1	Right	0	Steel	0	MPT	1	1.5	1	1.5	-
CC	1	Right	0	Steel	0	MPT	1	1.5	1	1.5	-
HC-2	1	Right	0	Steel	0	MPT	1	1.5	1	1.5	-

Coil	# of Coils High	Face Type	Total Fin Height (in)	Fin Length (in)	Coil Face Area (ft^2)	Fin Material	Fin Thickness (in)	Fin Type	Tube Diameter (in)	Tube Material	Tube Wall Thickness (in)
HC-1	1	Full	27.50	39.0	7.4	Aluminum	0.008	Corrugated	0.500	Copper	0.016
CC	1	Full	27.50	39.0	7.4	Aluminum	0.008	Corrugated	0.500	Copper	0.016
HC-2	1	Full	27.50	39.0	7.4	Aluminum	0.008	Corrugated	0.500	Copper	0.016

Coil	Coil Coating	Dry Weight (lbs)	Fluid Weight (lbs)	Fluid Volume (ft^3)	Header Material	Casing Material	Intermediate Drain Pan Material	Fouling Factor ($hr.ft^2.°F/BTU$)
HC-1	None	50	11	0.2	Copper	Galvanized	-	-
CC	None	129	42	0.7	Copper	Galvanized	-	-
HC-2	None	48	11	0.2	Copper	Galvanized	-	-

Notes

- Performance is shown for the entire coil bank. Performance is not per coil.
- Coil index indicates position in segment. Example: CC-1, index 1; Spacer, index 2; CC-1, index 3
- Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.
- All Coils: Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.
- HC-1[1]: AHRI Certified:Yes.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.
- CC[1]: AHRI Certified:Yes.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.
- HC-2[1]: AHRI Certified:Yes.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.
- All Coils: BDW Tube Spacing: 1.25 x 1.08
- All Coils: Coil Dll Version: 9.0
- CC[1]: Note: When Conditions that produce condensate exist, coil face velocities above 626 fpm may result in condensate carryover.



Drain(s)

Details			
Segment	Drain Pan		
	Liner Material	Connection Location	Liner Coating
CC	Stainless Steel, 304	Right	None

Filter(s)

Details							
Segment	**Type**	**Depth**	**Filter Loading**	**Media/MERV**	**# of Spares**	**Spare Filter Media**	**Frame Material**
RF	Pre Filter	2"	Side	Pleated 30% Efficiency (MERV 8)	2	Pleated 30% Efficiency (MERV 8)	Galvanized Steel
RF	Primary Filter	4"	Side	Mini Pleat 80% Efficiency (MERV 13)	2	Mini Pleat 80% Efficiency (MERV 13)	
FF	Primary Filter	2"	Side	Pleated 30% Efficiency (MERV 8)	2	Pleated 30% Efficiency (MERV 8)	Galvanized Steel

Sizes				Filter Gauge Details		
Segment	**Filter**	**1st Filter Size H x W (in)**	**1st Qty**	**Location**	**Type**	**Range (in w.g)**
RF	Pre Filter	24x20	2	Door	Combined Magnehelic with Flag	0 - 2.0
RF	Primary Filter	24x20	2			
FF	Primary Filter	24x20	2	Door	Magnehelic with Flag	0 - 2.0

Damper(s)

Details											
Segment	**Air Path**	**H x W (in)**	**Qty**	**Total Face Velocity (ft/min)**	**Face Area (ft^2)**	**Airflow (CFM)**	**Min Airflow Measurement (CFM)**	**Type**	**Config**	**Model**	**Material**	**Blade Orientation**
MB	Return Air	9.50 x 28.00	1	1,486	1.8	2,745	-	Control	100%	CD60	Galvanized	Parallel
HW	Exhaust Air	6.00 x 37.00	1	600	1.5	925	-	Control	100%	CD60	Galvanized	Parallel
HW	Outside Air	6.00 x 37.00	1	600	1.5	925	-	Control	100%	CD60	Galvanized	Parallel

Door(s)

Details												
Segment(s)	Location	Swing	Hinge Location	H x W x T (in)	View Port	ViewPort Wire	Test Port	Spare Gasket	Thermal Break	Fastener Type	Safety Latch	Noncontact Safety Interlock
IP	Right	Outward	Front	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
RF	Right	Outward	Front	30 x 10 x 2	None	-	-	-	Yes	Plated	-	-
HW	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
HW	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
XA-1	Right	Outward	Front	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
CC	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
XA-2	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FS	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	Yes	-
MB	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FF	Right	Outward	Front	30 x 10 x 2	None	-	-	-	Yes	Plated	-	-
XA-3	Right	Outward	Rear	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	-	-
FE	Right	Outward	Front	30 x 18 x 2	Standard Double Pane	-	-	-	Yes	Plated	Yes	-

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Energy Recovery Wheel(s)

Details							
MFG	Type	Model	Media	Coating	Arrangement	Purge Angle (°) / Airflow (CFM)	Bypass
AirXChange	Enthalpy	ERC-3628C	Polymer	Silica Gel	Vertical	-	Yes

Design Conditions									
OA Airflow (CFM)	EA Airflow (CFM)	Summer Outdoor		Summer Indoor		Winter Outdoor		Winter Indoor	
		DB (°F)	WB (°F)	DB (°F)	WB (°F)	DB (°F)	WB (°F)	DB (°F)	WB (°F)
2,670	1,975	84.80	78.00	78.00	64.90	18.00	16.00	68.00	56.70

Design Performance									
Net Effectiveness (%)		Sensible Effectiveness (%)		Latent Effectiveness (%)		Relative Humidity (%)		Total Recovered Load (BTU/Hr)	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
72.21	75.03	77.29	77.65	71.62	71.98	63.60	67.62	72,714.51	122,340.13

Supply Air Conditions (DB, °F)		Supply Air Conditions (WB, °F)		Leaving Exhaust Air Conditions (DB, °F)		Leaving Exhaust Air Conditions (WB, °F)	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
80.85	45.70	71.37	41.02	0.00	0.00	0.00	0.00

Motor Details						
Power (HP)	Voltage	Phase	Frequency (Hz)	FLA (Amps)	Inverter Rated Motor	Motor Control
0.2	460	3	60	0.44	Yes	VFD

Motor Control(s)

VFD Details									
Segment	Type	V/Ph/Hz	Input/Output Amps*	Efficiency (%)	Heat Loss (at 100% load)	Enclosure	Bypass	Disconnect Type	RFI/EMI EMC Filter
FE	AYK-580	460/3/60	3/3	98	55	NEMA 1	-	Fused	Yes
FS	AYK-580	460/3/60	7.6/7.6	98	133	NEMA 1	-	Fused	Yes
HW	AYK-580	460/3/60	2.1/2.1	98	45	NEMA 1	-	Fused	Yes

Notes (ABB VFD)
*Drives are rated for use below 3,000 ft and 104°F. Refer to the Air-Mod Engineering Guide Form 100.42-EGI (813) for additional information.
Drives are current rated devices. The HP ratings provided are for reference only and are based on typical 4-pole motors at nominal voltages (NEC Table 430-150). If full motor torque is required, ensure the drive has a continuous current rating equal to, or greater than, the full load amp rating of the motor.
Storage Temperature: -40°F to 158°F (-40°C to 70°C).
Ambient Operating Temperature: Temperate 5°F to 104°F (-15°C to 40°C). De-rating to operate at 122°F (50°C).
Relative Humidity: 5% to 95% non-condensing. Maximum relative humidity is 60% in the presence of corrosive gasses.
Altitude: 100% Load Capacity (No De-rating) up to 3,300 ft. (1,000 m). 1% derating for each 330 ft. above 3,300 ft. Installations above 6,600ft. (2,000 m) require review.
If 8KHZ Switching Frequency is used, de-rate output current to 80%.
Overload Current Rating: 110% for 1 minute every 10 minutes and is capable of 130% short term-overload rating for 2 seconds our of each minute.
If applicable, motor overload protection in the bypass mode is provided by a Class 20 motor overload relay.
The customer is responsible for providing either a platform/catwalk or portable means to access the VFD when the VFD is installed where the center of the handle of the disconnecting means in its uppermost position is greater than 78” above the finished floor.
Input line Impedance: 5% Equivalent Input Impedance with internal reactor(s). Patented swinging choke design for superior harmonic mitigation.
Use Copper Conductors Only. Do not use aluminum wire.

Face Velocity and Static Pressure

Summary						
Segment	Description	Face Area (ft²)	Airflow (CFM)	Face Velocity (ft/min)	Supply Fan Static Pressure (in w.g.)	Exhaust/Return Fan Static Pressure (in w.g.)
IP	Inlet Air Opening	1.8	2,745	1,520	0.39	0.00
RF	2" Pleated 30% Efficiency (MERV 8)	6.7	2,745	412	0.22	0.00
RF	Dirty Filter Allowance - Pre Filter	0.0		0	0.50	0.00
RF	4" Mini Pleat 80% Efficiency (MERV 13)	6.7	2,745	412	0.49	0.00
RF	Dirty Filter Allowance	0.0		0	0.50	0.00
HW	Energy Wheel - Supply Air	0.0	2,670	0	0.77	0.00
HC-1	Heating - 1 Row - 12 Fins Per Inch	7.7	2,745	358	0.04	0.00
CC	Cooling - 6 Row - 10 Fins Per Inch	7.7	2,745	358	0.43	0.00
HC-2	Heating - 1 Row - 10 Fins Per Inch	7.7	2,745	358	0.03	0.00
FS	Supply Air Opening	5.6	2,745	494	0.04	0.00
FS	External Static - User Entered	0.0		0	1.13	0.00
MB	CD60 (Control Damper - Galvanized Airfoil)	1.8	2,745	1,486	0.00	0.17
MB	Return Air Opening	1.8	2,745	1,486	0.00	0.37
FF	2" Pleated 30% Efficiency (MERV 8)	6.7	2,745	412	0.00	0.22
FF	Dirty Filter Allowance	0.0		0	0.00	0.50
HW	Energy Wheel - Exhaust Air	0.0	1,975	0	0.00	0.59
FE	Exhaust Air Opening	1.8	1,975	1,094	0.00	0.20
FE	External Static - User Entered	0.0		0	0.00	0.75
				Total	**4.54**	**2.80**

Dimensions and Weight

Details					
Segment	Description	Length[1] (in)	Height (in)	Width[2] (in)	Weight[3] (lbs)
MB	Mixing Box	24	36	51	293
FF	Flat Filter	16	36	51	159
HW	Heat Wheel	41	72	51	835
XA-3	Access	22	36	51	197
FE	Fan (Exhaust)	44	36	51	633
IP	Inlet Plenum	44	36	51	477
RF	Rigid Filter	22	36	51	268
HC-1	Heating Coil	16	36	51	270
XA-1	Access	18	36	51	157
CC	Cooling Coil	32	36	51	475
HC-2	Heating Coil	10	36	51	169
XA-2	Access	18	36	51	157
FS	Fan (Supply)	43	36	51	771
Overall		**244**			

Notes

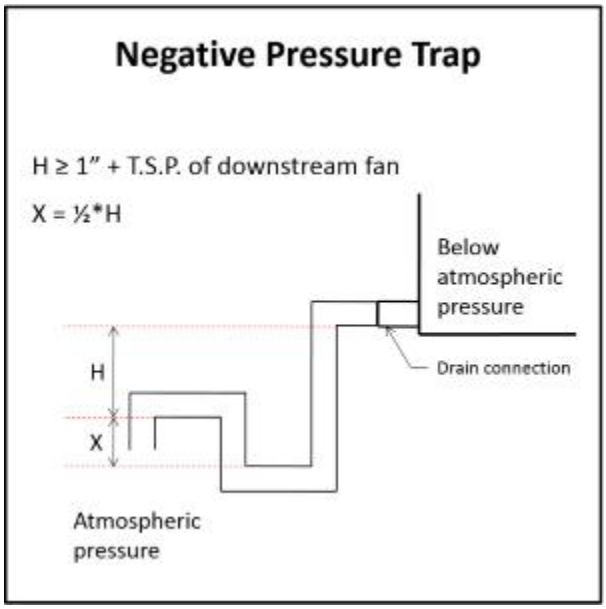
[1]The length includes bottom tier segments only.

[2]The width does not include coil connection extensions or door latches that extend beyond the unit casing. The width does not include the depth of any pipe chases.

[3]See Shipping Summary for notes on weights.

Recommended Trap Height

Details									
Segment	Applicable Fan	Fan TSP (in w.g.)	Positive or Negative	Calculated Dimensions (in)			Recommended Dimensions (in)		Base Rail Height (in)
				H	X	H + X	H	H + X	
CC	Supply Fan	4.54	Negative	5.47	2.74	8.20	5.50	8.25	8



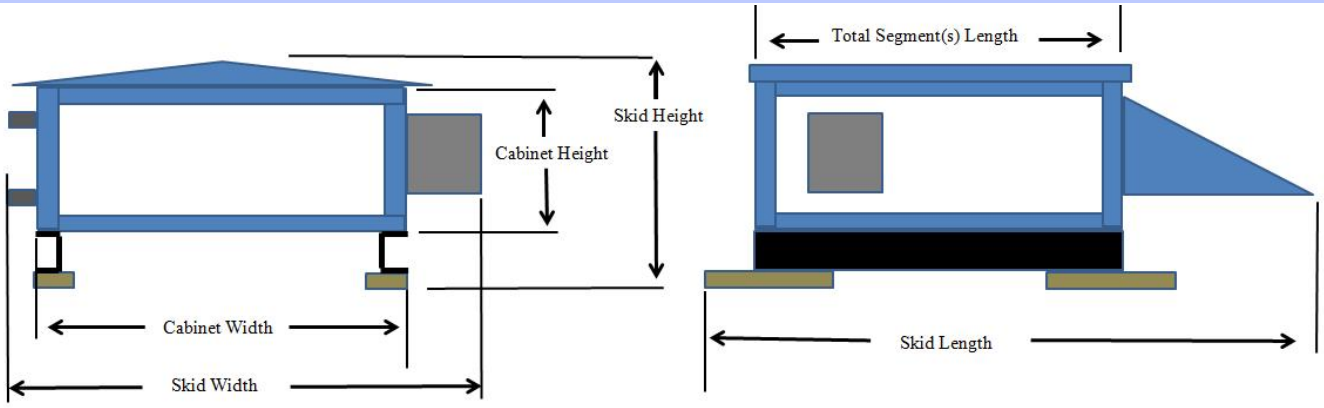
Notes
Formulas and calculations are recommendations only. Contractor shall determine actual dimensions required for each trap based on jobsite conditions, and application requirements.
Refer to the Installation Manual of the IOM for more information.

Statement of Compliance

Details
Air Handling Unit AHU's meet IBC seismic requirements for non-critical equipment (Ip = 1.0) for locations with design spectral response Sds <= 0.43. Units must be rigid mounted.
The anchorage of the unit to the ground or building structure needs to be evaluated by and is the responsibility of the engineer of record.
Specification of seismic requirements is the responsibility of the project design engineer. If formal certification is required, please contact your sales representative and/or application engineer for review. Certain application and site requirements may require additional cost and/or lead time.
Component locations are listed as Segment Hand (Unit Hand): ex. Left (Right). See Submittal Drawing for additional details.
Air handling unit parameters vary depending on conditions. Parameters such as airflows, air pressure drops, and coil capacities are shown for design conditions.

Shipping Summary

Details					
Skid	**Skid Length (in)**	**Skid Height (in)**	**Skid Width (in)**	**Shipping Weight (lbs)**	**Operating Weight (lbs)**
RF IP XA-3 FE	66	86	67	1,626	1,575
HW	41	86	67	893	835
FS XA-2 HC-2 CC XA-1 HC-1 MB FF	137	87	67	2,489	2,451
Overall					**4,861**



Notes

Skid Width: Total width of the shipping skid, including any items that may extend beyond the cabinet (this includes any door handles, coil connections, drain connections, lifting lugs, mounted pipe-chases, electrical/control components, tie-down brackets, side dampers).

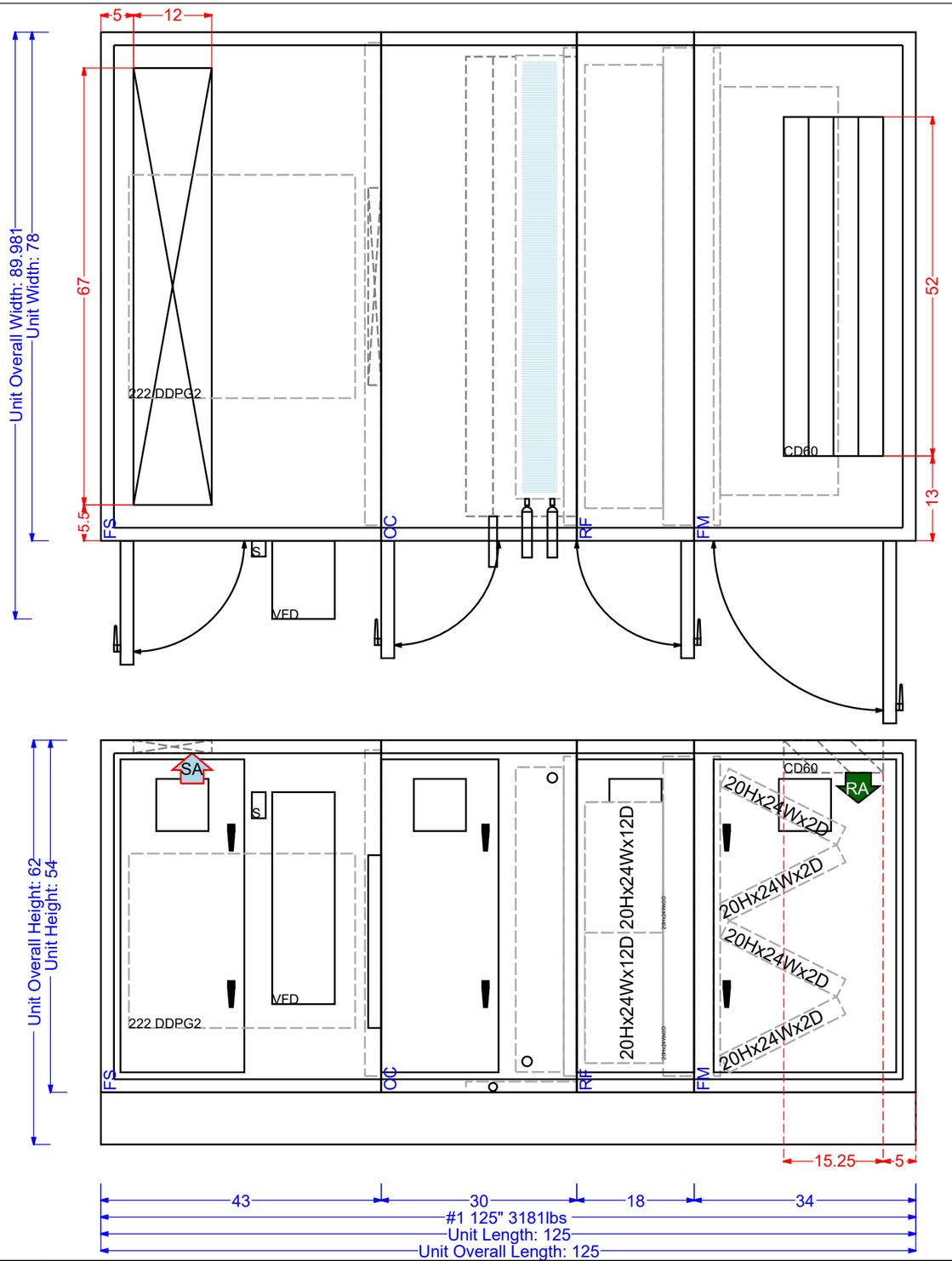
Skid Height: Total height of the shipping skid, including any items that may extend beyond the cabinet (this includes any base-rails, shipping wood-blocks, roof peak, discharge flanges, mounted gas-furnace flue pipes).

Skid Length: Total length of the shipping skid, including any items that may extend beyond the cabinet (this includes any mounted rain-hoods, discharge flanges, tie-down brackets, shipping wood-blocks, front dampers, split connectors, electrical/control components, outrigging extensions, isolation dampers, inlet baskets).

Shipping Weight: Represents the estimated shipping weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation but not any consequential shipping impact. Shipping weight does not include ship loose and/or field-installed items but does include estimate for shipping materials and/or opening covers.

Operating Weight: Represents the estimated operational weight with a tolerance of +/- 10% for values greater than 5,000 lbs. Values less than 5,000 lbs. may have higher percentage variation. Operational weight estimate includes unit shell, internal components and structure, and known ship loose and/or field-installed items (weather hoods, pipe chases, factory-provided filter media and estimated fluid weight in coils). Actual operating weight will be heaver due to additional field installed materials including but not limited to field-provided filter media, piping, control devices, and/or inertia base concrete.

Unit Drawings



UNIT CONSTRUCTION

MODEL: **PAI-54x78** UNIT TYPE:**Indoor**
MOTOR LOCATION: **(FS)Left**
UNIT OPERATING WEIGHT: **3278 lbs.(+/- 10%)**

PLAN VIEW

Right / Rear (Supply) / Front (Return) / Left

AIRFLOW

NOTES

Units with a baserail and a bottom opening: Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit.A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and / or factory package control boxes, coil connections, rain hoods, pipe chases, AMS - 60 damper / EAML louver(if applicable,) base rail - in order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

Skid weights represent estimated shipping weight including shipping materials and/or opening covers but does not include ship loose and/or field-installed items.

Dimension tolerances: Unit (+/- 1/2"); Piping(+/ -2")

(SL) - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

SEGMENT	TYPE	HAND	QTY	SPLY	RTN
CC	**MPT**	**Left**	**1 Sup 1 Ret**	**1.5"**	**1.5"**

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Left side(s) of unit)

SEGMENT LIST

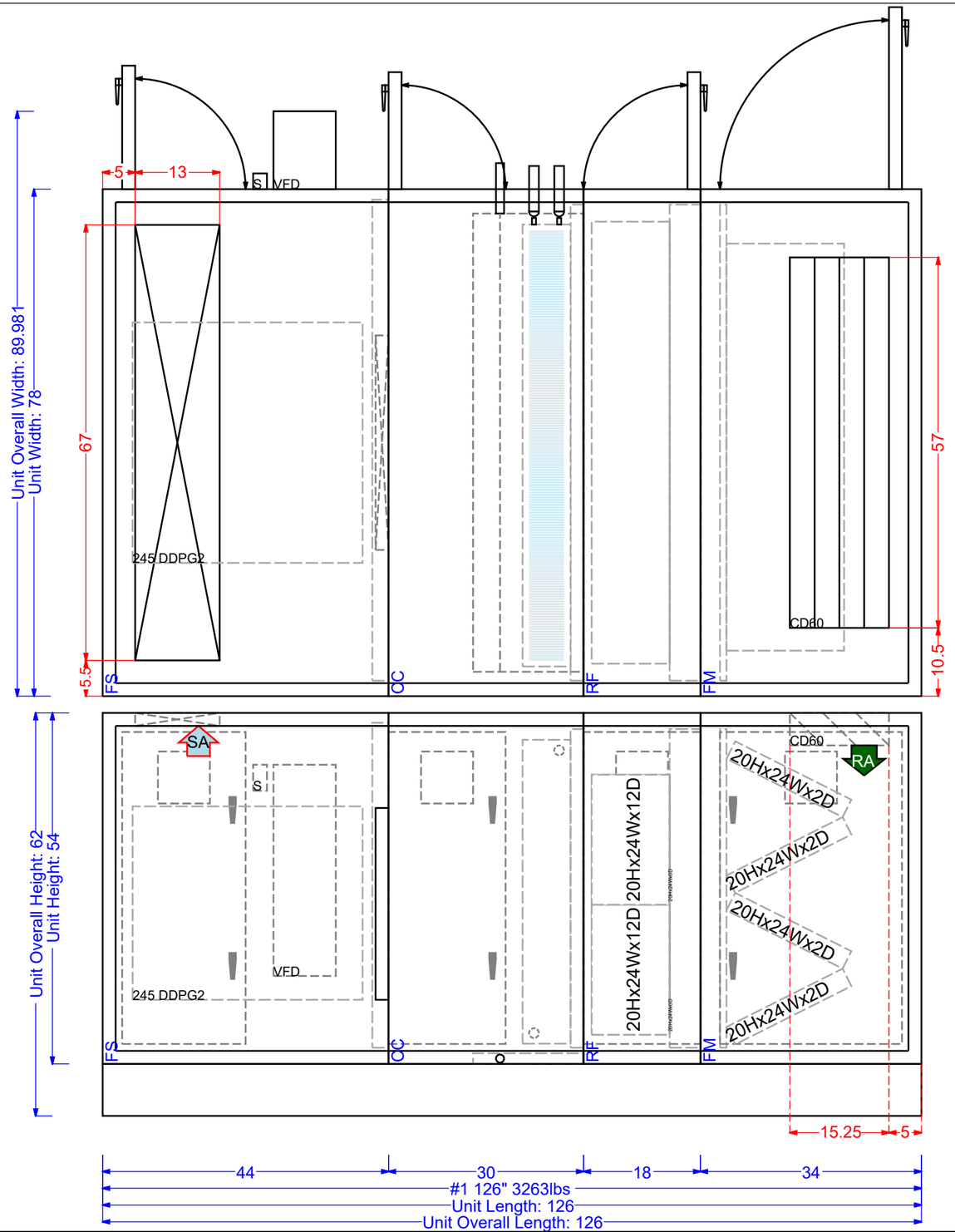
SEG	DESCRIPTION	X START	LENGTH
FM	**Filter Mixing Box**	**0**	**34**
RF	**Rigid Filter**	**34**	**18**
CC	**Cooling Coil**	**52**	**30**
FS	**Fan (Supply)**	**82**	**43**

REV	DATE	REVISION CHANGE	REV BY

Solution XT UNIT DRAWING
MODEL: **PAI-54x78** **1/30/2026 6:38:11 PM UTC**
DESIGNATION: **AHU-101**
PROJECT NAME: **F35 Special Access Program Facility Ebbing ANGB**

QUICK VIEW
CONTRACT #:
UNIT TAG: **AHU-101**

ALL DIMENSIONS SHOWN IN: INCHES
DRAWING SCALE: NTS
DIMENSION TOLERANCES: UNIT(+/- 1/2"); PIPING(+/- 2")
DRAWING NOT TO BE USED FOR CONSTRUCTION



UNIT CONSTRUCTION

MODEL: **PAI-54x78** UNIT TYPE:**Indoor**

MOTOR LOCATION: **(FS)Left**

UNIT OPERATING WEIGHT: **3360 lbs.(+/- 10%)**

PLAN VIEW

Right / Rear (Supply) / Front (Return) / Left

AIRFLOW

NOTES

Units with a baserail and a bottom opening: Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit.A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and / or factory package control boxes, coil connections, rain hoods, pipe chases, AMS - 60 damper / EAML louver(if applicable,) base rail - in order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

Skid weights represent estimated shipping weight including shipping materials and/or opening covers but does not include ship loose and/or field-installed items.

Dimension tolerances: Unit (+/- 1/2"); Piping(+/ -2")

(SL) - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

SEGMENT	TYPE	HAND	QTY	SPLY	RTN
CC	**MPT**	**Right**	**1 Sup 1 Ret**	**1.5"**	**1.5"**

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Right side(s) of unit)

SEGMENT LIST

SEG	DESCRIPTION	X START	LENGTH
FM	**Filter Mixing Box**	**0**	**34**
RF	**Rigid Filter**	**34**	**18**
CC	**Cooling Coil**	**52**	**30**
FS	**Fan (Supply)**	**82**	**44**

REV	DATE	REVISION CHANGE	REV BY

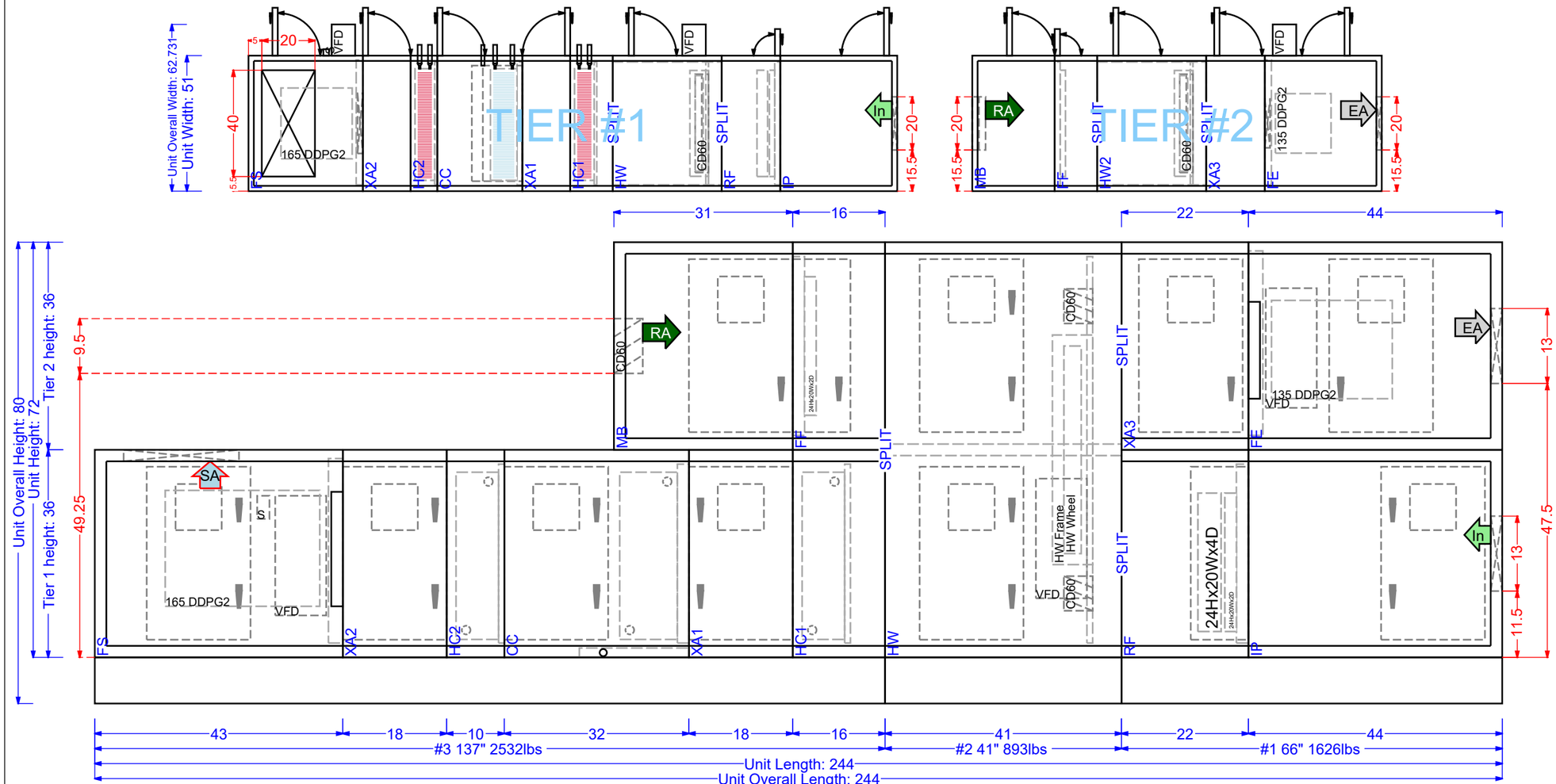
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MODEL: **PAI-54x78** **1/30/2026 8:39:15 PM UTC**
DESIGNATION: **AHU-102**
PROJECT NAME: **F35 Special Access Program Facility Ebbing ANGB**

QUICK VIEW

CONTRACT #:
UNIT TAG: **AHU-102**

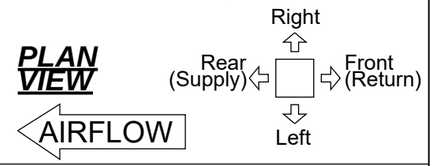
ALL DIMENSIONS SHOWN IN: INCHES
DRAWING SCALE: NTS
DIMENSION TOLERANCES: UNIT(+/- 1/2"); PIPING(+/- 2")
DRAWING NOT TO BE USED FOR CONSTRUCTION



UNIT CONSTRUCTION

MODEL: **PAI-36x51** UNIT TYPE:**Indoor**
MOTOR LOCATION: **(FS)Right(FE)Left**
UNIT OPERATING WEIGHT: **4904 lbs.(+/- 10%)**

PLAN VIEW



NOTES

Units with a baserail and a bottom opening: Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit.A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and / or factory package control boxes, coil connections, rain hoods, pipe chases, AMS - 60 damper / EAML louver(if applicable,) base rail - in order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

Skid weights represent estimated shipping weight including shipping materials and/or opening covers but does not include ship loose and/or field-installed items.

Dimension tolerances: Unit (+/- 1/2"); Piping(+/ -2")

(SL) - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

SEGMENT	TYPE	HAND	QTY	SPLY	RTN
HC	**MPT**	**Right**	**1 Sup 1 Ret**	**1.5"**	**1.5"**
CC	**MPT**	**Right**	**1 Sup 1 Ret**	**1.5"**	**1.5"**
HC	**MPT**	**Right**	**1 Sup 1 Ret**	**1.5"**	**1.5"**

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Right side(s) of unit)

SEGMENT LIST

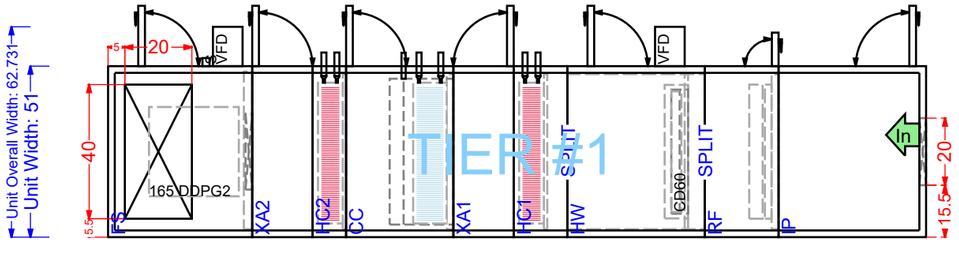
SEG	DESCRIPTION	X START	LENGTH
HW	**Heat Wheel**	**66**	**41**
HC	**Heating Coil**	**107**	**16**
XA	**Access**	**123**	**18**
CC	**Cooling Coil**	**141**	**32**
HC2	**Heating Coil**	**173**	**10**
XA2	**Access**	**183**	**18**
FS	**Fan (Supply)**	**201**	**43**
IP	**Inlet Plenum**	**0**	**44**
RF	**Rigid Filter**	**44**	**22**
FF	**Flat Filter**	**107**	**16**
MB	**Mixing Box**	**123**	**31**
FE	**Fan (Exhaust)**	**0**	**44**
XA3	**Access**	**44**	**22**

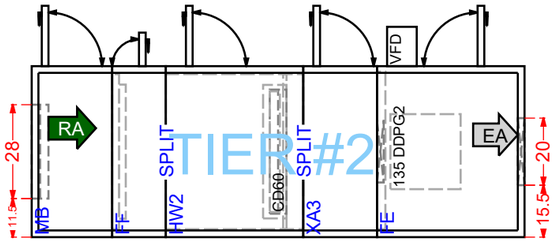
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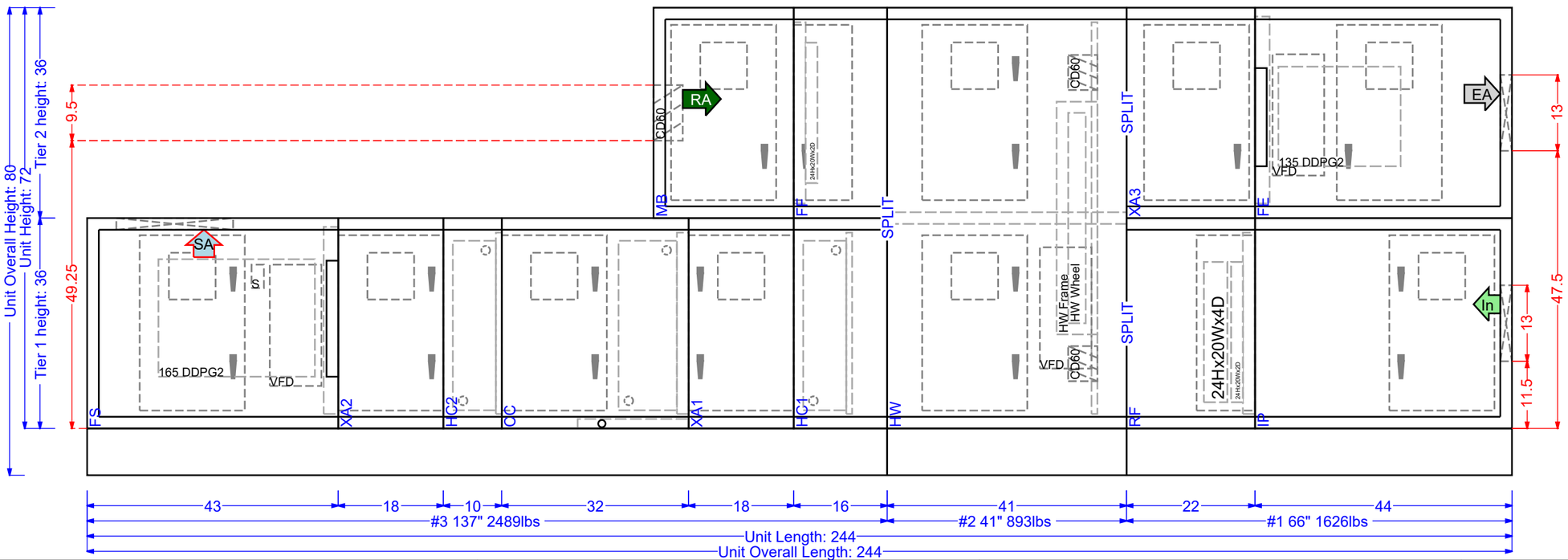
Solution XT UNIT DRAWING
MODEL: **PAI-36x51** **9/9/2026 4:52:46 PM UTC**
DESIGNATION: **DOAS-101**
PROJECT NAME: **F35 Special Access Program Facility Ebbing ANGB**

QUICK VIEW
CONTRACT #:
UNIT TAG: **DOAS-101**

ALL DIMENSIONS SHOWN IN: INCHES
DRAWING SCALE: NTS
DIMENSION TOLERANCES: UNIT(+/- 1/2"); PIPING(+/- 2")
DRAWING NOT TO BE USED FOR CONSTRUCTION



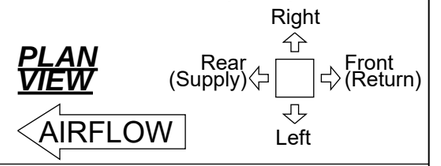




UNIT CONSTRUCTION

MODEL: **PAI-36x51** UNIT TYPE:**Indoor**
MOTOR LOCATION: **(FS)Right(FE)Left**
UNIT OPERATING WEIGHT: **4861 lbs.(+/- 10%)**

PLAN VIEW



NOTES

Units with a baserail and a bottom opening: Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit.A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and / or factory package control boxes, coil connections, rain hoods, pipe chases, AMS - 60 damper / EAML louver(if applicable,) base rail - in order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

Skid weights represent estimated shipping weight including shipping materials and/or opening covers but does not include ship loose and/or field-installed items.

Dimension tolerances: Unit (+/- 1/2"); Piping(+/ -2")

(SL) - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

SEGMENT	TYPE	HAND	QTY	SPLY	RTN
HC	**MPT**	**Right**	**1 Sup 1 Ret**	**1.5"**	**1.5"**
CC	**MPT**	**Right**	**1 Sup 1 Ret**	**1.5"**	**1.5"**
HC	**MPT**	**Right**	**1 Sup 1 Ret**	**1.5"**	**1.5"**

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Right side(s) of unit)

SEGMENT LIST

SEG	DESCRIPTION	X START	LENGTH
HW	**Heat Wheel**	**66**	**41**
HC	**Heating Coil**	**107**	**16**
XA	**Access**	**123**	**18**
CC	**Cooling Coil**	**141**	**32**
HC2	**Heating Coil**	**173**	**10**
XA2	**Access**	**183**	**18**
FS	**Fan (Supply)**	**201**	**43**
IP	**Inlet Plenum**	**0**	**44**
RF	**Rigid Filter**	**44**	**22**
FF	**Flat Filter**	**107**	**16**
MB	**Mixing Box**	**123**	**24**
FE	**Fan (Exhaust)**	**0**	**44**
XA3	**Access**	**44**	**22**

REV	DATE	REVISION CHANGE	REV BY

Solution XT UNIT DRAWING

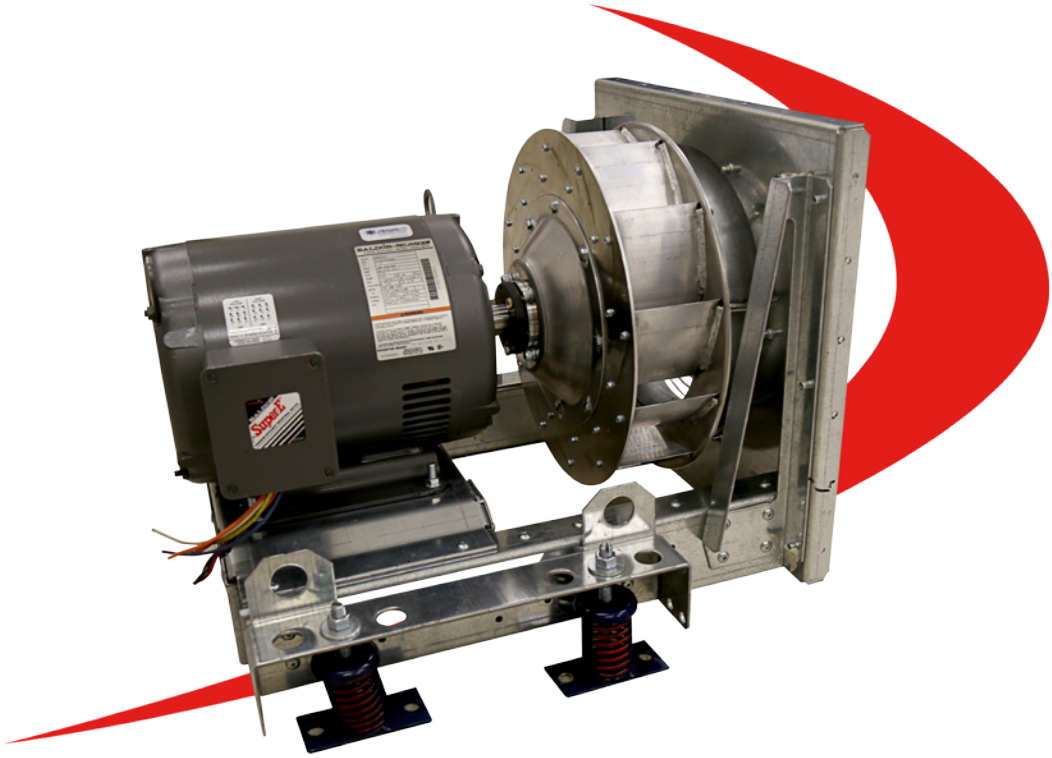
MODEL: **PAI-36x51** **9/9/2026 4:52:46 PM UTC**
DESIGNATION: **DOAS-102**
PROJECT NAME: **F35 Special Access Program Facility Ebbing ANGB**

QUICK VIEW

CONTRACT #:
UNIT TAG: **DOAS-102**

ALL DIMENSIONS SHOWN IN: INCHES
DRAWING SCALE: NTS
DIMENSION TOLERANCES: UNIT(+/- 1/2"); PIPING(+/- 2")
DRAWING NOT TO BE USED FOR CONSTRUCTION

Additional Data Sheets



GEN II DDP

PART# 0601780001_REV_A

INSTALLATION, OPERATION & MAINTENANCE MANUAL

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

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INTRODUCTION

This Installation Manual is provided as a guide for the installation of fans manufactured by Lau. It is the responsibility of the purchaser to provide qualified personnel experienced in the installation, operation, and maintenance of air moving equipment. Instructions given in this manual are general in nature and apply to a variety of models manufactured by Lau. Read this Installation Manual completely before installing the fan. Additional product and engineering information is available at www.Laufan.com. Always follow good safety practices when installing, maintaining and operating air moving equipment.

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GENERAL SAFETY INFORMATION

Only qualified personnel should install the fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards.

Some important Guidelines:

- Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. In Canada, follow the Canadian Electric Code (CEC).
- The rotation of the impeller is critical. It must be free to rotate without striking or rubbing any stationary objects.
- Motor must be securely mounted and adequately grounded.
- Do not operate fan impeller faster than max catalogued fan rpm. Adjustments to fan speed significantly effects motor load. If the fan speed is changed, the motor current should be checked to be sure it is not exceeding the motor nameplate amps.
- Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace power cable immediately if damaged.
- Verify that the power source is compatible with the equipment.



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



Always disconnect power before working on or near a fan. Lock and tag the disconnect switch



Precaution should be taken in explosive atmospheres

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SHIPPING & RECEIVING

All Lau products are carefully constructed and inspected before shipment to insure the highest standards of quality and performance. Compare all components with the bill of lading or packing list to verify that the proper unit was received. Check each unit for any damage that may have occurred in transit. Any damage should be reported immediately to the carrier and the necessary damage report filed.

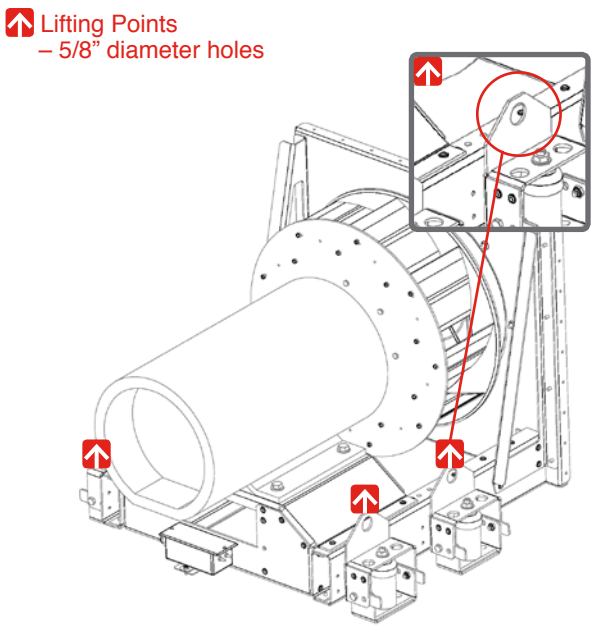
HANDLING

Handling of all air moving equipment should be conducted by trained personnel and be consistent with safe handling practices. Verify the lift capacity and operating condition of handling equipment. Maintain handling equipment to avoid serious personal injury. Units shipped completely assembled may be lifted with slings and spreader bars. Lift the fan in a fashion that protects the fan and fan coating from damage. Never lift a fan by the inlet or discharge flange, shafting or drives, impeller, motor, motor base, or in any other manner that may bend or distort parts.

Lifting Instructions

Fans are designed to be lifted and moved as a single module. See below for designed lifting points for the fan.

1. Carefully remove any crate and packing materials.
2. Place the fan(s) onto the mounting structure using the recommended lifting points as shown. Lift each fan individually into position.



Maximum Fan Weight Specifications

Fan Size	Max. Total Fan Weight (lbs.)
105	164.1
122	173
135	208.6
150	253.1
165	273.3
182	385.5
200	406.1
222	433.5
245	494.1
270	642.7
300	770.1
330	1281.2
365	1295.3
402	1426.4

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SHORT TERM STORAGE

If fan installation is delayed, store the unit in a protected area. Protect the fan and motor bearings from moisture and vibration (or shock loading).

LONG TERM STORAGE

If a fan is to be stored for any length of time and the bearings are re-greasable, the motor bearings should immediately be filled with grease while rotating the fan and then the bearings should be re-greased and rotated monthly. This will prevent moisture, which condenses within the bearing, from corroding the raceways.

STORAGE PROCEDURES

Fans should be stored indoors whenever possible where control over temperature, humidity, shock and dust is reasonably maintained. If units are to be stored outside, they should be covered with a water-resistant material. Stored equipment should be on a clean, dry floor or blocked up off the ground to prevent unit from setting directly on the ground.

Periodic Check

On a monthly interval, the equipment should be checked to ensure that it has remained in an acceptable stored condition. The fan and motor should be rotated several times by hand. The fan impeller should be left at approximately 180 degrees from that of the previous month to prevent damaging the motor bearings.

BASES (Foundation and Isolation)

Critical to every fan installation is a strong, level foundation. Structural bases must be sturdy enough to prevent flexing and vibration. Design, fabrication, and installation of the isolation base are the customers responsibly.

After the fan, isolation base, and isolators are installed, the entire assembly must be levelled. Floor mounted fans should be installed on a flat, level, rigid foundation.

Fans mounted to or within a structure should be placed as close as possible to a rigid member such as a wall or column. The structure must be designed for rotating equipment; static design for strength is not sufficient to insure proper operation. Structural resonance should be at least 20% above the maximum fan operating speed.

Any ducting should have independent support; do not use the fan to support ducting. Isolating the fan from ductwork with flex connections eliminates transmission of vibration.

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UNIT START UP

When the unit is removed from storage, all grease should be purged and replenished with fresh grease. The following check list should be adhered to insure proper operation:

Operation Check List

Verify that proper safety precautions have been followed:

- ☐ Electrical power must be locked off.

Check fan mechanism components:

- ☐ System connections are properly made and tightened.
- ☐ Impeller and fan surfaces are clean and free of debris.
- ☐ Rotate the impeller by hand to verify it has not shifted in transit.

Check fan electrical components:

- ☐ Motor is wired for proper supply voltage.
- ☐ Motor was properly sized for power
- ☐ Motor is properly grounded.
- ☐ All leads are properly insulated.

Trial "bump":

- ☐ Turn on power just long enough to start assembly rotating.
- ☐ Check rotation for agreement with rotation arrow.

Perform checklist again until unit is operating properly. Verify fastener tightness. These may have loosened during shipment or installation.

- ☐ Bushing set screw torque
- ☐ Bolts on inlet funnel.
- ☐ Motor bolt torque
- ☐ Nuts holding housing frame to base and base to ground (customer specifications)
- ☐ Bushing fastener torque
- ☐ Ensure piezo tubing will not contact the impeller

C Bushing Fastener Torque

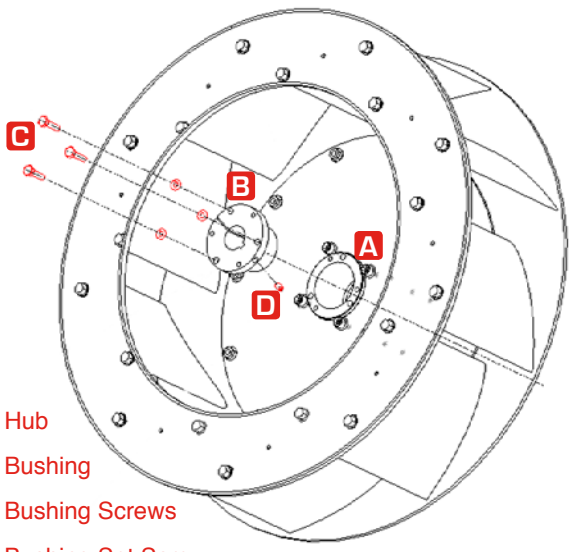
Bushing Type	Screw Size	Recommended Torque
JA	10-24	60 in-lbs.
SD/SDS	¼-20	108 in-lbs.
SK	5/16-18	180 in-lbs.
SF	3/8-16	360 in-lbs.

D Bushing Set Screw Torque

Bushing Type	Screw Size	Recommended Torque
SD/SDS	¼-20	60 in-lbs.
SK	5/16-18	110 in-lbs.
SF	3/8-16	200 in-lbs.

Motor Bolt Torque

NEMA Frame	Bolt Size (Grade 5)	Washers Size (Top and Bottom)	Recommended Torque(ft-lb)
56–145T	5/16	5/16	18
182–215T	3/8	3/8	31
254U–286TS	1/2	1/2	75
324T–365T	9/16	9/16	107



A Hub
B Bushing
C Bushing Screws
D Bushing Set Screw

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MOTOR MAINTENANCE

The three basic rules of motor maintenance are: keep the motor clean, dry and properly lubricated. Keeping motors and windings clean is important because dirt and dust can cause heat to be trapped causing overheating and/or premature failure. Blow dust and dirt out of windings and off the motor periodically. Use low pressure (50 psi) airstream to prevent winding damage. Keep the areas surrounding the motor clear so the air can circulate through the motor cooling fan.

Motors should be kept dry to avoid electrical short circuits. Motors kept in storage for long periods of time can have moisture condense on the windings. Be certain the motor is dry before using.

Some smaller motors are permanently lubricated. Motor bearing lubrication, if required, must follow a rigorous schedule. Motors less than 10 hp running eight hours a day in a clean environment should be lubricated once every five years; motors 15 to 50 hp, every 3 years; and motors 50 to 150 hp, yearly. See motor manufacturer specifications for recommended greases. For motors in a dusty or dirty environment or running 24 hours a day, divide the service interval by 2. If the environment is very dirty or high temperatures exist, divide the service interval by 4. Lubrication requirements are normally attached to the motor. Do not over-lubricate.

The major cause of motor bearing failure is contamination of grease, insufficient grease, over lubrication, and incompatibility of grease. If a fan is to be stored for any length of time and the bearings are re-greasable, the motor bearings should immediately be filled with grease while rotating the fan and then the bearings should be re-greased and rotated monthly. This will prevent moisture, which condenses within the bearing, from corroding the raceways.

STRUCTURAL MAINTENANCE

All structural components or devices used to support or attach the fan to the isolation base, or other structure should be checked at regular intervals. Vibration isolators, bolts, foundations, etc, are subject to failure from corrosion, erosion, and other causes. Improper mounting can lead to poor operation characteristics, fan fatigue, and failure. Check components for corrosion, cracks, or other signs of stress.

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TROUBLESHOOTING GUIDELINES

Use safety practices when investigating fan or system performance problems. General safe practices and performance troubleshooting guidelines can be found in AMCA Publication 410: Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans, and AMCA Publication 202-98 (R2011): Troubleshooting. Fan application and field measurement procedures can be found in AMCA Publication 201-02 (R2011): Fans and Systems and AMCA Publication 203-90 (R2011): Field Performance Measurement of Fan Systems.

Troubleshooting Performance Problems:

The lists below indicate possible areas to check when air or sound values do not meet expectations. Most fan problems can be pinpointed to one of these common causes.

Air Capacity Problems:

1. **Resistance of system not at design rating.** If resistance is lower than expected airflow can be higher and horsepower can be lower. If resistance is higher than anticipated, air volume will be down.
2. **Fan speed is not at design speed.**
3. **Air density not at design values.** Also check air performance measurement techniques / procedures.
4. **Mechanical air devices (e.g. dampers), are closed or plugged.** Also check filters.
5. **Impeller mounted improperly or is rotating in reverse.**
6. **Parts of system or fan have been damaged or need cleaning.**

Noise Problems:

1. **Fan is not at design point of operation.** Fan forced to operate in an unstable flow region.
2. **Bearing failure.** Check bearings.
3. **Supply voltage high or inconsistent supply frequency.** Adjustable frequency controllers can generate motor noise.
4. **Objects which are installed in a high velocity airstream can generate noise.** This includes flow sensors, turning vanes, etc.
5. **Non-uniform fan inlet conditions.**
6. **Acoustics or sound measurement procedure incorrect.**

Vibration Problems:

1. **Misalignment of drive components.**
2. **Poor foundations (isolation base) or mounting structure (resonances).**
3. **Foreign object trapped in rotating components.**
4. **Damaged rotating components (bearings, shaft, fan, impeller).**
5. **Broken, loose or missing setscrews.**
6. **Loose bolts.**
7. **Vibration transmitted by another source.**
8. **Water accumulating in airfoil blades.**
9. **Fan is operating in stall or unstable flow region.**

NOTE: All fans manufactured by Lau are factory balanced prior to shipment. Improper handling and movement of the fan during shipment may cause the rotating assembly to shift out of alignment. Balance should be checked once the fan is installed. If a final trim balance is required, it is the end user's responsibility to bring the fan back to factory specifications. Final trim balancing is not the responsibility of Lau.

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INSTALLATION

Bolt fan(s) to base or other structure.

Installation Instructions for Restrained Spring Isolators [FIGURE 1]

1. **Identify the location of each isolator with the appropriate submittal drawing. (if supplied)**
2. **Locate the bottom spring holes in position and secure to the base.**
3. **Remove the bolt and nut from the side of each lower spring bracket and remove the shipping lock. The bolts and nuts are to be discarded.**
4. **Turn the leveling bolt counter clockwise on the lowest equipment corner until the equipment is level. Do not attempt to place all the weight on one spring, but distribute the load proportionately by adjusting each isolator in sequence.**
5. **Adjust the isolator by turning the leveling nut counterclockwise one turn. Repeat this step to each isolator leveling nut, one turn at a time, until the housing top plate is centered between the rubber snubbing pads on the leveling screw on all isolators.**

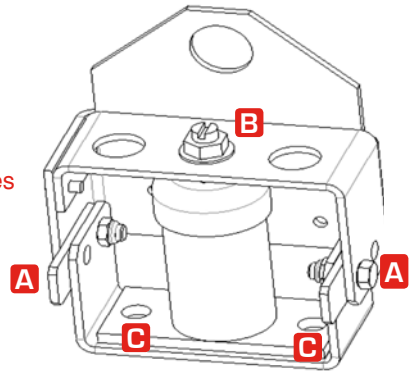
Installation Instructions for Neoprene Isolators [FIGURE 2]

1. **Identify the location of each isolator with the appropriate submittal drawing. (if supplied)**
2. **Locate the bottom spring holes in position and secure to the base.**
3. **Remove the bolt and nut from the side of each lower spring bracket and remove the shipping lock. The bolts and nuts are to be discarded.**

   NOTE: Do not attempt to move the equipment laterally while it is supported on the isolators. If it is necessary to move the equipment, remove the weight from the isolators by raising the equipment. Failure to follow this procedure could result in bent or broken leveling bolts or springs, or damage to the neoprene bottom spring cap.

[FIGURE 1]

A Shipping Lock
B Leveling Bolt
C Bottom Spring Holes

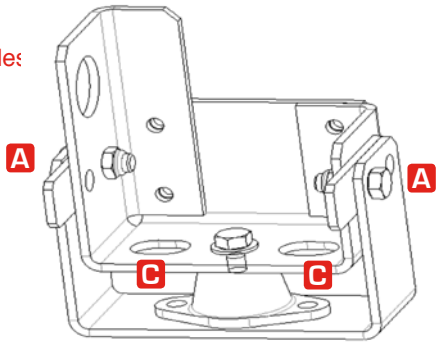


6. **Continue to adjust each leveling bolt (in sequence) until the equipment is at its operating height.**
7. **Tighten the small cap screw, thus securing the spring isolator to the supported equipment and locking the leveling bolt against turning.**

   NOTE: Do not attempt to move the equipment laterally while it is supported on the isolators. If it is necessary to move the equipment, remove the weight from the isolators by raising the equipment. Failure to follow this procedure could result in bent or broken leveling bolts or springs, or damage to the neoprene bottom spring cap.

[FIGURE 2]

A Shipping Lock
C Bottom Spring Holes



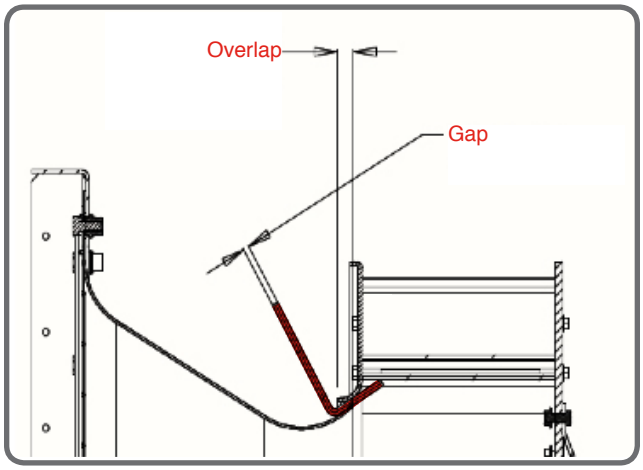
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RADIAL GAP, OVERLAP AND IMPELLER ALIGNMENT

Efficient fan performance can be maintained by having the correct gap and overlap between the impeller and inlet funnel. These items should be checked at installation, after the fan has been in operation for 24 hours, and after the unit has been serviced.

Gap– distance between the OD of the funnel and the ID of the impeller concentricity.
Overlap– distance the funnel and impeller overlap one another.

This sketch shows both the gap and overlap dimensions for all sizes.



Gap is adjusted by loosening the inlet funnel bolts and centering the funnel on the impeller.
Caution: Never loosen the motor attachment bolts to make adjustments to the impeller-to-funnel gap.

Overlap is adjusted by loosening the impeller hub from the shaft and moving the impeller to the desired position along the shaft. The transition between the inlet funnel and impeller should be as shown; there is a smooth feel to the profile when moving from one component to the other.

Gap / Overlap Dimensions

Model	Minimum Overlap (Inches)	Maximum Overlap (Inches)	Minimum Gap (Inches)
105	0.12	0.29	0.06
122	0.12	0.32	0.07
135	0.12	0.35	0.07
150	0.19	0.41	0.09
165	0.25	0.47	0.11
182	0.31	0.5	0.11
200	0.38	0.57	0.12
222	0.44	0.63	0.14
245	0.5	0.69	0.17
270	0.56	0.76	0.2
300	0.62	0.88	0.24
330	0.75	0.96	0.26
365	0.81	1.13	0.27
402	0.88	1.23	0.31

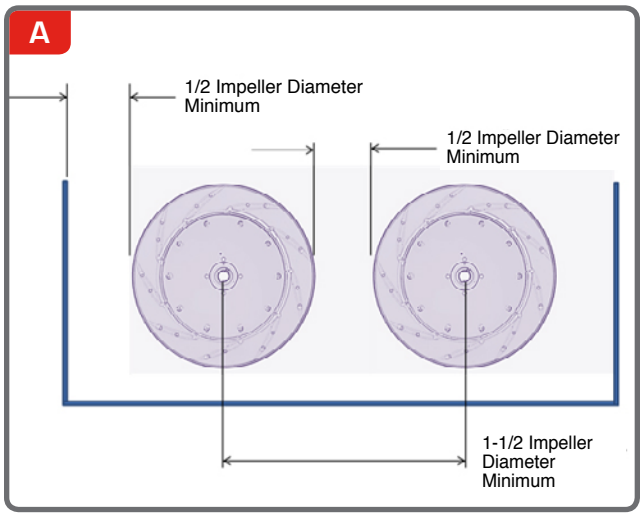
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FAN SPACING

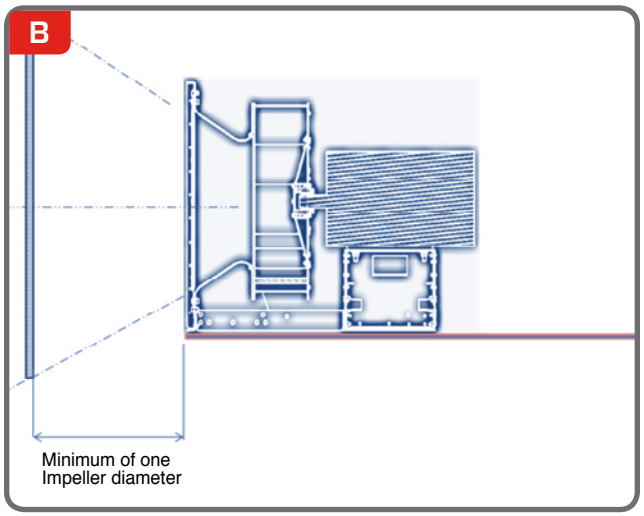
Location and Placement of Plenum Fans in Air Handlers

- Center the fan inlets in both the horizontal and vertical planes.
- A Shows guidelines for spacing two or more fans side by side in the plenum. Fans should not be closer than one-half the wheel diameter.
- For inlet clearance, see B A minimum of one fan impeller diameter clearance is recommended.

Fan spacing with two or more fans



Recommended Inlet Spacing



Location and Placement of Plenum Fans in Air Handlers

- Center the fan inlets in both the horizontal and vertical planes.
- A shows guidelines for spacing two or more fans side by side in the plenum. Fans should not be closer than one-half the wheel diameter.
- For inlet clearance, see B. A minimum of one fan impeller diameter clearance is recommended.

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PIEZOMETER DATA

HOW IT WORKS

The Piezo system is based on the principle of a flow nozzle. The inlet funnel of the fan is used as the flow nozzle, and the flow can be calculated by measuring the static pressure drop through the inlet funnel. The pressure drop is measured from the tap located on the face of the inlet funnel to the piezometer in the throat. The inlet tap is connected to the high-pressure side of the transducer and the piezometer is connected to the low-pressure side (see diagram below).

Measurement of Airflow

Several factors affect the accuracy of this method of determining flow. The equations below assume the following:

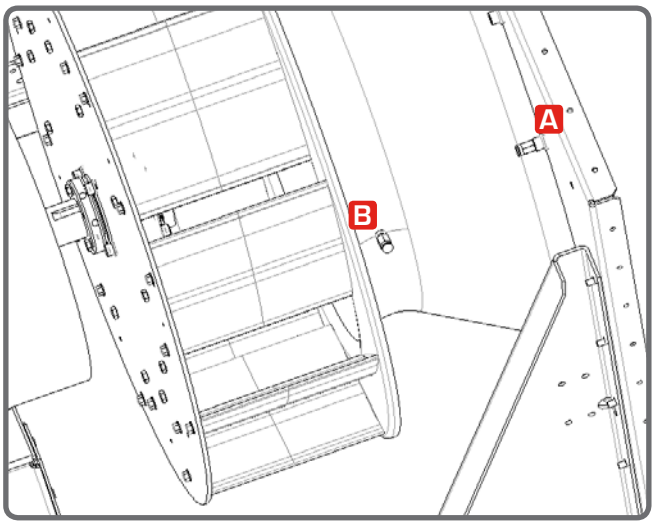
- There are no vanes or other obstructions in or near the inlet
- Flow entering the funnel (no pre-swirl)
- Impeller to inlet funnel overlap
- Accurate determination of air density at the inlet

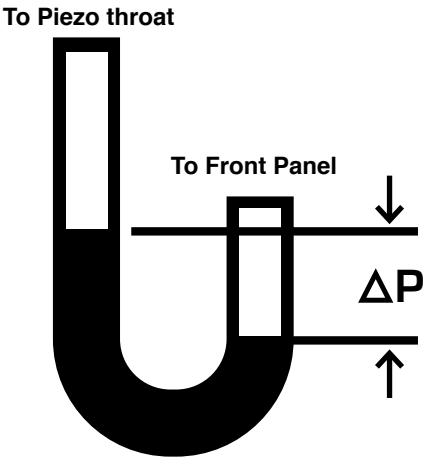
K Factor

Fan Size	Gen II DDP
105	598
122	763
135	910
150	1181
165	1441
182	1688
200	2136
222	2649
245	3092
270	4156
300	4810
330	5748
365	7072
402	8609

A Front Pressure Tap HIGH PRESSURE

B Piezometer LOW PRESSURE





Calculation when using the Piezo

For standard air (ρ = 0.075 lb/ft3):

(CFM) = K Factor * √(delta pressure)

- K Factor = value from chart
- Delta Pressure (ΔP) = The differential in static pressure from the piezometer and the front pressure tap (inches w.g.)

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LauFan.com

Gen II DDP

PART# 0601780001_REV_A

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AMCA LICENSED
See Page 2

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

CD60 LOW LEAKAGE CONTROL DAMPER

High Performance Airfoil
Class 1A Leakage Rated

APPLICATION

The CD60 is a low leak, galvanized steel damper designed with airfoil blades for higher velocity and pressure HVAC systems. It meets the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and is AMCA licensed as a Class 1A damper.

STANDARD CONSTRUCTION

FRAME
5" x 1" x 16 gage (127 x 25 x 1.6) galvanized steel hat channel reinforced with corner braces for structural strength equal to 11 gage (3.05) channel frames. Low profile 3 1/2" x 3/8" x 16 gage (89 x 10 x 1.6) galvanized steel channel top and bottom frame on dampers under 12" (305) high.

BLADES
Galvanized steel airfoil shaped, double skin construction of 14 gage (2.0) equivalent thickness, 6" (152) wide. Parallel or opposed action.

SEALS
Ruskiprene blade edge seals and flexible metal compressible jamb seals.

BEARINGS
Stainless steel sleeve.

LINKAGE
Concealed in frame.

AXLES
1/2" (13) plated steel hex. Removable control shaft extends 6" (152) beyond frame.

MAXIMUM SIZE
Single section – 60"w x 72"h (1524 x 1829).
Multiple section assembly – Unlimited size.

MINIMUM SIZE
Single blade – 8"w x 6"h (203 x 152).
Two blades, parallel or opposed action: 8"w x 10"h (203 x 254).

TEMPERATURE LIMITS
-72°F (-60°C) minimum and +275°F (+135°C) maximum.

FEATURES

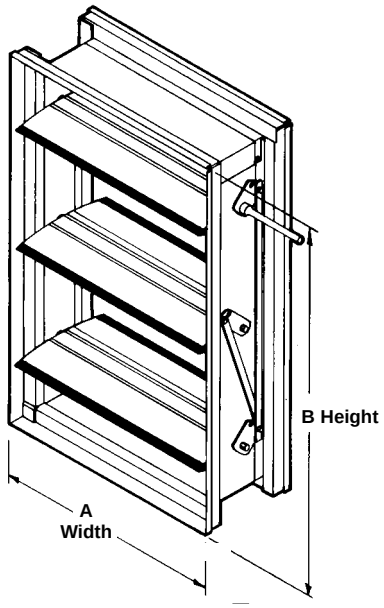
- Airfoil blade design for low pressure drop and less noise generation.
- One piece interlocking frame design to reduce racking.
- Positive lock axles, noncorrosive bearings and shake proof linkage for low maintenance operation.
- Blade edge seals mechanically lock into the blade for superior sealing.

OPTIONS

- Factory-installed, pneumatic and electric actuators.
- Enamel and epoxy finishes.
- SP100 Switch Package to remotely indicate damper blade position.
- Heavier frame construction with U-channel frame.
- Front, rear or double flange frame with or without bolt holes.
- Face and bypass configurations.

NOTE: Dimensions shown in parenthesis ( ) indicate millimeters.

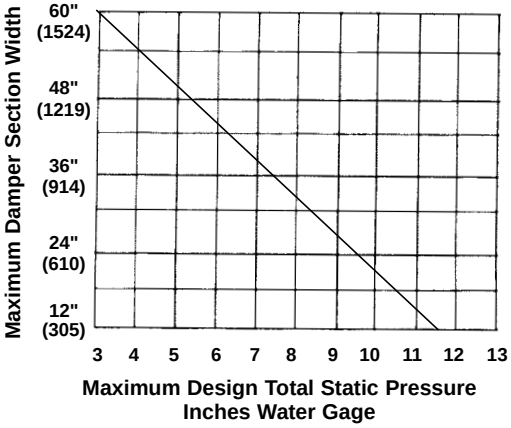
*Units furnished approximately 1/4" (6) smaller than given opening dimensions.



© Ruskin Co. July 2004

CD60 AMCA LICENSED PERFORMANCE DATA

CD60 PRESSURE LIMITATIONS



The CD60 may be used in systems with total pressures exceeding 3.5" by reducing damper section width as indicated. Example: Maximum design total pressure of 8.5" w.g. would require CD60 damper with maximum section width of 36" (914).
Pressure limitations shown above allow maximum blade deflection of 1/180 of span on 60" (1524) damper widths. Deflections in other damper widths (less than 48" [1219]) at higher pressures shown will result in blade deflection substantially less than 1/180 of span.

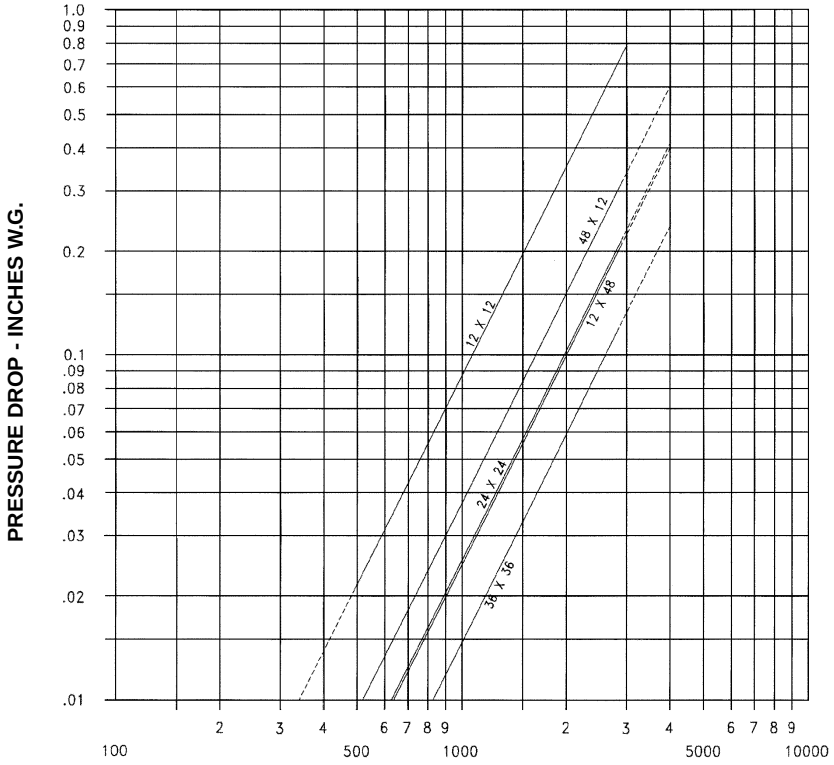
Ruskin Company certifies that the CD60 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program.The AMCA International Certified Ratings Seal applies to Air Performance and Air Leakage.

Pressure/ Class	Leakage, L/s/m² (ft³/min/ft²)			
	Required Rating		Extended Ranges (Opt.)	
	1" (0.25 kPa)	4" (1.0 kPa)	8" (2.0 kPa)	12" (3.0 kPa)
1A	3 (15.2)	N/A	N/A	N/A
1	4 (20.3)	8 (40.6)	11 (55.9)	14 (71.1)
2	10 (50.8)	20 (102)	28 (142)	35 (178)
3	40 (203)	80 (406)	112 (569)	140 (711)

DAMPER WIDTH (INCHES)	1 IN. W.G.	4 IN. W.G.	8 IN. W.G.
12" (305)	IA	I	II
24" (610)	IA	I	II
36" (914)	IA	I	NA
48" (1219)	IA	I	NA
60"(1524)	IA	I	NA

Leakage testing conducted in accordance with AMCA Standard 500-D-98. Torque applied holding damper closed, 5 in. lbs./sq. ft. on opposed blade dampers and 7 in. lbs./sq. ft. on parallel blade dampers. Air leakage is based on operation between 50°F to 104°F. All data corrected to represent standard air density 0.075 lbs/ft³.

VELOCITY VS. PRESSURE DROP



FACE VELOCITY - FEET/MINUTE
AMCA FIG. 5.3

CD60 sizes 12 x 12, 24 x 24, 48 x 12, 12 x 48, 36 x 36 (305 x 305, 610 x 610, 1219 x 305, 305 x 1219, 914 x 914)

All data corrected to represent standard air at a density of 0.075 lbs/ft³.

CD60 SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans, or in accordance with schedules, control dampers that meet the following minimum construction standards. Frame shall be 16 gage (1.6) galvanized steel structural hat channel with tabbed corners for reinforcement for 11 gage (3.05) structural equivalence. Blades shall be 14 gage (2.0) equivalent thickness galvanized steel, roll-formed airfoil type for low pressure drop and low noise generation. Blade edge seals shall be Ruskiprene type or equivalent suitable for -72°F (-60°C) to +275°F (+135°C) mechanically locked into the blade edge. Adhesive or clip-on type seals are unacceptable. Jamb seals shall be flexible metal, compression type to prevent leakage between blade end and damper frame. Blade end overlapping frame is unacceptable.

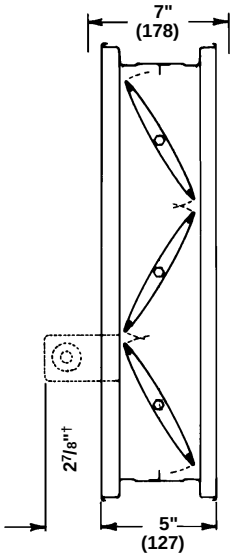
Bearings shall be corrosion resistant, permanently lubricated stainless steel sleeve type turning in an extruded hole in the damper frame. Axles shall be hexagonal positively locked into the damper blade. Linkage shall be concealed out of airstream, within the damper frame to reduce pressure drop and noise. Submittal must include leakage, maximum air flow and maximum pressure ratings based on AMCA Publication 500. Damper shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as a class 1A damper. Dampers shall be Ruskin CD60 model.

Specifier Select Options.

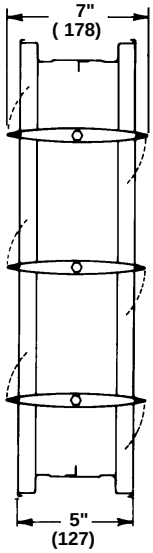
SP100: Dampers shall be equipped with factory installed damper position indication switch package. The switch package shall include two position indication switches linked directly to the damper blade to provide full open and full closed damper blade position. The switch package shall be capable of interfacing with the HVAC control system and provide remote damper blade position status. Switch package shall be Ruskin Model SP-100.

Factory Mounted Damper Actuators: If control damper actuators are required, they shall be furnished and mounted by the damper manufacturer in their factory. Each damper shall be cycle tested at the factory prior to shipment.

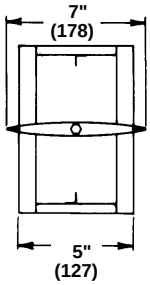
DIMENSIONAL INFORMATION



OPPOSED BLADE



PARALLEL BLADE



Low profile frame illustrated is typical for units under 12" (305) high.

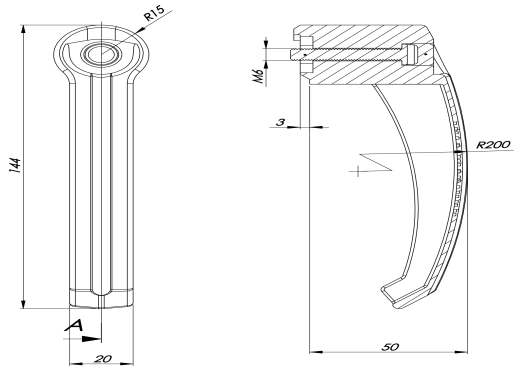
Allegis Product Detail

1-866-378-7550

Allegis Part Number: 265076-00P
Description: NON-LOCKING VENTILATION L-HANDLE

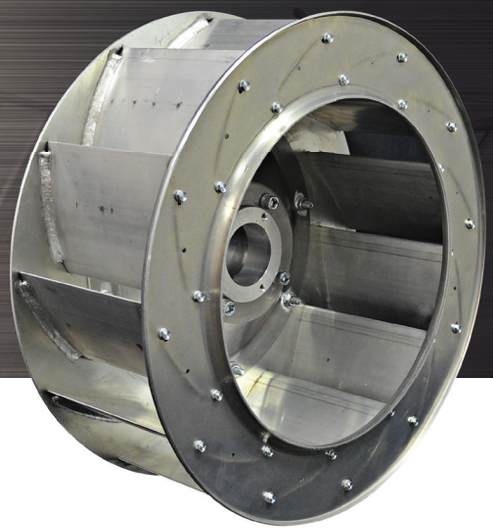
Print





- Designed for the HVAC industry
- Can be used as part of a complete latching system (KlimaFlex)
- Nylon 6 construction
- Supplied with screw and plastic cover plug
- Black finish
- **Individually Packaged**

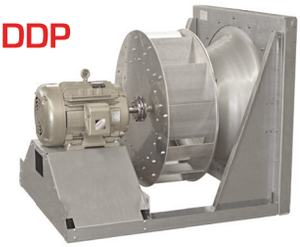
GEN II DDP



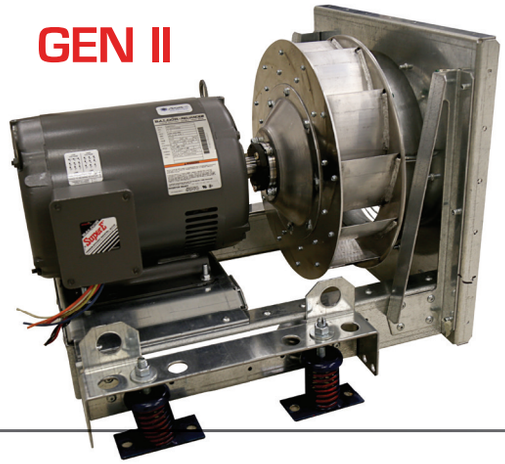
HIGH PERFORMANCE DIRECT DRIVE PLENUM FANS

Lau has combined our comprehensive expertise and more than 80 years of air moving experience to design plenum fans are both economical and environmentally friendly.

DDP



GEN II



IDDP



FEATURES

- Compact Size & Weight
- Reduced Inlet Cone Technology
- Several Isolation Configuration Options Available
  - Rigid - Neoprene - Spring - Seismic
- Higher Efficiency
- Manufactured with Lau's Corus Wheel - Welded, Airfoil Aluminum Wheel
- Direct Drive

DESIGN HIGHLIGHTS

SIZES	10.5" through 40.25"
EFFICIENCY	74% Peak Total: FEG 80
FLOW	Up to 55,000 cfm
PRESSURE	Up to 8 inches wg

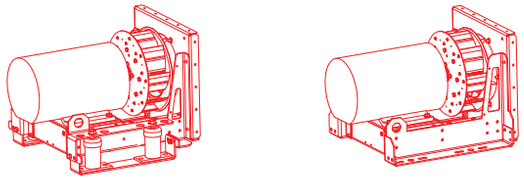
OPTIONS

Piezometer Pick Up Pressure Tap

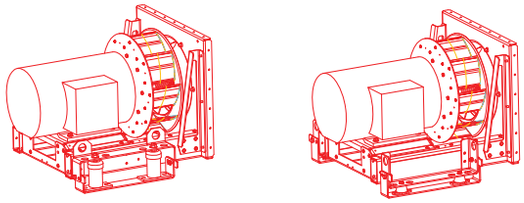
Inlet / Outlet Screen

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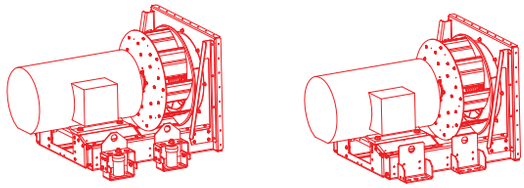
MOUNTING OPTIONS FOR EVERY APPLICATION.



MODELS 105-135 INTEGRAL FRAME



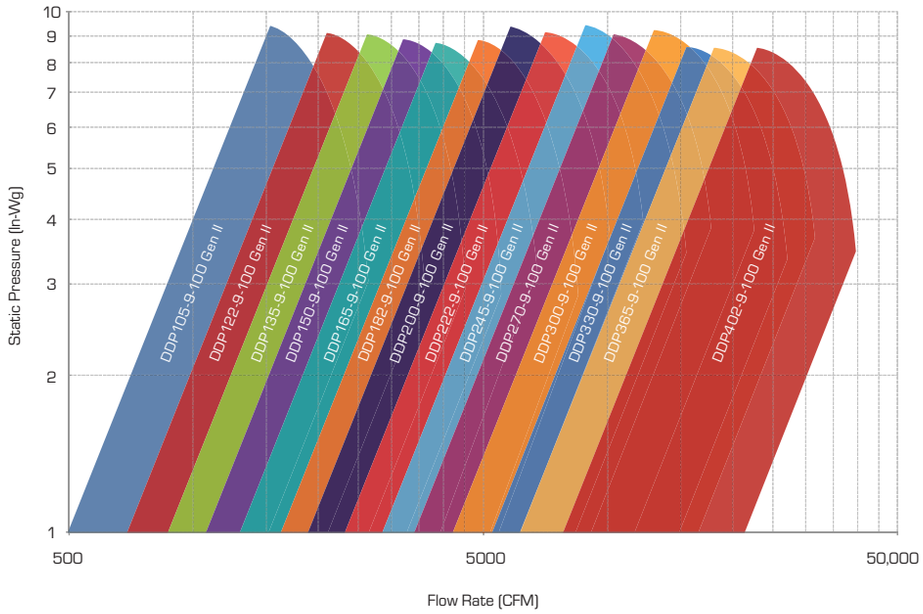
MODELS 150-165 UNITIZED



MODELS 182-402 INDIVIDUALIZED

MOUNTING OPTIONS BY SIZE

	Rigid Mount	Rubber	Spring	Seismic
105	X	X	X	X
122	X	X	X	X
135	X	X	X	X
150	X	X	X	X
165	X	X	X	X
182	X		X	X
200	X		X	X
222	X		X	X
245	X		X	X
270	X		X	X
300	X		X	X
330	X		X	X
365	X		X	X
402	X		X	X



For your application specific performance, please refer to Element at **www.laufan.com/element**

1 Sort

Make selections based on fan technology and operating points, or simply by energy efficiency and operating points.

2 Compare

Compare side by side performance, size, efficiency and operating costs of the top 20 selections and quickly identify the optimum air moving solution to meet your application.

GEN II DDP

For more information visit LauFan.com.
Call 937-476-6500

Follow Lau @LauOEM

OUR EXPERTISE, YOUR AIR-MOVING SOLUTION

Koch Filter Corporation
Filtration Products Crafted with Pride

Multi-Pleat Elite™

Self-Supporting Extended Surface Pleated Filter



High performance MERV 8 mechanical air filter media is self-supporting and requires no metal support grid downstream. No metal components means the filter is completely incinerable after use.

Exclusive vForm™ Pleating Technology maintains uniform pleat spacing in every filter. In addition, vForm™ Pleating Technology insures the same pleat configuration used for decades in our original Multi-Pleat products. Same aerodynamic v-shaped pleat design, same superior performance.

Sturdy, moisture-resistant, beverage board perimeter frame and cross-braces provide structural integrity even in difficult operating conditions.

The media used in the Multi-Pleat Elite is extraordinarily resilient and is engineered to endure the rigors of shipping, handling, installation and operation.

Koch Green

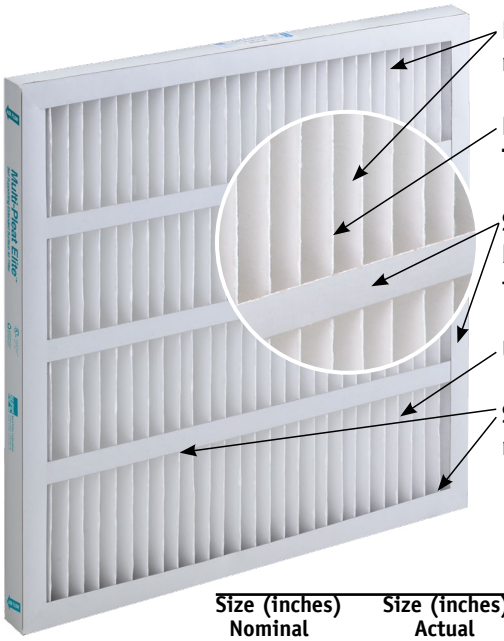
Multi-Pleat Elite earns the Koch Green Icon for one or more following categories: Earns LEED Points, Reduces Energy Costs, Extends Filter Lifecycles, Conserves Resources, and Improves Indoor Environmental Quality.

Features:

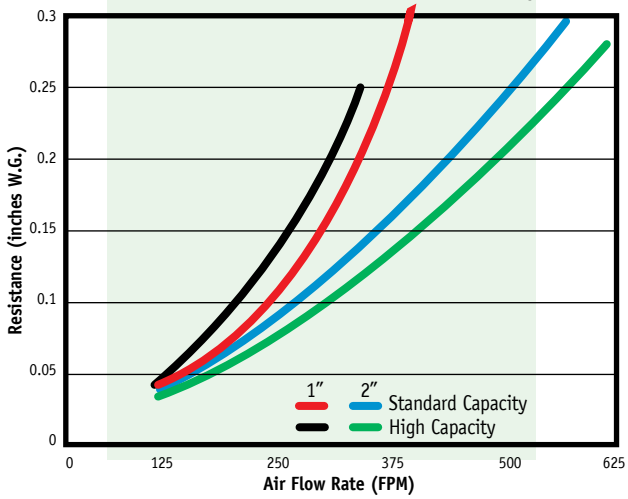
- Exclusive vForm™ Pleating Technology
- MERV 8 performance rating
- Self-supporting pleats requires no metal reinforcement
- Low resistance to airflow reduces energy costs
- Moisture-resistant beverage board frame
- Completely incinerable

Koch Filter Corporation…Durable. Reliable. Versatile.

Multi-Pleat Elite Technical Data



Initial Resistance vs. Filter Face Velocity



Additional Multi-Pleat Elite Product Information

ASHRAE Test Standard 52.2-2007.

Recommended maximum continuous operational temperature is 150° F (93°C).

Multi-Pleat Elite filters are classified as Underwriter's Laboratories Class 2 according to U.L. Standard 900.

			Standard Capacity Elite		High Capacity Elite	
Size (inches) Nominal W x H x D	Size (inches) Actual W x H x D	Capacity (CFM)	Initial Resistance (in. W.G.)	Media Area (Sq. Ft.)	Initial Resistance (in. W.G.)	Media Area (Sq. Ft.)
12 x 24 x 1	$11^{3/8}$ x $23^{3/8}$ x $^{3/4}$	600	0.29	3.3	0.20	3.8
14 x 20 x 1	$13^{1/2}$ x $19^{1/2}$ x $^{3/4}$	590	0.29	3.4	0.20	3.8
14 x 25 x 1	$13^{1/2}$ x $24^{1/2}$ x $^{3/4}$	730	0.29	4.3	0.20	4.8
15 x 20 x 1	$14^{1/2}$ x $19^{1/2}$ x $^{3/4}$	630	0.29	3.6	0.20	4.1
16 x 20 x 1	$15^{1/2}$ x $19^{1/2}$ x $^{3/4}$	670	0.29	3.8	0.20	4.3
16 x 24 x 1	$15^{1/2}$ x $23^{3/8}$ x $^{3/4}$	800	0.29	4.6	0.20	5.2
16 x 25 x 1	$15^{1/2}$ x $24^{1/2}$ x $^{3/4}$	840	0.29	4.8	0.20	5.4
20 x 20 x 1	$19^{1/2}$ x $19^{1/2}$ x $^{3/4}$	840	0.29	4.7	0.20	5.4
20 x 24 x 1	$19^{1/2}$ x $23^{3/8}$ x $^{3/4}$	1000	0.29	5.7	0.20	6.5
20 x 25 x 1	$19^{1/2}$ x $24^{1/2}$ x $^{3/4}$	1050	0.29	6.0	0.20	6.8
24 x 24 x 1	$23^{3/8}$ x $23^{3/8}$ x $^{3/4}$	1200	0.29	7.1	0.20	8.1
12 x 24 x 2	$11^{3/8}$ x $23^{3/8}$ x $1^{3/4}$	1000	0.26	5.4	0.20	7.8
14 x 20 x 2	$13^{1/2}$ x $19^{1/2}$ x $1^{3/4}$	980	0.26	5.5	0.20	7.9
14 x 25 x 2	$13^{1/2}$ x $24^{1/2}$ x $1^{3/4}$	1215	0.26	6.9	0.20	9.9
15 x 20 x 2	$14^{1/2}$ x $19^{1/2}$ x $1^{3/4}$	1050	0.26	6.0	0.20	8.4
16 x 20 x 2	$15^{1/2}$ x $19^{1/2}$ x $1^{3/4}$	1115	0.26	6.5	0.20	8.8
16 x 24 x 2	$15^{1/2}$ x $23^{3/8}$ x $1^{3/4}$	1340	0.26	7.8	0.20	10.6
16 x 25 x 2	$15^{1/2}$ x $24^{1/2}$ x $1^{3/4}$	1400	0.26	8.1	0.20	11.0
18 x 24 x 2	$17^{1/2}$ x $23^{3/8}$ x $1^{3/4}$	1500	0.26	8.4	0.20	12.3
20 x 20 x 2	$19^{1/2}$ x $19^{1/2}$ x $1^{3/4}$	1400	0.26	8.0	0.20	11.1
20 x 24 x 2	$19^{1/2}$ x $23^{3/8}$ x $1^{3/4}$	1675	0.26	9.6	0.20	13.4
20 x 25 x 2	$19^{1/2}$ x $24^{1/2}$ x $1^{3/4}$	1740	0.26	10.0	0.20	14.0
24 x 24 x 2	$23^{3/8}$ x $23^{3/8}$ x $1^{3/4}$	2000	0.26	11.4	0.20	16.2
25 x 25 x 2	$24^{1/2}$ x $24^{1/2}$ x $1^{3/4}$	2170	0.26	12.5	0.20	17.4

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Koch Filter Corporation
Filtration Products Crafted with Pride

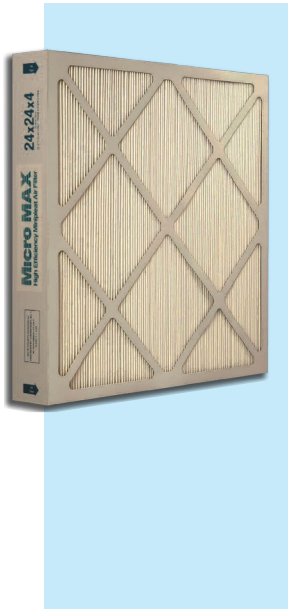
MicroMax™

Extended Surface Minipleat Filter



- Minipleat Design
- Beverage Board or Metal Frame
- Three Efficiency Ranges
  - 90-95% (MERV 14)
  - 80-85% (MERV 13)
  - 60-65% (MERV 11)
- Compact 4" Depth
- Lightweight Construction

MicroMAX Minipleat Filter



The Koch MicroMAX *is an extended surface minipleat filter designed for use in a wide variety of air filtration systems. The MicroMAX offers a unique combination of high efficiency and low pressure drop making it the ideal filter for use in any standard HVAC system.*

The added advantages of its compact 4" depth and lightweight-yet-rigid construction also give the MicroMAX unsurpassed capability to perform in more specialized and difficult applications.

Standard Applications

- Hospitals
- Industrial Plants
- Commercial Buildings
- Universities
- Pharmaceutical Facilities
- Sports Arenas

Extreme Applications

- Gas Turbines
- Variable-Air-Volume Systems
- High Humidity / High Moisture Areas

Specialized Applications

- Diffusion Filters for Automotive Paint Spray Booths
- Prefilters for HEPA filters in Clean Rooms and other critical areas

Compact MicroMAX Design...

Reduces Shipping Cost...



Compared with most competitive filter, which are packaged only one-per-carton, **MicroMAX** filters are packaged thress-per-carton. This multiple packaging means substantial reductions in shipping costs.

...Saves Space

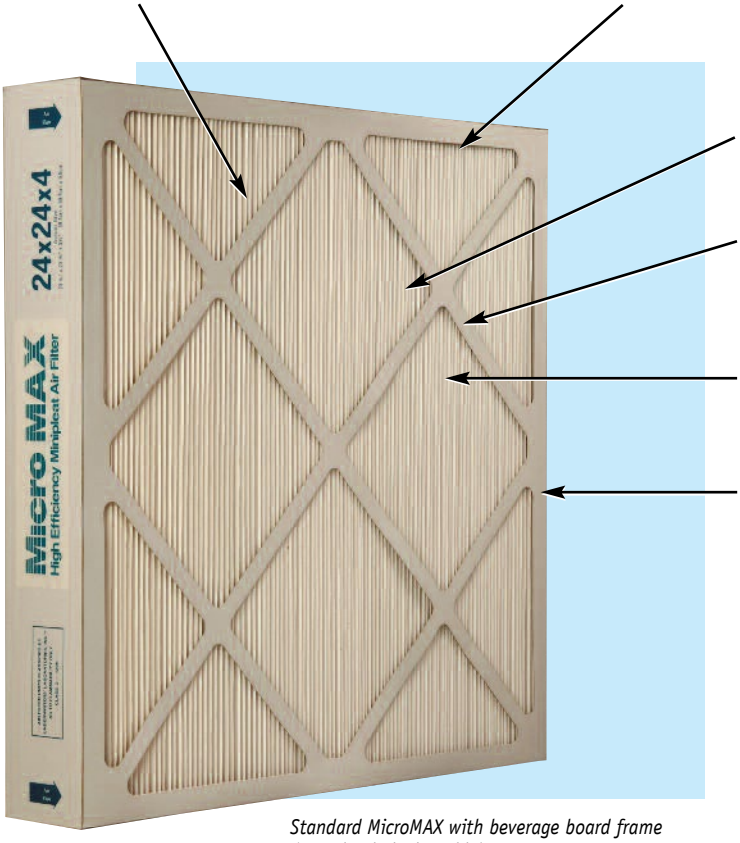


MicroMAX filters contain 120 sq. ft. of media, yet they are only 4" deep, and weigh just 7 lbs. each. Most competitive 12" deep filters with equal media area required three times the storage space, and weigh as much as 25 lbs. each.

MicroMax Construction

Minipleat design offers 120 sq. ft. of media in a 24”x24”x4” frame for high dust holding capacity and extended filter lifecycles.

Media pack is completely sealed within the frame to eliminate air bypass.



Minipleat configuration provides high efficiency and lower pressure drop.

Die-cut supports are bonded to media pack for rigidity.

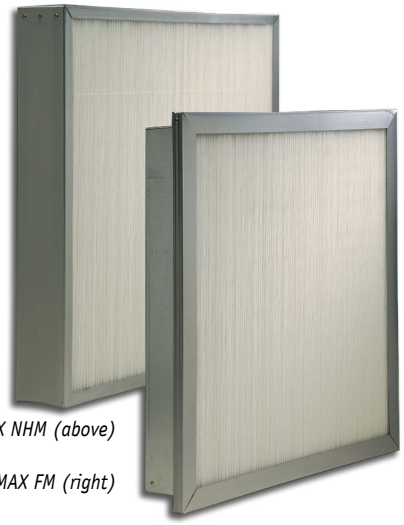
Specially-formulated adhesive bead insures even airflow and filter strength.

Available with double-walled, moisture resistant, beverage board frame (completely incinerable) or galvanized stell frame. MicroMAX with galvanized frames are offered with peripheral header (model FM) or no header (model NHM).

Standard MicroMAX with beverage board frame (completely incinerable)

Dual Density Filter Media

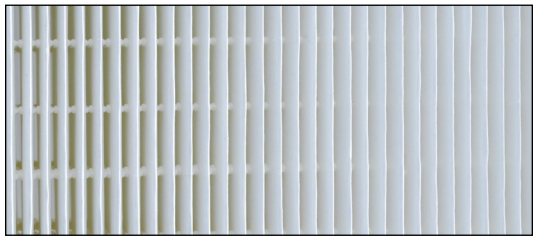
The media used in MicroMAX minipleat filters is composed of microfiberglass paper, treated with a specially-formulated, water-repllent binder. Millions of fibers are constructed into a Graded Density mat, with coarse fibers upstream and finer fibers on the air-exiting side. This dual-density insures full media utilization, which results in higher dust holding capacity and extended filter life. Also available with antimicrobial-treated media.



MicroMAX NHM (above)

MicroMAX FM (right)

Adhesive bead seprators uniformly secure the pleats to allow maximum air flow with minimal pressure drop.



MicroMAX Performance Data

MODEL NO	RATED FILTER FACE VELOCITY (FPM)	NOMINAL SIZE (W X H X D)	ACTUAL SIZE (W X H X D)	RATED AIR FLOW CAPACITY (CFM)	RATED INITIAL RESISTANCE (IN. W.G.)	RECOMMENDED FINAL RESISTANCE (IN. W.G.)	GROSS MEDIA AREA (SQ. FT.)	SHIPPING WEIGHT [1] (lbs. per CTN)
MicroMAX 90 - 95% (MERV 14)								
MX-9-444	500	24x24x4	23-3/8x23-3/8x3-3/4	2000	0.68	1.5	120	20
MX-9-054	500	20x25x4	19-1/2x24-1/2x3-3/4	1750	0.68	1.5	111	18
MX-9-044	500	20x24x4	19-3/8x23-3/8x3-3/4	1650	0.68	1.5	106	16
MX-9-004	500	20x20x4	19-1/2x19-1/2x3-3/4	1400	0.68	1.5	88	11
MX-9-844	500	18x24x4	17-3/8x23-3/8x3-3/4	1500	0.68	1.5	95	11
MX-9-654	500	16x25x4	15-1/2x24-1/2x3-3/4	1400	0.68	1.5	88	11
MX-9-604	500	16x20x4	15-1/2x19-1/2x3-3/4	1100	0.68	1.5	70	9
MX-9-244	500	12x24x4	11-3/8x23-3/8x3-3/4	1000	0.68	1.5	63	19
MicroMAX 80 - 85% (MERV 13)								
MX-8-444	500	24x24x4	23-3/8x23-3/8x3-3/4	2000	0.59	1.5	120	20
MX-8-054	500	20x25x4	19-1/2x24-1/2x3-3/4	1750	0.59	1.5	111	18
MX-8-044	500	20x24x4	19-3/8x23-3/8x3-3/4	1650	0.59	1.5	106	16
MX-8-004	500	20x20x4	19-1/2x19-1/2x3-3/4	1400	0.59	1.5	88	11
MX-8-844	500	18x24x4	17-3/8x23-3/8x3-3/4	1500	0.59	1.5	95	11
MX-8-654	500	16x25x4	15-1/2x24-1/2x3-3/4	1400	0.59	1.5	88	11
MX-8-604	500	16x20x4	15-1/2x19-1/2x3-3/4	1100	0.59	1.5	70	9
MX-8-244	500	12x24x4	11-3/8x23-3/8x3-3/4	1000	0.59	1.5	63	19
MicroMAX 60 - 65% (MERV 11)								
MX-6-444	500	24x24x4	23-3/8x23-3/8x3-3/4	2000	0.40	1.5	120	20
MX-6-054	500	20x25x4	19-1/2x24-1/2x3-3/4	1750	0.40	1.5	111	18
MX-6-044	500	20x24x4	19-3/8x23-3/8x3-3/4	1650	0.40	1.5	106	16
MX-6-004	500	20x20x4	19-1/2x19-1/2x3-3/4	1400	0.40	1.5	88	11
MX-6-844	500	18x24x4	17-3/8x23-3/8x3-3/4	1500	0.40	1.5	95	11
MX-6-654	500	16x25x4	15-1/2x24-1/2x3-3/4	1400	0.40	1.5	88	11
MX-6-604	500	16x20x4	15-1/2x19-1/2x3-3/4	1100	0.40	1.5	70	9
MX-6-244	500	12x24x4	11-3/8x23-3/8x3-3/4	1000	0.40	1.5	63	19

1 . Shipping weights listed above apply to MicroMAX with beverage board frames. Add 10 lbs. per carton for metal framed models.

2. Data based on ASHRAE 52.1 and 52.2.
3. MicroMAX filters are classified as U.L. Class 2. Testing conducted according to U.L. Standard 900.
4. Width and height dimensions are interchargeable. MicroMAX filters may be installed with pleats in either direction.
5. Filters may be operated at up to 125% of rated face velocity.
6. MicroMAX filters should be used with a perfilters for maximum performance.

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*Denotes manufacturing site.

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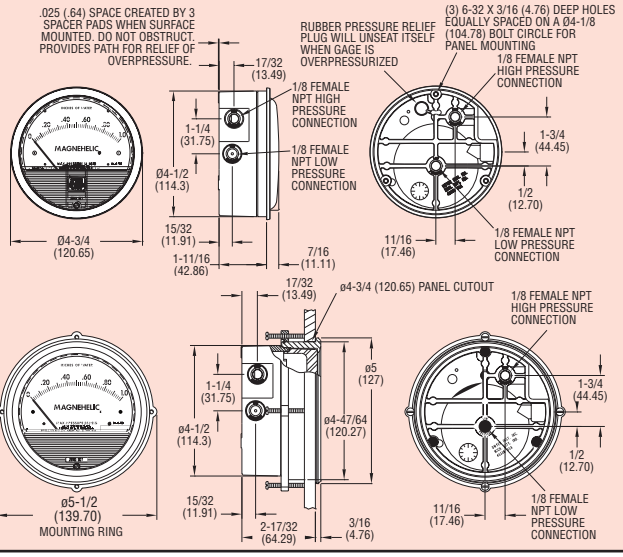
Series 2000

Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%

RoHS





Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% of full-scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Mounting

A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. Although calibrated for vertical position, many ranges above 1″ may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4-9/16″ hole is required for flush panel mounting. Complete mounting and connection fittings, plus instructions, are furnished with each instrument. See pages 6 and 7 for more information on mounting accessories.



Flush, Surface or Pipe Mounted



Enclosure Mounted

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% of FS (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -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).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. See Overpressure Protection Note on next page.
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 Approval: RoHS. **Note:** -SP models not RoHS approved.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

ACCESSORIES



Model 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.



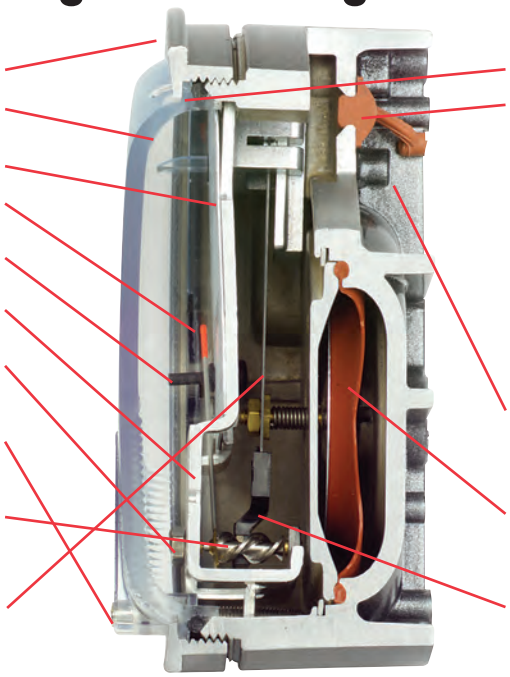
Model A-605 Air Filter Gage Accessory Kit
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings 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

Series 2000

Magnehelic® Gage Models & Ranges



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.

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.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

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.

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.

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 or 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	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

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%
• • Accuracy +/-4%
*MP option standard
**HP option standard

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

VELOCITY AND VOLUMETRIC FLOW UNITS
Scales are available on the Magnehelic® 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
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-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.


AIRXCHANGE®

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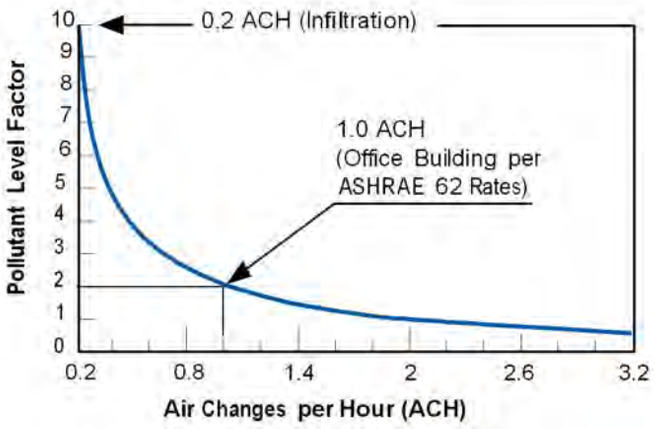
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The Fundamentals

Why Ventilation?

The Heating, Ventilation, and Air-Conditioning (HVAC) community plays a vital role in providing healthy indoor environments in which to live, learn, work, and play. With half of all illnesses attributable to indoor airborne contaminants, the Environmental Protection Agency (EPA) has declared indoor air quality a public health priority. Ventilation with outdoor air is the only strategy that can simultaneously reduce the levels of *all* indoor pollutants. This strategy, in general accordance with the *Dilution Principle,* is shown in the chart below.



Dilution Principle

Each doubling of the ventilation rate results in a 50% reduction in the concentration of all constant source air pollutants evenly mixed within the space. At 1.0 ACH, pollutant concentrations are reduced by a factor of 5.

National, state, and local codes mandate minimum outdoor air ventilation rates based on ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality. The challenge is to introduce the outdoor air at the levels required by the codes while maintaining indoor comfort and conserving energy.

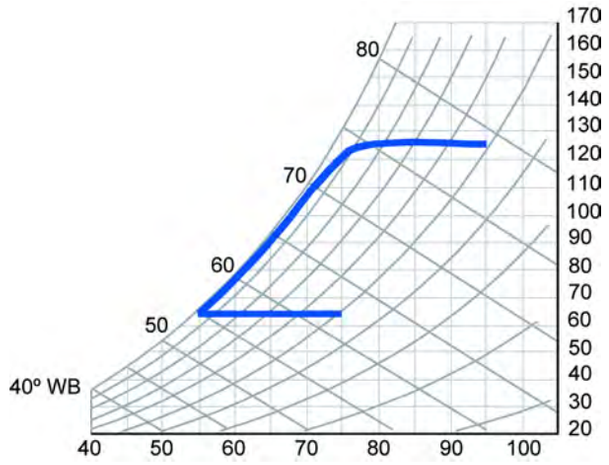
Why *Energy Recovery* Ventilation?

Building Code requirements for increased outdoor air ventilation rates have placed new demands on both HVAC equipment and building operating budgets. At the same time, new refrigerants being deployed to lower atmospheric ozone concerns have reduced equipment capacity and global warming is threatening to place even greater restrictions on our use of energy.

Energy recovery ventilation reduces the load on the system treat to outdoor air by taking advantage of the work that has already been done to heat, cool, humidify or dehumidify the space. Instead of exhausting building energy to the outside, it is temporarily captured on the surfaces of the enthalpy wheel heat exchanger and then released to pre-heat, pre-cool, humidify, or dehumidify the incoming air. Enthalpy wheels do this with exceptional efficiency and are the leading technology for achieving energy conservation while ventilating for health and comfort.

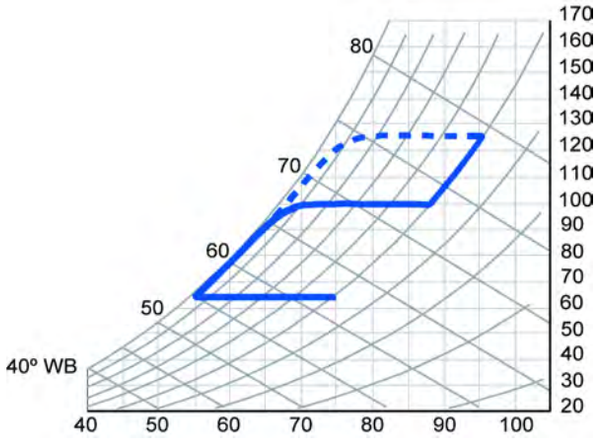
The Power of Enthalpy

The next three figures illustrate the power of enthalpy exchange. The first chart shows the result of just adding the required load from increased ventilation to the normal air conditioning process line.



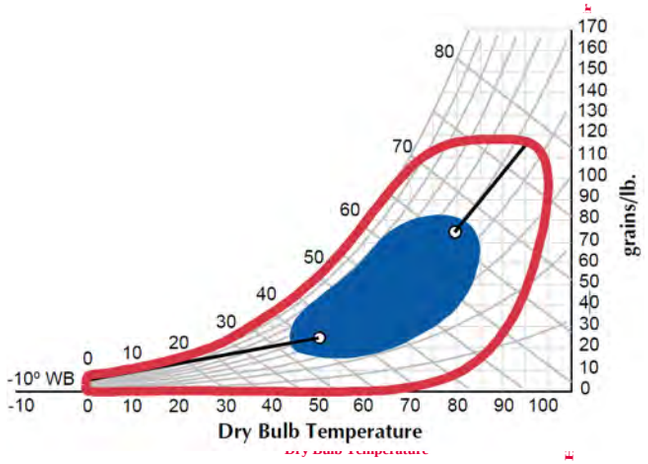
HVAC Conventional System Process Line

The chart below shows the new process line when using enthalpy recovery. The cooling load (work) saved is a direct result of the difference in the two enthalpies.



Enthalpy Process Line

As shown below, with the use of an enthalpy recovery device, the conditions entering the coil or the building are in a more advantageous area of the psychometric chart, and actually reduce the workload on the coil or the system.



Weather Compressor

Commercial buildings use approximately 4.5 quadrillion BTUH/year for cooling, heating, ventilation and refrigeration.

Potential energy savings of 15% total commercial HVAC and R

In a study commissioned by the U.S. Department of Energy and Pacific Northwest National Laboratory, it was determined that “if enthalpy recovery were widely used, 0.55 Quads of energy could be saved annually.” This would result in an astounding 20% reduction of the total energy used in commercial HVAC and R.

Why Airxchange Components?

Airxchange designs have evolved over 30 years of field experience with packaged ventilators, as well as OEM applications and an installed base of over 250,000 wheel cassettes.

The patented Airxchange technology incorporates a unique set of solutions that are ideally suited for a wide range of products.

Airxchange is dedicated to the OEM component market. The components are the choice of leading HVAC manufacturers for the following applications:

- Commercial ventilators
- Unit ventilators and accessories for packaged unitary heating and air conditioning products
- Packaged HVAC units with integrated energy recovery
- Standard, semi-custom and custom air handlers

Airxchange Technology at Work

ERV systems have found application in a wide variety of building environments, including:

- Animal Shelters
- Bars and Clubs
- Bingo Halls
- Casinos
- Churches
- Clinics
- Day Care Facilities
- Dormitories
- Exercise Facilities
- Function Halls
- Hair Salons
- Houses
- Hospitals
- Ice Rinks
- Locker Rooms
- Manufactured Homes
- Manufacturing Plants
- Mobile Offices
- Modular Classrooms
- Modular Homes
- Mortuaries
- Nail Salons
- Nursing Homes
- Office Buildings
- Photo Processing
- Pools
- Printing Shops
- Prisons
- Restaurants
- Schools
- Smoking Lounges
- Supermarkets
- Veterinary Hospitals

Common Features

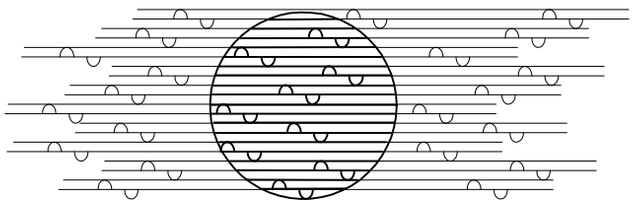
All Airxchange Energy Recovery Ventilation (ERV) components utilize a unique parallel plate energy transfer matrix design that optimizes the energy recovery surface area for a given diameter and depth of a rotary heat exchanger. In addition, a polymer film matrix offers ideal properties that limit counterproductive axial conduction of heat. This combination achieves the required performance in a thin, light weight configuration.

All Airxchange desiccant-coated enthalpy wheels are corrosion resistant. They are washable due to patented and proprietary processes that secure the desiccant to the matrix substrate with a permanent mechanical bond without the use of adhesives.

Recognizing the different needs of the unitary packaged and air handling segments of commercial space conditioning equipment, Airxchange components are available in Standard Matrix and Channel Matrix configurations.

Standard Matrix

The standard construction employs a series of small conical internal dimples (standoffs) to separate the film layers and define the geometry of the matrix.



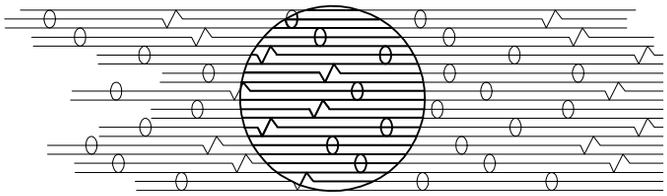
Standard Matrix

The standard construction is always suitable for ventilation in comfort applications and is generally specified for:

- Stand-alone ERVs
- Accessories, or integration into packaged unitary HVAC equipment

Channel Matrix with Mechanical Purge

Airxchange 75 mm depth components are available in the Channel Matrix configuration with an optional adjustable mechanical purge sector. Channel matrix wheels employ the same ideal parallel plate geometry as the standard configuration, however, the internal standoffs are axial ridges that separate intake and exhaust air streams while determining the matrix geometry



Channel Matrix

With the channel matrix configuration, a mechanical purge sector may be required to control the amount of exhaust air that transfers to the supply air stream by the carryover mechanism. Using an adjustable purge sector, carryover can be reduced to less than 1% while limiting excess fan energy to less than 10%. This configuration is ideal for air handlers and other high pressure applications where the Standard Matrix might allow higher carryover or excessive fan energy losses. It is also responsive to applications and engineering specifications in which it is necessary to limit the recirculation of exhaust air.

Custom Designs

The Airxchange approach to the design and production of ERV components provides unique flexibility and capability. Custom wheels and segments can be produced in a wide variety of geometries to optimize the trade-offs between *size, effectiveness*, and *pressure loss*.

For your specific needs, please contact the factory if our catalog offerings do not meet your needs; we can engineer components to satisfy your specific requirements.

The *Fresh* Approach to Energy Recovery

Optimized Design

Airxchange achieves optimum performance through the use of polymer film material that is spirally wound into a parallel plate energy transfer matrix. Low thermal conductivity of the polymer material minimizes axial heat flow, thus permitting the design of thinner, light weight wheels ranging in thickness from 25 to 75 mm.

All wheels consist of a welded assembly of hubs, spokes, and rim. For wheels larger than 750 mm in diameter, the spokes form pockets for retention of energy transfer segments that are removable without the use of tools. Under 750 mm diameter, the wheel is permanently embedded in a monolithic, spirally wound energy recovery matrix.

Energy transfer matrices are cut and framed into either 4, 6, 8, or 16 pie-shaped segments - depending on the size of the wheel. Segments are sized for ease of handling during installation, removal, and cleaning.

Silica Gel Desiccant

The Airxchange silica gel desiccant has superior moisture handling capacity in the working range above 30% R.H., the range concern for all standard space conditioning environments and outdoor air design conditions.

Flexible Performance

Airxchange technology provides a wide range of performance characteristics in a given wheel cassette size. This results in flexibility of component selection for a wide assortment of outdoor air ventilation applications. Wheels are available in desiccant coated (enthalpy wheel) and uncoated (sensible wheel) configurations.

Mechanical Considerations

The Airxchange wheel matrix is resistant to mechanical damage and the polymer film is not subject to corrosion in coastal locations or swimming pool areas. The combination of a replaceable polymer matrix with an all-welded stainless steel hub, spoke and rim assembly provides an infinite design life. This results in a reliable heat exchanger for a wide variety of applications.

Airxchange ERV components have a life expectancy that matches or exceeds that of a complete heating and air conditioning system. Additional reliability considerations include:

- Bearings with a rated L-10 life in excess of 400,000 hours
- Urethane stretch wheel drive belts designed and tested specifically for this application
- Motors selected from highly respected industry suppliers

Serviceability

Serviceability was the basic consideration of Airxchange leading to designs of small monolithic and patented segmentation of large energy transfer matrices.

Removable segments offer easy cleaning and replacement.

Removable segments make wheel cleaning and replacement both possible and convenient. All wheels larger than 30" in diameter are made in patented segments that are removable without the use of tools. Thus, the wheels are easy to handle in the plant and in the field.

Cleaning

All Airxchange energy transfer matrices are washable. Airxchange utilizes proprietary technology to permanently bond the silica gel desiccant to the surfaces of the patented heat exchange matrix without adhesives — the desiccant cannot be removed by washing.

Latent heat transfer effectiveness is restored by cleaning.

Summary of Products and Options

Standard Matrix Models

Standard Matrix Models

Model			Media		Options		Electrical Configuration								
ERC-xxxx			Monolithic	Segmented	DW	S	01	02	03	04	05	06	07	08	12
Standard Matrix Models	Sizes Available	Desiccant			Double Wall	Sensible	115V, 1PH 50/60HZ	208-230V, 1PH, 50/60HZ	200/ 208-230V 1PH, 50/60HZ	200-230/460V, 3PH, 60HZ	200/400V, 3PH, 50 HZ, (European)	575V, 3PH, 60HZ	460V, 1PH, 60HZ	380V, 3PH, 50//60HZ	200-220V // 200-230V 1PH, 50//60HZ
Duty							STD	STD	STD	STD/INV	STD/INV	STD/INV	STD	STD/INV	STD
1" Series															
ERC-15	1502		■			■	■	■							
ERC-19	1904		■			■	■	■							
ERC-21	2106		■			■	■	■							
1.5" Series															
ERC-36	3615	3623	■		■	■	■		■	■	■	■	■	■	■
ERC-46	4625	4637	■		■	■	■		■	■	■	■	■	■	■
ERC-52	5230	5245	■		■	■	■		■	■	■	■	■	■	■
ERC-58	5860		■		■	■	■			■	■	■			■
2" Series															
ERC-19	1906		■			■	■	■							
ERC-21	2108		■			■	■	■							
ERC-25	2509		■			■	■	■							
3" Series															
ERC-36	3622	3628	■		■	■	■		■	■	■	■	■	■	■
ERC-41	4128	4136	■		■	■	■		■	■	■	■	■	■	■
ERC-46	4634	4646	■		■	■	■		■	■	■	■	■	■	■
ERC-52	5248	5262	■		■	■	■		■	■	■	■	■	■	■
ERC-58	5856	5874	■		■	■	■			■	■	■			■
ERC-64	6475	6488	■		■	■	■			■	■	■			■
ERC-68	6876	68100	■		■	■	■			■	■	■			■
ERC-74	7490	74122	■		■	■	■			■	■	■			■

■ STANDARD FEATURE ■ OPTIONAL FEATURE

The table shown above lists all Airxchange Standard Matrix cassettes with colors indicating features and options that are currently available.

To develop a Standard Matrix Airxchange Model Number, select a cassette model number from the Standard Models beginning on page 24 of this catalog, followed by the **Option**, and **Electrical Configuration** codes indicated in the table above.

For example: **ERC-7490 - DW - 04**

The example is a Model ERC-7490 containing standard desiccant segments, in a double wall cassette, with a 200-230/460 V/3 Ph, 50/60 Hz motor.

Multi-Voltage motors are not pre-wired unless specified by the customer. All motors are shipped with the relevant wiring diagram.

Channel Matrix Model

Channel Matrix Models

Model				Media		Options		Electrical Configuration								
ERC-xxxxC						DW	S	01	02	03	04	05	06	07	08	12
Channel Matrix Models	Sizes Available		Desiccant	Monolithic	Segmented	Double Wall	Sensible	115V. 1PH 50/60HZ	208-230V, 1PH, 50/60HZ	200/208-230V, 1PH, 50/60HZ	200-230/460V, 3PH, 60HZ	200/400V, 3PH, 50HZ,	575V, 3PH, 60HZ	460V, 1PH, 60HZ	380V, 3PH, 50/60HZ	200-220V // 200-230V 1PH, 50/60HZ
Duty								STD	STD	STD	STD/INV	STD/INV	STD/INV	STD	STD/INV	STD
ERC-25C	2510	2513														
ERC-30C	3014	3019														
ERC-36C	3622	3628														
ERC-41C	4128	4136														
ERC-46C	4634	4646														
ERC-52C	5248	5262														
ERC-58C	5856	5874														
ERC-64C	6475	6488														
ERC-68C	6876	68100														
ERC-74C	7490	74122														
ERC-81C	81110	81146														
ERC-86C	86125	86170														
ERC-92C	92135	92180														
ERC-99C	99160	99215														
ERC-104C	104195	104250														
ERC-110C	110220	110290														

STANDARD FEATURE

OPTIONAL FEATURE

To develop an Airxchange Channel Matrix Model Number, select a cassette model number from the Channel Matrix Models beginning on page 24 of this catalog, followed by the **Option**, and **Electrical Configuration** codes indicated in the table above.

For example: **ERC-7490C - DW - 04**

The example is a Model ERC-7490C containing channel matrix desiccant segments, in a double wall cassette, with a 200-230/460 V/3 Ph, 50/60 Hz motor.

Multi-Voltage motors are not pre-wired unless specified by the customer. All motors are shipped with the relevant wiring diagram.

The Airxchange Advantage

Invention and Cost Effectiveness

Airxchange has changed the energy recovery ventilation market with its new and unique approach to design and manufacture of heat wheels. Through the use of new materials, patented designs, and innovative manufacturing techniques, Airxchange has responded to the market challenge making energy recovery ventilation practical for all HVAC systems.

Cassettes and Components

Airxchange patented cassettes are complete ERV components consisting of a stainless steel wheel, washable energy transfer matrix, bearings, structural support beams, seals, motor, and drive-train. The cassette is a UL recognized component. Airxchange UL and AHRI certification support your engineering, manufacturing, sales, and marketing efforts.

Technology Benefits

- Reduced loads at design allow significant downsizing of the heating and cooling plant
- Energy efficient ventilation reduces operating costs
- Reduced design loads and operating costs combine for rapid payback
- Increased ventilation improves indoor air quality
- Greater efficiency permits raising the outdoor air quantity without increasing the heating/cooling plant. This makes it ideal for retrofit applications as well as new systems.

Product Features and Benefits

- Completely welded, stainless steel wheel structures for corrosion resistance and long service life
- Removable energy transfer segments for easy cleaning or replacement
- A spare set of energy transfer segments that can facilitate maintenance, reduce service time and minimize downtime in smoking and other high maintenance applications
- Washable energy transfer matrix for long life and sustained effectiveness
- UL recognized component for quick approvals
- Permanently bonded silica gel desiccant for long life
- AHRI Certified performance for engineering confidence

Desiccant Process

Airxchange desiccant wheels are coated using a patented and proprietary process that permanently bonds the silica gel to the surface of the polymer substrate without adhesives. Even after years of operation and repeated washings, the Airxchange desiccant remains in place doing its job.

Optimized for Ventilation

The Airxchange wheel is optimized for the ventilation of conditioned space and should not be confused with heat regenerated wheels used in dehumidification and desiccant cooling. A silica gel desiccant is used for its superior absorption characteristics in the working range above 30% R.H., precisely the range encountered in heating and air conditioning applications.

Flexibility by Design

Flexibility is inherent in Airxchange designs. The same cassette dimensions and wheel diameters can be produced with a variety of different airflow and efficiency characteristics. This results in a wide variety of design choices for the OEM HVAC equipment manufacturer and greater flexibility in both production and field applications.

Getting Longer Life from Your Ventilation Unit

Materials are selected for durability using stainless steel welded wheel construction and patented polymer energy transfer matrices. No special coatings are required in marine environments or swimming pool applications. Design life is in excess of 25 years, except for motors and belts.

Time-Tested Products

Airxchange energy recovery ventilation components are proven products with more than theoretical benefits. They have been time-tested during more than 30 years of use.

About AHRI

The *Air Conditioning, Heating, and Refrigeration Institute* (AHRI) is an association of at least 90% of the manufacturers involved in the HVAC & R industry. AHRI establishes equipment standards for performance and administers certification programs to ensure compliance to those standards. By providing equipment bearing the AHRI seal, the end user is assured of repeatable performance from a credible and reliable manufacturer.

The AHRI seal signifies repeatable performance from a reliable manufacturer.

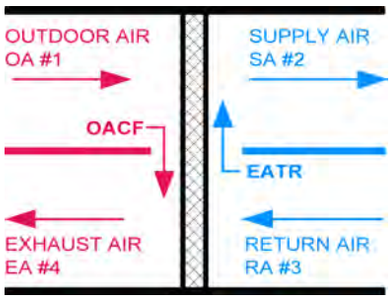


AHRI Standard 1060 Label

AHRI Standard 1060

AHRI Standard 1060 was established to rate the performance of factory-made air-to-air energy heat exchangers for use in Energy Recovery Ventilation equipment. The standard uses the ASHRAE 84 Method of Testing Air-to-Air Heat Exchangers as the test reference. The AHRI standard outlines the performance parameters to be reported in any literature.

It is important to understand what the parameters mean to the overall equipment performance. The air stream measuring convention that is the basis for the discussion in this catalog is detailed in this figure.



Cassette Airflow Convention (summer conditions)

The Effectiveness Equation

The effectiveness, ε, of air-to-air heat exchangers is measured in terms of:

- Sensible energy (heat) transfer: dry-bulb temperature
- Latent energy (water vapor or moisture) transfer: humidity ratio
- Total energy (heat and moisture) transfer: enthalpy

$$\varepsilon = m_s (x_1 - x_2) / m_{min} (x_1 - x_3)$$

Air Transfer between Exhaust and Supply

Standard 1060 has developed definitions for air transfer from one stream to another, as follows:

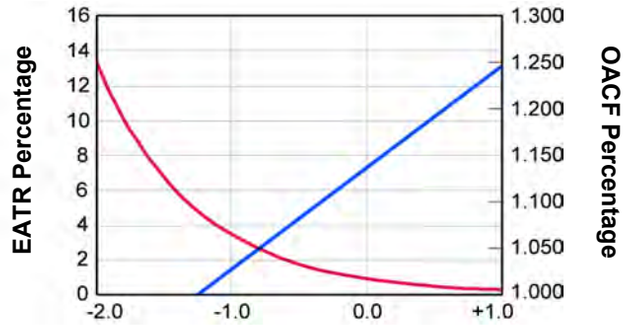
- Outdoor Air Correction Factor (OACF) = Difference in airflow (CFM) measured between OA and SA, presented as a ratio:

  OACF = OA flow/SA flow

  The OACF includes air lost through purge and seal leakage from the OA supply to the exhaust air stream.

- Exhaust Air Transfer Ratio (EATR) = Percentage of supply airflow that originated as return air (measured using tracer gas).

The sample curve below shows the typical relationship between EATR, OACF, and static pressure. The AHRI ratings include data characterizing EATR and OACF for each component.



OACF and EATR Percentages

OACF and EATR are reported at three selected pressure conditions and the resultant purge angle (if a purge is provided) at which these values were determined.

For actual AHRI certified ratings at the AHRI test conditions, see the section entitled Performance Data beginning on page 27. This data is provided in a table similar to the table below.

Nominal Airflow (scfm)					
Net Airflow (scfm)					
Effectiveness					
SCFM	Effectiveness (%)			ΔP (in.w.c.)	
	S	L	T		
Heating Conditions					
100%					
75%					
Cooling Conditions					
100%					
75%					
Net Effectiveness					
Heating Conditions					
100%					
Cooling Conditions					
100%					

Delta P	EATR	OACF	Purge Angle
-1.00			
0.00			
1.00			

AHRI Data Delivery Method

The tabularized AHRI Certified Rating information allows AHRI and OEMs to periodically check the validity of manufacturer data. All other data is tabulated under Application Ratings. This is data that is specified at other than standard conditions. Please note that according to the latest revision of the AHRI Standard 1060, net effectiveness is no longer rated under the certification program. This information will, however, be included in the performance section for informative purposes only.

Airxchange Performance Selection Software is available to determine actual design parameters. Further information on this software is provided in Performance Selection and Calculations beginning on page 24.

Certifying your OEM Product

The AHRI Certified Products Directory for Air-to-Air Energy Recovery Ventilation Equipment lists packaged products that incorporate certified components. ERVs, accessories, unitary equipment and air handlers that incorporate Airxchange components are eligible to bear the AHRI Standard 1060 certification seal, at no cost to the OEM. Airxchange is happy to assist engineers and product managers listing units in the AHRI Certified Products Directory and will also provide electronic files of the required data submittal sheets.

Guidelines

Energy recovery cassettes can be incorporated within the design of packaged rooftop units and accessories, airhandlers, energy recovery ventilators, or site-built air handling systems.

The guidelines include: accessibility, orientation, lifting and support, diameter seal adjustment, and wheel drive motor characteristics. For overall dimensions refer to the section entitled Physical Data beginning on page 43.

Accessibility

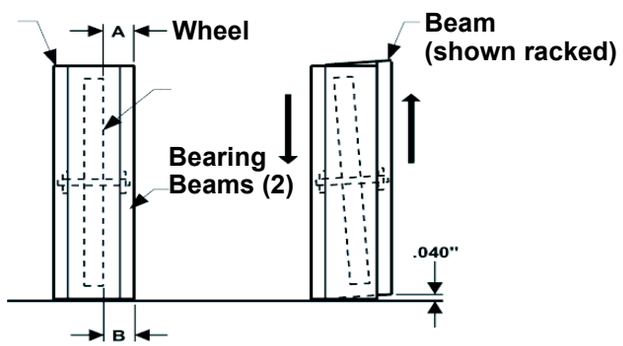
The cassette and all its operative parts including motor, belt, pulley, bearings, seals and energy transfer segments must be accessible for service and maintenance. The most practical design to allow complete access is one in which the motor side of the cassette can slide at least half way out of the cabinet or ductwork for service. This design requires that adequate clearance be provided outside of the installed cabinet.

Where cassettes are permanently installed in a cabinet, access to both faces of the cassette must be provided. Internal partitions that separate air streams must allow access for bearing removal.

Orientation, Lifting and Support

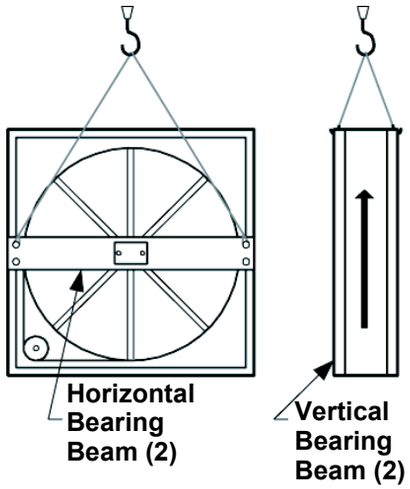
The Energy Recovery Cassette may be mounted in any orientation. However, care must be taken to make certain that the cassette frame remains flat and the bearing beams are not racked. After installation, be sure that the distance between wheel rim and bearing beam is the same at each end of one bearing beam to within ¼". A small amount of racking can be compensated for by adjusting the diameter seals. If dimensions A and 8 in the following figure differ by more than ¼", racking must be corrected to ensure that the drive belt will not disengage from the wheel.

Bearing beam racking of as little as .040" on a 74" diameter wheel causes the wheel to tilt 3/16" at the rim.



Avoid Racking of Cassette Frame

When lifting larger cassettes, ensure the provided lifting holes in the bearing beams are used as shown in the figure below.



Lifting Hole Locations

Diameter Seals

Diameter seals are adjusted at the factory when the wheel is in the vertical position. Cassettes installed at angles greater than 30° from vertical may require seal readjustment. A final check of seal adjustment is recommended for all designs.

Wheel Drive Motor

Cassettes provided with single phase PSC wheel drive motors include the capacitor. Single phase motors may be pre-wired at the factory with a three pin Amp connector. The motor is designed to rotate clockwise when viewed from the pulley side.

Three phase wheel drive motors are provided with a junction box and optional cord/connector. Motors may be pre-wired at the factory upon request. Wiring diagrams are provided with each motor. When wired according to the wiring diagram, the motor rotates clockwise when viewed from the pulley side.

3-phase motors must be wired according to the wiring diagram to assure clockwise rotation or the wheel.

Frost Control

Frost control is required in extremely cold climates to preserve performance and assure the continuous supply of outdoor air. Enthalpy wheel frost control strategies take advantage of inherently low frosting thresholds.

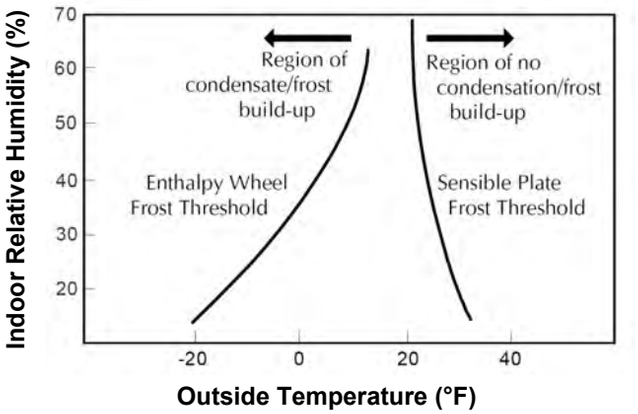
Enthalpy wheels have inherently low frosting thresholds.

This results in minimized energy use and maximized design load reductions.

Frost Threshold

Frost formation causes reduction of airflow through the heat exchanger. Without frost control, energy recovery and airflow may be significantly reduced.

The *frost threshold temperature* is the point at which frost begins to accumulate on heat exchanger surfaces. It is a function of both outside temperature and indoor relative humidity. The following figure compares the frost threshold of a plate-type sensible heat exchanger with that of an enthalpy wheel.



Frost Thresholds: Enthalpy Wheels vs. Heat Exchangers

Note that while frost forms at between 22° F and 30° F in a plate-type exchanger, frost thresholds for enthalpy wheels are generally 20 to 30 degrees lower. This is because the enthalpy wheel removes water from the exhaust air stream, effectively lowering the dew point of the exhaust. The water removed is subsequently picked up through desorption, re-evaporation or sublimation by the entering outdoor air.

Economic Impact of Enthalpy Recovery

Depending on the indoor R.H. in areas where winter outside temperatures are between -5° F and 22° F, enthalpy wheel components have a significant advantage over sensible plate type units because...

No added cost for frost control is required.

Even in colder areas, in most cases, enthalpy wheel systems for schools and office buildings can be designed without frost control because most of the frosting hours are at night when the building is unoccupied. Bin data, such as that provided by ASHRAE or AIRX ERC performance modeling software, can be consulted to qualify daytime applications in cold climates for frost-free operation.

The following table lists typical frost threshold temperatures for Airxchange ERV wheels over a wide range of indoor air temperatures and relative humidities. Frost control is not required until outdoor air temperatures are below the threshold.

Indoor Air R.H. %	Indoor Air Dry Bulb Temperature			
	70° F	72° F	75° F	80° F
20	−14	−13	−11	−8
30	−3	−2	−1	3
40	5	7	9	11
50	12	13	15	18
60	18	19	21	26

Frost Threshold Temperatures

Frost Control Designs

In regions of extreme winter temperatures, Airxchange ERV components are utilized effectively with specific frost control techniques, such as:

- *Preheat* frost control, a universally applicable strategy which meets all design requirements.
- *Variable effectiveness*, which can be used to advantage certain applications. This method includes both bypass and speed control.
- On/Off (timed cycle)
- Exhaust Only

Enthalpy Wheel Cleaning

Over time, build up of material on energy transfer surfaces reduces latent energy transfer and airflow. Because of this, periodic cleaning is generally required to maintain building moisture control and to supply required ventilation rates.

Cleaning Needs

Tar and oil based aerosols condensing on desiccant surfaces eventually closes off micron-sized pores, reducing the efficiency with which the desiccant can transfer moisture. This material, which does not adversely affect sensible heat transfer, can only be removed by washing with water and a detergent.

"Sticky" material that builds up on the face of the parallel plate energy transfer matrix, can bridge the narrow opening between the parallel plates so as to reduce airflow. This material can be removed with a brush, vacuum or flat bladed scraper.

Self-Cleaning

Particles small enough to enter the energy transfer matrix will pass through. Larger particles attempting to enter are blown clear as the wheel rotates into the counter-flowing airstream.

Cleaning Frequency

Because of the self cleaning characteristics for dry particles, the presence of oil and tar based aerosols in the air being supplied or exhausted will be the major factor determining the need and frequency for cleaning. Other factors are climate and operating schedule.

Desiccant is not lost in the washing process.

Use the following guidelines and initial annual inspections to establish an appropriate cleaning schedule:

- In normal indoor environments of schools, office buildings, or homes, reductions in airflow or effectiveness may not occur for five to ten years.
- In commercial, institutional, and residential applications with moderate occupant smoking, measurable changes in latent energy (water vapor) transfer and some loss of airflow can occur in less than five years.
- In applications of unusually high levels of occupant smoking, such as lounges, nightclubs, bars and restaurants, latent effectiveness may be severely reduced in less than one year without loss of airflow.
- In industrial applications, such as welding and machine, which ventilate high levels of smoke or oil-based aerosols, a three to six month washing cycle may be required.
- In all applications, loss of indoor moisture control during the cooling season could indicate the need to clean enthalpy wheels.

About Airflow

Materials blocking airflow entry to the energy transfer matrix can readily be removed in the dry state by vacuum or by scraping with a flat blade while the energy transfer matrices remain in the wheel within the air moving cabinet. However, removal of oil and tar based coatings requires washing with water and alkaline based coil cleaners.

About Moisture Transfer

Restoration of latent effectiveness to near original performance only requires soaking in a water and detergent solution to loosen deposited tars and oils, followed by a rinse. Because removal of desiccant during the cleaning process would cause permanent loss of latent effectiveness, Airxchange wheels feature silica gel desiccant permanently bonded to the heat exchange surface without adhesives. The permanent nature of the bond between the substrate and desiccant is readily demonstrated by the inability to rinse, soak, scrub, or otherwise remove desiccant from its substrate.

About Removable Segments

To facilitate washing, all energy transfer wheels 25" in diameter and larger are made with energy transfer segments that are removable in minutes without the use of tools. Depending on wheel size, individual segments weigh between 4 and 23 pounds. Easily handled, removed segments and small wheels can be washed on site or at a remote location.

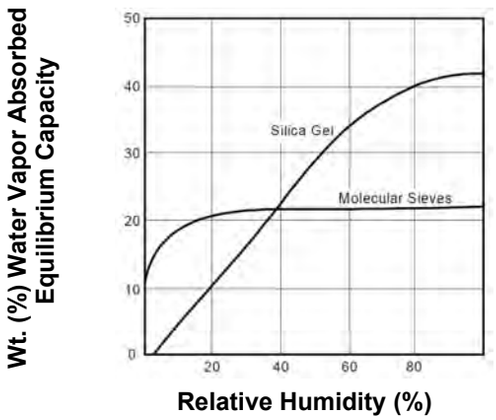
Silica Gel Desiccant

What is it?

Silica gel is a highly porous solid adsorbent material that structurally resembles a rigid sponge. It has a very large internal surface composed of myriad microscopic cavities and a vast system of capillary channels that provide pathways connecting the internal microscopic cavities to the outside surface of the sponge. Silica gel enthalpy wheels transfer water by rotating between two air streams of different vapor pressures. The vapor pressure differential drives water molecules into/from these cavities to transfer moisture from the more humid air stream to the drier airstream.

Adsorption: Silica Gel vs. Molecular Sieve

The following figure shows the characteristic curve for adsorption of water on silica gel. It shows the percent weight adsorbed versus relative humidity of the air stream in contact with the silica gel. The amount of water adsorbed rises linearly with increasing relative humidity until R.H. reaches near 60%. It then plateaus at above 40% adsorbed as relative humidity approaches 100%. For contrast, the curve for molecular sieves rises rapidly to plateau at about 20% adsorbed at 20% R.H.



Effect of Relative Humidity on Desiccant Capacity

The graph above explains the following application considerations:

- Molecular sieves are preferred for regenerated applications such as desiccant cooling and dehumidification systems that must reduce processed air streams to very low relative humidities.
- Silica gel has superior characteristics for recovering space conditioning energy from exhaust air and handling high relative humidity outside conditions. Another key point is that the transfer of water by absorption/desorption is not dependent on temperature. Thus, the silica gel enthalpy wheel works to reduce latent load at difficult part-load conditions.

Purge

Purge removes exhaust air that would be otherwise carried to the supply air stream by the rotating wheel matrix. Outdoor air is used to clean or purge the wheel matrix before it rotates from the exhaust air stream to the supply air stream. The driving force for the purge stream is the pressure differential between the outdoor air and return air compartments adjacent to the wheel. Purge is accomplished by utilizing the wheel matrix or by mechanical means.

Two Choices of Purge Technology

Airxchange offers two distinct technologies to support the purge process:

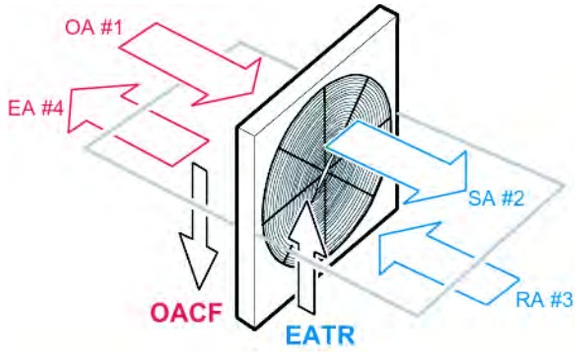
- Through-Matrix Purge using Standard Matrix components
- Channel Matrix with optional Mechanical Purge

Design Considerations

If purge is desired, the design considerations include:

- Use of outdoor air to flush carryover through the open matrix
- Adjusting fans and pressures so that any seal leakage is from supply to exhaust
- Ensuring that pressures are not excessive resulting in wast- ed fan energy

The following diagram defines the terminology of airflow for consideration of purge:



Airflow Configuration Convention

- EATR (%) is composed of carryover leakage resulting from the rotation of the wheel from Return air to Supply air and any seal leakage in that direction, minus the impact of purge. Purge airflow removes return air from the wheel volume before it enters the supply side of the component.

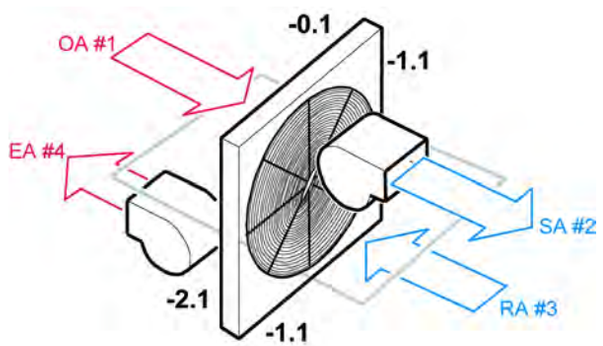
- Outdoor Air Correction Factor (OACF) is the difference in airflow measured between OA and SA, presented as a ratio. The OACF includes air lost through purge and leakage from the outdoor air stream to the exhaust stream. Accordingly, OACF is used to size the fans.

Through-Matrix Purge

This technology employs the Airxchange standard energy transfer matrix. It is well suited for comfort applications where EATR values of 4% to 6% are acceptable.

The performance of through-matrix purge is competitive with mechanical purge sectors supplied with fluted wheels, how- ever, through-matrix purge is less expensive and simpler for most field applications. Effective purge yielding an EATR of 1% or less can be achieved with through-matrix technology when- ever static pressure differences are positive from supply to exhaust on both sides of the wheel. By making best use of system characteristics and fan placement, EATR (cross-leakage) can be held to 1% or less.

For example, in the draw-thru, draw-thru configuration shown below, where all static pressures are negative, nominal wheel delta P is 1" on both sides.



Compartment Pressures to Achieve Effective Purge

Typical data for standard wheels with through-matrix purge is given in the following table which indicates that in order to obtain less than 1% EATR, as much as 14% of the flow entering the outdoor air hood will be used to purge the matrix and seals into the exhaust compartment. To achieve this, the exhaust fan must be sized to result in 114% of normal flow.

OA to EA (Delta P in. w.g.)	SA to RA (Delta P in. w.g.)	OACF Ratio	EATR %
1.0	-1.0	1	6.5
1.5	-0.5	1.06	3.2
2.0	0.0	1.14	0.6
2.5	0.5	1.20	0.1
3.0	1.0	1.24	0
4.0	2.0	1.32	0

Purge Data Comparison

The values shown in the table above and the next table (mechanical purge) differ slightly from wheel size to wheel size due to wheel geometry. In general, larger wheels and thinner wheels will see smaller leakage as a percentage of design flow. Data for specific wheels is located in Performance Data beginning on page 27.

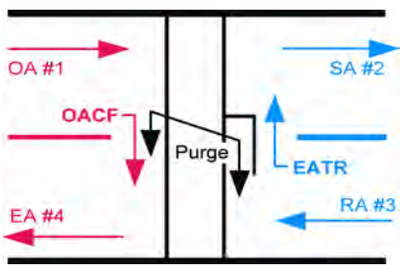
Channel Matrix with Mechanical Purge

Airxchange channel matrix technology is the option of choice to limit excessive leakage of air in critical higher pressure applications. Channel technology results in greater energy savings throughout the system. These designs require a mechanical purge if it is necessary to minimize the impact of carryover of exhaust air. This is a wedge-shaped sector that captures and redirects the supply air to the exhaust side.

In summary, channel matrix designs:

- Limit excessive leakage of air and limit resulting additional fan energy requirements in high differential pressure applications
- With adjustable purge, limit EATR (exhaust air transfer, or cross-leakage) to less than 1% in sensitive applications over a wide range of pressure differentials

The following diagram defines airflows and delta P:



Airflows with Mechanical Purge

The driving forces for OACF and purge are provided by the plenum pressures in the wheel compartment and adjusted by system and component pressure loss and fan placement.

EATR of 1% or lower can be provided whenever pressures are positive from supply to exhaust on both sides of the wheel. The table below represents sample application performance data based on tracer gas testing and airflow measurements obtained in laboratory testing. Purge Angles for EATR < 1% and minimum OACF are shown in the table on the next page:

OA to EA (Delta P in. w.g.)	SA to RA (Delta P in. w.g.)	Purge Angle	OACF Ratio	EATR %
1	−1	15°	1	>>1
1.5	−0.5	15°	1.06	1.60
2.0	0.0	3.3°	1.055	0.996
2.5	0.5	1.8°	1.073	0.991
3.0	1.0	1.1°	1.086	0.991
4.0	2.0	0.4°	1.107	0.994

Mechanical Purge Data Comparison

Equations for Energy Recovery System Design

Fan capacity and the various ratios can be calculated manually using the following equations, or by using the Airxchange Performance Modeling Software. For definitions of the terminology used in these equations, refer to the Airflows with Mechanical Purge figure on the previous page of this catalog.

- To size a draw-thru fan at location #2:
  Required Fan CFM =
  Desired Outdoor Air CFM (1 + EATR)

- To size a blow-thru fan at location #1:
  Required Fan CFM =
  Desired Outdoor Air CFM (1 + EATR) (OACF)

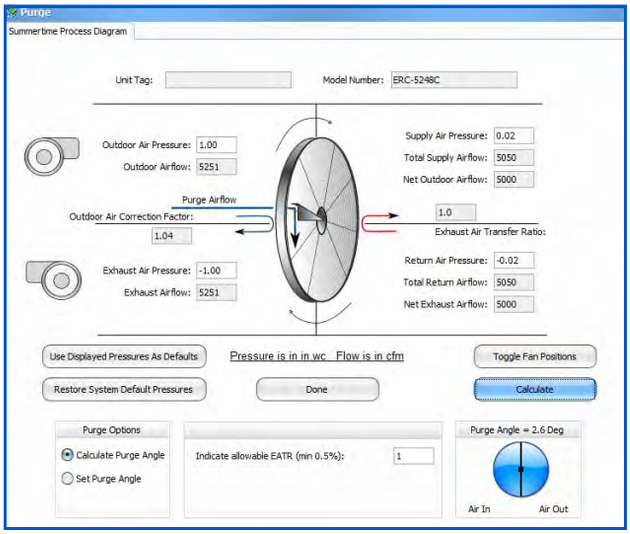
- To size a draw-thru fan at location #4:
  Required Fan CFM = Desired Exhaust CFM +
  Required CFM at location #1 - Desired CFM at #2

- To correct the outdoor airflow measurement at the outdoor air hood (all arrangements):
  Measured Outdoor Air CFM =
  Desired Outdoor Air CFM (1 + EATR) (OACF)

Performance Modeling Software

Airxchange software models the purge system parameters to simplify the design process. For any desired outdoor airflow and set of operating pressures, airflows in all four plenums, EATR, and OACF are provided by the model. Fan size can now be calculated using this information.

An example of a Purge System Diagram developed from the modeling software is shown here.



Purge System Diagram

Fungal Growth and Moisture Transfer

Water Transfer

In Airxchange silica gel-based desiccant wheels, the water molecules are individually transferred by absorption to and from the silica gel surfaces. Water is present on the wheel in a molecular layer only, and condensation does not occur. Thus, these wheels experience dry moisture transfer. There is no bulk liquid water present that could support fungal growth or dis- solve other chemical species. Water transfer to and from the wheel's desiccant surfaces occurs in the vapor phase. There are no wet surfaces and liquid water does not enter the air stream. Silica gel is also highly selective for water, based on the strong preference of the gel surface for the dipolar water molecule over other compounds.

The sensible, non-desiccant coated Airxchange wheel can transfer water through a mechanism of condensation and re-evaporation. However, there is no accumulation of water, unless the frost threshold is violated through misapplication of the component. In this case, the water is in the form of frost or ice, which does not support fungal growth. Sensible, uncoated wheels from all manufacturers are identical in this regard.

Field Experience

Airxchange has over 250,000 wheels in the field, including both desiccant and sensible varieties in a broad range of applications, without a single reported instance of mold or fungal growth on the wheel. Airxchange enthalpy wheels play a primary role for the control of moisture in buildings. In many cases, Airxchange wheels and ERV units have been installed successfully for the purpose of correcting mold and fungal growth problems resulting from inadequate ventilation and excessive humidity levels.

Airxchange enthalpy wheels play a primary role in the control of moisture in buildings.

Fire and Electrical Safety

All Airxchange products have carried the UL label since first manufactured in 1981. Currently Airxchange energy recovery cassettes are UL Recognized Components under UL Standard 1812, Ducted Heat Recovery Ventilators. UL's follow up services program assists our ongoing compliance with these standards.

Part of the UL investigation for listing under Standards 1812 involves an evaluation of the fire safety of the heat wheel matrix. Airxchange wheels are subjected to the UL 900 fire test for air filter units. This test evaluates both flammability and smoke density under operating conditions simulating actual use in an air stream. Airxchange wheels easily surpass the criteria established for widely used Class 2 filters. Therefore, Airxchange products are accepted for installation in accordance with NFPA 90A by virtue of their UL listing for safety and their UL 900 test results for flammability and smoke density.

Copies of the Airxchange UL Listing Card are available on request.

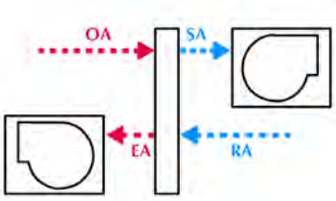
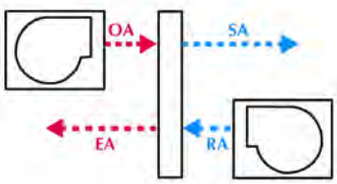
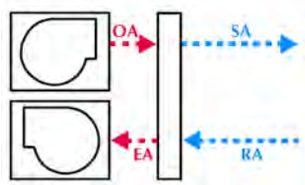
Application Considerations

As a supplier of ERV components to OEM HVAC manufacturers, Airxchange cites the following application considerations for the engineer.

Industrial Processes	• Cross-transfer of pollutants from exhaust to supply air. • Operational temperature range required. • Ability to clean the pollutants from the exhaust air stream that deposit on the wheel. • Do not use energy recovery from fume hood exhaust.
Print Shops	• Do not use energy recovery from the print head exhaust. • An ERV may require supplementary heating and dehumidification to control the space humidity to tolerances required for paper based products. • Regular cleaning to keep latent performance at factory original levels is suggested.
Swimming Pools	• A properly sized pool dehumidifier in addition to a sensible or latent recovery wheel is required to control indoor relative humidity in pool spaces. • The exhaust air contains chlorine molecules that will combine with condensate on cool surfaces to create mild solutions of hydrochloric acid. Metal parts should be coated or chosen for resistance to corrosion. • Pools must be ventilated to at least ASHRAE minimums 24 hours a day to avoid chlorine build-up. • Frost control for low temperature operation at higher humidities should be considered. ASHRAE design conditions for the pool deck are 80° F and 60% R.H.
Ice Rinks	• Ventilation air must be dried and pretreated to keep indoor relative humidity below the dew points at ice levels on the rink. • Enthalpy wheels are recommended for controlling the introduction of humidity from the outdoor air. • Ventilation can be staged for occupancy, but allowance must be made for the operation of gas-fired Zamboni ice machines during low occupancy. • Frost control is rarely required due to the dry nature of exhaust air.
Hospitals	• Enthalpy recovery wheels are acceptable for ventilation in common use areas such as patient rooms, waiting areas, and hallways. • Operating rooms and labs may need to avoid the possibility of even the slightest cross-transfer of exhaust to supply. Most hospital ventilation codes require final filters and separation of intake and exhaust. • Wheels must be regularly cleaned and maintained to assure the highest supply air quality. • Ventilation is a 24/7 requirement, so provision for low temperature operation (frost control) must be considered in cold climates.
Nursing Homes	• Odor generation mandates ventilation rates at or above those listed in • ASHRAE Standard 62. • Enthalpy recovery assists with humidity control, which is important for occupant comfort and health. • Frost control is required in many cold climates. • Special laboratory or infectious disease areas should have dedicated exhausts.

Correctional Facilities	• Odor generation mandates ventilation rates at or above those listed in ASHRAE Standard 62. • 24/7 operation requires low temperature (frost) operational controls in many cold climates. • The possible need to control infectious disease, particularly tuberculosis, requires applications care and may require final filters.
Toilet Exhaust	• ASHRAE Standard 62 Addendum Y classifies air and the use of bathroom exhaust when used in an energy recovery system. Class 2 air (bathrooms) may be re-designated as Class 1 air (office space, classrooms, corridors, common areas) in the process of recovering energy when it is diluted with outdoor air such that no more than 10% of the resulting air stream is Class 2 air. • Consider additional exhaust to balance flows when using energy recovery. • Make-up air for toilet exhaust is generally provided by transfer air from surrounding spaces. • The mixing of toilet exhaust with space ventilation exhaust is acceptable for systems where cross-transfer is limited to 10% or less of the exhaust air stream.
Hospitality/Smoking	• Control and separation of smoking and non-smoking areas presents design challenges as does kitchen ventilation from grills, fryers, and ovens. • Where smoking is allowed and exhausted through an enthalpy recovery wheel, thorough cleaning every 90 days is highly recommended to avoid buildup of tars and nicotine on the surface of the wheel. • Supply air coming through a wheel that has smoking room exhaust must always be supplied back to the smoking space. It should not be supplied to non-smoking areas due to concerns for odor transfer. Space conditioning should be provided separately, as well.
Retail	• Retail ventilation is important to minimize the concentration of chemicals in the space due to clothing dyes, paint, and formaldehyde from products and furnishings. • Significant savings in ventilation costs are available due to long hours of operation. • Cross-transfer of pollutants is not an issue, nor is the mixing of toilet and space exhaust for recovery purposes. • Frost control should be considered in colder climates.
General	• Observe care in siting the supply air intake of the energy recovery ventilator. Avoid the possibility of direct transfer of exhaust air back into the space. • Avoid placing plumbing and bathroom vents near supply air intakes. • Avoid placing kitchen exhaust near outdoor air supply intakes. • Never use rotary enthalpy recovery on contaminated exhausts from laboratory hoods. • Never use rotary enthalpy wheels on paint booth exhaust. • Never use rotary enthalpy wheels on direct exhaust of automobile engines, or diesel exhausts.

Fan Placement

Configuration	Description		
	Advantage	Cautions	Remedy
Draw-Thru Supply/Draw-Thru Exhaust 	• Good airflow distribution across the wheel • Minimal cross-transfer • Most energy efficient use of fans	Cross-transfer direction depends on delta P	Design the system so static pressure in both chambers is nearly equal
Blow-Thru Supply.Blow-Thru Exhaust 	Minimal cross-transfer	• Cross-transfer direction depends on delta P • Turbulence between fan and wheel increases energy use over draw-thru configurations	Design the system so static pressure in both chambers is nearly equal.
Blow-Thru Supply/Draw-Thru Exhaust 	Good for minimizing cross-transfer between exhaust and supply	OACF will be higher with standard matrix wheels	Design the system so static pressure in both chambers is nearly equal.
Draw-Thru Supply/Blow-Thru Exhaust 	**No Advantage - DO NOT USE**	• Significant transfer of exhaust air • Significant waste of fan energy	No Advantage

Unequal Flows of Exhaust and Outside Air

When outdoor air and exhaust airflows are equal at the AHRI rated condition, the system is balanced and energy recovery effectiveness is equal for both flows. This results in maximum recovery effectiveness of the entire ventilation system.

As shown in the adjacent graph, when the airflows are unequal, the effectiveness of the higher airflow decreases while that of the lower airflow increases. This building system imbalance is made up by infiltration or ex filtration having an energy recovery effectiveness of 0%. Thus, unbalanced flow reduces the benefit of energy recovery for the building system. The effect of unequal airflow on efficiency is potentially significant and can be calculated, as follows.

1. ***Determine the Flow Ratio.***

   Flow Ratio = CFM_{min} / CFM_{max}

2. ***Use the adjacent graph to find the effect on effectiveness by locating the flow ratio value on the X-axis and drawing a vertical line from that point. ε_{max} will be the lower line and ε_{min} will be the upper line.***

   Example:

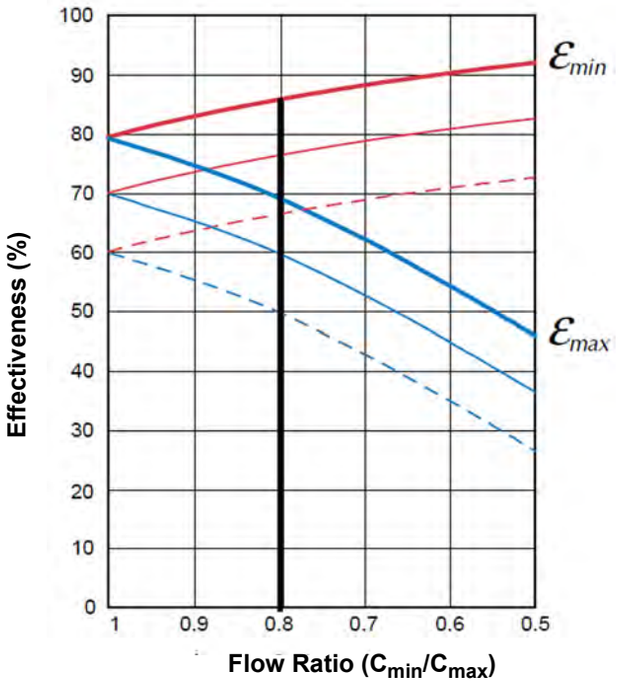
   Outdoor air = 5000 CFM; Exhaust Air = 4000 CFM

   For a flow ratio of 4000 CFM / 5000 CFM = 0.8, the adjacent figure results in:

   ε_{max} = 12% lower and ε_{min} = 6% higher.

The performance modeling software automatically calculates performance for unbalanced flow conditions.

Thus, if base effectiveness for the system is 80%, these unequal flows result in ε_{max} = 68% and ε_{min} = 86%.



Impact of Unequal Flows on Effectiveness

Wheel Motor Location

Airxchange recommends that the wheel drive motor always be located on the *indoor* or *building side* of the exhaust air stream. For air handling applications, the exhaust air stream is typically located above the supply air stream. In this application, we recommend that the motor be located on the *indoor* or *building side* of the supply air stream.

Airxchange will supply the cassette with the motor in either location, as requested.

Performance Selection and Calculations

Manual Cassette Selection

Since the objective of Energy Recovery Ventilation is to pre-treat the outdoor air, the initial known parameter is the OA CFM. Using the CFM and desired effectiveness, consult the Performance Data tables beginning on page 24 to select the cassette and to obtain the pressure drop, and the sensible, latent and total effectiveness. To assist this process, the Airxchange model number provides information on the nominal maximum flow at 60% to 70% total effectiveness and 0.75 to 1" pressure drop depending on matrix selection.

Example:

Outdoor Airflow rate = 5000 CFM

- For a 3" cassette, using Performance Data beginning on page 27; the appropriate selection is ERC-5248 on page 32.
- The first two digits designate the wheel diameter and the last two digits are the nominal CFM in hundreds.

  Thus:

  ERC-5248 indicates a 52" cassette, with nominal airflow of 4800 CFM.

Selection Guidelines

The Airxchange computerized performance modeling and selection program is the easiest and most accurate method of selecting cassettes for use in OEM systems. However, to reduce the amount of trial and error, this section provides some selection guidelines and performance trade-offs to help you gain an intuitive sense of the various relationships between the performance parameters.

1. ***The first parameter determined when a designer is selecting a cassette for incorporation into a unit design is the maximum OA CFM.***

2. ***The matrix design selection is the next step.***
   a. Standard
      This matrix is used primarily in accessories, DX packaged units or stand-alone Energy Recovery Ventilators when the fans are in the draw-thru/draw-thru positions with relatively low differential pressures.
   b. Channel matrix is used primarily in Air Handling Units (AHU) where the fan placement is variable and the differential pressures can be large. It is also used with optional mechanical purge when carry-over (EATR) is required to be < 1% while minimizing fan energy. Available only in 3" thickness.

3. ***Now consider the wheel geometries.***
   This is where the cost/performance trade-offs are addressed. The geometries and their general effects are shown in the Wheel Geometry Trade-offs table below. Note that for a given wheel size, the nominal CFM decreases as the open face area decreases. For example, 6488 to 6475 indicates decreasing open face area for the 3" depth, 64" diameter wheel.

Parameter Affected	Wheel Thickness *1" to 3"*	Wheel Diameter *Small to Large*	Open Face Area *Less to More*
Airflow	Increase	Increase	Increase
Effectiveness	Increase	Increase	Decrease
Pressure Drop	Decrease	Decrease	Decrease
$/BTUH	Decrease	Decrease	Decrease

Wheel Geometry Trade-Offs

4. ***Other factors to consider to determine final unit $/BTUH cost:***
   a. Fan sizing and BHP due to OACF/EATR
   b. Other pressure losses resulting from package features
   c. OA airflow as a percentage of total supply CFM
   d. $/BTUH saved vs $/BTUH first cost

Performance Calculations

After the cassette has been selected, the performance information may be used to determine the various state conditions. The balanced flow equations to use are as follows:

- *Dry-bulb Temperature:*
  Cooling: Tsa = Toa - ε_S x (Toa - Tra)
  Heating: Tsa = Toa + ε_S x (Tra - Toa)

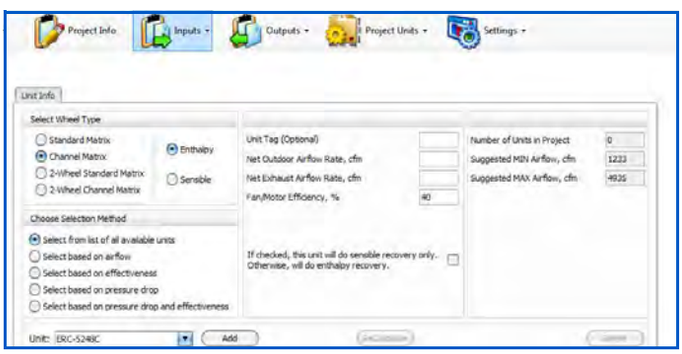
- *Humidity Ratio:*
  Cooling: Wsa = Woa - ε_L x (Woa - Wra)
  Heating: Wsa = Woa + ε_L x (Wra - Woa)

- *Enthalpy:*
  Cooling: Hsa = Hoa - ε_T x (Hoa - Hra)
  Heating: Hsa = Hoa + ε_T x (Hra - Hoa)

- *Where:*
  T = Dry-bulb Temperature
  W = Humidity Ratio
  H = Enthalpy
  oa = Outdoor Air
  RA = Return Air
  SA = Supply Air
  ε_S = Sensible Effectiveness
  ε_L = Latent Effectiveness
  ε_T = Total Effectiveness

Performance Modeling Software

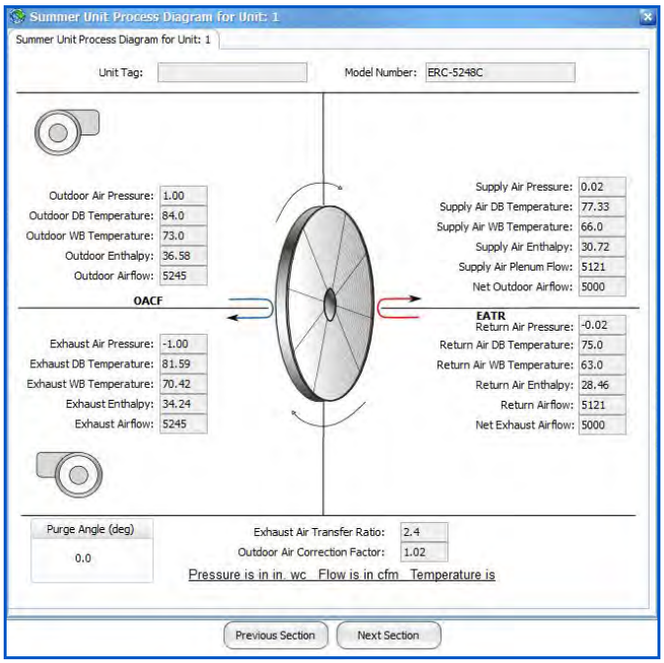
The preferred method of selection and modeling of the performance (which also provides the economic analysis) is the Airxchange Performance Modeling Software, AIRX. This pro- gram allows the OEM designer to specify cassette selection based on various parameters. AIRX Inputs, shown below, is the initial selection screen.



Initial Input Selection Screen

System Modeling

A new feature is the ability to model the pressures and airflows (balanced and unbalanced) allowing the designer total flexibility while incorporating the Airxchange cassette into the design. This results in the system diagram shown below.



Unit Process Diagram

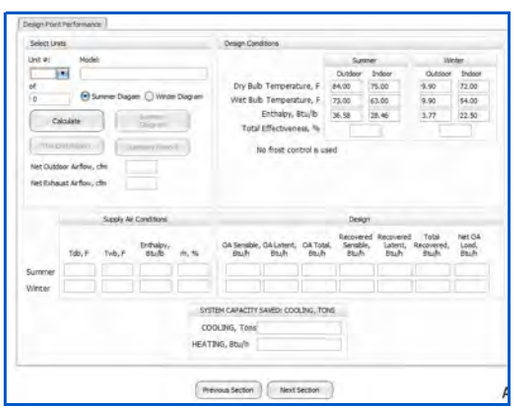
Performance and Economic Analysis

The program outputs provides:

- Leaving air conditions
- System size reduction, thus reducing first cost
- Energy savings analysis using weather bin data

Cost savings (net of blower power) using input utility rate

Using this information along with the designer's building load and equipment cost information allows for a complete payback or life-cycle cost analysis.

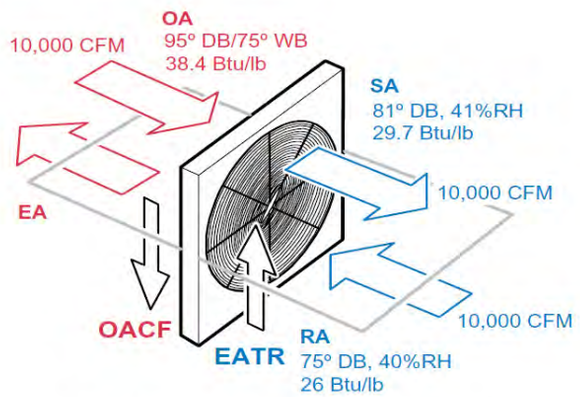


Design Point Output Screen

HVAC System Capacity Reduction

A significant benefit of enthalpy energy recovery is the ability to use it to reduce the size and cost of the chiller and boiler in a central system and that of the DX packaged unit in a distributed system. While it is optional to take advantage of the benefits in the central system, it is mandatory in the DX system to achieve proper control of humidity. If this is not done, the system becomes over-sized and could result in excessive moisture and occupant discomfort.

The following example shows the power of enthalpy in reducing the size of the central system components:

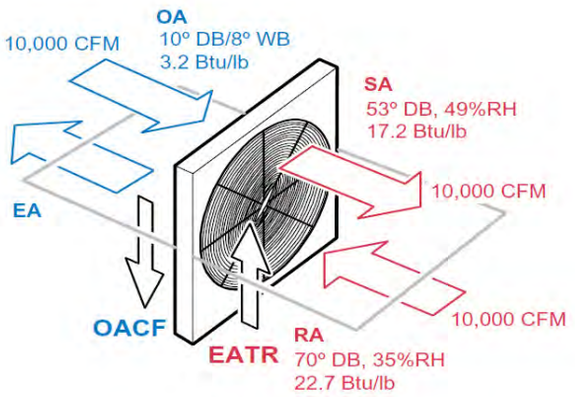


Capacity Reduction, Summer Cooling

Btuh = 4.5 x SCFM x (Hoa − Hsa)
= 4.5 x 10,000 x (38.4 − 29.7)
= 391,500 Btuh

Tonnage = 391,500/12,000
= 32.6 tons

Chiller Capacity Reduction



Capacity Reduction, Winter Heating

Btuh =4.5 x SCFM x (Hoa − Hsa)
=4.5 x 10,000 x (3.2 − 17.2)
=630,000 Btuh

Boiler HP =Btuh/33,470 Btuh/hp
=630,000/33,470
= 18.8 hp

Boiler Capacity Reduction

Series 36C and 41C - 3" Cassettes

Application Ratings

Series 36C
CFM: 1000 to 3900
Size: 40" by 40"

SCFM	ERC-3622 C					ERC-3628 C				
	Effectiveness (%)				ΔP (in.w.c.)	Effectiveness (%)				ΔP (in.w.c.)
	S	L	T Clg	T Htg		S	L	T Clg	T Htg	
1000	85.0	79.8	82.2	83.1	0.46					
1100	84.1	79.1	81.4	82.3	0.50					
1200	83.2	78.4	80.6	81.5	0.55					
1300	82.3	77.6	79.8	80.6	0.59					
1400	81.4	76.9	79.1	79.8	0.64	77.1	71.1	73.9	74.9	0.48
1500	80.5	76.2	78.3	78.9	0.68	76.1	70.2	73.0	74.0	0.51
1600	79.6	75.5	77.5	78.1	0.73	75.1	69.4	72.1	73.0	0.54
1700	78.7	74.7	76.7	77.2	0.77	74.1	68.5	71.1	72.1	0.57
1800	77.8	74.0	75.9	76.4	0.82	73.1	67.7	70.2	71.1	0.60
1900	76.8	73.3	75.1	75.5	0.86	72.1	66.8	69.3	70.2	0.63
2000	75.9	72.6	74.3	74.7	0.91	71.1	65.9	68.4	69.2	0.66
2100	75.0	71.8	73.5	73.8	0.96	70.1	65.1	67.5	68.3	0.69
2200	74.1	71.1	72.7	73.0	1.00	69.1	64.2	66.6	67.3	0.72
2300	73.2	70.4	71.9	72.1	1.05	68.1	63.4	65.7	66.4	0.75
2400	72.3	69.6	71.1	71.2	1.09	67.1	62.5	64.8	65.4	0.78
2500	71.3	68.9	70.3	70.4	1.14	66.1	61.6	63.9	64.4	0.81
2600	70.4	68.1	69.5	69.5	1.18	65.1	60.8	63.0	63.5	0.84
2700	69.5	67.4	68.7	68.7	1.23	64.1	59.9	62.1	62.5	0.87
2800						63.0	59.0	61.1	61.5	0.90
2900						62.0	58.2	60.2	60.6	0.93
3000						61.0	57.3	59.3	59.6	0.96
3100						60.0	56.4	58.4	58.6	0.99
3200						59.0	55.6	57.5	57.7	1.02
3300						58.0	54.7	56.5	56.7	1.05
3400						56.9	53.8	55.6	55.7	1.08
3500						55.9	52.9	54.7	54.8	1.11
3600						54.9	52.1	53.7	53.8	1.14
3700						53.9	51.2	52.8	52.8	1.17
3800						52.8	50.3	51.9	51.8	1.20
3900						51.8	49.4	50.9	50.8	1.23

Series 41C
CFM: 1400 to 4800
Size: 44" by 44"

SCFM	ERC-4128 C					ERC-4136 C				
	Effectiveness (%)				ΔP (in.w.c.)	Effectiveness (%)				ΔP (in.w.c.)
	S	L	T Clg	T Htg		S	L	T Clg	T Htg	
1400	83.8	78.8	81.2	82.0	0.52					
1600	82.3	77.7	79.9	80.6	0.59					
1800	80.9	76.5	78.6	79.3	0.66	76.5	70.6	73.4	74.4	0.50
2000	79.4	75.3	77.3	77.9	0.74	74.9	69.2	71.9	72.9	0.55
2200	77.9	74.2	76.1	76.5	0.81	73.3	67.8	70.4	71.3	0.59
2400	76.5	73.0	74.8	75.2	0.88	71.7	66.5	69.0	69.8	0.64
2600	75.0	71.8	73.5	73.8	0.96	70.1	65.1	67.5	68.2	0.69
2800	73.5	70.6	72.2	72.4	1.03	68.5	63.7	66.0	66.7	0.74
3000	72.0	69.4	70.9	71.0	1.10	66.8	62.3	64.6	65.2	0.79
3200	70.5	68.2	69.6	69.6	1.18	65.2	60.9	63.1	63.6	0.84
3400	69.0	67.0	68.3	68.2	1.25	63.6	59.5	61.6	62.1	0.88
3600						61.9	58.1	60.1	60.5	0.93
3800						60.3	56.7	58.7	58.9	0.98
4000						58.7	55.3	57.2	57.4	1.03
4200						57.0	53.9	55.7	55.8	1.08
4400						55.4	52.5	54.2	54.2	1.13
4600						53.7	51.0	52.7	52.7	1.18
4800						52.1	49.6	51.2	51.1	1.22

Rated in Accordance with AHRI Standard 1060.

AHRI Certified Ratings

Series 36C

Nominal Airflow (scfm)	2200
Net Airflow (scfm)	2200

Effectiveness

SCFM	Effectiveness (%)			ΔP (in.w.c.)
	S	L	T	
Heating Conditions				
100%	74	71	73	1.00
75%	79	75	78	
Cooling Conditions				
100%	74	71	73	1.00
75%	79	75	77	
Net Effectiveness				
Heating Conditions				
100%	74	71	73	1.00
Cooling Conditions				
100%	74	71	73	1.00

Delta P	EATR	OACF	Purge Angle
0.00	2.4	1.03	0.0
0.50	0.8	1.07	2.0
1.00	0.9	1.08	1.0

2600
2600

Effectiveness

Effectiveness (%)			ΔP (in.w.c.)
S	L	T	
65	61	64	0.85
72	66	70	
65	61	63	0.85
72	66	69	
65	61	64	0.85
65	61	63	0.85

EATR	OACF	Purge Angle
2.1	1.03	0.0
0.9	1.05	1.0
0.6	1.07	1.0

Series 41C

Nominal Airflow (scfm)	2700
Net Airflow (scfm)	2700

Effectiveness

SCFM	Effectiveness (%)			ΔP (in.w.c.)
	S	L	T	
Heating Conditions				
100%	74	71	73	1.00
75%	79	75	78	
Cooling Conditions				
100%	74	71	73	1.00
75%	79	75	77	
Net Effectiveness				
Heating Conditions				
100%	74	71	73	1.00
Cooling Conditions				
100%	74	71	73	1.00

Delta P	EATR	OACF	Purge Angle
0.00	3.0	1.03	0.0
0.50	0.8	1.07	3.0
1.00	0.8	1.08	2.0

3200
3200

Effectiveness

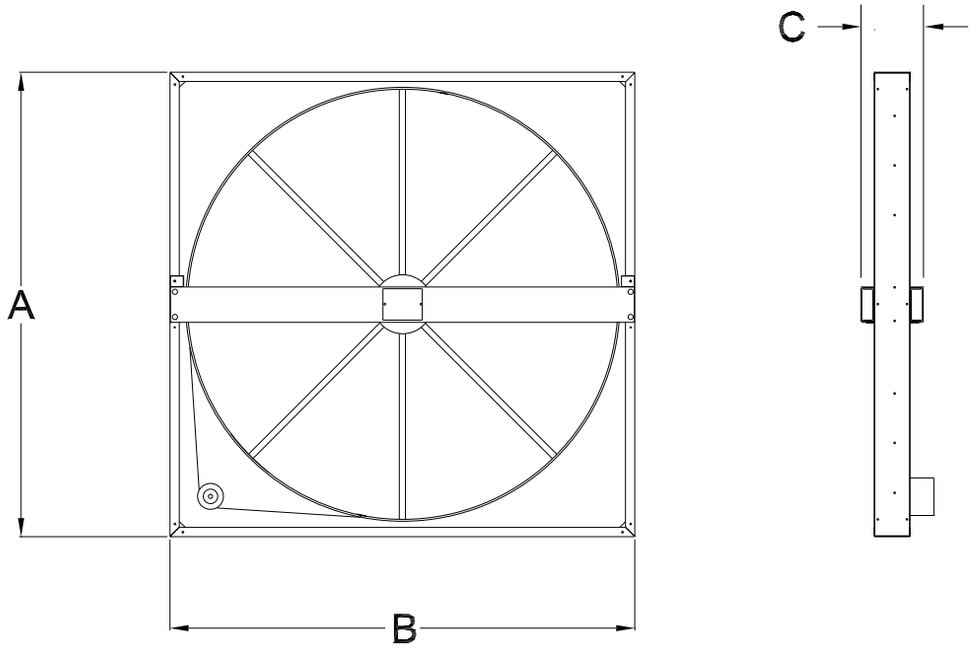
Effectiveness (%)			ΔP (in.w.c.)
S	L	T	
65	61	64	0.85
72	66	70	
65	61	63	0.85
72	66	69	
65	61	64	0.85
65	61	63	0.85

EATR	OACF	Purge Angle
2.5	1.02	0.0
0.7	1.06	2.0
0.8	1.06	1.0

Ratings certified in accordance with the AHRI Air-to-Air Energy Recovery Ventilation Equipment Certification Program, which is based on AHRI Standard 1060-2000.

1. ***Performance Data is based on balanced flow.***
2. ***Pressure loss is shown for standard air. The performance modeling software should be used to obtain thermal performance and pressure loss at actual CFM.***

Segmented Cassettes



Series	Wheel Depth	# of Models	Dimensions (inches)			Max. Weight	Wheel Type
			A	8	C		
ERC-25	3"	2	29	29	7.0	36	Segmented
ERC-30	3"	2	34	34	7.0	61	Segmented
ERC-36	1.5"	2	39.82	39.82	7.0	80	Segmented
ERC-36	3"	4	39.82	39.82	7.0	118	Segmented
ERC-41	3"	4	44	44	7.5	170	Segmented
ERC-46	3"	4	50	50	7.5	185	Segmented
ERC-52	1.5"	2	56.19	56.19	7.5	188	Segmented
ERC-52	3"	4	56.19	56.19	7.5	220	Segmented
ERC-58	1.5"	1	62.42	62.42	8.5	290	Segmented
ERC-58	3"	4	62.42	62.42	10.2	320	Segmented
ERC-64	3"	4	68	68	10.2	344	Segmented
ERC-68	3"	4	72	72	11.2	408	Segmented
ERC-74	3"	4	78	78	11.2	454	Segmented
ERC-81	3"	2	85	85	13.1	580	Segmented
ERC-86	3"	2	91	91	13.1	656	Segmented

Standard and Alternate Electrical Data

ERC-25 thru ERC-30							
Motor Code	Voltage	Phase	HZ	Amps	RPM	HP	DUTY
01	115	1	50/60	0.7	1050	N/A	STD
02	208-230	1	50/60	0.3	1050	N/A	STD
12	200-230	1	50/60	0.3	1050	N/A	STD

ERC-36							
Motor Code	Voltage	Phase	HZ	Amps	RPM	HP	Duty
01	115	1	50/60	0.76	825	1/20	STD
03	200/208-230	1	50/60	0.6	825	1/20	STD
04	200-230/460	3	60	0.7-0.88/0.44	1140	1/6	INV
05	200/400	3	50	0.7/0.44	1140	1/6	INV
06	575	3	60	0.46	1140	1/6	INV
07	460	1	60	0.25	825	1/12	STD
08	380//380	3	50//60	0.5//0.44	1140	1/6	INV
12	200-230	1	50/60	0.6	825	1/20	STD

ERC-41 thru ERC-52							
Motor Code	Voltage	Phase	HZ	Amps	RPM	HP	Duty
01	115	1	50/60	1.9	1075	1/6	STD
03	200/208-230	1	50/60	1.2	1075	1/6	STD
04	200-230/460	3	60	0.7-0.88/0.44	1140	1/6	INV
05	200/400	3	50	0.7/0.44	1140	1/6	INV
06	575	3	60	0.46	1140	1/6	INV
07	460	1	60	0.6	1075	1/6	STD
08	380//380	3	50//60	0.5//0.44	1140	1/6	INV
12	200-230	1	50/60	0.9	1075	1/6	STD

ERC-58 thru ERC-86							
Motor Code	Voltage	Phase	HZ	Amps	RPM	HP	Duty
01	100//115	1	50//60	5.0//4.3	720//850	1/4	STD
04	200-230/460	3	60	1.9-2.2/1.1	850	1/4	INV
05	200/400	3	50	1.9/1.1	850	1/4	INV
06	575	3	60	0.88	850	1/4	INV
08	380//380	3	50//60	1.1//1.1	850	1/4	INV
12	200-220//200-230	1	50//60	2.5-2.6//2.4-2.1	720//850	1/4	STD

ERC-92 thru ERC-110							
Motor Code	Voltage	Phase	HZ	Amps	RPM	HP	Duty
01	100//115	1	50//60	7.6//6.4	720//850	1/3	STD
04	200-230/460	3	60	2.0-2.25/1.1	850	1/3	INV
05	200/400	3	50	2.0/1.1	850	1/3	INV
06	575	3	60	0.9	850	1/3	INV
08	380//380	3	50//60	1.2//1.1	850	1/3	INV
12	200-220//200-230	1	50//60	3.8-4.1//3.4-3.2	720//850	1/3	STD

USES AIRXCHANGE STANDARD PRICED MOTOR

Series ERC-13 Through ERC-110

1. General Specifications.

The energy recovery cassette shall incorporate a rotary wheel in an insulated cassette frame complete with removable energy transfer media, seals, drive motor and drive belt.

Energy recovery wheel performance shall be AHRI 1060 certified and bear the AHRI certified label. Components that are independently tested or “rated in accordance with” shall not be acceptable. Manufacturer membership in AHRI is not an acceptable substitute. Certified components must be listed as active in the AHRI Directory. (www.ahridirectory.org)

The energy recovery cassette shall be an Underwriters Laboratory UR recognized component for fire and electrical safety and bear the UR symbol. Recognized components shall be listed in the UL directory. (http://database.ul.com)

The energy recovery cassette shall comply with NFPA 90A by virtue of UL standard 1812 and UL900 fire test for determination of flammability and smoke density.

The energy recovery cassette shall carry a 5-Year standard warranty on the entire cassette assembly (excluding the motor) from the date of shipment. Motors shall carry the manufacturers standard 18 month warranty from the date of manufacture.

2. Cassette Frame and Wheel Construction.

Cassette frame and structural components shall be constructed of G90 galvanized steel for corrosion resistance.

Wheel structure shall consist of a welded hub, spoke and continuous rolled rim assembly of stainless steel, and shall be self-supporting without energy transfer segments present.

Wheel structure shall be connected to the shaft by means of taper lock bushings.

Wheel bearings shall be permanently sealed and selected for a minimum 30 year L-10 life of 400,000 hours. Bearings requiring external grease fittings or periodic maintenance are not acceptable.

Standard cassette may be affixed within the cabinet in any orientation without the need for factory modification.

3. Energy Transfer Media

Energy transfer media shall be constructed of a durable synthetic lightweight polymer.

Media shall be wound continuously with one flat and one structural layer in an ideal parallel plate geometry. Airflow across heat exchanger surface shall remain laminar.

Energy transfer media shall not exceed 3” in depth.

Energy transfer media shall be suitable for use in corrosive, marine or coastal environments without the need for additional coatings.

Sensible only energy transfer media shall be constructed in the same fashion as the enthalpy transfer media with the exception of the desiccant coating process required for enthalpy wheels.

4. Coatings and Desiccant.

Desiccant shall be either silica gel or molecular sieve and permanently bonded to the energy transfer media without the use of binders or adhesives, which may degrade desiccant performance. Desiccants not permanently bonded are not acceptable due to potential delamination or erosion of the desiccant from the energy transfer media.

Desiccant shall be non-migrating nor shall it dissolve or deliquesce in the presence of water or high humidity.

Energy transfer media shall be capable of repeated washings without significant degradation of the desiccant bond as documented by an independent third party.

5. Removable Energy Transfer Segments.

Wheels 25" in diameter and greater shall be provided with removable energy transfer segments.

Segments shall be removable without the use of tools to facilitate maintenance and cleaning.

6. Seals.

All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set.

Seals shall be non contact nylon pile brush seal orientated in a labyrinth style configuration.

Diameter Seals shall be fully adjustable and easily accessible.

Perimeter seals shall be permanently mounted to the wheel rim and not require adjustment. Seals that mount to the frame are not acceptable.

7. Drive System.

The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box.

Three phase motors shall be suitable for use in both standard and inverter rated applications.

Wheels 52” and smaller shall use a urethane stretch belt for wheel rim drive without the need for external tensioners.

Wheels 58” and larger shall use a urethane non-stretch belt with integral cord and constant tensioner.

Wheel drive system shall not require periodic adjustment.

8. Maintenance.

Energy recovery segments shall be cleanable outside of the cabinet with detergent or alkaline coil cleaner and water.

Energy transfer segments shall be capable of submersion in a cleaning solution. Submersion shall be capable of restoring latent performance to within AHRI certified performance limits.

9. Purge.

A mechanical purge shall be available as an optional accessory as to avoid excessive fan power.

When required the mechanical purge sector shall be factory installed and field adjustable.

Purge settings shall be calculated using AHRI certified data and adjusted per the wheel manufacturers selection software.

Purge shall be capable of limiting Exhaust Air Transfer Ratio (EATR) values to 0.4% through proper fan and purge adjustment.

10. Options.

Double wall option shall be available to encapsulate all exposed insulation within the cassette frame.

Corrosion protection option shall consist of powder coating all exposed metals and inclusion of stainless steel bearings.

The powder coating shall have a minimum thickness of 2.0 mils and be rated for a 1,000 hour salt spray.

Specification Details are Subject to Change Without Notice

Due to the Airxchange Policy of continuous product improvement, specification for Energy Recovery Components are subject to change without notice.



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Johnson Controls

AYK 580 Air-Modulator

ENGINEERING GUIDE



1 - 75HP / (4.6 to 273 Amps) **208 - 240VAC**

1.5 - 150HP / (2.1 to 180 Amps) **380 - 480VAC**

2 - 125HP / (2.7 to 125 Amps) **515 - 600VAC**

Introduction

AIR-MODULATOR

Johnson Controls has led the HVAC industry in variable speed drive (VSD) technology since 1979 with the introduction of the Turbo-Modulator – the variable speed drive specifically designed for centrifugal chiller application. The Johnson Controls involvement in applying electronics to HVAC technology exceeds that of any other company either in the HVAC industry or the electronics industry. Since 1983, when the Air-Modulator was introduced, Johnson Controls has successfully applied thousands of these drives to fans, pumps, and cooling towers providing exceptional energy savings, high-reliability, and performance.

This Air-Modulator guide is intended as a reference to application and installation information for the HVAC design engineer. The content of this guide provides general theory of operation, application information, key design parameters, and complete specifications.

Why Variable Speed?

Centrifugal fans and pumps are commonly used in HVAC equipment. Because of their centrifugal design, any reduction in the speed at which the fan or pump operates causes a cubic reduction in the horsepower the motor requires. This is represented by the following equation:

$$\frac{(RPM_2)^3}{(RPM_1)^3} = \frac{(HP_2)}{(HP_1)}$$

EXAMPLE:

SPEED %	HP %
100%	100%
90%	73%
80%	51%
70%	34%
60%	22%
50%	13%
40%	7%
30%	3%

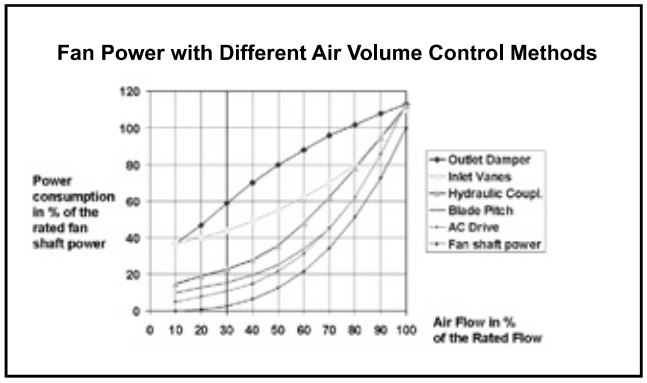
This shows that a 10% reduction in the RPM of the fan or pump results in a 27% reduction in horsepower required. Therefore, a means by which the RPM or speed of the fan or pump could be reduced would produce significant energy savings. The Air-Modulator provides such a means by varying the speed of the fan or pump motor.

What is a Variable Speed Drive?

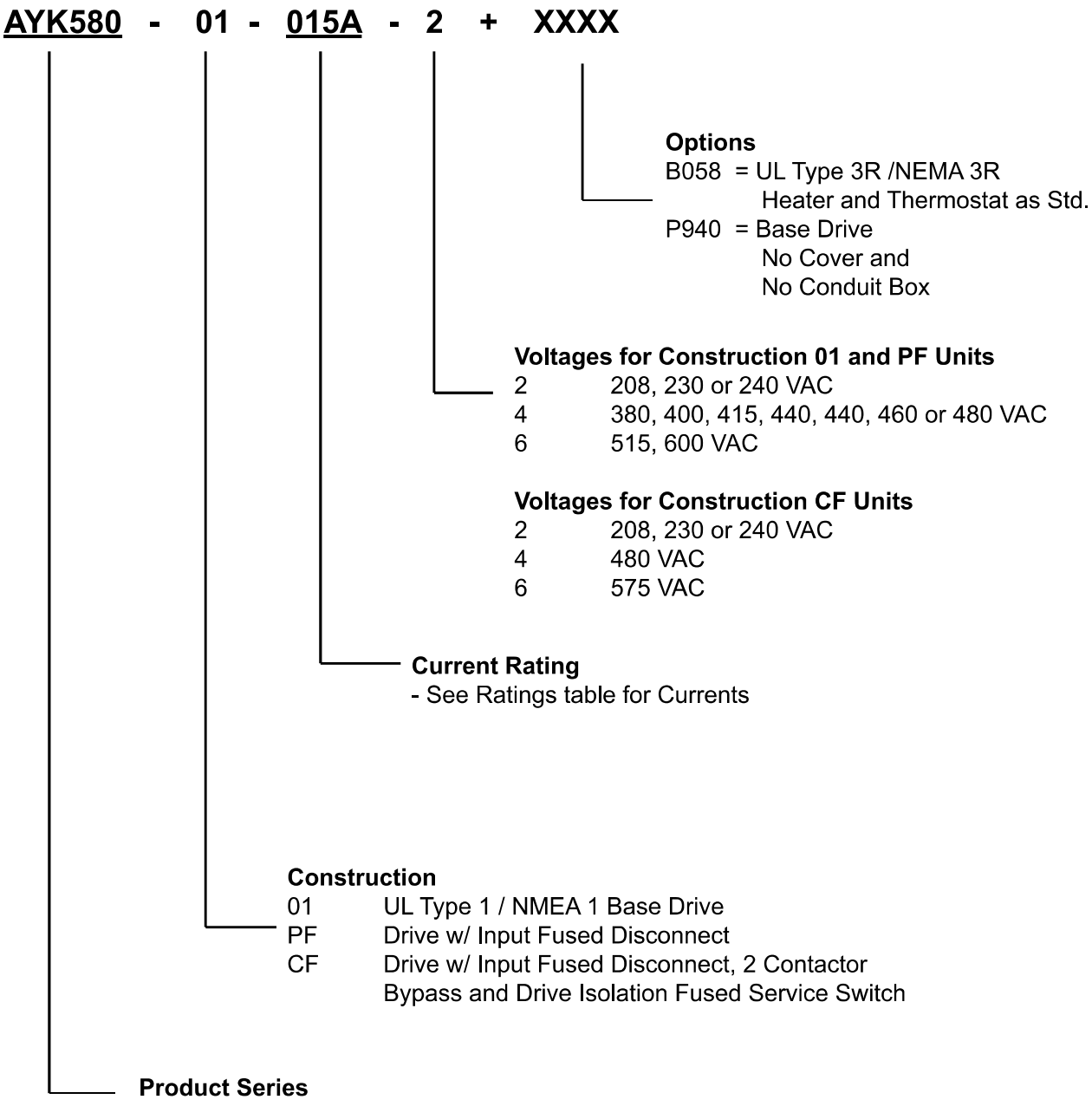
A variable speed drive is an electronic device which changes the speed of a motor by changing the frequency and voltage fed to the motor. An AC motor runs at a speed proportional to the frequency applied, as described in the following formula:

$$\text{Synchronous motor speed} = \frac{120 \times \text{frequency}}{\text{Number of motor poles}}$$

The speed is dependent on the frequency; a change in frequency will change the motor speed. The AC motor, however, must also have the voltage vary in the same proportion as the frequency to maintain full torque capabilities throughout the speed range. Therefore, a variable speed drive must change both the frequency and the voltage of the power fed to the motor to vary speed while maintaining torque for the required load.



Nomenclature



Product Description

AYK580

The AYK580 is a Johnson Controls Variable Frequency LV AC Drive for the control of three phase AC motors. Johnson Controls applies this product regularly on Johnson Controls Air Handlers. These AC Drives are manufactured by ABB for Johnson Controls. This affords users with the opportunity to have one feature rich AC drive applied throughout a facility for HVAC requirements, with minimal familiarization training, parts and service, allowing Johnson Controls to provide for your total service needs.

The AYK580 is an adjustable frequency AC drive designed specifically for the HVAC market that achieves the ultimate in flexible motor control performance. Offering two modes of motor control: Scalar (V/Hz) and Sensorless Vector as well as PM Motor control. The AYK580 performs accurate speed control of any standard squirrel cage motor.

With drives ranging from 1 to 150 HP, the AYK580 series features an 'intuitively obvious' multi-lingual, full graphic display panel that also provides an assistant to aid users in start-up. The control panel can be mounted on the cover of the drive, or remotely, and can upload, store, and download parameters.

The AYK580 comes equipped with an extensive library of pre-programmed HVAC application macros that, at the touch of a button, allow rapid configuration of inputs, outputs, and parameters for specific HVAC applications to maximize convenience and minimize start-up time.

The AYK580 can be used for the simplest to the most demanding HVAC applications. Two integral option slots can be configured with additional relay outputs, 24 V AUX power, as well as a host of different communication bus adapters.

The AYK580 has a 110% short term overload rating for one minute out of ten and is capable of 130% short-term overload rating for 2 seconds out of each minute.

AYK580 - 01 - 015A - 4 + B058

Product Series

Construction

01	UL Type 1 / NMEA 1 Base Drive
PF	Drive w/ Input Fused Disconnect
CF	Drive w/ Input Fused Disconnect, 2 Contactor Bypass and Drive Isolation Fused Service Switch

Current Rating
- See Ratings table for Currents

Voltage

2	208, 230 or 240 VAC
4	380, 400, 415, 440, 440, 460 or 480 VAC
6	515, 600 VAC

Options
B058 = UL Type 3R, NEMA Type 3R

+P940 = Base Drive No Cover and No Conduit Box

Product Description *(continued)*

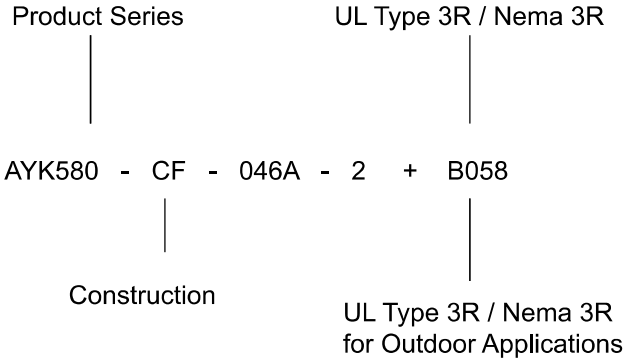
AYK580 Smart Code

Johnson Controls is introducing a smart type code for the AYK580 drive. The purpose of the code is to provide a unique alpha-numeric code that will be used for ordering or post sale support to define the specifics

of enclosure type, construction, voltage, current, and installed options for ease of continued support. This type code represents the basic drive product. To add options to these products, simply add a + at the end of the type code followed by the catalog code shown for that option. Please refer to the smart code table for each configuration showing the allowed options for each configuration.

Example: AYK580-CF-046A-2 plus a B058,

The type code that should be indicated on the order would be:



AYK580-01 (Base Drives)

The AYK580-01 Base Drive is available from 1 to 100 HP (4.6 to 273 Amps) at 208/230/240V, 1 to 350 HP / (2.1 to 414 Amps) at 380/400/415/440/460/480V, and 2 to 250 HP (2.7 to 271 Amps) at 600V input voltages. The AYK580-01 Base Drive has nine frame sizes (R1 to R9). They also include as standard an advanced control panel for user interface, parameter adjustments and drive operations.They are mounted on the front of the drive and can be remote mounted if required.

Wall mounted AYK58001

All AYK580-01 Base Drives are able to be wall mounted and come with a Conduit/Junction Box as standard to meet UL Type 1 (NEMA 1) applications.The front section of the wall mounted AYK580-01 contains the electronics, power and control wire terminals. The rear section forms a cooling channel. The two section construction allows the unit to be installed protruding through a wall, or through the rear wall of a customer supplied enclosure using additional hardware (R1 to R9), placing the rear section in a cooling air duct to minimize the heat inside the cabinet. In standard installations, the drive is mounted directly onto a wall and uses the provided conduit box (required for NEMA 1 installation). The Conduit Box and it's required hardware is included as standard with all 01 Base Drives. If not needed please discard at your discretion. Conduit openings (knock-outs) are provided for bottom and side conduit entry. For mounting inside a customer

supplied cabinet, the conduit box may be removed.

AYK580-PF (AYK580 Drive with Fast Acting Fused Input Disconnect)

The AYK580 Drive with Fused Input Disconnect as Standard is an AYK580- 01 base drive packaged with a fused (PF). The AYK580-PF is available in a wall mounted enclosure from 1 to 75 HP (4.6 to 211 Amps) at 208/230/240V, 1 to 150 HP (2.1 to 180 Amps) at 380/400/ 415/440/460/480V and 2 to 125 HP (2.7 to 125 Amps) at 600 Volt. The AYK580 Drive Pack comes in a standard UL Type 1 (NEMA 1) galvanized Non Rust steel enclo- sure and <+B058> UL Type 3R (Nema 3R).

The AYK580 Drive Pack has the NEMA 1 AYK580-01 base drive mounted on the top of a back panel allowing access to the drive control panel for user interface. The AYK580 Drive Pack provides an enclosed fused disconnect with door-mounted operator (padlockable in the OFF position), electronic motor overload protection (provided from the base drive), and provisions for external control connec- tions. Conduit openings (knock-outs) are provided for bottom and rear conduit entry.

Complete, pre-engineered packages reduce time, effort and the cost of installing the JCI configured packages.

AYK580-CF (AYK580 Drive w/ Fused Disconnect Input, 2 Contactor Classic Bypass, Fast Acting Fused Drive isolation Service Switch)

The AYK580 Drive with classic bypass is an AYK580-01 base drive packaged with a fused (CF) input main disconnect switch, a two contactor bypass and a fast acting drive isolation service switch. This configuration allows the motor to be run at full volt- age in the event the drive is shut down for service. The Fast Acting Fused Drive Isolation Service Switch serves two pur- poses: It incorporates Fast Acting Drive Input Fusing which protects the bypass circuit if the drive was to ever fail as well as a switch to Isolate the Drive from the Bypass and Power Source for service. These pre-engineered packages reduce time, effort, and the cost of installation.

The bypass function is configured entirely of standard industrial control components. It includes two Mechanically interlocked contactors, an Electronic motor overload relay, a control power transformer with primary and secondary fusing, and cover mounted Hand-Off-Auto switch and Drive-Off-Bypass selector switch.

Bypass is accomplished by means of the two contactors. One is the bypass contactor used to connect the motor directly to the power line. The other is the drive output contactor that dis- connects the motor from the drive output when operating in the bypass mode. This prevents the “back feeding” that would occur if line voltage were applied to the drive output terminals. The drive output contactor and the bypass contactor are mechanically interlocked to prevent simultaneous operation. Motor overload protection in the bypass mode is provided by a Class 10, 20 or 30 electronic motor overload relay. AYK580 Drive W/ Bypass Packages include a J Type fused (CF) input disconnect switch with a door mounted external operating handle that is interlocked with the enclosure door and lockable in the OFF position with up to three padlocks. The multi-lingual, al- phanumeric drive control panel is mounted on the enclosure door. As Standard a Fast Acting Fused Drive Service Switch isolates the drive from the power source for ser- vice and provides superior functionality to a three contactor arrangement.

Drive W/ Bypass Packages are available in UL TYPE 1 (NEMA 1) Non Rust galvanized steel enclosures and <+B058> UL Type 3R (Nema 3R) through 75 HP (211 Amps) at 208/230V, 150HP (180 Amps) at 460 Volt and 125 HP (125 Amps) at 575 Volt

Application considerations

Always follow and abide by proper Lock-Out/Tag-Out proce- dures when working with electrical equipment.

Because of the variety of uses for the AYK580, those responsi- ble for the application and control of these drives must satisfy themselves that all necessary steps have been taken to insure that they meet all performance and safety requirements regard- ing national and local laws, regulations, codes and standards. Unless otherwise noted, AYK580 products found in this Engineering Guide are designed to meet UL Type (UL & cUL Environmental Ratings) and NEMA Type (National Electrical Manufacturers Association) standards.

AYK580-01 Base Drives are Approved for installation in a CE first environment. Restricted distribution is also provided with the AYK580-01 Base Drives at 480V, which carry the CE mark. The AYK580 Drives with input disconnect or classic bypass are supplied for UL/cUL and are not provided with a CE mark. These listings are based on standard product and any exceptions to this will be noted in the appropriate section.

Branch Circuit Protection (The AYK580-01 Base Drive)

The AYK580-01 Base Drive does not include a Disconnect Device. A means to Disconnect and Put power must be installed between the AC Power Source and the AYK580-01 Base Drive. This branch circuit protection must:

- Be sized to conform to applicable safety regulations, including, but not limited to, both National and local electrical codes.
- Be locked in the open position during installation and maintenance work.

The disconnect device must not be used to control the motor. Instead use the control panel, or commands to the I/O terminals for motor control. Cycling the disconnect de- vice cycles power to the drive’s DC capacitors. These ca- pacitors have a maximum limit of 5 cycles in ten minutes.

Product Description *(continued)*

Fuses

See the AYK580-01 user's manual for fuse recommendations for short circuit protection on the drive's input power. These recommendations are not requirements if branch circuit protection is otherwise provided per NEC. UL508A manufacturers are not required to use the recommended fuses for the purpose of UL listing a panel that includes the AYK580.

Branch circuit protection (AYK580- PF/CF Drive Packages)

he Drive with fast acting input fused disconnect (AYK580-PF) or Drive with classic bypass, J Type Fused Main Power Input Disconnect and fast acting drive fused isolation service switch (AYK580-CF) is supplied with a means to disconnect input power sized per UL508A, and the disconnect is lockable in the open position. The Main Fused Disconnects in both packages provide short circuit for the drive panel. AYK550-CD and sized to conform to applicable safety regulations, including, but not limited to, both National and local electrical codes.

Selecting the Correct Drive Capacity

All AYK550 drives are current rated devices. The HP ratings provided are for reference only and are based on typical 4-pole motors at nominal voltages (NEC Table 430-150). If full motor torque is required, ensure the drive has a continuous current rating equal to, or greater than, the full load amp rating of the motor.

JOHNSON CONTROLS PACKAGE CONFIGURATIONS

The following AYK580 JCI Drive configurations are available as standard product offerings:



Base Drive

"01" Configuration

- AYK580 VFD UL Type 1 / NEMA 1 / conduit box supplied as standard
- AYK580 HVAC advanced control panel supplied as standard
- 100K SCCR at 480 V w/ fast acting drive input fusing





Base Drive with Fused Disconnect

"PF" Configuration

- AYK580 VFD "01" Base Drive w/ fast acting drive input fusing belly box
- Available as standard:
  - UL Type 1 / Ne,a 1 indoor
  - UL Type 3R / Nema 3R outdoor
- Fused main disconnect with pad lockable handle
- 100K SCCR at 480 V

Base Drive with Bypass, VFD Isolation Service Switch, Main Fused Disconnect

"CF" Configuration



- AYK580 VFD avilable as standard UL Type 1 / Nema 1 indoor UL Type 3R / Nema 3R outdoor Supplied as standard Special note: Heater and thermostat included on all 3R units.
- Main J Type fused disconnect with pad lockable handle in the open position
- VFD input fast acting fused service disconnect
- Control power transformer
- Classic 2 contactor (wide range coil) mechanical bypass
- Class 10, 20, or 30 elecronic overload relay for bypass circuit
- VFD/OFF/BYPASS (3 position) selector switch
- HAND/OFF/AUTO (3 position) selector switch for operation in bypass only. HOA in VFD mode through VFD control panel



Product Description *(continued)*



FIGURE 1 - "CF" PACKAGE: DRIVE WITH FUSED DISCONNECT INPUT, MECHANICAL 2 CONTACTOR BYPASS, VFD FAST ACTING FUSED ISOLATION SERVICE DISCONNECT, NEMA 2 INFOOR INSTALLATION

Application

GENERAL APPLICATION CONSIDERATIONS

Horsepower/Amerpage Range

The Johnson Controls AYK580 is a complete product line covering the nominal horsepower sizes from 1 HP to 100 HP (4.6 Amps o 273 Amps) for 208 V to 240V/3-Phase, 1 HP to 150 HP (2.1 Amps to 180 Amps) for 380V to 480V/3-Phase, and 2 HP to 125 HP (2.7 Amps to 125 Amps) for 600V/3-Phase. The critical sizing parameter is the output current rating of the drive . The nameplate FLA rating of the motors must not exceed the output current rating of the drive at 208, 230, 380, 480 or 575 VAC. Horsepower Ratings are for reference ONLY.

The AYK580 Drives are designed with sufficient current capacity to be applied to high efficiency motors. The current capacity complies with the industry's Energy Policy Act (EPACT) motor full load amp ratings. VFD FLA output ratings meet or exceed Table 430-250 of the National Electric Code® 1993.

Power Supply

The base drive (AYK580-01) is designed for nominal 208 V to 2240 V (+10%...-15%), 48-63 Hz, 380 V to 480 V (+10%...-15%), 48-63 Hz input power, or (+10%///-15%), 600 V. For other power supply systems, a step transformer must be used. The minimum required kVA rating of the transformer must be calculated as follows:

Transformer kVA =

$$\frac{1.732 \times \text{Line to Line Voltage} \times \text{VFD Input Amps}}{1000}$$

Power factor correction capacitors are not required as the Air-Modulator maintains a .98 power factor at nominal load.

Example:

399.05 kVA =

$$\frac{1.732 \times 480 \times 480}{1000}$$

In this example the drive is supplied with 480 V AC and rated for 480 amps. Based upon the calculation a 400 KVA isolation transformer would be required for the example above. When requesting information from the transformer vendor let them know that 100% of the transformer load will be a variable speed drive.

Location

These drives are designed for indoor location, in a NEMA-1 classification area, having 5°F to 104°F (-15°C - 40°C) ambient temperature limits. The relative humidity of the area should be between 5% to 95% non-condensing.

Sufficient clearance (as noted in the dimensional section) to permit normal servicing and maintenance should be provided around the entire unit.

Power Wiring

These drives are equipped with power lugs for easy connection of power wiring. Maximum wiring size for each Air-Modulator is listed in the power and control wiring drawing, Form 100.04-PA1.2. A single point ground connection is provided in the drive package. Power wiring should be sized and installed in accordance with the National Electrical Code (NEC). Copper wire is required for all power wiring connections to all of the AYK580-01 base drives and packages.

DO NOT USE ALUMINIUM WIRE

Terminals Are Not Rated For Use With Aluminium Wire

For wiring and fuse sizing purposes, follow the guidelines for Rated Input Current and Max Prefuse Amps listed in Performance Data.

The AYK580-01 base drives are designed with electronic I^2t U.L. listed overload protection which limits the current to 100% of the motor rated current eliminating the need for thermal overload relays. This is in compliance with section 430-250 of the NEC.

Control Wiring / Interface

Johnson Controls provides as standard on Air-Modulators a single point control interface which accepts standard control signals (4-20mA, 0-5VDC, 0-10VDC) mounted in the unit. Also available for factory mounting is a pneumatic control interface which accepts a standard 3-15 PSIG control signal.

NOTE:

For 380V, 50Hz applications, size VFD for FLA that meet or exceed motor FLA.

Application *(continued)*

FAN APPLICATIONS

Theory of Operation

Variable Air-Volume (VAV) systems have long been accepted as the energy efficient air distribution method. Johnson Controls and other HVAC suppliers have, traditionally, offered Variable Inlet Vanes (VIV) on air handling units to provide this variable air volume capability. VIVs unload the fan by adding a pre-swirl to the air as it enters the fan in such a way as to provide a reduction in head pressure across the fan and a decrease in air flow rate. This causes a change in the operating point of the fan on the system curve (Fig. 2) and a subsequent reduction in the horsepower drawn by the fan motor.

Alternatively, the Air-Modulator unloads the fan by slowing it down. This shifts the RPM curve on which the fan operates. By reducing the RPM curve, the operating point now requires significantly less brake horsepower than a system using VIVs. This is shown in Fig. 3. The part load performance comparison is shown in Fig. 4.

Application

Variable speed drives can be applied to forward-curved, airfoil or backward-inclined centrifugal fans. When retrofitting the Air-Modulator to a fan with existing VIVs, the VIVs should either be removed or locked into the wide open position. Leaving the vanes on the fan will require the fan to use more power than if they were removed. The power penalty can range from 5% to 25% of FLA depending on fan size and velocity of air across the vanes. The smaller the fan, the higher the penalty.

Sequence of Operation

The typical variable speed air system is depicted in Fig. 5. It consists of an air handling unit being controlled by an Air-Modulator, duct work, and standard temperature controls. Under full load conditions, the fan is running at full speed and the discharge dampers are fully open, allowing the maximum amount of cooling into the space. As the cooling diminishes, the temperature controls send a signal to the dampers to close; this increases the static pressure in the duct work. A static pressure sensor in the duct work sends a signal through a receiver/controller to the Air-Modulator, telling it to slow down the motor proportionally.

The reduced motor and fan speed matches the air flow to the space temperature. As the space temperature rises, the dampers open lowering the duct static pressure. A reduction in static pressure will cause the Air-Modulator to increase the speed of the motor, again matching the air flow to the space temperature.

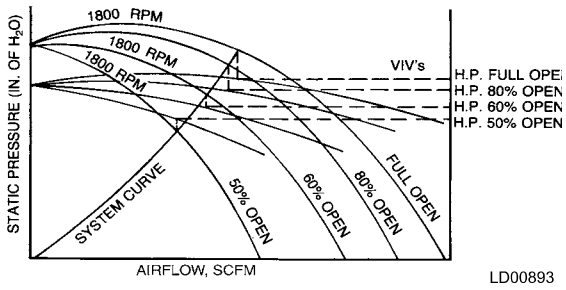


FIGURE 2 - FAN CURVES WITH INLET VANE CONTROL

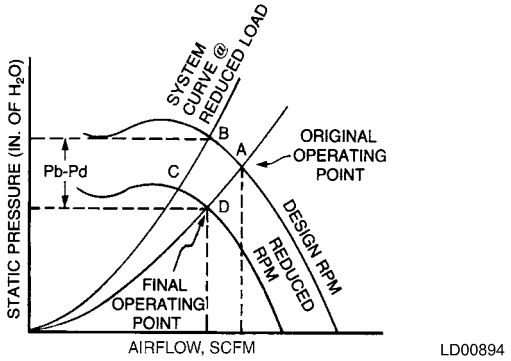


FIGURE 3 - FAN CURVES WITH VARIABLE SPEED CONTROL

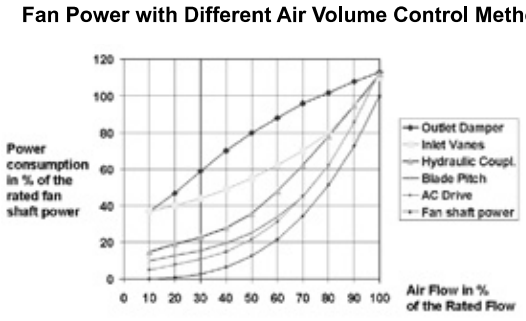


FIGURE 4 - AIR-MOD PART LOAD PERFORMANCE

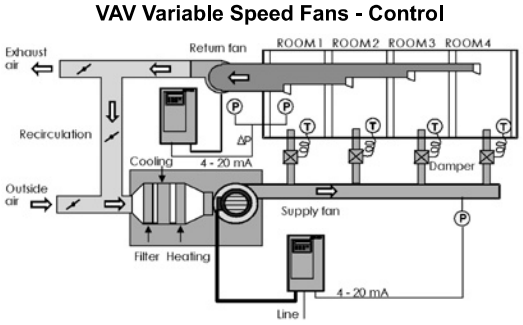


FIGURE 5 - TYPICAL VAV SYSTEM

RETROFIT FAN APPLICATIONS

Mechanical Volume Control Retrofit

The Air-Modulator can be easily retrofitted into existing systems. The existing starter controls can be integrated into the Air-Modulator as well as the existing transducer can be fed into the Air-Mod's PI controller for set-point control. The existing volume controls (ie: inlet guide vane, discharge damper, etc) can be removed or locked in the full open position. See Fig 6.

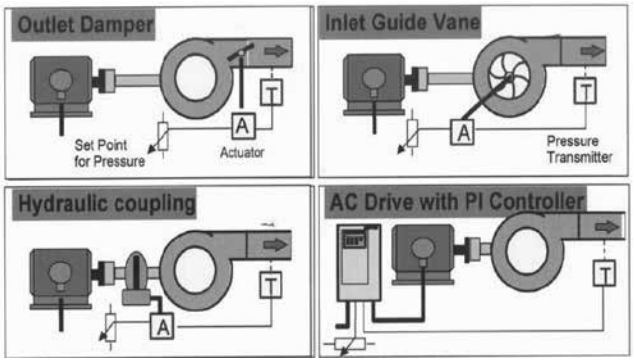


FIGURE 6 - AIR VOLUME CONTROL OF THE CENTRIFUGAL FAN

Constant Volume Retrofit

The simplest of all air conditioning systems is a supply fan unit serving a single zone with constant air volume as shown in Fig. 7. Typically, this system is controlled by a automatic temperature control (ATC) panel that cycles the AHU starter ON/OFF based on a temperature of a single zone. This is very inefficient and can be converted to variable volume with an air modulator which monitors room temperature and discharge temperature to automatically control fan speed by adjusting the frequency output to the motor.

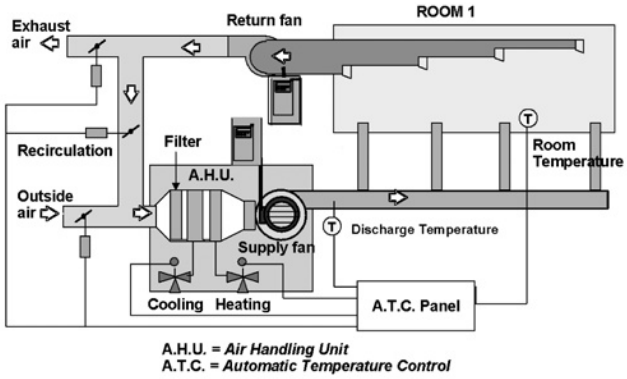


FIGURE 7 - CONSTANT VOLUME SYSTEM - RETROFIT

Direct Expansion VAV System

Air-Modulators can also be used on DX systems. The Air-Modulator can be used to control the supply fan to reduce coil freezing or to control condenser fan speed to optimize head pressure.

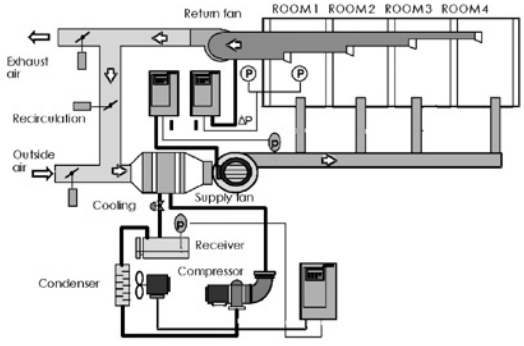


FIGURE 8 - DIRECT EXPANSION VAV SYSTEM

Application *(continued)*

FAN CONTROL

Theory of Operation

The fan control macro (HVAC PFC) of the JCI Drive provides on/off commands to control up to three constant speed fans operating in parallel with the fan controlled by the drive. The PID Setpoint Controller in the drive controls the process pressure by controlling the speed of the motor connected to the drive and starting additional constant speed motors whenever maximum speed operation of the adjustable speed motor is not sufficient to satisfy the process requirement. This feature can eliminate the need for a PLC.

Adjustments are provided for start and stop points and delay timers. Three step asjustments to the reference and two groups of PID settings can be applied to accommodate different operating characteristics with various numbers of parallel units in operation. An automatic sequence change feature helps ensure equal duty time for all of the motors. Instead of using the PID controller of the JCI Drive to regulate the process, an open-loop capacity output command can be used to directly set the flow provided by the parallel combination of the fans.

When the fan control feature is used, the adjustable speed motor is connected to a drive output or optional output contactor and the constant speed motor or motors are connected to a motor starter or starters. The optional output contactor and starters are controlled using the JCI Drive's digital (relay) outputs and interlock inputs. Optional digital I/O modules may be required.

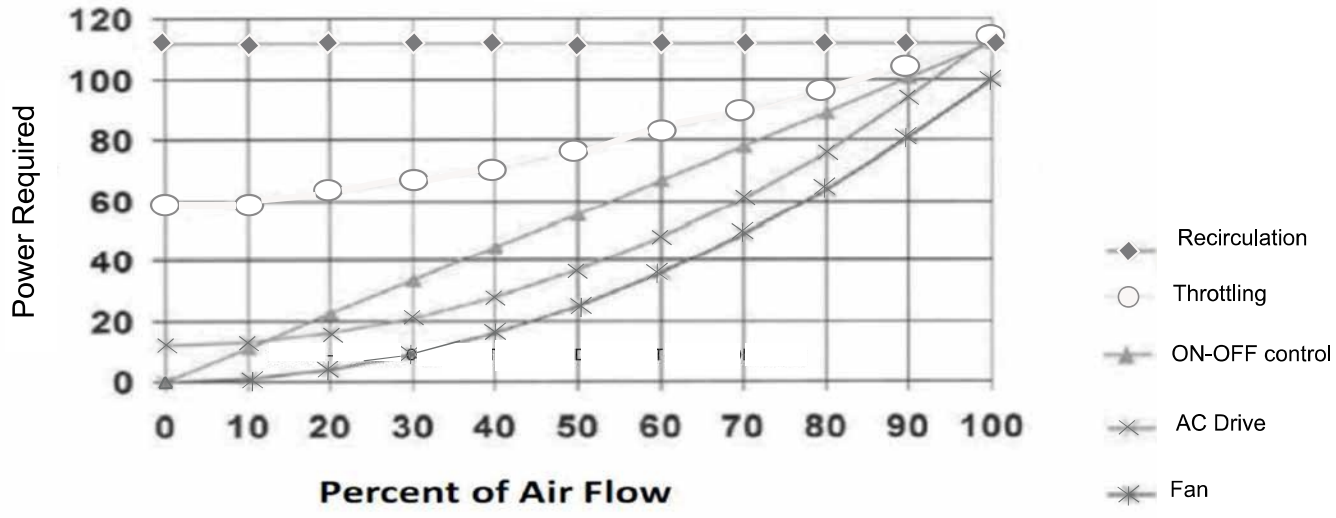


FIGURE 9 - FAN CONTROL

Product Overview



FIGURE 43 - AYK580 WALL MOUNT DRIVE

Product Overview - AYK580-01

The AYK580 drive sets new standards in both simplicity and reliability, and ensures smooth, energy-efficient operation of your HVAC systems in normal and mission-critical situations.

AYK580-01, wall-mounted base drives

The AYK580-01 wall-mounted drives are available from 1 to 100 HP at 208/240 V, 1 to 350 HP at

480 V, and 2 to 250 HP at 575 V. The AYK580-01 drives are available in UL (NEMA) Type 1 and 12 configurations. In standard installations, the drive is mounted directly onto a wall and uses the provided conduit box. Conduit openings are provided for bottom conduit entry & exit. For mounting in a customer-supplied cabinet, the conduit box may be removed. The drive has a 100 kA SCCR rating when paired with appropriately sized upstream fuses.

Features for HVAC

The AYK580 comes standard with an intuitive control panel used to configure, control, and monitor the drive. An optional Bluetooth control panel allows the drive to be configured via the control panel or the DriveTune app.

A robust HVAC firmware package provides drive, motor, and application protection features. Examples of drive protection features include undervoltage, overvoltage, overcurrent, and ground fault protection. The AYK580 also has a variety of motor protection features including overload and stall protections.

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

Specifications

TABLE 12 - TECHNICAL SPECIFICATIONS

PRODUCT COMPLIANCE (COMPLETE LIST ON FOLLOWING PAGE)	
AYK580-01	CE, UL, cUL
SUPPLY CONNECTION	
Input voltage (U1)	
AYK580-xx-xxxA-2	208…240V
AYK580-xx-xxxA-4	380…480V
AYK580-xx-xxxA-6	515…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 AYK580-01	0.98
Efficiency at rated power AYK580-01	98.0%
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	1.35 for 2 second
Variable Torque	(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, Rin > 200 kΩ
Current reference	0 (4) to 20 mA, Rin = 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, Rload: > 100 kΩ
Current reference	0 to 20 mA, Rload: < 500 Ω
Applicable potentiometer	1 kΩ to 10 kΩ
Internal auxiliary voltage	24 V DC ±10%, max. 250 mA
Accuracy	+/- 1% full scale range at 25°C (77°F)
Output updating time	2 ms
6 digital inputs	12 to 24 V DC, 10 to 24 V AC, Connectivity of PTC sensors supported by a single digital input. PNP or NPN connection (5 DIs with NPN connection). Programmable

TABLE 12 - TECHNICAL SPECIFICATIONS (CONT'D)

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
Adjustable filters on analog inputs and outputs	
All control inputs isolated from ground and power	
OPERATION	
Air temperature	0 to -15 °C (32 to 5 °F). -15 to +50 °C (5 to 122 °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 (AYK580-01 only)
EMC (according to EN61800-3)	AYK580-01 class C2 (1st environment restricted distribution)

Specifications (continued)

TABLE 12 - TECHNICAL SPECIFICATIONS (CONT'D)

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

Feature Overview

Communication

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

Available as plug-in options: BACnet/IP, Modbus TCP, PROFIBUS-DP, DeviceNet, EtherNet/IP, LonWorks (coming 2019)

Application functions

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

Protection functions

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

Panel functions

- First start assistant
- Primary settings for HVAC applications
- Hand-Off-Auto operation mode
- HVAC quick set-up
- Includes Day, Date and Time
- Operator Panel Parameter Backup (read/write)
- Full Graphic and Multilingual Display for Operator Control, Parameter Set-Up and Operating Data Display:
  - Output Frequency (Hz)
  - Speed (RPM)
  - Motor Current
  - Calculated % Motor Torque
  - Calculated Motor Power (kW)
  - DC Bus Voltage
  - Output Voltage
  - Heatsink Temperature
  - Elapsed Time Meter (resettable)
  - kWh (resettable)
  - Input / Output Terminal Monitor
  - PID Actual Value (Feedback) & Error Fault Text
  - Warning Text
  - Three (3) Scalable Process Variable Displays
  - User-Definable Engineering Units

Motor control features

- Scalar (V/Hz) and vector modes of motor control
- Supported motor types
  - Asynchronous motor,
  - Permanent magnet motor (vector),
  - SynRM (vector)Squared
- V/Hz shapes
  - Linear
  - Squared
- Energy optimization
- IR compensation
- Slip compensation
- Three (3) Critical Frequency Lockout Bands

PID Control

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

Feature Overview (continued)

STANDARD FEATURES (UNIQUE TO AYK580-PF/CF) DRIVE WITH INPUT DISCONNECT OR CLASSIC BYPASS

Standards

- UL, 508

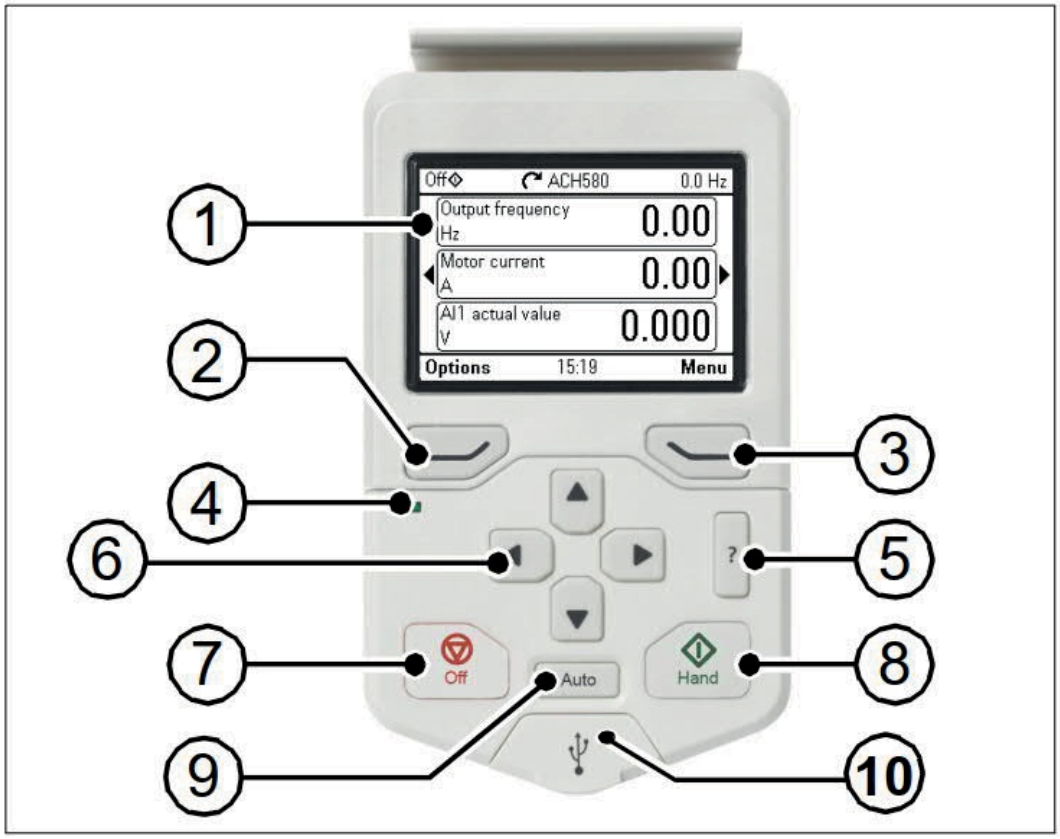
Features Unique to AYK580 Drive with Input Disconnect (AYK580-PF)

- Main Input Fused Disconnect ONLY
- Main Input Fused Disconnect Lockable
- (Open Position)
- Nema 3R units
- (Std. w/CPT, Heater & Thermostat Setting)
- All features as defined in Base Drive Features

Features Unique to AYK580 Drive Pack with Bypass (AYK580-CF)

- Main Input Fused Disconnect ONLY
- Main Input Fused Disconnect Lockable
- (Open Position)
- Control Power Transformer
- Two Contactor Classic Bypass
- (Mechanically interlocked)
- Contactors are ABB (AF) Wide Range
- Electronic Coil Type
- Motor Bypass Electronic Overload selectable
- (Class 10, 20 or 30 / Default Set Class 20)
- Fused Drive Input Service Switch as Standard
- Nema 3R units
- (Std. w/CPT, Heater & Thermostat Setting)
- All features as defined in Base Drive Features

LAYOUT OF THE STANDARD HAND-OFF-AUTO PANEL CONTROL PANEL



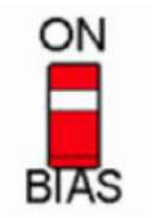
CALLOUT	DESCRIPTION	CALLOUT	DESCRIPTION
1	Layout of the control panel display	6	Arrow keys
2	left softkey	7	Off (see Hand, Off, and Auto)
3	Right softkey	8	Hand (see Hand, Off, and Auto)
4	Status LED, see the *LEDs* section in *Maintenance and Hardware Diagnostics* in the *Hardware Manual of the Drive*	9	Auto (see Hand, Off, and Auto)
5	Help	10	USB connector

FIGURE 44 - STANDARD HAND-OFF-AUTO PANEL CONTROL PANEL LAYOUT

Switches and LEDs

Switches

TABLE 13 - 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.		Bus not terminated
			Bus terminated
S5 (BIAS)	Activated on the biasing voltages to the bus. One (and only one) device, preferably at the end of the bus must have the bias on.		Bias off (default)
			Bias on

LEDS

Drive LEDs

There is a green POWER and a red FAULT LED on the front of the drive. They are visible through the panel cover but invisible if a control panel is attached to the drive. The following tabl describes the drive LED indications

Drive LEDs POWER and FAULT, on the front of the drive, under the control panel/panel cover

If a control panel is attached to the drive, switch to remote control (otherwise a fault is generated), and then remove the panel to be able to see the LEDs.

TABLE 14 - LEDS

LEDS OFF	LED LIT AND STEADY		LED BLINKING	
No power	Green (POWER)	Power supply on the board OK	Green (POWER)	Blinking: Drive in an alarm state Blinking for one second:
				Drive selected on the control panel when multiple drives are connected to the same panel bus
	Red (FAULT)	Active fault in the drive. To reset the fault, press RESET from the control panel or switch off the drive power.	Red (FAULT)	Active fault in the drive. To reset the fault, switch off the drive power.

Installation

Study the installation instructions of the AYK580-01 manual carefully before proceeding. Failure to observe the warnings and instructions may cause a malfunction or personal hazard.

WARNING: Before you begin, read the Safety Instructions in AYK580-01-IOM

1. Check the 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.

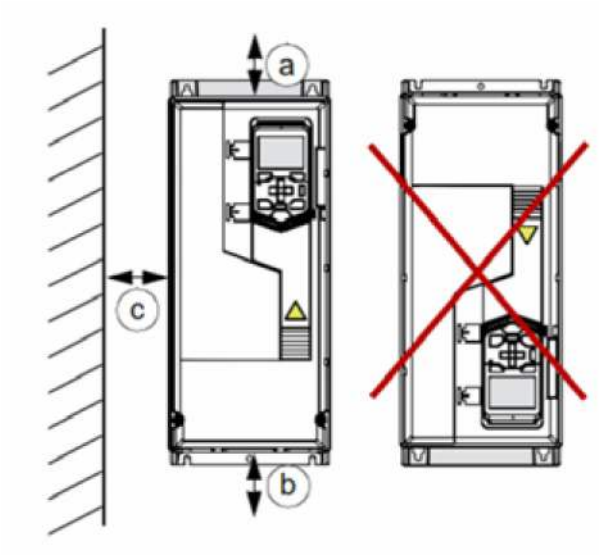


TABLE 15 - VERTICALLY ALONE CLEARANCES

FRAME SIZE	VERTICAL INSTALLATION - FREE SPACE					
	ALOVE (A)		BELOW (B)		BESIDE (C)*	
	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

*Free space between the drive and other objects, for example, walls

FIGURE 45 - INSTALLING UNIT VERTICALLY ALONE

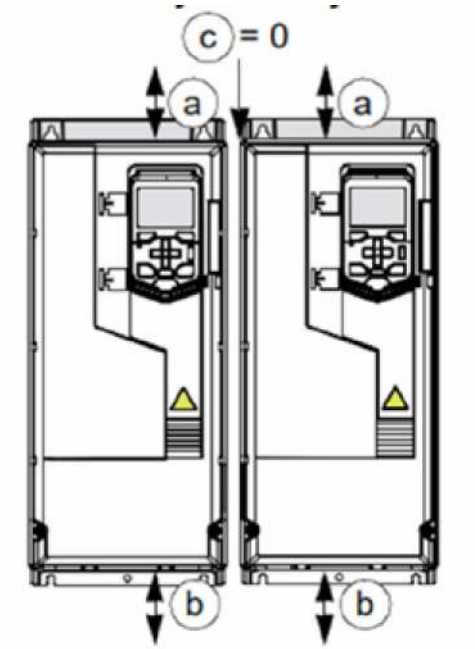


TABLE 16 - VERTICAL SIDE BY SIDE CLEARANCES

FRAME SIZE	VERTICAL INSTALLATION SIDE BY SIDE FREE SPACE					
	ALOVE (A)		BELOW (B)*		BESIDE (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

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

FIGURE 46 - INSTALLING UNIT VERTICALLY SIDE BY SIDE

Installation (continued)

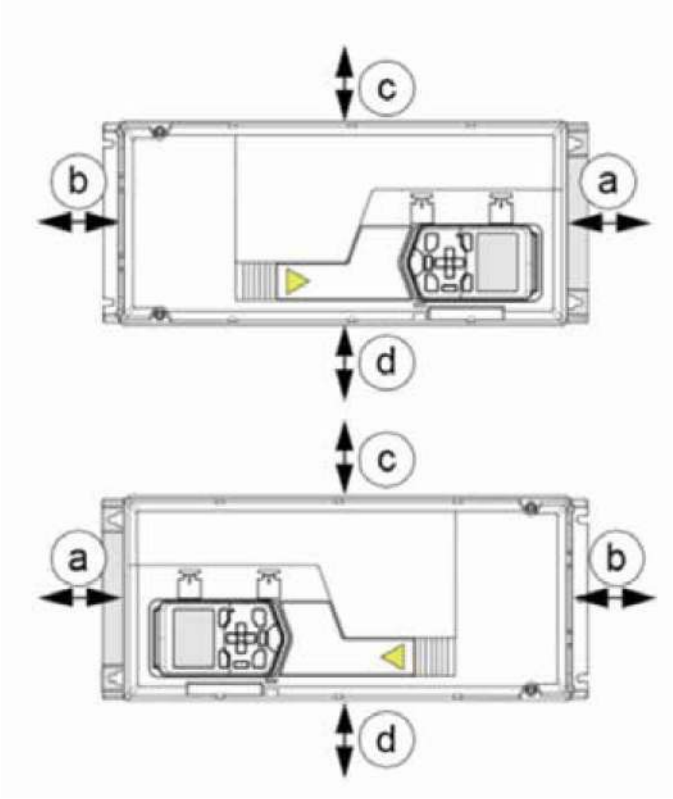


TABLE 17 - HORIZONTAL SIDE BY SIDE INTSTALLATION CLEARANCES

FRAME SIZE	IP21 (IP20)			
	ABOVE (A)		BELOW (B)*	
	MM	IN.	MM	IN.
R1	150	5.91	86	3.39
R2	150	5.91	86	3.39
R3	200	7.87	53	2.09
R4	30	1.18	200	7.87
R5	30	1.18	200	7.87
FRAME SIZE	**SIDE UP (C)**		**SIDE DOWN (D)**	
	MM	**IN.**	**MM**	**IN.**
R1	30	1.18	200	7.87
R2	30	1.18	200	7.87
R3	30	1.18	200	7.87
R4	30	1.18	200	7.87
R5	30	1.18	200	7.87

*Free space below is always measured from the drive frame, not from the cable box

FIGURE 47 - HORIZONTAL SIDE BY SIDE INTSTALLATION

NOTE:
1. You can install IP21 / UL Type 1 drives horizontally but the installation meets IP29 requirements only.
2. In the horizontal mounting, the drive is not protected from dripping water
3. The vibration specificattion in the Ambient Conditions section may not be fulfilled.

EMC AND VAR SCREWS

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

NOTE: When the internal EMC filters are 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. When identified, the EMC and VAR screws may be correctly configured for that power system.

TABLE 18 - 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 = Terra Neutral - Separate

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

   IT = Isolated Neutral

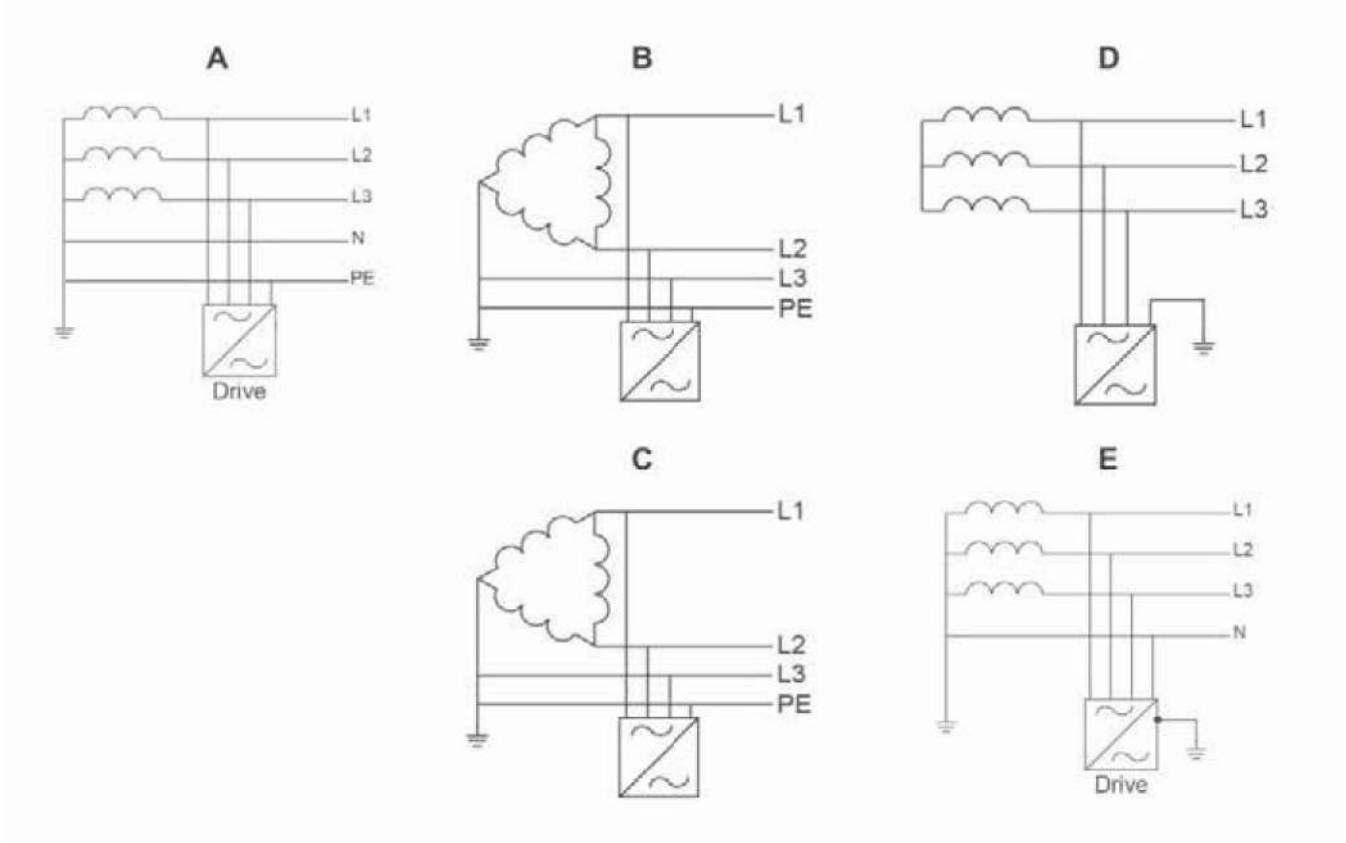
   Earth is either ungrounded or high-resistive (>30 ohms) non-symmetrical earth path.

   TT = Tera Tera

   Earth at source and Earth at destination (no earth conductor between source and consumer, the soil is used as the earth return path)

Installation (continued)

FIGURE 48 - ELECTRICAL POWER SYSTEM TYPES



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).

TABLE 19 - DEFAULT MATERIAL

FRAME	DEFAULT SCREW MATERIAL (NORTH AMERICA)			FRAME	DEFAULT SCREW MATERIAL (EXCEPT NORTH AMERICA)		
	EMC (DC)	EMC (AC)	VAR		EMC (DC)	EMC (AC)	VAR
R1...R3	Nylon	N/A	Metal	**R1...R3**	Nylon	N/A	Metal
R4...R5	Nylon	Nylon	Metal	**R4...R5**	Nylon	Metal	Metal
R6...R9*	Nylon	Nylon	Metal	**R6...R9***	Nylon	Metal	Metal

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

EMC/VAR screw type selection for various 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 conneted.

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

EMC filter

The EMC filter in the drive reduces the electromagnetic noise produced by the drive. Electromagnetic noise could interfere with or affect other electrical products. The EMC filter 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 correct protection.

Replacement parts kits and torque values

TABLE 20 - 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

TABLE 21 - 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

TABLE 22 - AYK-580-01 NORTH AMERICA

		TN SYSTEM OF 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]

NOTE: Bold text represents a change from the default material

[1] Metal screw must not be 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.

Installation (continued)

TABLE 23 - AYK580-O1 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	Metal	Nylon
R4[3]	EMC (DC)	Metal	Nylon[1]	Nylon
	EMC (AC)	Metal	Nylon	Nylon
	VAR	Metal	Metal	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

NOTE: Bold text represents a change from the default material
[1] Optional, for greater noise filtering
[2] 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.

Complete Parameters List

GROUP 1
Actual values
01.01 Motor speed used
01.02 Motor speed estimated
01.03 Motor speed %
01.06 Output frequency
01.07 Motor current
01.08 Motor current % of motor nom
01.09 Motor current % of drive nom
01.10 Motor torque
01.11 DC voltage
01.13 Output voltage
01.14 Output power
01.15 Output power % of motor nom
01.16 Output power % of drive nom
01.17 Motor shaft power
01.18 Inverter GWh counter
01.19 Inverter MWh counter
01.20 Inverter kWh counter
01.24 Flux actual %
01.30 Nominal torque scale
01.50 Current hour kWh
01.51 Previous hour kWh
01.52 Current day kWh
01.53 Previous day kWh
01.54 Cumulative inverter energy
01.55 Inverter GWh counter (resettable)
01.56 Inverter MWh counter (resettable)
01.57 Inverter kWh counter (resettable)
01.58 Cumulative inverter energy (resettable)
01.61 Abs motor speed used
01.62 Abs motor speed %
01.63 Abs output frequency
01.64 Abs motor torque
01.65 Abs output power
01.66 Abs output power % motor nom
01.67 Abs output power % drive nom
01.68 Abs motor shaft power

GROUP 3
Input references
03.01 Panel reference
03.02 Panel reference remote
03.05 FB A reference 1
03.06 FB A reference 2
03.09 EFB reference 1
03.10 EFB reference 2

GROUP 4
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04.01 Tripping fault
04.02 Active fault 2
04.03 Active fault 3
04.06 Active warning 1
04.07 Active warning 2
04.08 Active warning 3
04.11 Latest fault
04.12 2nd latest fault
04.13 3rd latest fault
04.16 Latest warning
04.17 2nd latest warning
04.18 3rd latest warning
04.40 Event word 1
04.41 Event word 1 bit 0 code
04.43 Event word 1 bit 1 code
04.45 Event word 1 bit 2 code
04.47 Event word 1 bit 3 code
04.49 Event word 1 bit 4 code
04.51 Event word 1 bit 5 code
04.53 Event word 1 bit 6 code
04.55 Event word 1 bit 7 code
04.57 Event word 1 bit 8 code
04.59 Event word 1 bit 9 code
04.61 Event word 1 bit 10 code
04.63 Event word 1 bit 11 code
04.65 Event word 1 bit 12 code
04.67 Event word 1 bit 13 code
04.69 Event word 1 bit 14 code
04.71 Event word 1 bit 15 code

GROUP 5
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05.01 On-time counter
05.02 Run-time counter
05.03 Hours run
05.04 Fan on-time counter
05.10 Control board temperature
05.11 Inverter temperature
05.22 Diagnostic word 3

GROUP 6
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06.01 Main control word
06.11 Main status word
06.16 Drive status word 1
06.17 Drive status word 2
06.18 Start inhibit status word
06.19 Speed control status word
06.20 Constant speed status word
06.21 Drive status word 3
06.22 HVAC status word
06.30 MSW bit 11 selection
06.31 MSW bit 12 selection
06.32 MSW bit 13 selection
06.33 MSW bit 14 selection

GROUP 7
System info
07.03 Drive rating id
07.04 Firmware name
07.05 Firmware version
07.06 Loading package name
07.07 Loading package version
07.11 Cpu usage
07.25 Customization package name
07.26 Customization package version
07.30 Adaptive program status
07.31 AP sequence state

GROUP 10
Standard DI, RO
10.02 DI delayed status
10.03 DI force selection
10.04 DI forced data
10.21 RO status
10.22 RO force selection
10.23 RO forced data
10.24 RO1 source
10.25 RO1 ON delay
10.26 RO1 OFF delay
10.27 RO2 source
10.28 RO2 ON delay
10.29 RO2 OFF delay
10.30 RO3 source
10.31 RO3 ON delay
10.32 RO3 OFF delay
10.99 RO/DIO control word
10.101 RO1 toggle counter
10.102 RO2 toggle counter
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GROUP 11
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11.21 DI5 configuration
11.38 Freq in 1 actual value
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11.42 Freq in 1 min
11.43 Freq in 1 max
11.44 Freq in 1 at scaled min
11.45 Freq in 1 at scaled max

GROUP 12
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12.02 AI force selection
12.03 AI supervision function
12.04 AI supervision selection
12.11 AI1 actual value
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12.13 AI1 forced value
12.15 AI1 unit selection
12.16 AI1 filter time
12.17 AI1 min
12.18 AI1 max
12.19 AI1 scaled at AI1 min
12.20 AI1 scaled at AI1 max
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12.22 AI2 scaled value
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12.25 AI2 unit selection
12.26 AI2 filter time
12.27 AI2 min
12.28 AI2 max
12.29 AI2 scaled at AI2 min
12.30 AI2 scaled at AI2 max
12.101 AI1 percent value
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13.12 AO1 source
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13.15 AO1 unit selection
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13.17 AO1 source min
13.18 AO1 source max
13.19 AO1 out at AO1 src min
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13.22 AO2 source
13.23 AO2 forced value
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GROUP 15
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15.02 Detected extension module
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15.04 RO/DO status
15.05 RO/DO force selection
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15.11 RO5 ON delay
15.12 RO5 OFF delay
15.22 DO1 configuration
15.23 DO1 source
15.24 DO1 ON delay
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15.32 Freq out 1 actual value
15.33 Freq out 1 source
15.34 Freq out 1 src min
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19.11 Ext1/Ext2 selection
19.18 HAND/OFF disable source
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20.02 Ext1 start trigger type
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20.09 Ext2 in2 source
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20.40 Run permissive
20.41 Start interlock 1
20.42 Start interlock 2
20.43 Start interlock 3
20.44 Start interlock 4
20.45 Start interlock stop mode
20.46 Run permissive text
20.47 Start interlock 1 text
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21.03 Stop mode
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21.09 DC hold speed
21.10 DC current reference
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21.16 Pre-heating current
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21.19 Scalar start mode
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21.23 Smooth start
21.24 Smooth start current
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22.18 Ext2 speed ref1
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22.20 Ext2 speed function
22.21 Constant speed function
22.22 Constant speed sel1
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22.24 Constant speed sel3
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22.73 Motor potentiometer up source
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22.76 Motor potentiometer min value
22.77 Motor potentiometer max value
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23.29 Variable slope rate

GROUP 24
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24.04 Speed error inverted
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25.01 Torque reference speed control
25.02 Speed proportional gain
25.03 Speed integration time
25.04 Speed derivation time
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25.06 Acc comp derivation time
25.07 Acc comp filter time
25.15 Proportional gain em stop
25.53 Torque prop reference
25.54 Torque integral reference
25.55 Torque deriv reference
25.56 Torque acc compensation

GROUP 28
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28.01 Frequency ref ramp input
28.02 Frequency ref ramp output
28.11 Ext1 frequency ref1
28.12 Ext1 frequency ref2
28.13 Ext1 frequency function
28.15 Ext2 frequency ref1
28.16 Ext2 frequency ref2
28.17 Ext2 frequency function
28.21 Constant frequency function
28.22 Constant frequency sel1
28.23 Constant frequency sel2
28.24 Constant frequency sel3
28.26 Constant frequency 1
28.27 Constant frequency 2
28.28 Constant frequency 3
28.29 Constant frequency 4
28.30 Constant frequency 5
28.31 Constant frequency 6
28.32 Constant frequency 7
28.41 Frequency ref safe
28.51 Critical frequency function
28.52 Critical frequency 1 low
28.53 Critical frequency 1 high
28.54 Critical frequency 2 low
28.55 Critical frequency 2 high
28.56 Critical frequency 3 low
28.57 Critical frequency 3 high
28.71 Freq ramp set selection
28.72 Freq acceleration time 1
28.73 Freq deceleration time 1
28.74 Freq acceleration time 2
28.75 Freq deceleration time 2
28.76 Freq ramp in zero source
28.92 Frequency ref act 3
28.96 Frequency ref act 7
28.97 Frequency ref unlimited

GROUP 30
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30.01 Limit word 1
30.02 Torque limit status
30.11 Minimum speed
30.12 Maximum speed
30.13 Minimum frequency
30.14 Maximum frequency
30.17 Maximum current
30.18 Torq lim sel
30.19 Minimum torque 1
30.20 Maximum torque 1
30.21 Min torque 2 source
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30.23 Minimum torque 2
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30.26 Power motoring limit
30.27 Power generating limit
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31.02 External event 1 type
31.03 External event 2 source
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31.05 External event 3 source
31.06 External event 3 type
31.07 External event 4 source
31.08 External event 4 type
31.09 External event 5 source
31.10 External event 5 type
31.11 Fault reset selection
31.12 Autoreset selection
31.13 Selectable fault
31.14 Number of trials
31.15 Total trials time
31.16 Delay time
31.19 Motor phase loss
31.20 Earth fault
31.21 Supply phase loss
31.22 STO indication run/stop
31.23 Wiring or earth fault
31.24 Stall function
31.25 Stall current limit
31.26 Stall speed limit
31.27 Stall frequency limit
31.28 Stall time
31.30 Overspeed trip margin
31.32 Emergency ramp supervision
31.33 Emergency ramp supervision delay
31.36 Aux fan fault bypass

GROUP 32
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32.05 Supervision 1 function
32.06 Supervision 1 action
32.07 Supervision 1 signal
32.08 Supervision 1 filter time
32.09 Supervision 1 low
32.10 Supervision 1 high
32.11 Supervision 1 hysteresis
32.15 Supervision 2 function
32.16 Supervision 2 action
32.17 Supervision 2 signal
32.18 Supervision 2 filter time
32.19 Supervision 2 low
32.20 Supervision 2 high
32.21 Supervision 2 hysteresis
32.25 Supervision 3 function
32.26 Supervision 3 action
32.27 Supervision 3 signal
32.28 Supervision 3 filter time
32.29 Supervision 3 low
32.30 Supervision 3 high
32.31 Supervision 3 hysteresis
32.35 Supervision 4 function
32.36 Supervision 4 action
32.37 Supervision 4 signal
32.38 Supervision 4 filter time
32.39 Supervision 4 low
32.40 Supervision 4 high
32.41 Supervision 4 hysteresis
32.45 Supervision 5 function
32.46 Supervision 5 action
32.47 Supervision 5 signal
32.48 Supervision 5 filter time
32.49 Supervision 5 low
32.50 Supervision 5 high
32.51 Supervision 5 hysteresis
32.55 Supervision 6 function
32.56 Supervision 6 action
32.57 Supervision 6 signal
32.58 Supervision 6 filter time
32.59 Supervision 6 low
32.60 Supervision 6 high
32.61 Supervision 6 hysteresis

GROUP 34
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34.02 Timer status
34.04 Season/exception day status
34.10 Timed functions enable
34.11 Timer 1 configuration
34.12 Timer 1 start time
34.13 Timer 1 duration
34.14 Timer 2 configuration
34.15 Timer 2 start time
34.16 Timer 2 duration
34.17 Timer 3 configuration
34.18 Timer 3 start time
34.19 Timer 3 duration
34.20 Timer 4 configuration
34.21 Timer 4 start time
34.22 Timer 4 duration
34.23 Timer 5 configuration
34.24 Timer 5 start time
34.25 Timer 5 duration
34.26 Timer 6 configuration
34.27 Timer 6 start time
34.28 Timer 6 duration
34.29 Timer 7 configuration
34.30 Timer 7 start time
34.31 Timer 7 duration
34.32 Timer 8 configuration
34.33 Timer 8 start time
34.34 Timer 8 duration
34.35 Timer 9 configuration
34.36 Timer 9 start time
34.37 Timer 9 duration
34.38 Timer 10 configuration
34.39 Timer 10 start time
34.40 Timer 10 duration
34.41 Timer 11 configuration
34.42 Timer 11 start time
34.43 Timer 11 duration
34.44 Timer 12 configuration
34.45 Timer 12 start time
34.46 Timer 12 duration
34.60 Season 1 start date
34.61 Season 2 start date
34.62 Season 3 start date
34.63 Season 4 start date
34.70 Number of active exceptions
34.71 Exception types
34.72 Exception 1 start
34.73 Exception 1 length
34.74 Exception 2 start
34.75 Exception 2 length
34.76 Exception 3 start
34.77 Exception 3 length
34.78 Exception day 4
34.79 Exception day 5
34.80 Exception day 6
34.81 Exception day 7
34.82 Exception day 8
34.83 Exception day 9
34.84 Exception day 10
34.85 Exception day 11
34.86 Exception day 12
34.87 Exception day 13
34.88 Exception day 14
34.89 Exception day 15
34.90 Exception day 16
34.100 Timed function 1
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34.102 Timed function 3
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34.111 Boost time activation source
34.111 Boost time duration

GROUP 35
Motor thermal protection
35.01 Motor estimated temperature
35.02 Measured temperature 1
35.03 Measured temperature 2
35.11 Temperature 1 source
35.12 Temperature 1 fault limit
35.13 Temperature 1 warning limit
35.14 Temperature 1 AI source
35.21 Temperature 2 source
35.22 Temperature 2 fault limit
35.23 Temperature 2 warning limit
35.24 Temperature 2 AI source
35.31 Safe motor temperature enable
35.50 Motor ambient temperature
35.51 Motor load curve
35.52 Zero speed load
35.53 Break point
35.54 Motor nominal temperature rise
35.55 Motor thermal time constant

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36.06 AL2 signal source
36.07 AL2 signal scaling
36.09 Reset loggers
36.10 PVL peak value
36.11 PVL peak date
36.12 PVL peak time
36.13 PVL current at peak
36.14 PVL DC voltage at peak
36.15 PVL speed at peak
36.16 PVL reset date
36.17 PVL reset time
36.20 AL1 0 to 10%
36.21 AL1 10 to 20%
36.22 AL1 20 to 30%
36.23 AL1 30 to 40%
36.24 AL1 40 to 50%
36.25 AL1 50 to 60%
36.26 AL1 60 to 70%
36.27 AL1 70 to 80%
36.28 AL1 80 to 90%
36.29 AL1 over 90%
36.40 AL2 0 to 10%
36.41 AL2 10 to 20%
36.42 AL2 20 to 30%
36.43 AL2 30 to 40%
36.44 AL2 40 to 50%
36.45 AL2 50 to 60%
36.46 AL2 60 to 70%
36.47 AL2 70 to 80%
36.48 AL2 80 to 90%
36.49 AL2 over 90%
36.50 AL2 reset date
36.51 AL2 reset time

GROUP 37
User load curve
37.01 ULC output status word
37.02 ULC supervision signal
37.03 ULC overload actions
37.04 ULC underload actions
37.11 ULC speed table point 1
37.12 ULC speed table point 2
37.13 ULC speed table point 3
37.14 ULC speed table point 4
37.15 ULC speed table point 5
37.16 ULC frequency table point 1
37.17 ULC frequency table point 2
37.18 ULC frequency table point 3
37.19 ULC frequency table point 4
37.20 ULC frequency table point 5
37.21 ULC underload point 1
37.22 ULC underload point 2
37.23 ULC underload point 3
37.24 ULC underload point 4
37.25 ULC underload point 5
37.31 ULC overload point 1
37.32 ULC overload point 2
37.33 ULC overload point 3
37.34 ULC overload point 4
37.35 ULC overload point 5
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37.42 ULC underload timer

GROUP 40
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40.01 Process PID output actual
40.02 Process PID feedback actual
40.03 Process PID setpoint actual
40.04 Process PID deviation actual
40.06 Process PID status word
40.07 Process PID operation mode
40.08 Set 1 feedback 1 source
40.09 Set 1 feedback 2 source
40.10 Set 1 feedback function
40.11 Set 1 feedback filter time
40.14 Set 1 setpoint scaling
40.15 Set 1 output scaling
40.16 Set 1 setpoint 1 source
40.17 Set 1 setpoint 2 source
40.18 Set 1 setpoint function
40.19 Set 1 internal setpoint sel1
40.20 Set 1 internal setpoint sel2
40.21 Set 1 internal setpoint 1
40.22 Set 1 internal setpoint 2
40.23 Set 1 internal setpoint 3
40.24 Set 1 internal setpoint 0
40.26 Set 1 setpoint min
40.27 Set 1 setpoint max
40.28 Set 1 setpoint increase time
40.29 Set 1 setpoint decrease time
40.30 Set 1 setpoint freeze enable
40.31 Set 1 deviation inversion
40.32 Set 1 gain
40.33 Set 1 integration time
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40.35 Set 1 derivation filter time
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40.37 Set 1 output max
40.38 Set 1 output freeze enable
40.39 Set 1 deadband range
40.40 Set 1 deadband delay
40.43 Set 1 sleep level
40.44 Set 1 sleep delay
40.45 Set 1 sleep boost time
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40.47 Set 1 wake-up deviation
40.48 Set 1 wake-up delay
40.49 Set 1 tracking mode
40.50 Set 1 tracking ref selection
40.57 PID set1/set2 selection
40.58 Set 1 increase prevention
40.59 Set 1 decrease prevention
40.60 Set 1 PID activation source
40.61 Setpoint scaling actual
40.62 PID internal setpoint actual
40.70 Compensated setpoint
40.71 Set 1 compensation input source
40.72 Set 1 compensation input 1

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40.73 Set 1 compensated output 1
40.74 Set 1 compensation input 2
40.75 Set 1 compensated output 2
40.76 Set 1 compensation non-linearity
40.80 Set 1 PID output min source
40.81 Set 1 PID output max source
40.89 Set 1 setpoint multiplier
40.90 Set 1 feedback multiplier
40.91 Feedback data storage
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40.96 Process PID output %
40.97 Process PID feedback %
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GROUP 41
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41.08 Set 2 feedback 1 source
41.09 Set 2 feedback 2 source
41.10 Set 2 feedback function
41.11 Set 2 feedback filter time
41.14 Set 2 setpoint scaling
41.15 Set 2 output scaling
41.16 Set 2 setpoint 1 source
41.17 Set 2 setpoint 2 source
41.18 Set 2 setpoint function
41.19 Set 2 internal setpoint sel1
41.20 Set 2 internal setpoint sel2
41.21 Set 2 internal setpoint 1
41.22 Set 2 internal setpoint 2
41.23 Set 2 internal setpoint 3
41.24 Set 2 internal setpoint 0
41.26 Set 2 setpoint min
41.27 Set 2 setpoint max
41.28 Set 2 setpoint increase time
41.29 Set 2 setpoint decrease time
41.30 Set 2 setpoint freeze enable
41.31 Set 2 deviation inversion
41.32 Set 2 gain
41.33 Set 2 integration time
41.34 Set 2 derivation time
41.35 Set 2 derivation filter time
41.36 Set 2 output min
41.37 Set 2 output max
41.38 Set 2 output freeze enable
41.39 Set 2 deadband range
41.40 Set 2 deadband delay
41.43 Set 2 sleep level
41.44 Set 2 sleep delay
41.45 Set 2 sleep boost time
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41.47 Set 2 wake-up deviation
41.48 Set 2 wake-up delay
41.49 Set 2 tracking mode
41.50 Set 2 tracking ref selection
41.58 Set 2 increase prevention
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41.60 Set 2 PID activation source
41.71 Set 2 compensation input source
41.72 Set 2 compensation input 1
41.73 Set 2 compensated output 1
41.74 Set 2 compensation input 2
41.75 Set 2 compensated output 2
41.76 Set 2 compensation non-linearity
41.80 Set 2 PID output min source
41.81 Set 2 PID output max source
41.89 Set 2 setpoint multiplier
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GROUP 43
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43.01 Braking resistor temperature
43.06 Brake chopper function
43.07 Brake chopper run permissive
43.08 Brake resistor thermal tc
43.09 Brake resistor Pmax cont
43.10 Brake resistance
43.11 Brake resistor fault limit
43.12 Brake resistor warning limit

GROUP 45
Energy efficiency
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45.02 Saved MW hours
45.03 Saved kW hours
45.04 Saved energy
45.05 Saved money x1000
45.06 Saved money
45.07 Saved amount
45.08 CO2 reduction in kilotons
45.09 CO2 reduction in tons
45.10 Total saved CO2
45.11 Energy optimizer
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45.14 Tariff selection
45.18 CO2 conversion factor
45.19 Comparison power
45.21 Energy calculations reset
45.24 Hourly peak power value
45.25 Hourly peak power time
45.26 Hourly total energy (resettable)
45.27 Daily peak power value (resettable)
45.28 Daily peak power time
45.29 Daily total energy (resettable)
45.30 Last day total energy
45.31 Monthly peak power value (resettable)
45.32 Monthly peak power date
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45.34 Monthly total energy (resettable)
45.35 Last month total energy
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45.37 Lifetime peak power date
45.38 Lifetime peak power time

GROUP 46
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46.02 Frequency scaling
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46.13 Filter time motor torque
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46.21 At speed hysteresis
46.22 At frequency hysteresis
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GROUP 47
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47.12 Data storage 2 int32
47.13 Data storage 3 int32
47.14 Data storage 4 int32
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47.23 Data storage 3 int16
47.24 Data storage 4 int16

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49.04 Communication loss time
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GROUP 50
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50.02 FBA A comm loss func
50.03 FBA A comm loss t out
50.04 FBA A ref1 type
50.05 FBA A ref2 type
50.06 FBA A SW sel
50.07 FBA A actual 1 type
50.08 FBA A actual 2 type
50.09 FBA A SW transparent source
50.10 FBA A act1 transparent source
50.11 FBA A act2 transparent source
50.12 FBA A debug mode
50.13 FBA A control word
50.14 FBA A reference 1
50.15 FBA A reference 2
50.16 FBA A status word
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51.13 FBA A Par13
51.14 FBA A Par14
51.15 FBA A Par15
51.16 FBA A Par16
51.17 FBA A Par17
51.18 FBA A Par18
51.19 FBA A Par19
51.20 FBA A Par20
51.21 FBA A Par21
51.22 FBA A Par22
51.23 FBA A Par23
51.24 FBA A Par24
51.25 FBA A Par25
51.26 FBA A Par26
51.27 FBA A par refresh
51.28 FBA A par table ver
51.29 FBA A drive type code
51.30 FBA A mapping file ver
51.31 D2FBA A comm status
51.32 FBA A comm SW ver
51.33 FBA A appl SW ver

GROUP 52
FBA A data in
52.01 FBA A data in1
52.02 FBA A data in2
52.03 FBA A data in3
52.04 FBA A data in4
52.05 FBA A data in5
52.06 FBA A data in6
52.07 FBA A data in7
52.08 FBA A data in8
52.09 FBA A data in9
52.10 FBA A data in10
52.11 FBA A data in11
52.12 FBA A data in12

GROUP 53
FBA A data out
53.01 FBA data out1
53.02 FBA data out2
53.03 FBA data out3
53.04 FBA data out4
53.05 FBA data out5
53.06 FBA data out6
53.07 FBA data out7
53.08 FBA data out8
53.09 FBA data out9
53.10 FBA data out10
53.11 FBA data out11
53.12 FBA data out12

GROUP 58
Embedded fieldbus
58.01 Protocol enable
58.02 Protocol ID
58.03 Node address
58.04 Baud rate
58.05 Parity
58.06 Communication control
58.07 Communication diagnostics
58.08 Received packets
58.09 Transmitted packets
58.10 All packets
58.11 UART errors
58.12 CRC errors
58.13 Token counter
58.14 Communication loss action
58.15 Communication loss mode
58.16 Communication loss time
58.17 Transmit delay
58.18 EFB control word
58.19 EFB status word
58.21 Device network usage
58.22 Token loop time
58.25 Control profile
58.26 EFB ref1 type
58.27 EFB ref2 type
58.28 EFB act1 type
58.29 EFB act2 type
58.30 EFB status word transparent source
58.31 EFB act1 transparent source
58.32 EFB act2 transparent source
58.33 Addressing mode
58.34 Word order
58.35 Return app error
58.40 Device object ID
58.41 Max master
58.42 Max info frames
58.43 Max APDU retries
58.44 APDU timeout
58.101 Data I/O 1
58.102 Data I/O 2
58.103 Data I/O 3
58.104 Data I/O 4
58.105 Data I/O 5
58.106 Data I/O 6
58.107 Data I/O 7
58.108 Data I/O 8
58.109 Data I/O 9
58.110 Data I/O 10
58.111 Data I/O 11
58.112 Data I/O 12
58.113 Data I/O 13
58.114 Data I/O 14

GROUP 70
Override
70.01 Override status
70.02 Override enable
70.03 Override activation source
70.04 Override reference source
70.05 Override direction
70.06 Override frequency
70.07 Override speed
70.10 Override enables selection
70.20 Override fault handling
70.21 Override auto reset trials
70.22 Override auto reset time
70.40 Override Log 1 Start Date
70.41 Override Log 1 Start Time
70.42 Override Log 1 End Date
70.43 Override Log 1 End Time
70.44 Override Log 1 Fault 1
70.45 Override Log 1 Fault 2
70.46 Override Log 1 Fault 3
70.47 Override Log 1 Warning 1
70.48 Override Log 1 Warning 2
70.49 Override Log 1 Warning 3
70.50 Override Log 2 Start Date
70.51 Override Log 2 Start Time
70.52 Override Log 2 End Date
70.53 Override Log 2 End Time
70.54 Override Log 2 Fault 1
70.55 Override Log 2 Fault 2
70.56 Override Log 2 Fault 3
70.57 Override Log 2 Warning 1
70.58 Override Log 2 Warning 2
70.59 Override Log 2 Warning 3
70.60 Override Log 3 Start Date
70.61 Override Log 3 Start Time
70.62 Override Log 3 End Date
70.63 Override Log 3 End Time
70.64 Override Log 3 Fault 1
70.65 Override Log 3 Fault 2
70.66 Override Log 3 Fault 3
70.67 Override Log 3 Warning 1
70.68 Override Log 3 Warning 2
70.69 Override Log 3 Warning 3

GROUP 71
External PID1
71.01 External PID act value
71.02 Feedback act value
71.03 Setpoint act value
71.04 Deviation act value
71.06 PID status word
71.07 PID operation mode
71.08 Feedback 1 source
71.11 Feedback filter time
71.14 Setpoint scaling
71.15 Output scaling
71.16 Setpoint 1 source
71.19 Internal setpoint sel1
71.20 Internal setpoint sel2
71.21 Internal setpoint 1
71.22 Internal setpoint 2
71.23 Internal setpoint 3
71.26 Setpoint min
71.27 Setpoint max
71.31 Deviation inversion
71.32 Gain
71.33 Integration time

Complete Parameters List (continued)

71.34 Derivation time
71.35 Derivation filter time
71.36 Output min
71.37 Output max
71.38 Output freeze enable
71.39 Deadband range
71.40 Deadband delay
71.58 Increase prevention
71.59 Decrease prevention
71.62 Internal setpoint actual

GROUP 72
External PID2

72.01 External PID act value
72.02 Feedback act value
72.03 Setpoint act value
72.04 Deviation act value
72.06 PID status word
72.07 PID operation mode
72.08 Feedback 1 source
72.11 Feedback filter time
72.14 Setpoint scaling
72.15 Output scaling
72.16 Setpoint 1 source
72.19 Internal setpoint sel1
72.20 Internal setpoint sel2
72.21 Internal setpoint 1
72.22 Internal setpoint 2
72.23 Internal setpoint 3
72.26 Setpoint min
72.27 Setpoint max
72.31 Deviation inversion
72.32 Gain
72.33 Integration time
72.34 Derivation time
72.35 Derivation filter time
72.36 Output min
72.37 Output max
72.38 Output freeze enable
72.39 Deadband range
72.40 Deadband delay
72.58 Increase prevention
72.59 Decrease prevention
72.62 Internal setpoint actual

GROUP 73
External PID3

73.01 External PID act value
73.02 Feedback act value
73.03 Setpoint act value
73.04 Deviation act value
73.06 PID status word
73.07 PID operation mode
73.08 Feedback 1 source
73.11 Feedback filter time
73.14 Setpoint scaling
73.15 Output scaling
73.16 Setpoint 1 source
73.19 Internal setpoint sel1
73.20 Internal setpoint sel2
73.21 Internal setpoint 1
73.22 Internal setpoint 2
73.23 Internal setpoint 3
73.26 Setpoint min
73.27 Setpoint max
73.31 Deviation inversion
73.32 Gain
73.33 Integration time
73.34 Derivation time
73.35 Derivation filter time
73.36 Output min
73.37 Output max
73.38 Output freeze enable
73.39 Deadband range
73.40 Deadband delay
73.58 Increase prevention
73.59 Decrease prevention
73.62 Internal setpoint actual

GROUP 74
External PID4

74.01 External PID act value
74.02 Feedback act value
74.03 Setpoint act value
74.04 Deviation act value
74.06 PID status word
74.07 PID operation mode
74.08 Feedback 1 source
74.11 Feedback filter time
74.14 Setpoint scaling
74.15 Output scaling
74.16 Setpoint 1 source
74.19 Internal setpoint sel1
74.20 Internal setpoint sel2
74.21 Internal setpoint 1
74.22 Internal setpoint 2
74.23 Internal setpoint 3
74.26 Setpoint min
74.27 Setpoint max
74.31 Deviation inversion
74.32 Gain
74.33 Integration time
74.34 Derivation time
74.35 Derivation filter time
74.36 Output min
74.37 Output max
74.38 Output freeze enable
74.39 Deadband range
74.40 Deadband delay
74.58 Increase prevention
74.59 Decrease prevention
74.62 Internal setpoint actual

GROUP 76
PFC configuration

76.01 PFC status
76.02 Multi-pump system status
76.05 Measured level
76.06 Measured level %
76.07 LC speed ref
76.11 Pump/fan status 1
76.12 Pump/fan status 2
76.13 Pump/fan status 3
76.14 Pump/fan status 4
76.21 Multi-pump configuration
76.22 Multi-pump node number
76.23 Master Enabled
76.24 IPC communications port
76.25 Number of motors
76.26 Min number of motors allowed
76.27 Max number of motors allowed
76.30 Start point 1
76.31 Start point 2
76.32 Start point 3
76.41 Stop point 1
76.42 Stop point 2
76.43 Stop point 3
76.50 LC full speed point
76.51 LC level source
76.52 LC level unit
76.53 LC efficient speed
76.54 LC max time at level
76.55 Start delay
76.56 Stop delay
76.57 PFC speed hold on
76.58 PFC speed hold off
76.59 PFC contactor delay
76.60 PFC ramp acceleration time
76.61 PFC ramp deceleration time
76.62 IPC smooth acceleration time
76.63 IPC smooth deceleration time
76.70 PFC Autochange
76.71 PFC Autochange interval
76.72 Maximum wear imbalance
76.73 Autochange level
76.74 Autochange auxiliary PFC
76.76 Max stationary time
76.77 Pump priority
76.81 PFC 1 interlock
76.82 PFC 2 interlock
76.83 PFC 3 interlock
76.84 PFC 4 interlock
76.90 LC low level switch
76.91 LC high level switch
76.92 LC low level switch
76.93 LC high level action
76.95 Regulator bypass control
76.101 IPC parameter synchronization
76.102 IPC synchronization settings
76.105 IPC synchronization checksum

GROUP 77
PFC maintenance and monitoring

77.10 PFC runtime change
77.11 Pump/fan 1 running time
77.12 Pump/fan 2 running time
77.13 Pump/fan 3 running time
77.14 Pump/fan 4 running time

GROUP 80
Flow calculation

80.01 Actual flow
80.02 Actual flow percentage
80.03 Actual flow
80.04 Specific energy
80.05 Estimated pump head
80.11 Flow feedback 1 source
80.12 Flow feedback 2 source
80.13 Flow feedback function
80.14 Flow feedback multiplier
80.15 Maximum flow
80.16 Minimum flow
80.17 Maximum flow protection
80.18 Minimum flow protection
80.19 Flow check delay
80.29 Total flow reset

GROUP 81
Sensor settings

81.01 Actual inlet pressure
81.02 Actual outlet pressure
81.10 Inlet pressure source
81.11 Outlet pressure source
81.12 Sensors height difference
81.20 Pressure unit
81.21 Flow unit
81.22 Length unit
81.23 Density unit

GROUP 82
Pump protection

82.20 Dry run protection
82.21 Dry run source
82.25 Soft pipe fill supervision
82.26 Time-out limit
82.30 Outlet minimum pressure protection
82.31 Outlet minimum pressure warning
82.32 Outlet minimum pressure fault
82.35 Outlet maximum pressure protection
82.37 Outlet maximum pressure warning
82.38 Outlet maximum pressure fault
82.40 Inlet minimum pressure protection
82.41 Inlet minimum pressure warning
82.42 Inlet minimum pressure fault
82.45 Pressure check delay

GROUP 84
Advanced damper control

84.01 Advanced damper configuration
84.02 Damper control status word
84.03 DA damper open input
84.04 DA damper open timeout
84.05 DA damper open timeout action
84.06 DA damper closed input
84.07 DA damper closed input timeout
84.08 DA damper closed input timeout action
84.13 OA damper open input
84.14 OA damper open timeout
84.15 OA damper open timeout action
84.16 OA damper closed input
84.17 OA damper closed timeout
84.18 OA damper closed timeout action

GROUP 95
HW configuration

95.01 Supply voltage
95.02 Adaptive voltage limits
95.03 Estimated AC supply voltage
95.04 Control board supply
95.15 Special HW settings
95.20 HW options word 1
95.21 HW options word 2

GROUP 96
System

96.01 Language
96.02 Pass code
96.03 Access level status
96.04 Macro select
96.05 Macro active
96.06 Parameter restore
96.07 Parameter save manually
96.08 Control board boot
96.10 User set status
96.11 User set save/load
96.12 User set I/O mode in1
96.13 User set I/O mode in2
96.16 Unit selection
96.20 Time sync primary source
96.51 Clear fault and event logger
96.70 Disable adaptive program

GROUP 97
Motor control

97.01 Switching frequency reference
97.02 Minimum switching frequency
97.03 Slip gain
97.04 Voltage reserve
97.05 Flux braking
97.08 Optimizer minimum torque
97.09 Switching frequency mode
97.10 Signal injection
97.11 TR tuning
97.13 IR compensation
97.15 Motor model temperature adaptation
97.16 Stator temperature factor
97.17 Rotor temperature factor
97.20 U/F Ratio

GROUP 98
User motor parameters

98.01 User motor model mode
98.02 Rs user
98.03 Rr user
98.04 Lm user
98.05 SigmaL user
98.06 Ld user
98.07 Lq user
98.08 PM flux user
98.09 Rs user SI
98.10 Rr user SI
98.11 Lm user SI
98.12 SigmaL user SI
98.13 Ld user SI
98.14 Lq user SI

GROUP 99
Motor data

99.03 Motor type
99.04 Motor control mode
99.06 Motor nominal current
99.07 Motor nominal voltage
99.08 Motor nominal frequency
99.09 Motor nominal speed
99.10 Motor nominal power
99.11 Motor nominal cos ϕ
99.12 Motor nominal torque
99.13 ID run requested
99.14 Last ID run performed
99.15 Motor polepairs calculated
99.16 Motor phase order

Specifications

SCOPE

TABLE 24 - CONFIGURATION AVAILABILITY

DESCRIPTION	TYPE CODE	AYK550	AYK580
Bypass with fused disconnect	CF	YES	YES
Non-bypass with fused disconnect	PF	YES	YES
Bypass with non-fused disconnect	CD	YES	NO
Non-bypass with non-fused disconnect	PD	YES	NO

STANDARD PACKAGED DRIVES - FUNCTION

Non-bypass with fused disconnect (PF)

This product includes the AYK580-01 base drive with a fused rotary through-the-door input disconnect switch.

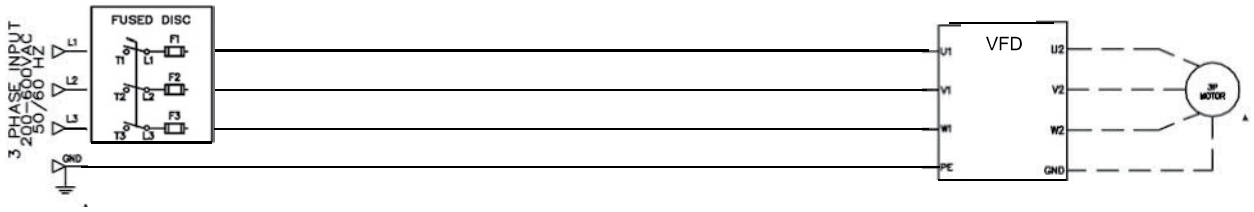


FIGURE 49 - NON-BYPASS WITH FUSED DISCONNECT (PF) CIRCUIT DIAGRAM

Electrical components

- Fused disconnect with Fast Acting class CC (R1 – R?) or Fast Acting J Fusing / DFJ fuses
- Variable frequency drive, AYK580
- Three phase motor (supplied by JCI)

Classic bypass with fused disconnect (CF)

This product includes the AYK580-01 base drive with a fused rotary through-the-door input disconnect switch plus a two-contactor (mechanically interlocked) bypass.

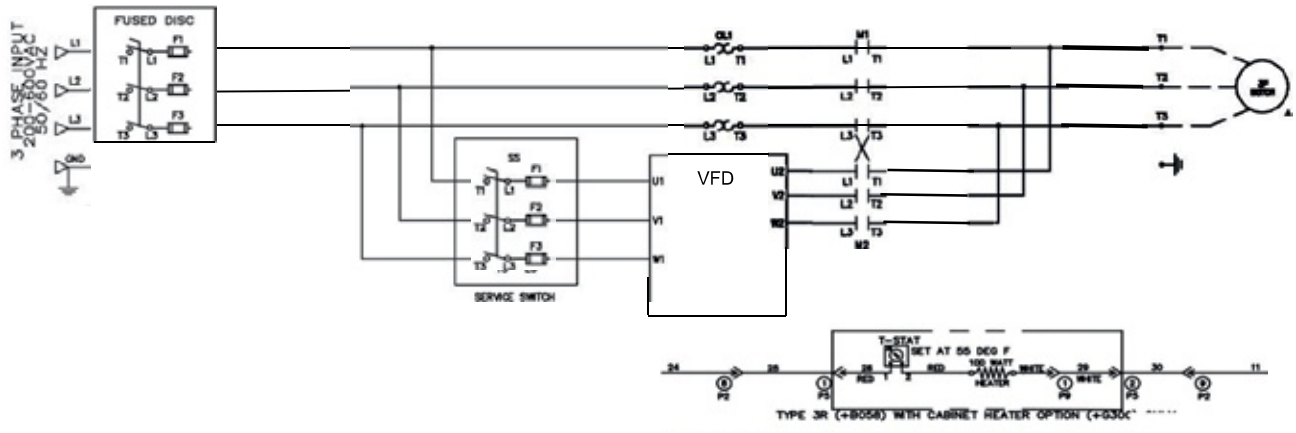


FIGURE 50 - CLASSIC BYPASS WITH FUSED DISCONNECT (CF) DIAGRAM

Specifications (continued)

Electrial components

- Fused disconnect with class J fuses
- Service switch with Fast Acting class CC (R1 – R?) or Fast Acting J Fusing / DFJ fuses
- Variable frequency drive, AYK580
- Two contactors, mechanically or electrically interlocked (ABB Type AF)
- Electronic overload relay (ABB Type EF)
- Three phase motor (supplied by JCI)

Standard Packaged Drives - Options

Options for the full line of products is shown below.

IMPORTANT: Some options will be included in all cases as noted.

CODE	DESCRIPTION	COMMENT
B058	UL Type 3R	Plus Code Required
G418	Alternate motor overload - one (1) standard rating below the standard motor overload for that unit (Bypas units only)	Optional on an SQ Basis If Required
G419	Alternate motor overload - two (2) standard ratings below the standard motor overload for that unit (Bypass units only)	Optional on an SQ Basis If Required
G441	Alternate motor overload - three (3) standard ratings below the standard motor overload for that unit (Bypass units only)	Optional on an SQ Basis If Required

Note: Depending on how the new electronic overloads line up with drive/motor amperages, the +G418, +G419 and +G441 option codes may not be required.

Special Order Packaged Drives

Definition

A “special order package” is defined as a unit that deviates in any way from the standard package as defined above.

Service Parts

Spare parts

ABB maintains a stock of the parts that may require replacement over the life of the drive unit. This includes fans, relays, fuses, etc. Contact ABB Drive Services for pricing and delivery.

Replacement Parts

Availability

Replacment parts are parts that do not normally fail over the life of the drive unit. This includes doors, covers, hinges, wires harnesses, etc. While ABB maintains a stock of these parts it is for use by the ABB factory to build new units. Availability as a separate replacement part to JCI may be limited.

Cabinet Doors

ABB purchases doors as part of a kit for a complete cabinet. Therefore, available as a replacement part is only as a complete cabinet. When a door is requested, ABB will supply a complete cabinet without electrical components. However, for bypass units, selector switches mounted on the door will be included.

Documentation

Each Configured unit will be shipped with electrical schematics supplied in a plastic bag within the enclosure.

Specifications (continued)

Overall Packaged Drive Specifications

TABLE 25 - OVERALL PACKAGED DRIVE SPECIFICATIONS

PACKAGE PRODUCT TYPES	
PF:	Drive with main fusible disconnect switch
CF:	Drive, 2 contactor classic bypass, main fusible disconnect, fusible drive input service switch, control pwer transformer and 2 selector switches (DRIVE-Off-BYPASS and HAND-OFF-AUTO) for control
PRODUCT OPTION CODES	
B058	UL Type 3R enclosure
G418	Motor overload relay, 1 size smaller (SQ Bassis ONLY)
G419	Motor overload relay, 2 sizes smaller (SQ Bassis ONLY)
G441	Motor overload relay, 3 sizes smaller (SQ Bassis ONLY)
AGENCY APPROVALS	
UL508C:	VFD Only
UL508A:	Yes
cUL:	Yes
CSA	No – Available as a special quote request if required.
PACKAGED DRIVE NAME-PLATE RATINGS	
Short Circuit Current Rating:	100,000 RMS for all symmetrical Amperes (see drive specification / Exception: (575V SCCR 5KA)
INPUT:	
Voltage:	208 to 230 VAC 3-phase ±10%, 60 Hz; 460 VAC 3-phase ±10%, 60 Hz; 575 VAC 3-phase ±10%, 60 Hz 380V/400/ 415 VAC ±10%, 50/60 Hz (SQ Required / Available Upon Request)
FLA:	To be provided
Frequency:	60 Hz unit Frequency Tolerance 57-63 Hz 50/60 Hz unit Frequency Tolerance 48-63 Hz
OUTPUT:	
Voltage:	208 to 230 VAC 3-phase ±10%, 60 Hz; 460 VAC 3-phase ±10%, 60 Hz 380V/400/ 415 VAC ±10%, 50/60 Hz; 460 VAC 3-phase ±10% 60 Hz, 575 VAC 3-phase ±10%, 60 HZ
FLA:	See ratings table
Frequency:	See drive specifications
INPUT SUPPLY	
Input Voltage (U1):	208 to 230 VAC 3-phase ±10%, 60 Hz; 460 VAC 3-phase ±10%, 60Hz;380/400/ 415VAC ±10%, 50/60 Hz; 575 VAC 3-phase ±10%, 60 Hz
Frequency:	60 Hz unit Frequency Tolerance 57-63 Hz 50/60 Hz unit Frequency Tolerance 48-63 Hz
Line Limitations:	Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor (cosj):	0.98 at nominal load
LOAD CHARACTERIS-TICS	
Application:	HVAC Fans Factory Mounted
MOTOR	
HP:	1 to 75 HP at 208/ 230V; 1 to 75 HP at 380/400/415V; 1 to 150 HP at 460V, 1 to 125 HP at 575V
Design Type:	NEMA B Standard Efficiency
3-Phase FLA:	Less than or equal to the panel rating

Specifications (continued)

TABLE 23 - OVERALL PACKAGED DRIVE SPECIFICATIONS (CONT'D)

I peak (amps):	Estimating 6 times Motor FLA (with motor FLA not exceeding panel max amps) for a motor across the line start in bypass
Load Profile Ramp / Starting Time (sec):	We have assumed a 15 second start time

TABLE 26 - ENCLOSURE CHARACTERISTICS (UL TYPE 1)

FEATURE	DESCRIPTION
UL Enclosure Protection Class:	UL Type (NEMA) 1
Material:	
Type:	Galvanized Steel
Gauge:	
Enclosure:	14 gauge
Mounting Plate:	12 gauge
Internal Component Back plate:	12 gauge
Air Dams:	16 gauge
Remaining:	14 gauge
Assembly Type:	Bolt, Screw, & Rivet
Ventilation:	Forced air via VFD
Accessories:	
Drip Shield	No
Louvers	No
Heater	No
Drain Plug	No
Thermostat	No
Keypad Shield	No
Solar Shield – Door	No
Top Drip Shield	No
Conduit:	
Location/Placement:	
Entry	Rear (factory mount) / Bottom (field mount)
Exit	Rear (factory mount) / Bottom (field mount)
Knockout Dimensions:	
R1- R6:	Varies by type and rating. See dimension drawings.
Door:	
Type:	Removable
Hinge:	2 (R1/R2), 3 (R3), or 4 (R4-R7) loose joint
Closure:	2 (R1-R3) or 3 (R4-R7) non-locking quarter-turn Latches
Lifting Configurations:	Type PF Wall Mounting Tabs R1-R7 Type CF lifting holes R1-R7

Specifications (continued)

TABLE 27 - ENCLOSURE CHARACTERISTICS (UL TYPE 3R)

FEAUTRE	DESCRIPTION
UL Enclosure Protection Class:	UL Type (NEMA) 3R (+B058 option)
Material:	
Type:	Cold rolled commercial quality steel per ASTM Specification A-1008/A-1008M
Gauge:	
Enclosure:	14 gauge
Internal Component Back plate:	12 gauge
Air Dams:	16 gauge
Remaining:	14 gauge
Assembly Type:	Weld & rivet
Ventilation:	Forced air via VFD
Coating:	
Type:	Powder coat
Thickness:	3.0-3.5 mils
Surfaces/Components:	Enclosure surfaces powder coated
Color Description & Code:	JCI Champagne Brown
Certifications:	UL Recognized
Accessories:	
Drip Shield	Yes (R1-R6 frames)
Louvers	No
Heater	Yes
Drain Plug	No
Thermostat	Yes
Keypad Shield	Yes
Solar Shield – Door	Standard on frames R4-R7
Conduit:	
Location/Placement:	
Entry	Rear (factory mount) / Bottom (field mount)
Exit	Rear (factory mount) / Bottom (field mount)
Knockout Dimensions:	
R1- R6:	Varies by type and rating. See dimension drawings.
Door:	
Type:	Removable
Hinge:	2 (R1/R2), 3 (R3), or 4 (R4-R7) loose joint
Closure:	2 (R1-R3) or 3 (R4-R7) non-locking quarter-turn latches
Lifting Configurations:	Type PF Wall Mounting Tabs R1-R7 Type CF lifting holes R1-R7

Specifications (continued)

TABLE 28 - COMMON FEATURES IN UL TYPE 1 AND 3R

FEATURE	DESCRIPTION
Controls	
Motor Control:	VFD (all types) or (CF) 2 Contactor Classic Bypass with Electronic Coil (ABB AF Series Contactors)
Control Mode:	Variable torque
Operating Mode:	Keypad (PF/CF) & 2-Wire Bypass (CF)
Speed Command Reference:	0-10 Vdc
Control Switches:	Hand-Off-Auto & Drive-Off-Bypass (CF)
Contactors:	Bypass & Drive Output Mechanically Interlocked (CF)
Overload:	
Up to 80 Amp:	Electronic Class 10, 20 or 30 (Default Set for Class 20)
Greater than 80 Amp:	Current Transformer/Overload (electronic class 10, 20 or 30) Combination
Control Transformer:	Primary voltage selectable 208/230/460VAC @ 60Hz or 380V/400V @ 50/60 Hz or 575 VAC @ 60 Hz. ABB reserves the right to select the kVA rating on a transformer to meeting technical specifications
Control Inputs:	
PF:	Run, constant speed, safeties (all dry contact)
CF:	External speed reference, safeties (up to 2), Run time clock
Control Outputs:	fault (relay), frequency (analog & relay), running (relay)
Disconnecting Means	
Disconnect:	Rotary thru door fused, open-lockable door closed
Service Switch:	Rotary disconnect accessible from inside enclosure.
Branch circuit protection:	PF, CF max fuse size based on a target of 175% of drive FLA subject to ABB UL File max branch fuse specifications required to achieve short circuit current rating
Internal Wiring	
Type:	THHN, MTW, or silicon rubber UL3213
Wire marking specification:	Slip on markers or printed on wire
Wire color specification:	
Power	Black, size per UL508A Table 28.1
AC Control	Red (AC line), white (AC neutral), 16 AWG
DC Control	Blue (DC +supply), blue (common), 20 AWG
Environmental	
Ambient Temperature:	-15 deg C to 40 deg C (Derate required for up to 50 degree C required)
Storage Temperature:	-40 deg C to 70 deg C
Humidity:	<95% non-condensing
Altitude:	up to 1000m (3300 ft.) without derate (Derate required for high altitude)
Packaging	
UL Type 1 - PF	Corragated paperboard box with plywood & insert internal (R1, R2) Wood pallet base & cardboard cover (R3-R6)
UL Type 1 - CF	Wood pallet base, corragated paperboard wrapper and cover
UL Type 3R- PF/CF	Wood pallet base, corragated paperboard wrapper and cover
Product Labeling	
General:	Per UL508A

Specifications (continued)

TABLE 26 - COMMON FEATURES IN UL TYPE 1 AND 3R (CONT'D)

FEATURE	DESCRIPTION
Exterior:	Warnings (risk of fire / shock, discharge wait)
	Caution (foreign voltage), & Controls (see controls section above)
Interior:	UL, UL Enclosure Type, & Ratings
Customized Base Drive	AYK580-01 brand labeled ACH580 with customized control panel

DEFINITION OF NEMA AND IEC ENVIRONMENTAL RATINGS

NEMA and IEC environmental ratings can be confusing. The following is a summary of the rating definitions and recommendations for application of each type supported by the AYK580 AC Drive product family.

NEMA 1, UL type 1

Indoor use primarily to provide a degree of protection against limited amounts of falling dirt

IP 2 1

(2) Protected against solid foreign objects of 12.5 mm diameter and greater

(1) Protected against certically falling water drops

Recommendation

Installation in clean environment such as clean room or in another enclosure with higher degree of protection.

NEMA 12, UL type 12

Indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dropping non-corrosive liquids.

IP 5 4

(5) Ingress of dust is not totally prevented, but dust does not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety.

(4) Water splashed against the enclosure from any direction does not have harmful effects.

Recommendation

Installation in environments with moderate to significant dust and contaminant particles. Acceptable for most applications on factory floors where dust is present but spraying liquids are not. Regular preventative maintenance for filter changing or cleaning. Inspect drive for dust or particle build up that may limit cooling in the future, clean as needed.

NEMA 3R, UL type 3R

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.

IP 2 4

(2) Protected against solid foreign objects of 12.5mm diameter and greater
(4) Water splashed against the enclosure from any direction shall have no harmful effects

Recommendation

Installation in outdoor environments where rain and other precipitates are commonly present. Also suitable for indoor installation where dripping or splashing water is present. Not recommended where significant dust and contaminant particles are present.

Appendix A

WIRING DIAGRAMS

TABLE 29 - WIRING DIAGRAMS

	DESCRIPTION	DRAWING NUMBER	PAGE
01	Base Drive with NEMA 1 conduit box as standard AYK580-01 Base Drive - R1 to R9 connections and wiring	#3AXD10000404024	103 - 105
PF	Base Drive with fused input disconenct AYK580 electrical drawings NON-BYPASS, N1 and N3R Special note: The same drawing is used for both NEMA 1 and NEMA 3R	#3AXD50000490134	108
CF	Base Drive with main fuse disconnect Classic 2 contactor bypass and drive isolation fast acting fused service switch switches AYK580 electrical drawings BYPASS, N1 and N3R Special note: The same drawing is used for both NEMA 1 and NEMA 3R	#3AXD50000489268	109

DEFAULT CONTROL CONNECTIONS FOR THE HVAC DEFAULT

Drawing Number	Customer Designation
3AXD10000404024	R1 580-01 Base Drive

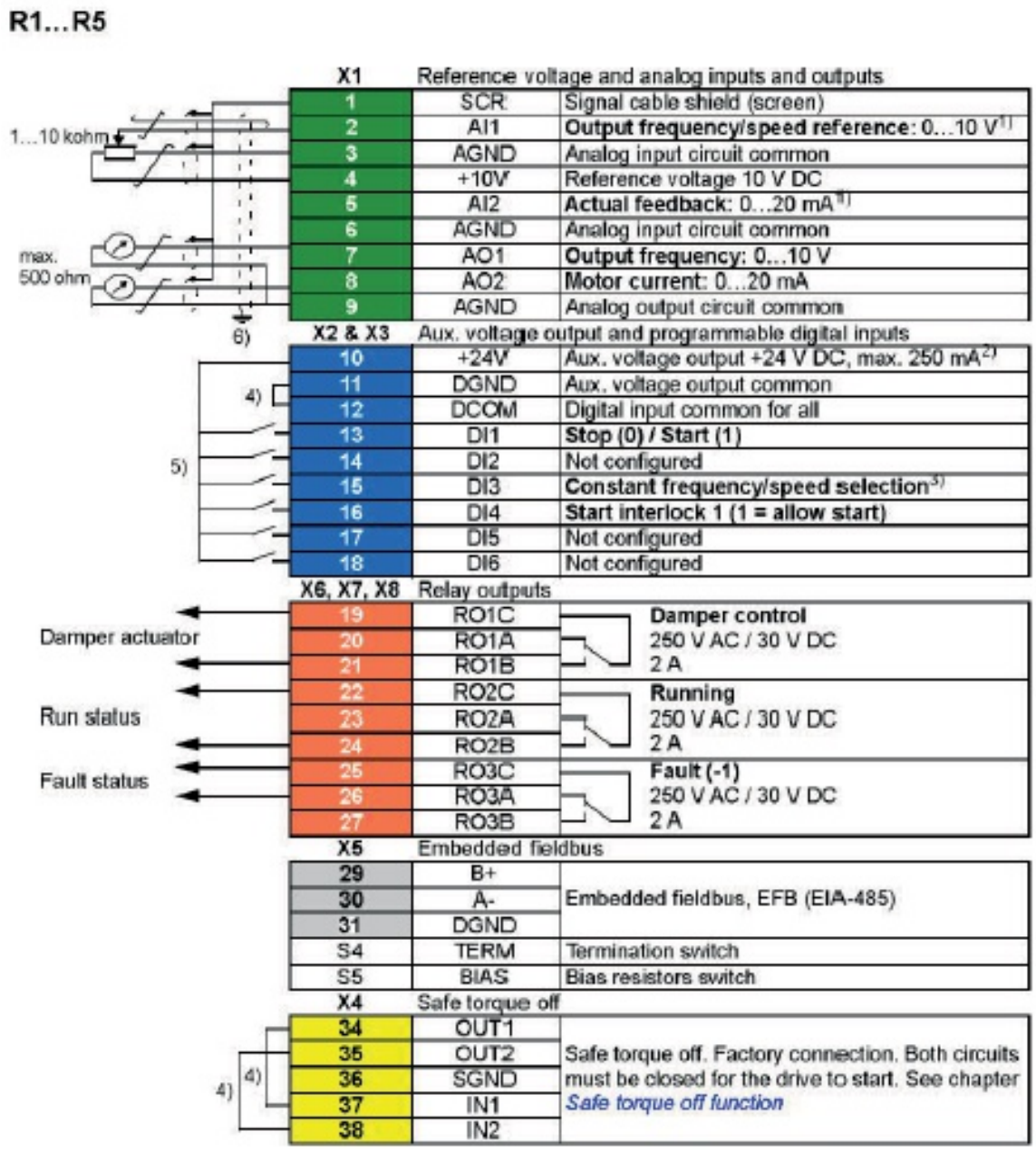


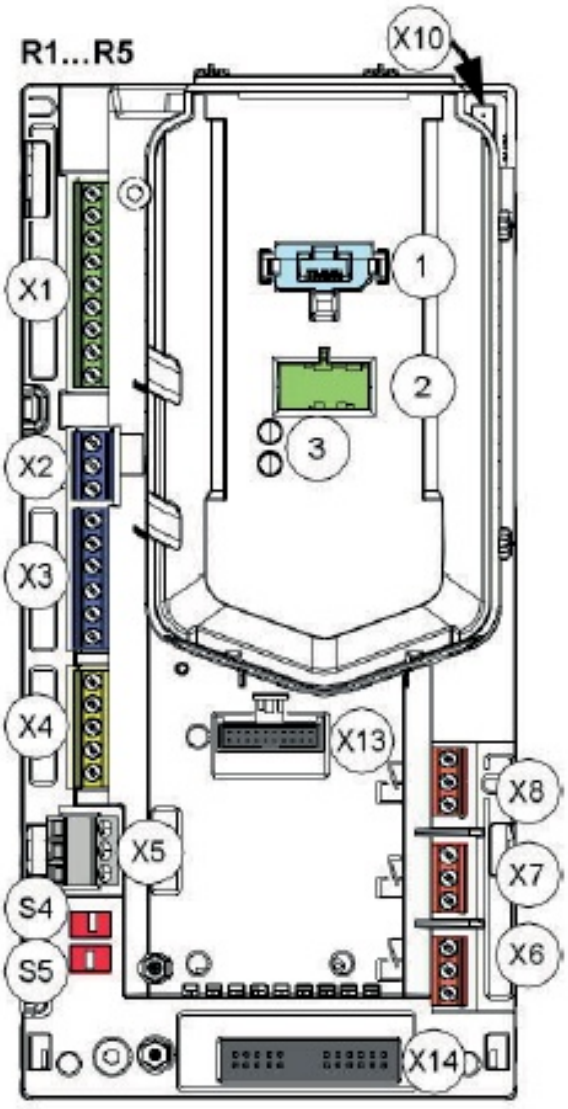
FIGURE 51 - DEFAULT CONTROL CONNECTIONS FOR THE HVAC DEFAULT

- Total load capacity of the auxiliary voltage output +24 VAC (X2:10) is 6.0 W (250 mA/24 VDC).
- Digital inputs D|1...D|5 also support 10 VAC to 24 VAC.
- Wire sizes:
  - 0.2...2.5mm² (24...14 AWG); terminals +24 V, DGND, DCOM, B=, A-, DGND, Ext. 24 V.
  - 0.14...1.5mm (26...16 AWG); terminals DI, AI, AO, AGND, RO, STO
- Tightening torques: 0.5...0.6 N·m (0.4 lbf·ft)

EXTERNAL CONTROL CONNECTION TERMINALS, FRAMES R1...R5

The layout of the external control connection terminals of the R1 frame is shown in the following figure. Layout of the external control connection terminals is identical in frames R1...R5, but the loaction of the control board with the terminals is different in frames R3...R5.

Drawing Number	Customer Designation
3AXD10000404024	R1 580-01 Base Drive



	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* See Switch Orientations Below
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. See section LEDs below .

FIGURE 52 - EXTERNAL CONTROL CONNECTION TERMINALS, FRAMES R1...R5

DEFAULT CONTROL CONNECTIONS FOR R6...R9

Drawing Number	Customer Designation
3AXD10000404024	R1 580-01 Base Drive

R6...R9

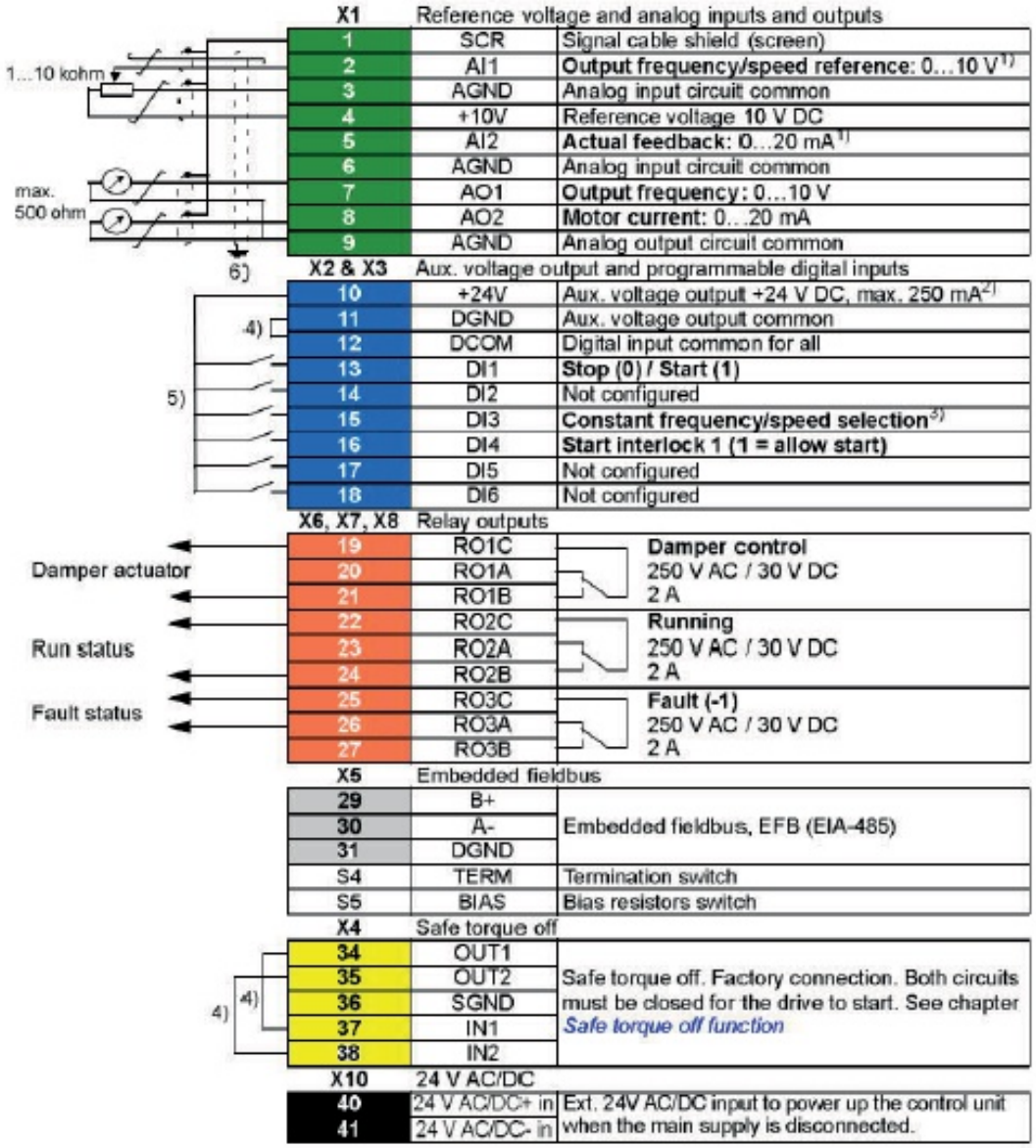


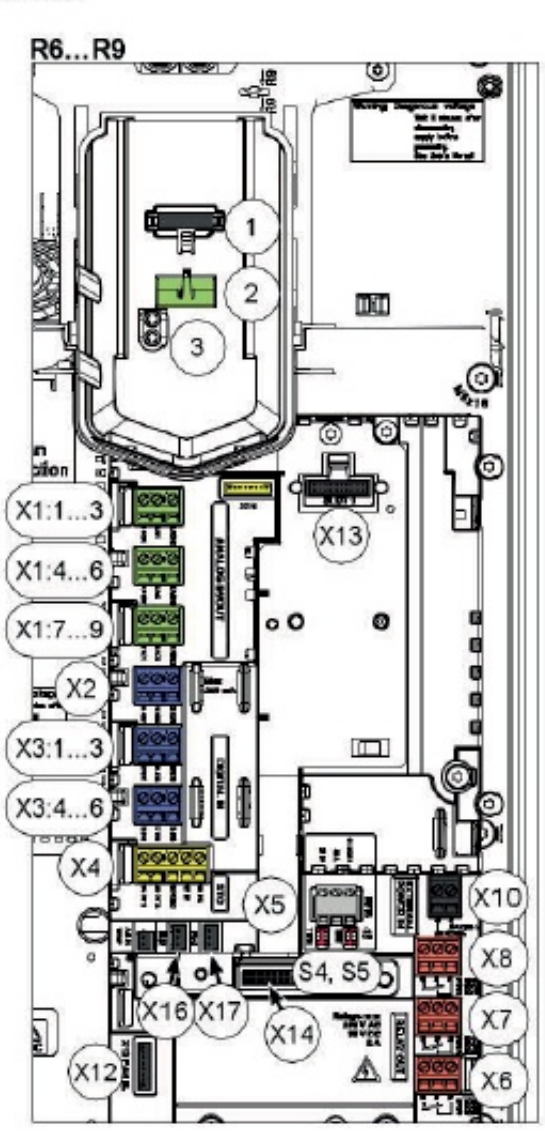
FIGURE 53 - DEFAULT CONTROL CONNECTIONS FOR R6...R9

- Total load capacity of the auxiliary voltage output +24 V (X2:10) is 6.0 W (250 mA/24 VDC).
- Digital inputs D|1...D|5 also support 10 VAC to 24 VAC
- Wire sizes: 0.14...2.5mm2 (26...16 AWG): All terminals
- Tightening torques: 0.5... 0.6 N·m (0.4 lbf·ft)

EXTERNAL CONTROL CONNECTION TERMINALS, FRAMES R6...R9

The layout of the external control connection terminals of frames R6...R9 is shown in the following figure:

Drawing Number	Customer Designation
3AXD10000404024	R1 580-01 Base Drive



	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* See Switch Orientations Below
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. See section LEDs below

FIGURE 54 - EXTERNAL CONTROL CONNECTION TERMINALS, FRAMES R6...R9

WARNING: Do not connect the +24 VAC cable to the control board ground when the control board if powered using an axternal 24 VAC supply.

Drawing Number	Customer Designation
3AXD10000404024	R1 580-01 Base Drive

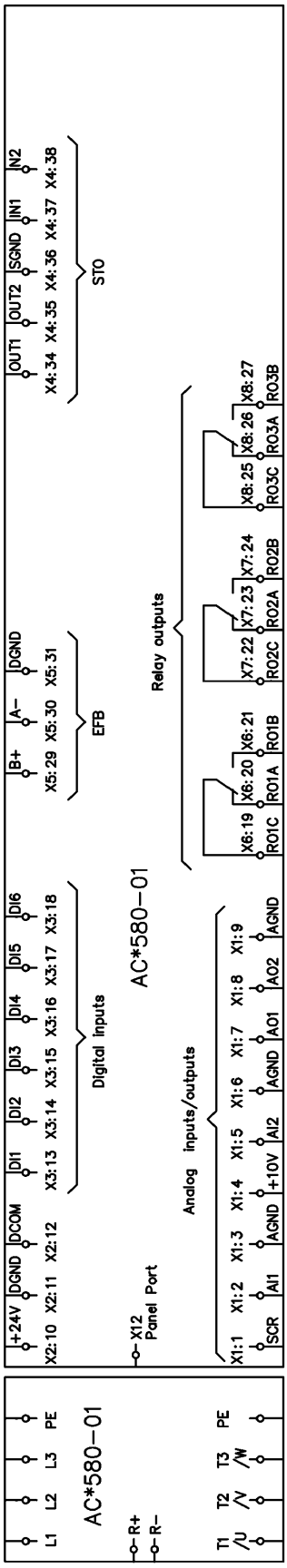
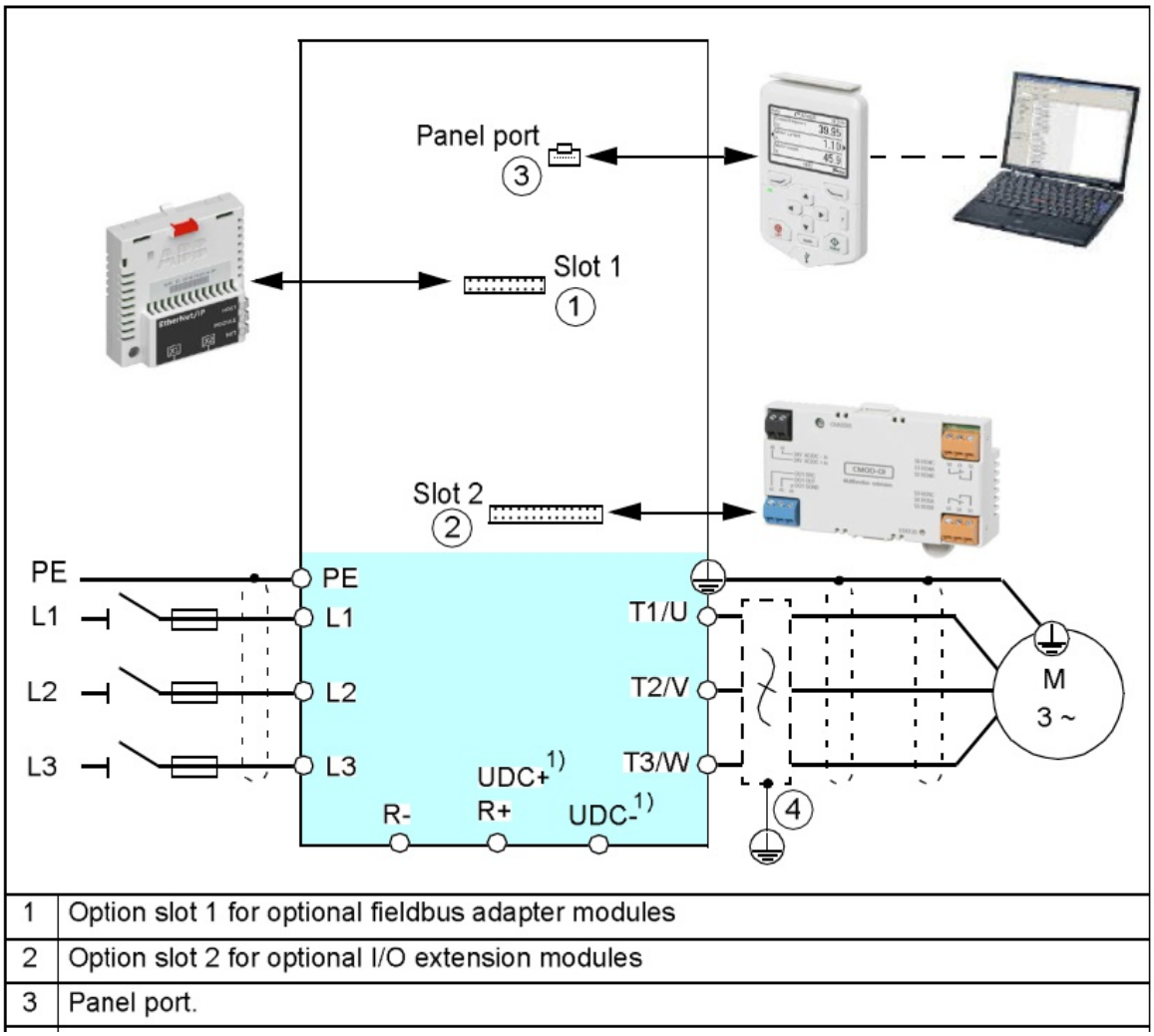


FIGURE 55 - WIRING CONNECTION FOR R0...R3 ACS580-01, ACH580-01, ACQ580-01

OVERVIEW OF POWER AND CONTROL CONNECTIONS

The following logical diagram shows the power connections and control interfaces of the drive.



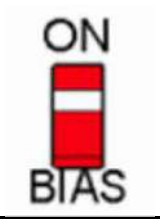
1	Option slot 1 for optional fieldbus adapter modules
2	Option slot 2 for optional I/O extension modules
3	Panel port.

FIGURE 56 - POWER CONNECTIONS AND CONTROL INTERFACES

Switches and LEDs

Switches

TABLE 30 - 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.		Bus not terminated
			Bus terminated
S5 (BIAS)	Activated on the biasing voltages to the bus. One (and only one) device, preferably at the end of the bus must have the bias on.		Bias off (default)
			Bias on

LEDS

Drive LEDs

There is a green POWER and a red FAULT LED on the front of the drive. They are visible through the panel cover but invisible if a control panel is attached to the drive. The following tabl describes the drive LED indications

Drive LEDs POWER and FAULT, on the front of the drive, under the control panel/panel cover

If a control panel is attached to the drive, switch to remote control (otherwise a fault is generated), and then remove the panel to be able to see the LEDs.

TABLE 31 - LEDS

LEDS OFF	LED LIT AND STEADY		LED BLINKING	
No power	Green (POWER)	Power supply on the board OK	Green (POWER)	Blinking: Drive in an alarm state Blinking for one second:
				Drive selected on the control panel when multiple drives are connected to the same panel bus
	Red (FAULT)	Active fault in the drive. To reset the fault, press RESET from the control panel or switch off the drive power.	Red (FAULT)	Active fault in the drive. To reset the fault, switch off the drive power.

FUSE	150VA CPT
1F	UL TYPE 3R
2F	1.0A
3F	1.0A
TAPS	2.0A
	H3/H2/H1 & H4

FRAME	CUSTOMER TORQUE REQUIREMENTS TERMINAL TORQUE (Nm)			
	U	V	W	PE
R1	1.0	1.0	1.0	1.5
R2	1.5	1.5	1.5	1.5
R3	3.5	3.5	3.5	1.5
R4	4.0	4.0	4.0	2.9
R5	5.6	5.6	5.6	2.2
R6	30	30	30	9.8
R7	40	40	40	9.8
INPUT DISCONNECT	TERMINAL TORQUE (Nm)			
OS30FACC12	1.9			
OS60JU12	3.4			
OS100JU03	5.7			
OS200JU03	22			
OS400JU03	42			

X1	REFERENCE VOLTAGE AND ANALOG I/O	
1	SCR	SIGNAL CABLE SHIELD (SCREEN)
2	AI1	OUTPUT FREQUENCY/SPEED REF 0 - 10V OR 2 - 20mA
3	AGND	ANALOG INPUT CIRCUIT COMMON
4	+10V	REFERENCE VOLTAGE 10 VDC
5	AI2	ACTUAL FEEDBACK: 0 - 20mA
6	AGND	ANALOG INPUT CIRCUIT COMMON
7	AO1	OUTPUT FREQUENCY 0 - 20mA
8	AO2	MOTOR CURRENT 0 - 20mA
9	AGND	ANALOG OUTPUT CIRCUIT COMMON
X2 AND X3	AUX VOLTAGE OUTPUT / PROGRAMMABLE DIGITAL INPUTS	
10	+24V	AUX VOLTAGE OUTPUT +24VDC 250mA MAX
11	DGND	AUX VOLTAGE OUTPUT COMMON
12	DCOM	DIGITAL INPUT COMMON FOR ALL
13	DI1	STOP (0) / START (1)
14	DI2	NOT CONFIGURED
15	DI3	CONSTANT FREQUENCY / SPEED SELECTION
16	DI4	START INTERLOCK 1 (1 = ALLOW START)
17	DI5	NOT CONFIGURED
18	DI6	NOT CONFIGURED
X6, X7, AND X8	RELAY OUTPUTS	
19	RO1C	READY
20	RO1A	250VAC / 30VDC
21	RO1B	2A
22	RO2C	RUNNING
23	RO2A	250VAC / 30VDC
24	RO2B	2A
25	RO3C	FAULT
26	RO3A	250VAC / 30VDC
27	RO3B	2A
X5	EMBEDDED FIELDBUS	
29	B+	EMBEDDED FIELDBUS
30	A-	EFB (EIA-485)
31	DGND	EFB (EIA-485)
S4	TERM	TERMINATION SWITCH
S5	BIAS	BIAS RESISTORS SWITCH
X10	24V AC / DC	
40	24VAC/DC+ IN	EXTERNAL 24V AC / DC INPUT TO POWER THE CONTROL
41	24VAC/DC- IN	UNIT WHEN THE MAIN SUPPLY IS DISCONNECTED.

NOTE: TERMINALS 40 AND 41 AVAILABLE ON R6 AND LARGER ONLY.

RHTR TEMPERATURE HI/LO JUMPER (X1)	HEATER ON TEMPERATURE	HEATER OFF TEMPERATURE
DEFAULT SETTING (X1 JUMPER:LO)	14.4°C 58°F	21.4°C 70.5°F
ALTERNATE SETTING (X1 JUMPER:HI)	17.8°C 64°F	24.4°C 76.5°F

* CLASS 1 CONTROL CIRCUIT or USE CLASS 1 CONDUCTORS

TYPE 3R (+B058) RHTR PCB

UH – NON-BYPASS DRIVE ONLY
PF – NON-BYPASS WITH FUSED DISC
B058 – TYPE 3R
– REFER TO PANEL LABEL FOR OPTIONS

LEGEND

———— OPTIONAL PANEL COMPONENTS
———— WIRING PROVIDED BY ABB
– – – – WIRING NOT PROVIDED BY ABB
---------- WIRING CONFIGURATION-FACTORY/FIELD
[•] – TERMINAL POINT
▲ – REMOTE DEVICE (BY OTHERS)
▽ – WIRE CONTINUATION POINT

NOTES:

A CONTACT CLOSURE BETWEEN 10 AND 13 CAUSES THE DRIVE TO START. (10 TO 16 MUST BE CLOSED)

A CONTACT CLOSURE BETWEEN 10 AND 15 WILL CAUSE DRIVE TO RUN AT A PRESET SPEED. SET PARAMETER 28.26 TO DESIRED SPEED.

A CONTACT CLOSURE BETWEEN 10 AND 16 WILL ENABLE THE MOTOR TO RUN

FIGURE 57 - N1-N3R FUSED DISC NON BYPASS

3AXD50000489268

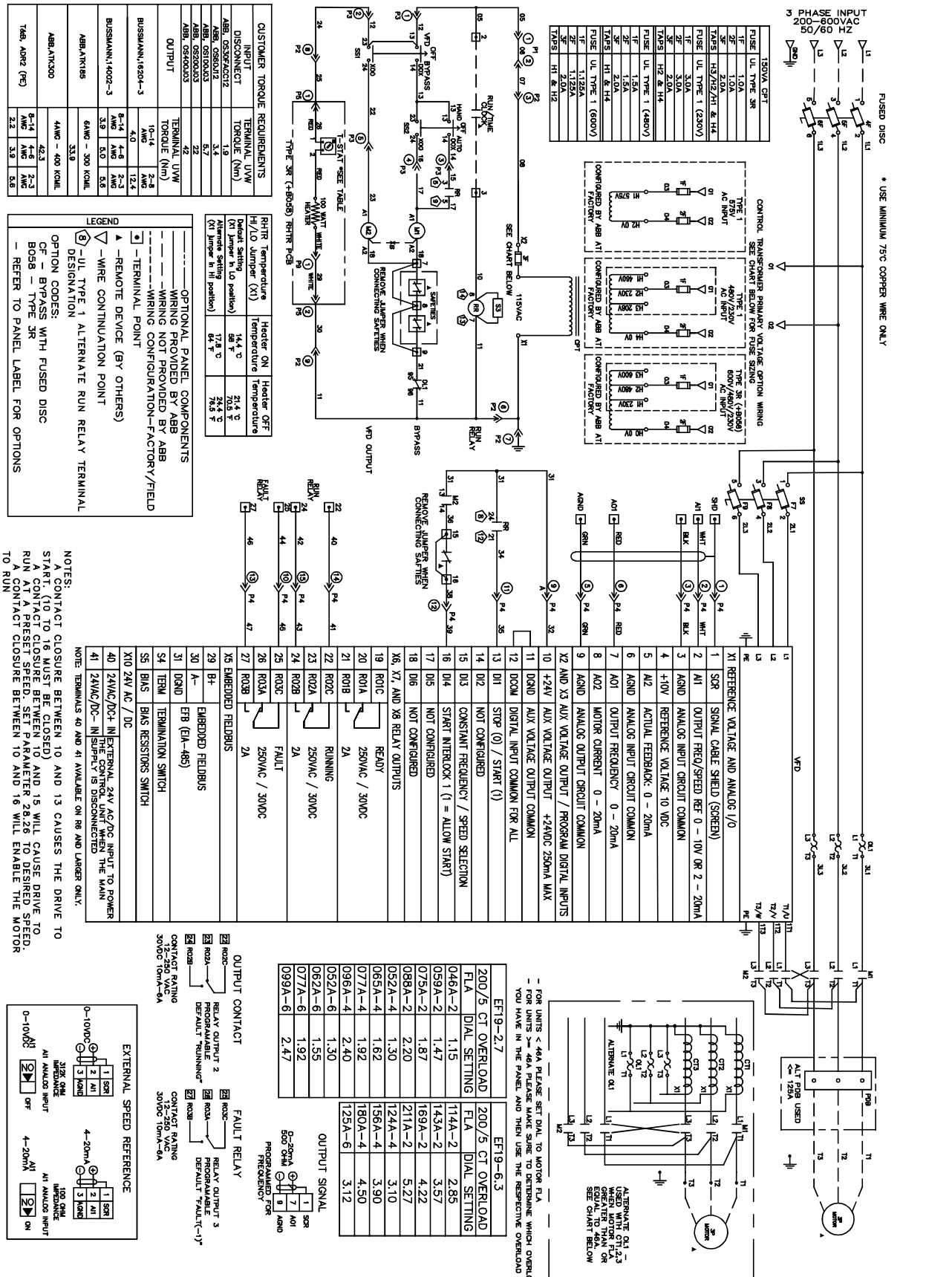


FIGURE 58 - N1-N3R FUSED DISC WITH BYPASS

Glossary

Ambient Temperature — The air temperature in the chamber in which a powered electronic unit resides. A unit's heat sinks rely on a lower ambient temperature in order to dissipate heat away from sensitive electronics.

Auto-tuning — The ability of a controller to execute a procedure that interacts with a load to determine the proper coefficients to use in the control algorithm. Auto tuning is a common feature of process controllers with PID loops. Auto-tuning is available (for SJ100) as a special command from a digital operator panel. See also *digital operator panel.*

Base Frequency — The power input frequency for which an AC induction motor is designed to operate. Most motors will specify a 50 to 60 Hz value. The inverters have a programmable base frequency, so you must ensure that parameter matches the attached motor. The term *base frequency helps* differentiate it from the carrier frequency. See also *carrier frequency and frequency setting.*

Braking Resistor — A braking resistor is a resistive load attached to a variable speed drive equipped with Dynamic Braking, referred to as a braking chopper. The resistor is used to dissipate regenerative power that exceeds the typical capability of the variable speed drive (see regenerative power).

Break-away Torque — The torque a motor must produce to overcome the static friction of a load, in order to start the load moving.

Brushes — A sliding electrical connection between a fixed post inside the motor housing and a ring on the motor shaft. Typically used in DC motors or low-cost AC motors, brushes route current to windings on the rotor. AC induction motors with a squirrel-cage design do not have the need for brushes. See also *commutation* and *squirrel cage.*

Bypass — The term bypass when used in the context of a variable speed drive is a feature of a drive package that incorporates an ability to bypass the variable speed drive in the event it is inoperable and operate the motor on the power line in a traditional manner starting the motor across the power line. The AYK550 is offered with bypass option (see description of AYK550-CD or AYK550-CF.

Carrier Frequency — The frequency of the constant, periodic, switching waveform that the inverter modulates to generate the AC output to the motor. See also *PWM.*

CE — A regulatory agency for governing the performance of electronic products in Europe. Drive installations designed to have C.E. approval must have particular filter(s) installed in the application.

Choke — Also known as inductor or reactor. This device is used to oppose changes in AC current. Its opposition to changes in current is measured in reactance. Reactance is Measurement of the opposition of a circuit or component to an alternating current, expressed in ohms. In variable frequency drive systems a choke, inductor or reactor are used in many different applications, most notably they are used within the variable speed drive in the DC circuit to attempt to minimize the impact of harmonic current draw from the network. Chokes can be applied external to the inverter to minimize the impact of network harmonics. See *also harmonics.*

DC Injection Braking — The inverter DC braking feature stops the AC commutation to the motor, and sends a DC current through the motor windings in order to stop the motor. Also called "DC injection braking," it has little effect at high speed, and is used as the motor is nearing a stop.

Dead Band — In a control system, the range of input change for which there is no perceptible change in the output. In PID loops, the error term may have a dead band associated with it. Dead band may or may not be desirable; it depends on the needs of the application.

Glossary *(continued)*

Digital Operator Panel (DOP) refers first to the operator keypad on the front panel of the inverter. It also includes hand-held remote keypads, which connect to the inverter via a cable. Finally, the DOP Plus is a PC-based software simulation of the keypad devices.

Diode A semiconductor device which has a voltage-current characteristic that allows current to flow only in one direction, with negligible leakage current in the reverse direction. See also *rectifier.*

Duty Cycle 1. The percent of time a square wave of fixed frequency is on (high) versus off (low). 2. The ratio of operating time of a motor, braking resistor, etc. to its resting time. This parameter usually is specified 0 in association with the allowable thermal rise for the device.

Dynamic Braking The optional dynamic braking unit also known as a dynamic brake chopper is the electronic switch that is used to dissipate regenerative power from the variable speed drive (see regenerative power). The Dynamic brake requires a braking resistor (a separate additional option) to be operational.

Error In process control, the error is the difference between the desired value or setpoint (SP) and the actual value of a the process variable (PV). See also *process variable* and *PID Loop.*

EMI Electromagnetic Interference – In motor/drive systems, the switching of high currents and voltages creates the possibility of generating radiated electrical noise that may interfere with the operation of nearby sensitive electrical instruments or devices. This issue is a physics issue that is applicable to all PWM variable speed drives. Certain aspects of an installation, such as long motor lead wire lengths, tend to increase the chance of EMI. Proper installation following the manufacturer's guidelines is the best means of minimizing the impact of this radiated noise from cabling connecting the variable speed drive to the motor.

Four-quadrant operation Referring to a graph of torque versus direction, a four-quadrant drive can turn the motor either forward or reverse, as well as decelerate in either direction (see also *regenerative power).* A load that has a relatively high inertia and must move in both directions and change directions rapidly requires four-quadrant capability from its drive.

Free-run Stop A method of stopping a motor, caused when the inverter simply turns off its motor output connections. This may allow the motor and load to coast to a stop, or a mechanical brake may intervene and shorten the deceleration time.

Frequency Setting While frequency has a broad meaning in electronics, it typically refers to motor speed for variable-frequency drives (inverters). This is because the output frequency of the inverter is variable, and is proportional to the attained motor speed. For example, a motor with a base frequency of 60 Hz can be speed controlled with an inverter output varying form 0 to 60 Hz. See also *base frequency, carrier frequency,* and *slip.*

Harmonics According to Fourier Series mathematics, a periodic (repeating) function (waveform) can be expressed as a the summation of a series of pure sine waves of related frequencies. The lowest frequency is the fundamental, while all the other wave components are called *harmonics. The* square waves used in inverters produce high-frequency harmonics, even though the main goal is to produce lower-frequency sine waves. These harmonics can be harmful to electronics (including motor windings) and cause radiated energy that interferes with nearby electronic devices. A choke is sometimes used to suppress the transmission of harmonics in an electrical system. See also *choke.*

Horsepower A unit of physical measure to quantify the amount of work done per unit of time. You can directly convert between horsepower and Watts as measurements of power.

IEEE 519	An industry standard which specifies allowable current and voltage distortion levels in an electrical distribution system. The current distortion levels are defined by the ratio of I_{SC} / I_L. Where I_{SC} is the short circuit current available from the source transformer and I_L is the maximum load demand current. The resulting ratio defines the allowable TDD total demand distortion which ranges from 5% to 20%. The standard also defines the maximum allowable voltage distortion limits defined as 3% for special applications and 5% for general systems.
IGBT	**Insulated Gate Bipolar Transistor** (IGBT) – a semiconductor transistor capable of conducting very large currents when in saturation and capable of withstanding very high voltages when it is off. This high-power bipolar transistor is the type used in inverters.
Inertia	The natural resistance a stationary object to being moved by an external force. See also *momentum.*
Intelligent Terminal	A configured input or output logic function on the Hitachi inverters. Each terminal may be assigned one of several functions.
Inverter	A device that electronically changes DC to AC current through a alternating process of switching the input to the output, inverted and non-inverted. A variable speed drive such as the Hitachi L100 is also called an inverter, since it contains three inverter circuits to generate 3-phase output to the motor.
Isolation Transformer	A transformer with 1:1 voltage ratio that provides electrical isolation between its primary and secondary windings. These are typically used on the power input side of the device to be protected. An isolation transformer can protect equipment from a ground fault or other malfunction of nearby equipment, as well as attenuate harmful harmonics and transients on the input power.
Jogging Operation	Usually done manually, a jog command from an operator's panel requests the motor/drive system to run indefinitely in a particular direction, until the machine operator ends the jog operation.
Matrix Filter	A passive filter used to mitigate harmonics on the line side of a drive system.
Momentum	The physical property of a body in motion that causes it to continue to move in a straight line. In the case of motors, the armature and shaft are rotating and possesses angular momentum.
Multi-speed Operation	The ability of a motor drive to store preset discrete speed levels for the motor, and control motor speed according to the currently selected speed preset. The Hitachi inverters have 16 preset speeds.
Motor Load	In motor terminology, motor load consists of the inertia of the physical mass that is moved by the motor and the related friction from guiding mechanisms. See also *inertia.*
N.E.C	The National Electric Code is a regulatory document that governs electrical power and device wiring and installation in the United States.
NEMA	The National Electric Manufacturer's Association. NEMA Codes are a published series of device ratings standards. Industry uses these to evaluate or compare the performance of devices made by various manufacturers to a known standard.
Power Factor (Displacement)	A measurement of the time phase difference between the fundamental voltage and fundamental current in an AC circuit. It represents the cosine of the angle of the phase difference.

Glossary *(continued)*

Power Factor (True)

A measurement of the ratio of the real power (kW) to the apparent power (kVA). Distortion power factor takes into account harmonic voltage and current distortion as well as voltage to current displacement.

Ride-Through

If the supply to a frequency converter is lost, the drive may continue to run without external power supply utilizing the kinetic energy of the rotating motor and driven equipment. The power loss ride-through time depends on the relationship between the load and the inertia of the rotating masses.

PID Loop

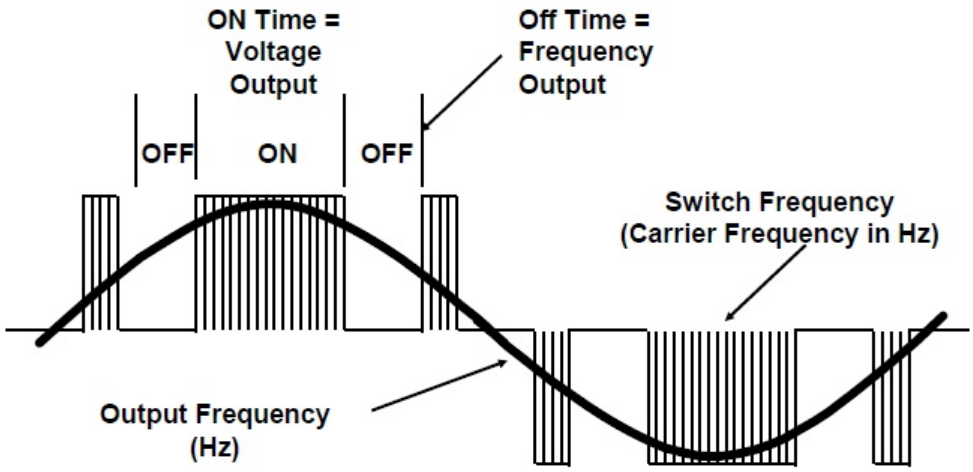
Proportional - Integral - Derivative – a mathematical model used for process control. A process controller maintains a process variable (PV) at a setpoint (SP) by using its PID algorithm to compensate for dynamic conditions and vary its output to drive the PV toward the desired value. For variable-frequency drives, the process variable is the motor speed. See also *error.*

Process Variable

A physical property of a process which is of interest because it affects the quality of the primary task accomplished by the process. For an industrial oven, temperature is the process variable. See also *PID Loop* and *error.*

PWM

Pulse-width modulation: A type of AC adjustable frequency drive that accomplishes frequency and voltage control at the output section (inverter) of the drive. The drive output voltage waveform is at a constant amplitude, and by “chopping” the waveform (pulse width-modulating), the average voltage is controlled. The chopping frequency is sometimes called *the carrier frequency.* The frequency that controls the speed of the motor is shown below as the output frequency. Motor voltage is controlled by the voltage on time versus off time shown of the pulsed DC voltage. In this manner both drive output voltage and drive output frequency can be controlled.



Reactance

The impedance of inductors and capacitors has two components. The resistive part is constant, while the reactive part changes with applied frequency. These devices have a complex impedance (complex number), where the resistance is the real part and the reactance is the imaginary part.

Rectifier

An electronic device made of one or more diodes which converts AC power into DC power. Rectifiers are usually used in combination with capacitors to filter (smooth) the rectified waveform to closely approximate a pure DC voltage source.

Regenerative Braking	A particular method of dissipating regenerative power which is different from a braking chopper and braking resistor where regenerative power is dissipated in heat generated by the resistor during braking. The variable speed drive with regenerative braking can generate the power back on to the power line minimizing heat dissipated into the environment.
Regenerative Power	When a variable speed drive accelerates a load the drive provides voltage and frequency to the motor which define its operating speed and the motor draws current from the variable speed drive based on the motor torque required to accelerate the load. When a motor is decelerated the motor starts to act like a generated and current flow is directed back to the drive. PWM variable speed drives are very efficient with typically 2 to 3% losses. It is these losses that define the variable speed drives ability to absorb regenerative power. When the motor is decelerated the drive must dissipate the energy that exceeds the drives natural losses. In cases where there is not a definite time requirement to stop or reduce a motors speed, variable speed drives have limit functions (typically DC bus over voltage controllers and current limits) that allow the drive to control the rate of deceleration to a level that it can control. In cases where predictable deceleration times or times faster than a motor would coast to a stop, are required see braking resistor or regenerative braking. Typically additional pump and fan applications do not require additional supplemental braking capability.
Regulation	The quality of control applied to maintain a parameter of interest at a desired value. Usually expressed as a percent (+/-) from the nominal, motor regulation usually refers to its shaft speed.
Rotor	The windings of a motor that rotate, being physically coupled to the motor shaft. See also *stator*
Saturation Voltage	For a transistor semiconductor device, it is in saturation when an increase in input (gate) current no longer results in an increase in the output (source/drain) current. The saturation voltage is the voltage from the power source to the transistor output (Vsource to Vdrain). The ideal saturation voltage is zero.
Sensorless Vector Control	A technique used in variable-frequency drives (such as SJ100 series) to rotate the force vector in the motor without the use of a shaft position sensor (angular). Benefits include an increase in torque at the lowest speed and the cost savings from the lack of a shaft position sensor.
Setpoint (SP)	The setpoint is the desired value of a process variable of interest. See also *Process Variable (PV)* and *PID Loop.*
Single-phase	An AC power source consisting of Hot and Neutral wires. An Earth Ground connection usually accompanies them. In theory, the voltage potential on Neutral stays at or near Earth Ground, while Hot varies sinusoidally above and below Neutral. This power source is named Single Phase to differentiate it from three-phase power sources. Some Hitachi inverters can accept single phase input power, but they all output three-phase power to the motor. See also *three-phase.*
Slip	The difference between the theoretical speed of a motor at no load (determined by its inverter output waveforms) and the actual speed. Some slip is essential in order to develop torque to the load, but too much will cause excessive heat in the motor windings and/or cause the motor to stall.
Squirrel Cage	A “nickname” for the appearance of the rotor frame assembly for an AC induction motor.
Stator	The windings in a motor that are stationary and coupled to the power input of the motor. See also *rotor*.

Glossary *(continued)*

Tachometer

1. A signal generator usually attached to the motor shaft for the purpose of providing feedback to the speed controlling device of the motor. 2. A speed-monitoring test meter which may optically sense shaft rotation speed and display it on a readout.

Thermal Switch

An electromechanical safety device that opens to stop current flow when the temperature at the device reaches a specific temperature threshold. In variable-speed drive systems, thermal switches are typically installed at or near the motor, in order to protect the windings from heat damage.

Transistor

A solid state, three-terminal device that provides amplification of signals and can be used for switching and control. While transistors have a linear operating range, inverters use them as high-powered switches. Recent developments in power semiconductors has produced transistors capable of handling hundreds of volts and tens of Amperes or more, all with high reliability. The saturation voltage has been decreasing, resulting in less heat dissipation. Hitachi inverters use state-of-the-art semiconductors to provide high performance and reliability, all in a compact package. See also *IGBT* and *saturation voltage.*

Trip

An event which causes the inverter to stop operation is called a “trip” event (as in*tripping* a circuit breaker). The inverter keeps a history log of trip events. They also require an action to clear.

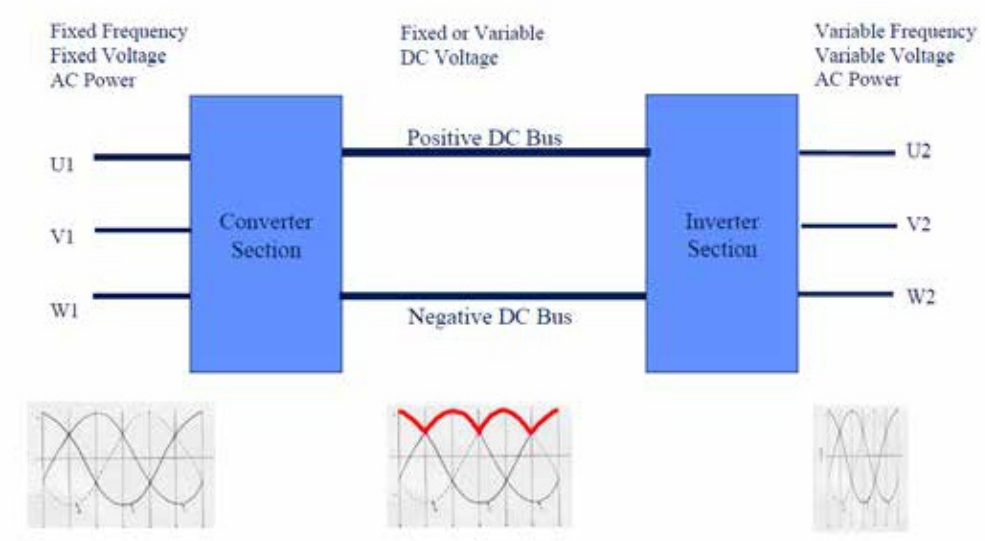
Twelve Pulse

A type of drive system consisting of a phase shift input transformer, (2) six-pulse diode module front ends and an inverter section, used to control a motor and reduce input side line harmonics.

Variable Speed Drive

A variable speed drive is an electronic device used to control the speed of an AC motor. It converts the incoming alternating current (AC) fixed voltage and frequency to a adjustable voltage and frequency output. This adjustable output is connected to a standard AC induction motor to control its speed.

The most popular type of Low Voltage (600VAC and below) variable speed Drive is a PWM Inverter. A PWM variable speed drive is a voltage source inverter supplied with converter section made up of a six pulse rectifier (6 diodes creating a three phase full wave bride) used for conversion of AC voltage from the power line to DC voltage used in the variable speed drive inverter section to generate the PWM output wave form for the motor (see PWM).



Notes



Printed on recycled paper

New Release
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www.johnsoncontrols.com

Rigging, Install and Maintenance

Rigging, Installation and Maintenance Information

For the most up to date information on transportation, rigging, installation, long term storage, maintenance recommendations for warranty, startup checklist and all other installation needs please visit these sites.

https://docs.johnsoncontrols.com/airhandling/r/York/en-US/Solution-documentation-index

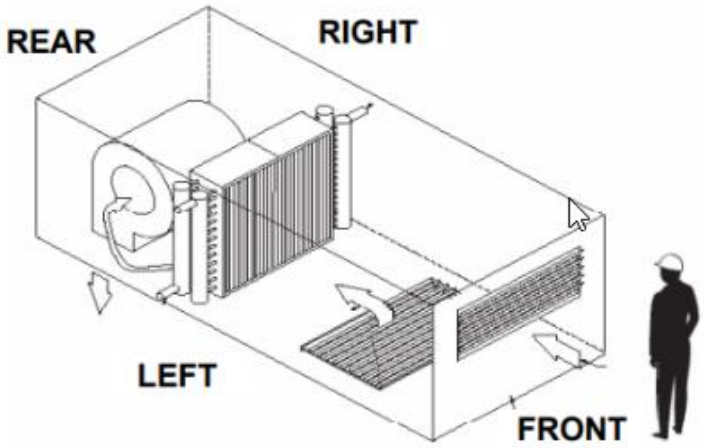
Refer to the following documents for information about Solution products:

Document number and link	Description
102.20-N1.pdf	Solution Installation and Assembly
50.20-CL3.pdf	York Long-Term Storage Periodic Checklist and Logs Air Handling Units
50.20-NM1.pdf	York Long-Term Storage Requirements General
50.20-NM3.pdf	York Long-Term Storage Requirement - Field Preparation Air Handling Units
100.00-CL1.pdf	York AHU Start-Up Checklist
102.20-MR1.pdf	Maintenance Recommendations For Solution Air Handler
102.20-M1.pdf	Solution Service Manual
102.20-OM2.pdf	York Operation and Maintenance
100.00-CL2.pdf	Air Handling Units Coil Leak Checklist
102.20-CL1.pdf	Check List - Steps to Protect New Equipment Warranty
102.20-FA1.pdf	Solution Field Assembly and Disassembly, Indoor/Outdoor Modules
50.05-NM2.pdf	Service Policy - Limited Warranty- Engineered Systems
50.07-NM1.pdf	Service Policy - Renewal Parts Availability
100.00-AG5.pdf	A2L Refrigerant and Safety Requirements
SI0620	Solution Membrane Roof Best Practice Service Information Letter

Submittal Approval Page

Equipment Release Approval Forms

The following table must be completed prior to releasing the equipment for fabrication. Please initial the column indicating the information contained in this submittal has been verified or indicate to refer to a marked-up page.



NOTE: Drive hand and coil hand determined by facing the inlet section

SUBMITTAL VERIFICATION	
	Purchaser Initials
Electrical voltage and electrical connections are compatible with jobsite requirements.	
Piping / Ductwork connections shown in this submittal are correct.	
Unit tag designations are correct.	
Equipment dimensions (length, width, and height) and weights have been verified to comply with jobsite conditions and rigging requirements. Please indicate approval by your initials on all included drawings.	
Verify “Unit Hand” of any Air Handling Equipment per the definition provided on the **“Equipment Release / Configuration Process”** form.	
Indicate equipment configuration choices on the **Equipment Release /Configuration Process** form (if included on this Submittal package) and sign the form.	

Equipment Release Approval Forms

Important Notes:

1) Actual fabrication release cannot commence until this form is signed by the customer and returned to JCI along with a release notification want date and ship to address.

2) Equipment "lead-time" does not start until confirmed release documentation is received, and the order is actually released to the factory.

3) Modifications to equipment configurations after fabrication release may impact cost and lead-time

4) Attached configurations are as shown in the approved equipment submittals or as defined in superseding customer correspondence.

5) AHU "Side" / "Hand" orientation is relative to a person standing inside an AHU with air hitting the back of the head.

6) Note that once this document is confirmed, the equipment configurations defined by this document take precedence over all other documents.

7) "Want date" and/or "ship to address" changes made after this document is confirmed may impact cost and lead-time.

8) Air handler drawings also include shipping split explosions with corresponding weights and dimensions. If additional splits are required, there will be additional costs and the unit length will increase.

Equipment Release Approval Forms

Please fill out the following table and refer to the receiving/rigging instructions in this submittal to help ensure a smooth delivery and installation of the equipment.

DELIVERY INFORMATION	
	Please fill out information below
Contact name for coordinating delivery of equipment with transportation company	
Contact phone number	
Advance notice required from transportation company prior to delivering equipment (typically 48 hours)	
Ship to address:	
Other special shipping instructions or requirements	

Equipment Release Approval Forms

Please fill out the following table for timely delivery of the filters and ensure they are not lost or damaged until it is time for unit startup.

FILTER DELIVERY INFORMATION	
	Please fill out information below:
Primary contact name, number, and email for coordinating delivery of filters with transportation company	
Alternate delivery contact name, phone number, and email (if applicable)	
Advance notice required from transportation company prior to delivery (typically 48 hours)	
Ship-to address	
Requested delivery date (NOTE: Subject to factory lead time)	
Other special shipping instructions or requirements	
Has the site agreed to accept the delivery of the filters? (YES or NO)	
Will the delivery trick be required to have a lift gate? (YES or NO)	

CUSTOMER APPROVAL

CUSTOMER APPROVAL:

Customer Name: _____

Signature (*) _____

Date: _____

END OF SUBMITTAL

Submittal

JOB NAME	F-35: Special Access Program Facility - Air Handling Units
PRODUCT	Spec
MANUFACTURER	Other
LOCATION	Fort Smith, Arkansas
DATE	September 16, 2026
ENGINEER	US Army Corp of Engineers
CONTRACTOR	Comfort Systems USA
SUBMITTED BY	Joey Smith

gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 Factory-Fabricated Air Handling Units

Provide draw-through type units as indicated. Units must include fans, coils, airtight insulated casing, prefilters, secondary filter sections, access sections where indicated, mixing box or combination sectional filter-mixing box, vibration-isolators, and appurtenances required for specified operation. Provide vibration isolators as indicated. Physical dimensions of each air handling unit must be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling.

2.10.1.1 Casings

Provide the following:

a. Casing sections 2 inch double wall type, constructed of a minimum 18 gauge galvanized steel, or 18 gauge corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Inner casing of double-wall units that are a minimum 20 gauge solid galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.

b. Individually removable exterior panels with standard tools. Removal must not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.

c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 18 gauge outer and 20 gauge inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Provide rigid doors with heavy duty hinges and latches. Inspection doors must be a minimum 12 inches wide by 12 inches high. Access doors must be a minimum 24 inches wide, the full height of the unit casing or a minimum of 6 foot, whichever is less.

d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 16 gauge corrosion resisting sheet steel conforming to ASTM A167, Type 304, conforming to ASHRAE 62.1. Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils must not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Provide coils that are individually removable from the casing.

e. Casing insulation that conforms to NFPA 90A. Insulate double-wall casing sections handling conditioned air with injected foam for an

R-value of not less than R-13. Seal double wall insulation completely by inner and outer panels.

f. Duct liner material, coating, and adhesive that conforms to fire-hazard requirements specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Only install liner where indicated. Protect exposed insulation edges and joints where insulation panels are butted with a metal nosing strip or coat to meet erosion resistance requirements of ASTM C1071.

g. A latched and hinged inspection door, in the fan and coil sections. Plus additional inspection doors, access doors and access sections where indicated.

2.10.1.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

2.10.1.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.10.1.4 Fans

Provide the following:

a. The fan (see schedules) shall be a single-width, single -inlet plenum fan. The fan blades shall be aluminum backward-inclined airfoil. Plenum fan shall be direct driven. Fan shaft shall not exceed 75 percent of its first critical speed at any cataloged speed. Fan wheel shall be keyed to the fan shaft to prevent slipping. The fan shafts shall be solid steel. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the entire fan assembly.

b. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Provide bearings that are permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.

c. Fans shall be factory mounted with manufacturer's standard vibration isolation mounting devices.

d. Where indicated to be installed, piezometer ring airflow measuring system shall monitor the pressure difference between the fan inlet and the smallest diameter of the inlet cone. Volumetric flow shall be calculated from empirically derived formulas based on testing by the fan manufacturer. System shall not use air restricting probes that reduce fan performance or create additional fan sound. System shall accurately measure within plus or minus 5 percent of reading.

e. Motor starters of with general-purpose enclosure. Select unit fan or

fans to produce the required capacity at the fan static pressure with sound power level as indicated. Obtain the sound power level values according to AMCA 300, ASHRAE 68, or AHRI 260 I-P.

2.10.1.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

2.11 TERMINAL UNITS

2.11.1 Room Fan-Coil Units

Provide base units that include galvanized coil casing, coil assembly drain pan air filter, fans, motor, fan drive, motor switch, an enclosure for cabinet models and casing for concealed models, and leveling devices integral with the unit for vertical type units. Obtain sound power level data or values for these units according to test procedures based on AHRI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models are acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. Fasten each unit securely to the building structure. Provide units with capacity indicated. Provide room fan-coil units that are certified as complying with AHRI 440, and meet the requirements of UL 1995.

2.11.1.1 Enclosures

Fabricate enclosures from not lighter than 18 gauge steel, reinforced and braced. All exposed cabinets shall be powder-coated white. For exposed cabinet units, provide enclosures with front panels that are removable and have 1/4 inch closed cell insulation or 1/2 inch thick dual density foil faced fibrous glass insulation. Make the exposed side of a high density, erosion-proof material suitable for use in air streams with velocities up to 4,500 fpm. For exposed cabinet units, provide a discharge grille that is of such design as to properly distribute air throughout the conditioned space. Provide galvanized or factory finished ferrous metal surfaces with corrosion resistant enamel, and access doors or removable panels for piping and control compartments, plus easy access for filter replacement. Provide duct discharge collar for concealed models.

2.11.1.2 Fans

Provide galvanized steel or aluminum, multiblade, centrifugal type fans. Dynamically and statically balance the fans. Provide accessible assemblies for maintenance. Disassemble and re-assemble by means of mechanical fastening devices and not by epoxies or cements.

2.11.1.3 Coils

Fabricate coils from not less than 3/8 inch outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Provide coils with not less than 1/2 inch outside

Submittal

JOB NAME	F-35: Special Access Program Facility - Air Handling Units
PRODUCT	Schedule
MANUFACTURER	Other
LOCATION	Fort Smith, Arkansas
DATE	September 16, 2026
ENGINEER	US Army Corp of Engineers
CONTRACTOR	Comfort Systems USA
SUBMITTED BY	Joey Smith

AIR HANDLING UNIT SCHEDULE (1/2)

TAG	LOCATION	ALTITUDE (FT)	SUPPLY AIR		SUPPLY FAN											PRE-FILTER			MAIN FILTER			DESIGN FILTER CONDITION
			MAX AIRFLOW (CFM)	MIN AIRFLOW (CFM)	QUANTITY	TYPE	EXTERNAL STATIC PRESSURE (IN W.C.)	BHP	RPM	DRIVE TYPE	MOTOR					TYPE	PRESSURE DROP (IN W.C.)	MERV	TYPE	PRESSURE DROP (IN W.C.)	MERV	
											SPEED CONTROL	HP	RPM	VOLTS	PHASE							
AHU-101	171 - MECHANICAL	449	9500	2880	1	PLENUM	3.5	14.7	2525	DIRECT	VFD	20	1800	460	3	PLEATED	0.65	8	CARTRIDGE	1.5	13	MID LIFE
AHU-102	251 - MECHANICAL	449	10400	3120	1	PLENUM	3.2	13.2	1907	DIRECT	VFD	15	1800	460	3	PLEATED	0.65	8	CARTRIDGE	1.5	13	MID LIFE

AIR HANDLING UNIT SCHEDULE (2/2)

TAG	TYPE	COOLING COIL														DISCHARGE SOUND POWER LEVEL (dB)								ELECTRICAL				WEIGHT (LBS)	NOTES
		CAPACITY		AIRSIDE							WATERSIDE																		
		TOTAL (MBH)	SENSIBLE (MBH)	DESIGN FLOW (CFM)	EAT DB (DEG. F)	EAT WB (DEG. F)	LAT DB (DEG. F)	LAT WB (DEG. F)	PRESSURE DROP (IN W.C.)	MAX. FACE VELOCITY (FT/MIN)	FLOW (GPM)	EWT (DEG. F)	LWT (DEG. F)	PRESSURE DROP (FT W.C.)	ROWS	FPI	63 HZ	125 HZ	250 HZ	500 HZ	1000 HZ	2000 HZ	4000 HZ	8000 HZ	FLA	HZ	PHASE	VOLTS		
AHU-101	CHILLED WATER	295.6	257.8	9500	78	62.3	52.3	51.9	0.5	500	39.4	42	57	7.5	4	12	83	88	90	88	87	83	85	77	27	60	3	460	2099	1,2,3,4,5
AHU-102	CHILLED WATER	336.8	282.2	10400	78	63.4	52.3	51.9	0.5	500	44.9	42	57	7.5	4	12	83	88	90	88	87	83	85	77	21	60	3	460	2600	1,2,3,4,5

NOTES:
1. PROVIDE WITH MANUFACTURER'S DISCONNECT, OVERLOAD PROTECTION, STARTER/VFD, AND SINGLE POINT POWER CONNECTION IN ACCORDANCE WITH DIVISION 26 SPECIFICATIONS.
2. PRESSURE DROPS ASSOCIATED WITH DIRTY FILTERS, COILS, ETC. SHALL BE INCLUDED IN THE TOTAL INTERNAL STATIC CALCULATION BY THE UNIT MANUFACTURER.
3. CHILLED WATER OPERATING FLUID IS WATER.
4. PROVIDE UNIT WITH MANUFACTURERS 8" HIGH BASE FRAME. INSCREASE BASE RAIL HEIGHT AS NECESSARY TO PROVIDE HEIGHT FOR CONDENSATE TRAP.
5. PROVIDE UNIT WITH PREFORATED PANELS TO REDUCE SOUND.

DEDICATED OUTDOOR AIR HANDLING UNIT SCHEDULE (1/4)

TAG	ALTITUDE (FT)	LOCATION	OUTSIDE AIR		SUPPLY FAN										OUTDOOR AIR PRE-FILTER				OUTDOOR AIR FINAL FILTER			
			MAX AIRFLOW (CFM)	MIN AIRFLOW (CFM)	QUANTITY	TYPE	EXTERNAL STATIC PRESSURE (IN W.C.)	BHP	RPM	DRIVE TYPE	MOTOR					TYPE	THICKNESS (IN)	PRESSURE DROP (IN W.C.)	MERV	TYPE	THICKNESS (IN)	MID LIFE PRESSURE DROP (IN W.C.)	MERV
											SPEED CONTROL	HP	RPM	VOLTS	PHASE								
DOAS-101	449	171 - MECHANICAL ROOM	2745	2745	1	PLENUM	1.31	3.4	2885	DIRECT	VFD	5	1800	460	3	PLEATED	2	0.65	8	CARTRIDGE	4	0.8	13
DOAS-102	449	251 - MECHANICAL ROOM	2670	2670	1	PLENUM	1.13	3.3	2849	DIRECT	VFD	5	1800	460	3	PLEATED	2	0.65	8	CARTRIDGE	4	0.8	13

DEDICATED OUTDOOR AIR HANDLING UNIT SCHEDULE (2/4)

TAG	PREHEAT COIL												COOLING COIL												
	TYPE	CAPACITY (MBH)	AIRSIDE				WATERSIDE						TYPE	TOTAL (MBH)	SENSIBLE (MBH)	AIRSIDE						WATERSIDE					
			AIRFLOW (CFM)	EAT (DEG F.)	LAT (DEG F.)	PRESSURE DROP (IN W.C.)	FLOW (GPM)	EWT (DEG. F)	LWT (DEG. F)	PRESSURE DROP (FT W.C.)	ROWS	FPI				DESIGN FLOW (CFM)	EAT DB (DEG. F)	EAT WB (DEG. F)	LAT DB (DEG. F)	LAT WB (DEG. F)	PRESSURE DROP (IN W.C.)	MAX. FACE VELOCITY (FT/MIN)	FLOW (GPM)	EWT (DEG. F)	LWT (DEG. F)	PRESSURE DROP (FT W.C.)	ROWS	FPI
DOAS-101	HOT WATER	119.7	2745	18	55	0.1	8	150	120	7	1	9	CHILLED WATER	233.8	90.5	2745	84.8	78	53	52.5	1	500	31.2	42	57	18	6	9
DOAS-102	HOT WATER	116.3	2670	18	55	0.1	7.8	150	120	7	1	9	CHILLED WATER	227.4	87.8	2670	84.8	78	53	52.5	1	500	30.3	42	57	18	6	9

DEDICATED OUTDOOR AIR HANDLING UNIT SCHEDULE (3/4)

TAG	REHEAT COIL											EXHAUST FAN								EXHAUST FILTER				ENERGY RECOVERY WHEEL									
			AIRSIDE				WATERSIDE							MOTOR										SUMMER ENERGY RECOVERY PERFORMANCE									
																								OUTSIDE AIR		SUPPLY AIR		RETURN AIR		EXHAUST AIR		
	TYPE	CAPACITY (MBH)	AIFRLOW (CFM)	EAT (DEG. F)	LAT (DEG. F)	PRESSURE DROP (IN W.C.)	FLOW (GPM)	EWT (DEG. F)	LWT (DEG. F)	PRESSURE DROP (FT W.C.)	FPI	AIRFLOW (CFM)	EXTERNAL STATIC PRESSURE (IN W.C.)	BHP	SPEED CONTROL	RPM	HP	VOLTS	PHASE	TYPE	THICKNESS (IN)	PRESSURE DROP (IN. W.C.)	MERV	DB (DEG. F)	WB (DEG. F)	DB (DEG. F)	WB (DEG. F)	DB (DEG. F)	WB (DEG. F)	DB (DEG. F)	WB (DEG. F)	MINIMUM EFFECTIVENESS (%)
DOAS-101	HOT WATER	45.6	2745	53	68	0.1	3.0	150	120	0.05	7	1975	0.86	1.30	VFD	1800	1.5	460	3	THROW AWAY	2	0.6	5	84.8	78	81.2	71.8	78	64.9	86.6	75.6	70
DOAS-102	HOT WATER	44.3	2670	53	68	0.1	3.0	150	120	0.05	7	1975	0.75	1.13	VFD	1800	1.5	460	3	THROW AWAY	2	0.6	5	84.8	78	81.2	71.8	78	64.9	86.6	75.6	70

DEDICATED OUTDOOR AIR HANDLING UNIT SCHEDULE (4/4)

TAG	WINTER ENERGY RECOVERY PERFORMANCE									ENERGY WHEEL ELECTRICAL					DIMENSIONS				
	OUTSIDE AIR		SUPPLY AIR		RETURN AIR		EXHAUST AIR		EFFECTIVENESS (%)	FLA	HZ	MCA	PHASE	VOLTS	HEIGHT (IN)	LENGTH (IN)	WIDTH (IN)	WEIGHT (LBS)	NOTES
	DB (DEG. F)	WB (DEG. F)	DB (DEG. F)	WB (DEG. F)	DB (DEG. F)	WB (DEG. F)	DB (DEG. F)	WB (DEG. F)											
DOAS-101	18	16	41.5	38	68	56.7	26.8	25.7	70	0.66	60	0.77	3	460	5' - 11"	20' - 0"	3' - 8"	2843	1,2,3,4,5
DOAS-102	18	16	41.5	38	68	56.7	26.8	25.7	70	0.66	60	0.77	3	460	5' - 11"	20' - 0"	3' - 8"	2843	1,2,3,4,5

NOTES:
1. PROVIDE WITH MANUFACTURERS DISCONNECT, OVERLOAD PROTECTION, STARTER/VFD IN ACCORDANCE WITH DIVISION 26 SPECIFICATIONS. PROVIDE THREE ELECTRICAL CONNECTIONS. ONE FOR SUPPLY FAN, ONE FOR EXHAUST FAN, AND ONE FOR ENERGY WHEEL.
2. PRESSURE DROPS ASSOCIATED WITH DIRTY FILTERS, COILS, ETC. SHALL BE INCLUDED IN THE TOTAL INTERNAL STATIC CALCULATION BY THE UNIT MANUFACTURER.
3. CHILLED WATER AND HEATING WATER OPERATING FLUID IS WATER.
4. PROVIDE AHU WITH MANUFACTURER'S 8" HIGH BASE FRAME. INCREASE BASE RAIL HEIGHT AS NECESSARY TO PROVIDE HEIGHT FOR CONDENSATE TRAP.
5. PROVIDE PIEZOMETER RING AIRFLOW MEASURING SYSTEM IN FAN INLET CONE.

LICENSED PROFESSIONAL ENGINEER
BYRON EDWARD K. FONSECA
M 41419
MECHANICAL
STATE OF CALIFORNIA
07/23/2025

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
0	READY-TO-ADVERTISE (RTA) SUBMITTAL	JUL 2025

DESIGNED BY: B. FONSECA
DRAWN BY: J. SMITH
CHECKED BY: C. DAZE
ISSUE DATE: JUL 2025
SOLICITATION NO.: W912QR25RA001
CONTRACT NO.: W912QR24C0007
SUBMITTED BY: B. STREEBIN
SIZE: ANSI D
FILE NAME:

US ARMY CORPS OF ENGINEERS
LITTLE ROCK DISTRICT
LITTLE ROCK, ARKANSAS

BURNS AND McDONNELL
9400 WARD PARKWAY,
KANSAS CITY, MO 64114
165438

F-35 SPECIAL ACCESS PROGRAM FACILITY
EBBING AIR NATIONAL GUARD BASE (ANGB), FORT SMITH, ARKANSAS

HVAC SCHEDULES

SHEET ID
M-601

READY-TO-ADVERTISE (RTA) SUBMITTAL