



Submittal Review Response

Project Name: **Hilo WWTP Rehabilitation and Replacement Project Phase 1**
Submittal No.: **15830-001.0**
Date: **8/25/2025**

Client: County of Hawai'i Carollo Project No.: 203975
Contractor: Nan, Inc.
Submittal Name: FANS
Reviewed By: Joe Keightley

SUBMITTAL REVIEW

Review is for general compliance with contract documents. No responsibility is assumed by Carollo for correctness of quantities, dimensions, and details. No deviation or variation is approved unless specifically addressed in these review comments. Refer to Section 01330 for additional requirements. The Contractor shall assume full responsibility for coordination with all other trades and deviations from contract requirements.

Approved	<input type="checkbox"/> No Exceptions
	<input type="checkbox"/> Make Corrections Noted - See Comments
	<input type="checkbox"/> Make Corrections Noted - Confirm
Not Approved	<input checked="" type="checkbox"/> Correct and Resubmit
	<input type="checkbox"/> Rejected - See Remarks
Receipt Acknowledged	<input type="checkbox"/> Filed for Record
	<input type="checkbox"/> With Comments - Resubmit

Review Comments:

General Submittal Comments:

1. This submittal only contains four Type 12 fans from the project fan schedule as shown in Specification 15830 Fans. It is assumed that the rest of the fans included in the project will be covered in future fan submittals.
2. This submittal includes two odor control fans. These two fans (07-FAN-1110/1120) were not reviewed as a part of this submittal review. Remove these fans from the submittal and resubmit.
3. Per note 5 in 15830 Fan Schedule, adjustable belt sheaves are required for both Headworks Loading Exhaust Fan 1 & 2 (02-EF-1330 & 02-EF-1340) and Headworks Channel Exhaust Fan 1 & 2 (02-EF-1390 & 02-EF-1396). Confirm adjustable belt sheaves will be provided.
4. Per note 27 in the 15830 Fan Schedule, the four Type 12 fans included in the submittal are to be provided with spring vibration isolators. Information and cutsheets on the spring vibration isolators are missing from the submittal. Revise to include these details.
5. Resubmit with individual cutsheets for the counterbalanced FRP backdraft dampers that are to be located on the discharge of the four exhaust fans included in this submittal. The submitted FRP backdraft dampers will be reviewed against the requirements detailed in Specification Section 15500.2.03.C.2 Common Work Results for HVAC.

6. Per contract drawings, these four fans require flex connections installed at the inlet and outlet of the fans. Contractor to confirm details on the flex connections will be provided in a forthcoming submittal.

Headworks Loading Exhaust Fan 1 & 2 (02-EF-1330 & 02-EF-1340)

7. Confirm the inlet box drain for Headworks Loading Exhaust Fan 1 & 2 (02-EF-1330 & 02-EF-1340) will be factory installed.

Headworks Channel Exhaust Fan 1 & 2 (02-EF-1390 & 02-EF-1396)

8. Per contract drawing 02-M-01-107 and 02-M-01-306, Headworks Channel Exhaust Fan 1 & 2 are not provided with an inlet box. Remove inlet box from the shop drawing submittal for both Headworks Channel Exhaust Fan 1 & 2 and resubmit shop drawing.

High Priority

CONTRACTOR SUBMITTAL TRANSMITTAL FORM REV. A

Owner: County of Hawaii
Contractor: Nan, Inc.
Project Name: Hilo WWTP Phase 1
Submittal Title:
TO:
From: Nan Inc.

Project No.: WW-4705R
Submittal Number:
For Information Only

Specification No. and Subject of Submittal / Equipment Supplier	
Spec:	Paragraph:
Authored By:	Date Submitted:

Submittal Certification	
Check Either (A) or (B):	
<input type="checkbox"/> (A)	We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings with <u>no exceptions</u> .
<input type="checkbox"/> (B)	We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings <u>except</u> for the deviations listed.
Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.	

General Contractor's Reviewer's Signature:		
Printed Name and Title: In the event, Contractor believes the Submittal response does or will cause a change to the requirements of the Contract, Contractor shall immediately give written notice stating that Contractor considers the response to be a Change Order.		
Firm:	Signature:	Date Returned:

PM/CM Office Use	
Date Received GC to PM/CM:	
Date Received PM/CM to Reviewer:	
Date Received Reviewer to PM/CM:	
Date Sent PM/CM to GC:	

Nan, Inc

PROJECT: HILO WWTP REHABILITATION
AND REPLACEMENT PROJECT - PHASE 1

JOB NO. WW-4705R

THIS SUBMITTAL HAS BEEN CHECKED BY
THIS CONTRACTOR. IT IS CERTIFIED
CORRECT, COMPLETE, AND IN
COMPLIANCE WITH CONTRACT
DRAWINGS AND SPECIFICATIONS. ALL
AFFECTED CONTRACTORS AND
SUPPLIERS ARE AWARE OF, AND WILL
INTEGRATE THIS SUBMITTAL (UPON
APPROVAL) INTO THEIR OWN WORK.

DATE RECEIVED _____
SPECIFICATION SECTION # _____
SPECIFICATION _____
PARAGRAPH _____
DRAWING _____
SUBCONTRACTOR _____
SUPPLIER _____
MANUFACTURER _____

CERTIFIED BY CQCM or Designee : _____

SECTION 15830

FANS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes fans, including:
 - 1. Type 3 - Filtered centrifugal roof supply fan.
 - 2. Type 5 - Centrifugal exhaust fans.
 - 3. Type 12 - Fiberglass reinforced plastic centrifugal fans.
 - 4. Type 13 - Fiberglass reinforced inline centrifugal fans.
 - 5. Type 14 - Fiberglass reinforced plastic upblast exhauster.
 - 6. Type 15 - Fiberglass reinforced plastic wall ventilators.

1.02 REFERENCES

- A. American Bearing Manufacturers Association (ABMA):
 - 1. 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc. (AMCA):
 - 1. 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
 - 2. 211 - Certified Rating Program- Product Rating Manual for Fan Air Performance.
 - 3. 300 - Reverberant Room Method for Sound Testing of Fan.
 - 4. 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- C. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
 - 1. 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - 2. 68 - Laboratory Methods of Testing to Determine Sound Power in a Duct.
- D. ASTM International (ASTM):
 - 1. A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - 2. D4167 - Standard Specification for Fiber Reinforced Plastic Fans and Blowers.
 - 3. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. National Electrical Code (NEC).
- F. National Electrical Manufacturers Association (NEMA):
 - 1. 250 - Enclosures for Electrical Equipment (1000 V Maximum).

- G. National Fire Protection Association (NFPA):
 - 1. 90A - Standard for Installation of Air Conditioning and Ventilating Systems.
 - 2. 820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
- H. National Roofing Contractors Association (NRCA).
- I. Occupational Safety and Health Administration (OSHA).
- J. Underwriters Laboratories, Inc. (UL).

1.03 DEFINITIONS

- A. As used in this Section and on the Drawings, abbreviations and Fan Schedule headings have the following meaning:
 - 1. SF or SPF: Supply Fan.
 - 2. EF or EXF: Exhaust Fan.
 - 3. Type: Fan type as specified in this Section.
 - 4. SP or ESP: Fan External Static Pressure in inches water column.
 - 5. Size: Nominal fan blade or wheel diameter in inches.
 - 6. Hp: Fan motor horsepower.
 - 7. V/Ph: Fan motor voltage and power phases.
- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 841 - IEEE Standard for Petroleum and Chemical Industry--Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 hp).
- C. NEMA:
 - 1. Type 1 enclosure in accordance with NEMA 250.
 - 2. Type 3R enclosure in accordance with NEMA 250.

1.04 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Provide fans that have sharply rising pressure characteristics which extend throughout the operating range and continue to rise beyond the efficiency peak.
 - 2. Provide fans that peak as close as possible to the maximum efficiency and whose operating range is within the normal fan selection range.
 - 3. When scheduled, provide guided vibration isolator for fans, so that not more than 10 percent of the vibration amplitude of the fan and motor is transmitted to the supporting structure.
 - 4. Design fan inner scroll and air stream surfaces to maintain smoothness for entire fan service life.
 - 5. Seismic supports: Seismic design criteria as specified in Section 01850 - Design Criteria.
 - 6. Wind supports for exterior units: Wind design criteria as specified in Section 01850 - Design Criteria.
 - 7. Electrical components: UL listed and meeting the design and installation requirements of the NEC.

- 8. Applicable portions as specified in Section 15050 - Common Work Results for Mechanical Equipment.
 - 9. Motors supplied with fans: TEFC, IEEE 841 Compliant, NEMA premium efficiency, Class F insulation, Class B temperature rise, 1.15 service factor; provide motor voltage phases and speed as scheduled; non-overloading on any point of the fan curve including belt losses.
 - 10. Roof curbs: Designed in accordance with NRCA standards.
 - 11. Insulation and adhesives: Meet NFPA 90A requirements for flame spread and smoke generation.
 - 12. Belt drive systems: Adjustable for minimum within 5 percent speed change, rated for 1.5 times maximum horsepower motor available for the scheduled fan size or model.
 - 13. Screens: Provide bird or insect screen as specified with the fan type or as listed on the Fan Schedule:
 - a. Bird screen: Stainless steel; 0.5-inch mesh 18-gauge.
 - b. Insect screen: Stainless steel mesh and frame.
 - 14. Finishes: When not specified with fan type, coat ferrous metals as specified in Section 09960 - High-Performance Coatings.
 - 15. Accessories: Provide accessories specified and those scheduled.
 - 16. Provide fans with fire/smoke control system as specified under paragraph Fire/Smoke Control System Design Requirements.
- B. Performance requirements:
- 1. Performance requirements are included in the Fan Schedule located at the end of this Section.
 - 2. Fan performance: Rated and licensed to bear the AMCA label in accordance with AMCA 210 and AMCA 211.
 - 3. Total sound power levels in the 8 octave band range as measured in accordance with ASHRAE 68, AMCA 301, or AMCA 300 as appropriate for each fan: Not to exceed the lesser of the following or the Sones levels on the Fan Schedule.

Sound Power Level, decibel levels referenced to 10-12 watts								
Frequency, Hz	63	125	250	500	1,000	2,000	4,000	8,000
General	100	98	94	88	84	84	78	75

- 4. Air filters supplied with fans: 25 to 30 percent dust spot efficiency when rated per ASHRAE Testing Standard 52.2.
 - 5. Bearings: Rated per ABMA 9 or 11 for a L10 life rating of not less than 50,000 hours; provide greater life when specified with each fan type.
- C. Electrical and control system design:
- 1. Design and supply necessary electrical power and control systems, components, and wiring to make a complete functioning system. Design to perform the system ventilating functions with the control systems as specified in Section 15936 - Instrumentation and Control Devices for HVAC or as indicated on the Drawings and as specified in the following sections:
 - a. Section 16050 - Common Work Results for Electrical.
 - b. Section 16060 - Grounding and Bonding.
 - c. Section 16075 - Identification for Electrical Systems.

- d. Section 16123 - 600-Volt or Less Wires and Cables.
 - e. Section 16130 - Conduits.
 - f. Section 16134 - Boxes.
 - g. Section 16140 - Wiring Devices.
 - h. Section 16222 - Low Voltage Motors Up To 500 Horsepower.
 - i. Section 16411 - Disconnect Switches.
- D. Fire control system design requirements:
- 1. Provide fan interlock from FACP to shut down fan upon smoke detection as indicated on the Drawings.

1.05 SUBMITTALS

- A. Submit as specified in the General Requirements and Section 15050 - Common Work Results for Mechanical Equipment.
- B. Product data:
 - 1. Materials.
 - 2. Primary and ancillary equipment.
 - 3. Sound Power Level in each of 8 octave bands and overall Sones.
 - 4. Fan system layout, mechanical, electrical power, and control diagrams.
 - 5. Supports, vibration isolators, and seismic bracing calculations and details.
 - 6. Calculated fan vibration levels and field-testing method.
 - 7. Bearing life.
 - 8. Fan performance curves showing specified operating condition.
- C. Provide vendor operation and maintenance manual as specified in Section 01782 - Operation and Maintenance Manuals.
 - 1. Furnish bound sets of installation, operation, and maintenance instructions for each type fan.
- D. Provide Manufacturer's Certificate of Source Testing as specified in Section 01756 - Commissioning.

1.06 QUALITY ASSURANCE

- A. Provide fans:
 - 1. Listed by UL.
 - 2. Rated in accordance with AMCA.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver units in 1 piece, factory assembled, internally wired, and lubricated.
- B. Protect equipment from dust and atmospheric exposure as recommended by the unit manufacturer.
 - 1. As a minimum provide temporary closures for equipment openings designed for airflow.

1.08 WARRANTY

- A. As specified in Section 01783 - Warranties and Bonds.

1.09 SPARE PARTS

- A. Spare parts list: Provide a detailed spare parts list that includes part names, part numbers, and telephone number for placing orders. Also, include a recommended spare parts list.

PART 2 PRODUCTS

2.01 TYPE 3, FILTERED CENTRIFUGAL ROOF SUPPLY FANS

- A. Manufacturers: One of the following or equal:
 1. Greenheck, Model RSFP.
 2. Loren Cook, Model ASP/ASP-T.
 3. ACME, Model PL.
- B. Characteristics:
 1. Roof-mounted, louvered penthouse hooded supply fan with hinged cover.
 2. Forward-curved centrifugal fan wheel.
 3. Materials: Aluminum louvered penthouse as scheduled.
 4. Fan bearings: Permanently lubricated ball bearing type.
 5. Belt drive rated for 150 percent of motor horsepower.
- C. Accessories:
 1. Filter section:
 - a. Low velocity 2-inch thick pleated, washable filters of commercially available sizes.
 - b. Filter face velocity: Not to exceed 350 feet per minute nominal flow.
 - c. Provide filters of identical size for any 1 unit.
 - d. Filters: American Air Filter or equal.
 2. Insulated cover to prevent condensation.
 3. Finishes: Provide Kynar paint coating over compatible primer on all aluminum surfaces.
 4. Provide roof curb and duct adapter; same material as fan and housing.
 - a. Extend a minimum of 8 inches above top of built up roofing.
 - b. Curb shall be a minimum height of 12 inches or as indicated on the Drawings.

2.02 TYPE 5, CENTRIFUGAL EXHAUST FANS

- A. Manufacturers: One of the following or equal:
 1. Greenheck, Model CUE.
 2. Cook, similar model.
 3. Penn, similar model.

- B. Characteristics:
 - 1. Type: Upblast centrifugal fan.
 - 2. Fan: backward inclined aluminum wheel.
 - 3. Housing: Aluminum.

- C. Accessories:
 - 1. Aluminum curb cap.
 - 2. Foam curb seal.

2.03 TYPE 12, FRP BASE MOUNT CENTRIFUGAL FANS

- A. Manufacturers: One of the following or equal:
 - 1. Hartzell Fan.
 - 2. New York Blower Co.

- B. Characteristics:
 - 1. Fan design/construction: In accordance with ASTM D4167.
 - 2. Fan housing: Solid fiberglass reinforced plastic (FRP).
 - 3. Fan wheel: Backward curved or backward inclined airfoil blades, non-overloading throughout entire curve at rated speed; solid FRP, totally encapsulated aluminum core insert for secure attachment to shaft.
 - 4. Shaft: Ground and polished Type 316 stainless steel with FRP sleeve in air stream. Shaft to have maximum 1 mil run-out.
 - 5. Bearings: Minimum ABMA L10 life rating of 100,000 hours, grease lubricated with lube tubes extended to outside of housing.
 - 6. Shaft seal: Provide Teflon elements in FRP casing, Type 316 stainless steel double lip rings and springs. Extend shaft seal 1/2 inch beyond seal.
 - 7. Duct connections: Provide flanged inlet and outlet connections for both fans and inlet boxes. Provide flexible connectors at the inlet box inlet and the fan outlet.
 - 8. Drain: Provide 1-inch diameter FRP pipe bonded to a low point in the housing; provide PVC ball valve and threaded plug.
 - 9. Fan inspection port: Provide 8-inch diameter fan housing port to allow examination of interior.
 - 10. Motor and belt cover/guard: Provide FRP or Type 316 stainless steel cover over motor and belt drive with louvered side panels to allow motor ventilation sufficient to prevent overheating at 100 percent of full load.
 - 11. Electrical grounding: Coat air stream surfaces with graphite impregnated resin with grounding straps to motor frames or fan base to control static electricity.
 - 12. Abrasive moisture coating: Coat fan wheel with 50 to 60 mil abrasive/erosive resistant coating.
 - a. Hartzell Hartkote, or accepted equal.
 - 13. Base support structures: Rigid Structural FRP, aluminum, or Type 316 stainless steel.
 - 14. Duct connection orientation: As indicated on the Drawings.
 - 15. Drive: Belt or direct as scheduled.
 - 16. FRP requirements:
 - a. Suitable for continuous operation when exposed to vapors and gases expected to include methane, hydrogen sulfide, chlorine gas, sulfur dioxide, gasoline vapors, ammonia, and water saturated air. Air stream may contain droplets of dilute sulfuric acid, greases, and particulate

- matter and may vary from 30 degrees Fahrenheit to 130 degrees Fahrenheit.
- b. Housing resin:
 - 1) Type: Premium polyester resin.
 - 2) Resin shall achieve Class I flame spread rating below 25 when tested in accordance with ASTM E84 without the use of additives.
 - 3) Manufacturer: One of the following or equal:
 - a) Ashland Chemical Co.
 - b) Derakane.
 - c) Hetron 92FR; Dow Chemical Co.
 - c. Wheel resin:
 - 1) Type: Premium Vinyl ester resin;
 - 2) Resin shall achieve Class II flame spread rating below 30 when tested in accordance with ASTM E84.
 - 3) Manufacturer: One of the following or equal:
 - a) Dow Chemical Co.
 - b) Derakane 510A40 or 570A40; Ashland Chemical Co.
 - c) Hetron.
 - d. Protect fiberglass surfaces with minimum 10-mil thickness of ultraviolet resistant resin after initial visual inspections of housing exterior is complete.
 - e. Provide Veil-Nexus corrosion resistant surfacing veil and additional coat of fiberglass reinforced plastic resin on surfaces exposed to the air stream for corrosion resistance and chopped strand fiberglass for structural core strength.
- 17.** Balancing: Dynamically balance fan assembly after fabrication and assembly to a maximum of 0.15 inches per second of unbalance at the operating speed.
- 18.** Other accessories:
 - a. Vibration isolators: Provide seismically restrained, spring type. Install per manufacturer's recommendations.
 - b. Cover access doors: FRP, neoprene gasket, non-hinged, stainless steel bolts.
 - c. Fasteners: Type 316 stainless steel and shall be encapsulated in FRP when exposed to air stream.
 - d. Inlet box:
 - 1) Provide FRP inlet box specifically designed by the fan manufacturer to optimize fan inlet conditions.
 - 2) Maximum pressure loss through inlet box shall be 1.0 inches water column at specified design flow rate.
 - 3) Inlet box shall be mounted and supported from integral fan/motor/inlet box base with rigid structural FRP, aluminum, or Type 316 stainless steel supports.
 - 4) Inlet box shall have a 1-inch drain connection at the lowest point in the orientation indicated on the Drawings; provide PVC ball valve and threaded plug.

2.04 TYPE 13, FRP INLINE CENTRIFUGAL FANS

- A. Manufacturers: One of the following or equal:
- 1. Hartzell Fan, Series 40.
 - 2. New York Blower Co.

B. Characteristics:

1. Fan design/construction: In accordance with ASTM D4167.
2. Fan housing: Solid fiberglass reinforced plastic (FRP).
3. Fan wheel: Backward curved or backward inclined airfoil blades, non overloading throughout entire curve at rated speed; solid FRP, totally encapsulated aluminum core insert for secure attachment to shaft.
4. Shaft: Ground and polished Type 316 stainless steel with FRP sleeve in air stream. Shaft to have maximum 1 mil run-out.
5. Bearings: Minimum ABMA L10 life rating of 100,000 hours, grease lubricated with lube tubes extended to outside of housing.
6. Shaft seal: Provide Teflon elements in FRP casing, Type 316 stainless steel double lip rings and springs. Extend shaft seal 1/2 inch beyond seal.
7. Duct connections: Provide flanged inlet and outlet connections for fans. Provide flexible connectors at the fan inlet and outlet.
8. Drain: Provide 1-inch diameter FRP pipe bonded to a low point in the housing; provide PVC ball valve and threaded plug.
9. Fan inspection port: Provide 8-inch diameter fan housing port to allow examination of interior.
10. Motor and belt cover/guard: Provide FRP, aluminum or Type 316 stainless steel cover over motor and belt drive with louvered side panels to allow motor ventilation sufficient to prevent overheating at 100 percent of full load.
11. Electrical grounding: Coat air stream surfaces with graphite impregnated resin with grounding straps to motor frames or fan base to control static electricity.
12. Abrasive moisture coating: Coat fan wheel with 50 to 60 mil abrasive/erosive resistant coating.
 - a. Hartzell Hartkote, or accepted equal.
13. Base support structures: Rigid Structural FRP, aluminum, or Type 316 stainless steel.
14. Duct connection orientation: As indicated on the Drawings.
15. Drive: Belt or direct as scheduled.
16. FRP requirements:
 - a. Suitable for continuous operation when exposed to vapors and gases expected to include methane, hydrogen sulfide, chlorine gas, sulfur dioxide, gasoline vapors, ammonia, and water saturated air. Air stream may contain droplets of dilute sulfuric acid, greases, and particulate matter and may vary from 30 degrees Fahrenheit to 130 degrees Fahrenheit.
 - b. Housing resin:
 - 1) Type: Premium polyester resin.
 - 2) Resin shall achieve Class I flame spread rating below 25 when tested in accordance with ASTM E84 without the use of additives.
 - 3) Manufacturer: One of the following or equal:
 - a) Ashland Chemical Co.
 - b) Derakane.
 - c) Hetron 92FR; Dow Chemical Co.
 - c. Wheel resin:
 - 1) Type: Premium Vinyl ester resin.
 - 2) Resin shall achieve Class II flame spread rating below 30 when tested in accordance with ASTM E84.
 - 3) Manufacturer: One of the following or equal:
 - a) Dow Chemical Co.

- b) Derakane 510A40 or 570A40; Ashland Chemical Co.
- c) Hetron.
- d. Protect fiberglass surfaces with minimum 10-mil thickness of ultraviolet resistant resin after initial visual inspections of housing exterior is complete.
- e. Provide Veil-Nexus corrosion resistant surfacing veil and additional coat of fiberglass reinforced plastic resin on surfaces exposed to the air stream for corrosion resistance and chopped strand fiberglass for structural core strength.
- 17. Balancing: Dynamically balance fan assembly after fabrication and assembly to a maximum of 0.15 inches per second of unbalance at the operating speed.
- 18. Other accessories:
 - a. Vibration isolators: Provide seismically restrained, spring type. Install per manufacturer's recommendations.
 - b. Cover access doors: FRP, neoprene gasket, non-hinged, stainless steel bolts.
 - c. Fasteners: Type 316 stainless steel and shall be encapsulated in FRP when exposed to air stream.

2.05 TYPE 14, FRP BELT DRIVE UPBLAST EXHAUSTER

- A. Manufacturers: One of the following or equal:
 - 1. Hartzell, Series 88.
 - 2. New York Blower Company, similar model.
- B. Characteristics:
 - 1. Fan design/construction: In accordance with ASTM D4167.
 - 2. Fan housing: Solid fiberglass reinforced plastic (FRP).
 - 3. Fan wheel: Backward curved, non-overloading throughout entire curve at rated speed; solid FRP, totally encapsulated aluminum core insert for secure attachment to shaft.
 - 4. Shaft: Ground and polished Type 316 stainless steel with Hastelloy or FRP sleeve in air stream. Shaft to have maximum 1 mil run-out.
 - 5. Bearings: Minimum ABMA L10 life rating of 50,000 hours, grease lubricated with lube tubes extended to outside of housing.
 - 6. Shaft seal: Provide Teflon elements in FRP casing, Type 316 stainless steel double lip rings and springs. Extend shaft seal 1/2 inch beyond seal.
 - 7. Electrical grounding: Coat air stream surfaces with graphite impregnated resin with grounding straps to motor frames or fan base to control static electricity.
 - 8. Abrasive moisture coating: Coat fan wheel with 50 to 60 mil abrasive/erosive resistant coating.
 - 9. Drive: Belt or direct as scheduled.
 - 10. FRP requirements:
 - a. Suitable for continuous operation when exposed to vapors and gases expected to include methane, hydrogen sulfide, chlorine gas, sulfur dioxide, gasoline vapors, ammonia, and water saturated air. Air stream may contain droplets of dilute sulfuric acid, greases, and particulate matter and may vary from 30 degrees Fahrenheit to 130 degrees Fahrenheit.
 - b. Housing resin:
 - 1) Type: Premium polyester resin.

- 2) Resin shall achieve Class I flame spread rating below 25 when tested in accordance with ASTM E84 without the use of additives.
 - 3) Manufacturer: One of the following:
 - a) Ashland Chemical Company.
 - b) Derakane.
 - c) Hetron 92FR; Dow Chemical Company.
 - c. Wheel resin:
 - 1) Type: Premium Vinyl ester resin;
 - 2) Resin shall achieve Class II flame spread rating below 30 when tested in accordance with ASTM E84.
 - 3) Manufacturer: One of the following:
 - a) Dow Chemical Company.
 - b) Derakane 510A40 or 570A40; Ashland Chemical Company.
 - c) Hetron.
 - d. Protect fiberglass surfaces with minimum 10-mil thickness of ultraviolet resistant resin after initial visual inspections of housing exterior is complete.
 - e. Provide Veil-Nexus corrosion resistant surfacing veil and additional coat of fiberglass reinforced plastic resin on surfaces exposed to the air stream for corrosion resistance and chopped strand fiberglass for structural core strength.
11. Balancing and Run Test: The wheel and shaft shall be dynamically balanced as an assembly to ISO Quality Grade G2.5. After final assembly, the fan is to be balanced to ANSI/AMCA Standard 204, Section 6, Table 6-3 for Industrial Process and Power Generation Equipment Level BV-3. Vibration levels to be less than 0.10 inch per second at the inboard and outboard bearings, horizontal and vertical planes, filter-in at the fan speed, fan rigidly mounted. After final balance, vibration levels should be re-recorded filter-out at running speed, documented and submitted to the ENGINEER as a certified balance report. After the fan is installed, the installing contractor (or the fan supplier) is to provide a coast-down analysis designed to identify the natural frequencies of the installed fan system and local field vibration services to achieve an in situ vibration performance of not-to-exceed 0.25 inch per second at the inboard and outboard bearings, horizontal, vertical, and axial planes, filter-out at fan speed, for rigid mount fans, and a not-to-exceed 0.25 inch per second in the same manner for flexible mount fans (rubber in shear or spring isolators). Additionally, adjacent fans must have fan speeds differing by at least 25 rpm. The results shall be performed with full spectrums recorded, documented, and submitted to Owner Representative.
12. Other accessories:
- a. Fasteners: Type 316 stainless steel and shall be encapsulated in FRP when exposed to air stream.

2.06 TYPE 15, FRP WALL VENTILATORS

- A. Manufacturers: One of the following or equal:
 - 1. Hartzell, Series 59.
- B. Characteristics:
 - 1. Wall-mounted, direct drive, packaged unit.
 - 2. High-efficiency 1-piece fiberglass airfoil-type propeller.

3. Fan Housing: 1-piece molded fiberglass fan housing with solid fiberglass motor support base.
 4. Motors: Totally enclosed motors.
 5. Hardware: Type 316L stainless steel.
 6. Provide other accessories as scheduled.
- C. Accessories:
1. Motor and fan side OSHA FRP guards.
 2. FRP wall-mount collar for wall mount installation when scheduled.
 3. FRP dampers with FRP damper guards when scheduled.
 4. FRP weather hood when scheduled.

2.07 SOURCE QUALITY CONTROL

- A. Factory test fans listed on the Fan Schedule for proper operation, performance, and electrical controls.
 1. Non-witnessed tests.
 2. Provide Manufacturer's Certificate of Source Testing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine and verify that Work is in condition to receive installation specified in this Section.
- B. Take measurements and verify dimensions to ascertain fit of installation.
- C. Ascertain support and openings are correctly located.

3.02 PREPARATION

- A. Before installation, remove dust and debris from equipment and ducts.
- B. During installation and until equipment is operated, protect equipment and ducts from dust and debris by covering openings with tape or plastic.

3.03 INSTALLATION

- A. Observe applicable installation requirements as specified in Section 15050 - Common Work Results for Mechanical Equipment.
- B. Anchoring and support:
 1. Provide anchoring and support for fans and appurtenances.
 2. Provide anchoring to sustain seismic and wind forces as specified in Section 01850 - Design Criteria.
- C. Adjust alignment of ducts where necessary to resolve conflicts with architectural features or to resolve conflicts with the Work of other trades.

- D. Install and wire unit fans and controls in accordance with manufacturer's recommendations.
- E. Install flexible connections to fans.
- F. Install roof curb and fan as recommended by fan manufacturer.
- G. For fan housings with threaded water trap drain, provide drain piped from fan housing to the nearest drain channel, floor drain, or sump.

3.04 FIELD QUALITY CONTROL

- A. Testing, Training, and Start-Up: As specified in Section 01756 - Commissioning and as in this Section.
- B. Test equipment and installation to verify tightness, operation, and unit vibration is within manufacturer's submitted maximum.
- C. Test equipment performance and balance equipment as specified in Section 15954 - Testing, Adjusting and Balancing for HVAC.

3.05 MANUFACTURER'S FIELD SERVICES

- A. Coordinate field service Work with the manufacturer's representative, and the Engineer prior to initiating such Work.
- B. Contractor shall furnish a qualified manufacturer's representative to provide manufacturer's field services as specified in Section 01756 - Commissioning.
- C. Require manufacturer's representative to perform the following services as described below and as specified in Section 01756 - Commissioning. The specified durations are the minimum required time on the job site. Additional services and/or longer durations shall be provided as needed at no additional cost to the Owner to meet the required quality of Work. Work to be done in a minimum of 6 trips:
 - 1. Installation Assistance: As required.
 - 2. Installation Inspection: 2 trips. 2 workdays each trip.
 - 3. Start-up/Testing Assistance: 2 trips, 2 workdays each trip.
 - 4. Training: As defined in Section 01756 - Commissioning. Provide training as follows:
 - a. Operations Training: None.
 - b. Mechanical Maintenance Training: 2 hours of training, presented twice, for a total of 4 hours.
 - c. Electrical Maintenance Training: None.
 - 5. Final Acceptance Checkout: 2 workdays (trip may be combined with training).

3.06 SCHEDULES

- A. Fan Schedule:

Tag. No.	Equipment Name	Fan					Motor			Additional Requirements (see notes)
		Type	Drive	Min. CFM	Min. ESP"	Max. RPM	hp	V/Ph.	Max. RPM	
02-EF-1320	Grit Pump Room Exhaust Fan	14	Belt	3,700	1.0	850	2	480/3	1,800	3,5,7,22,27
✓ 02-EF-1330	Headworks Loading Exhaust Fan 1	12	Belt	5,025	3.5	1,200	5	480/3	1,800	3,5,8,22,23,27
✓ 02-EF-1340	Headworks Loading Exhaust Fan 2	12	Belt	5,025	3.5	1,200	5	480/3	1,800	3,5,8,22,23,27
02-EF-1370	Grit Washer Room Exhaust Fan 1	14	Belt	4,600	1.5	1,200	2	480/3	1,800	3,5,7,22,27
02-EF-1380	Grit Washer Room Exhaust Fan 2	14	Belt	4,600	1.5	1,200	2	480/3	1,800	3,5,7,22,27
✓ 02-EF-1390	Headworks Channel Exhaust Fan 1	12	Belt	6,465	3.6	1,200	7.5	480/3	1,800	3,5,8,22,23,27
✓ 02-EF-1396	Headworks Channel Exhaust Fan 2	12	Belt	6,465	3.6	1,200	7.5	480/3	1,800	3,5,8,22,23,27
02-SF-1310	Grit Pump Room Supply Fan	3	Belt	4,000	1.15	800	2	480/3	1,800	1,3,5,7,17,22,27
02-SF-1350	Screenings and Grit Handling Supply Fan 1	3	Belt	8,500	1.7	900	7.5	480/3	1,800	1,3,5,7,17,22,27
02-SF-1360	Screenings and Grit Handling Supply Fan 2	3	Belt	8,500	1.7	900	7.5	480/3	1,800	1,3,5,7,17,22,27
02-SF-1570	Stairwell 1 Supply Fan	15	Direct	300	0.5	1,950	0.5	480/3	1,800	1,4,7,25
02-SF-1575	Stairwell 2 Supply Fan	15	Direct	200	0.5	1,950	0.5	480/3	1,800	1,4,7,25
02-SF-1810	Storage Room Supply Fan	15	Direct	750	0.5	1,800	0.5	480/3	1,800	1,4,7,25
03-EF-1420	Primary Gallery Exhaust Fan	14	Belt	3,000	1	1,300	2	480/3	1,800	3,5,7,21,22,27
03-SF-1410	Primary Gallery Supply Fan	3	Belt	3,300	1.0	1,000	1.5	480/3	1,800	1,3,5,7,17,22,27
03-SF-1575	Primary Gallery Stairwell Supply Fan	15	Direct	300	0.5	1,950	0.5	480/3	1,800	1,4,7,25
08-EF-1230	Chlorination Facility Exhaust Fan 1	14	Belt	180	0.2	680	0.25	480/3	1,800	3,5,7,21
11-EF-1530	Digester Control Building 1 Exhaust Fan 1	14	Belt	2,100	1.5	1,250	1.5	480/3	1,800	3,5,7,22,27
11-EF-1540	Digester Control Building 1 Exhaust Fan 2	14	Belt	2,100	1.5	1,250	1.5	480/3	1,800	3,5,7,22,27
11-EF-1560	Boiler Room Exhaust Fan	15	Belt	1,000	0.5	1,500	0.5	480/3	1,800	3,7,25
11-EF-2530	Digester Control Building 2 Exhaust Fan 1	14	Belt	2,750	1.5	1,320	1.5	480/3	1,800	3,5,7,22
11-EF-2540	Digester Control Building 2 Exhaust Fan 2	14	Belt	2,750	1.5	1,320	1.5	480/3	1,800	3,5,7,22
11-SF-1510	Digester Control Building 1 Supply Fan 1	12	Belt	2,600	1.3	1,250	1.5	480/3	1,800	1,2,3,5,6,7,17,22,23,27
11-SF-1520	Digester Control Building 1 Supply Fan 2	12	Belt	2,600	1.3	1,250	1.5	480/3	1,800	1,2,3,5,6,7,17,22,23,27
11-SF-1550	Boiler Room Supply Fan	12	Belt	2,700	1.1	950	1	480/3	1,800	3,5,7,22,27
11-SF-1575	Digester Control Building 1 Stairwell Supply Fan	15	Direct	200	0.5	1,950	0.5	480/3	1,800	1,4,7,25
11-SF-2510	Digester Control Building 2 Supply Fan 1	12	Belt	2,920	1.3	1,960	1.5	480/3	1,800	1,3,5,6,7,22,27
11-SF-2520	Digester Control Building 2 Supply Fan 2	12	Belt	2,920	1.3	1,960	1.5	480/3	1,800	1,3,5,6,7,22,27
11-SF-2575	Digester Control Building 2 Stairwell Supply Fan	12	Belt	200	0.5	620	0.25	480/3	1,800	1,5,6,7
12-EF-2530	Solids Handling Exhaust Fan 1	12	Belt	19,820	2	1,370	20	480/3	1,800	3,5,6,7,22,23,27
12-EF-2540	Solids Handling Exhaust Fan 2	12	Belt	19,820	2	1,370	20	480/3	1,800	3,5,6,7,22,23,27
12-SF-2510	Solids Handling Supply Fan 1	12	Belt	22,970	2	1,320	20	480/3	1,800	3,5,6,7,22,27
12-SF-2520	Solids Handling Supply Fan 2	12	Belt	22,970	2	1,320	20	480/3	1,800	3,5,6,7,22,27
12-SF-2550	Solids Handling Stairwell Supply Fan 1	15	Direct	1,300	0.5	1,750	0.25	480/3	1,750	1,4,7,20,25
12-SF-2560	Solids Handling Stairwell Supply Fan 2	15	Direct	1,000	0.5	1,750	0.25	480/3	1,750	1,4,7,20,25
12-SF-2570	Truck Loading Supply Fan 1	13	Belt	5,000	2	1,210	3	480/3	1,800	3,5,6,7,22,25,27
12-SF-2580	Truck Loading Supply Fan 2	13	Belt	5,000	2	1,210	3	480/3	1,800	3,5,6,7,22,25,27
13-EF-1530	SCADA Building Restroom 1 Exhaust Fan	5	Direct	60	0.14	1,010	1/15	115/1	1,010	7

Tag. No.	Equipment Name	Fan					Motor			Additional Requirements (see notes)
		Type	Drive	Min. CFM	Min. ESP"	Max. RPM	hp	V/Ph.	Max. RPM	
13-EF-1540	SCADA Building Restroom 2 Exhaust Fan	5	Direct	60	0.14	1,010	1/15	115/1	1,010	7
21-EF-1310	Chemical Feed Room Exhaust Fan	14	Belt	700	0.14	460	0.33	115/1	1,800	3,5,7,21,22,25
21-EF-1250	Generator Room Exhaust Fan	14	Belt	620	0.15	900	0.33	480/3	1800	1,5,7,21,25^{AD7}

Notes:

- 1. Provide bird screen.
- 2. Provide replaceable inlet filter in between the bird screen and intake of fan.
- 3. Provide backdraft damper, counterbalanced for minimum pressure loss.
- 4. Provide exterior weather hood.
- 5. Provide adjustable belt sheaves.
- 6. Provide vibration isolators.
- 7. Provide manufacturer standard motor enclosure.
- 8. Provide TEFC motor enclosure and wiring suitable for Class I, Div. 2 locations.
- 9. Provide explosion proof motor and wiring suitable for Class I, Div. 1 locations.
- 10. Provide variable frequency drive speed controller as specified in this Section.
- 11. Provide SCR speed controller as specified in this Section.
- 12. Provide exterior disconnect switch at fan, NEMA Type 3R.
- 13. Provide NEMA Type 1 disconnect switch at fan inside housing.
- 14. Provide 120 volt, line voltage thermostat Type 2 as specified in this Section.
- 15. Provide 24 volt, low voltage thermostat type T-5 as specified in this Section.
- 16. Interlock fan with motorized louver dampers, other fans or equipment as indicated on the Drawings.
- 17. Provide replaceable filters.
- 18. Provide motorized backdraft damper.
- 19. Provide exterior weather louver, Type L-6 as specified in Section 15852 - Louvers.
- 20. Provide fiberglass canopy hood, as indicated on the Drawings.
- 21. Fan selection based on existing opening; field verify opening size and select maximum sized, slowest rpm fan to fit opening and meet performance conditions.
- 22. Provide fire/smoke control system for all fans greater than 2,000 cfm.
- 23. Provide fan with FRP inlet box, as indicated on the Drawings.
- 24. Provide FRP discharge stack head, as indicated on the Drawings.
- 25. Provide the necessary accessories for wall mounting configuration.
- 26. At the fan manufacturer's option, the backdraft damper style BDD-4 may be located in the duct immediately downstream of the fan (below the ceiling). In this case, Contractor shall submit revised duct transition configuration for acceptance by the Engineer.
- 27. Provide seismically restrained spring vibration isolators.

END OF SECTION

^{AD7} Addendum No. 7 - July 2024

HARTZELL SUBMITTAL

910 S. Downing St., Piqua, OHIO 45356
PH: (937) 773-7411 | Fax: (937) 773-8994



Hartzell Order: 2521509 Date: May 21, 2025 Submittal Revision : 1

Customer: Nan Inc. Customer P.O.: 24077-00083

Transmitted To:

03ES
Paul Scott

Hartzell Contact Information:

- Technical Contact: Dakota Iddings | diddings@hartzell.com | ext3024
- All Other Inquiries: customerservice@hartzell.com | 937.773.7411

THE FOLLOWING DOCUMENTS ARE TRANSMITTED FOR:

- Record Only including Hartzell Air Movement, Inc. Terms & Conditions of Sale – No Response Required
 - For Approval including Hartzell Air Movement, Inc. Terms & Conditions of Sale – Written Authorization Required Prior to Production
 - Revised for Approval – Written Authorization Required Prior to Production
 - Final Copies
-

TYPES OF DRAWING(S) INCLUDED:

- Dimensional Drawings – standard General Arrangement drawing which may not include factory quoted items or all accessories
 - As-Built Drawings – includes factory quoted items & all accessories
 - Certified Drawings – As-Built drawings with registered PE signature, valid in State of Ohio
-

FOR APPROVAL	
<input type="checkbox"/>	APPROVED AS SUBMITTED
<input type="checkbox"/>	NOT APPROVED – RESUBMIT
SIGNED BY: _____	
TITLE: _____	
COMPANY: _____	
DATE: _____	

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- 02 [Hartzell Exceptions](#)
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 - .02 [Line: 02 | A41-0-271FA-66FGI8LT - Fiberglass Backward Curved Centrifugal Fan](#)
 - .03 [Line: 03 | A41-0-271FA100FGI8MT - Fiberglass Backward Curved Centrifugal Fan](#)
- 04 [Inspection and Testing Plan](#)
- 05 [General Storage Information](#)
- 06 [Installation, Operation & Maintenance Manual](#)
- 07 [Terms & Warranty](#)
- 08 [Appendix](#)

SUBMITTAL REVISION HISTORY



REV	Description of Change	Date
1	Original Submission	05/21/2025

The safe application and use of equipment supplied by Hartzell Air Movement, Inc. is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

Document: QMS-0175 Rev: 2

SECTION 02

HARTZELL EXCEPTIONS



Hartzell reserves the right to take exception to specifications delivered, if section is blank a specification has not been received and will incur a Change Order fee to review specification after initial submittal.

Markup Legend (if applicable):

- ✓ Applicable to Fan(s) Submitted upon
- ✗ Exception taken for Item Listed

SECTION 03.01

LINE ITEM TECHNICAL INFORMATION



Line No.: 2521509-01

Description: A41-1-402FA100FGFQT3 - Fiberglass Backward
Curved Centrifugal Fan

Tag: 07-FAN-1110/1120



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
Page 1 of 18

DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date:	5/19/2025 8:45:57 AM	Ship Method:	PPD CC
Salesman Code:	99WE	FOB:	Piqua
Partial Ship:	False	AR Terms:	Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
1	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

A41-1-402FA100FGFQT3
41 - Fiberglass Backward Curved Centrifugal Fan

Tag: 07-FAN-1110/1120

Performance
Volume Flow Rate: 23000.0 cfm
SP: 9.0 in. w.g. / TP: 9.37 in. w.g.
RPM: 1230.0
Density: 0.075 lbs/ft^3
Operating Temp: 70 °F
OPwr: 41.375 hp / SPwr: 41.375 hp

Motor
Operating Voltage: 460
HP: 50, RPM: 1750, Volts: 460, Hertz: 60, Phase: 3
Enclosure: TEFC IEEE-841, Frame Size: 326T, 1 Speed / 1 Winding
Drill and Tap: No
Special Features: MOTOR SPEC. 16222, INCLUDES 120V SPACE HEATERS. INTERNAL AEGIS RING w/RR#9, MEETS STD. 841, INVERTER READY NAMEPLATED, ---NOTE: NO RTD'S REQUIRED.
Vendor: BALDOR/ABB, Vendor P/N: ECP84115T-4-M21A-M39B-1, Vendor Lead Time: 2-4 weeks
Extended Electrical Leads: None, Extended Lube Lines: Yes

Fan
Arrangement: 01
Rotation and Discharge: Bottom Horizontal (Clockwise)
Mounting Location: Floor
Motor Position: W
Material: Fiberglass
Construction: ASTM D4167 97 (Includes Single Veil & Electric Grounding)
Fan Coating: Vinyl Ester
Prop/Wheel: FA - Backward Airfoil Centrifugal Wheel - Fiberglass
Prop/Wheel Coating: Electric Grounding

Standard Accessories (Included)
Water Slinger
Inlet Support, Steel - Inorganic Zinc Coating w/ Epoxy Topcoat



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

Page 2 of 18

DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	

Additional Accessories

Bolted Access Door, Fiberglass
Drain, CPVC w/ CPVC Plug (Factory Installed)
Extended Lube Lines to Fan Bearings, 316SS
316SS Hardware to Complete Fan
316SS Shaft
Teflon Double Lip Seal w/ purge option in a 316SS Casing
Drilled Inlet Flange, PS15-69
Drilled Outlet Flange, PS15-69
Inlet Box, Fiberglass w/ 316SS Support Legs ; 12:00 Orientation
Arrangement #1 Sub Base, 316SS

1.03, B, 4 – HARTZELL – L-10 life rating of 200,000 bearings.

Vitech C1D1 Vibration Switch

Description and Dimensions: PART# 6124-083

HARTZELL – Quote neoprene gasketing-ADDER , (For bolted access door.)

316 SST base and bearing supports and inlet support.

Material of Construction: 316 Stainless Steel,

LVR Sound Reduction Wrap

Shaft & Belt Guard

Material of Construction: 316 Stainless Steel,

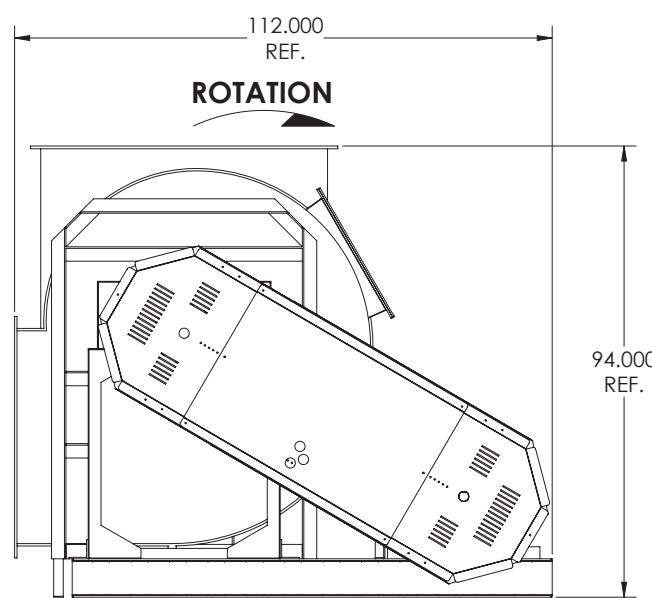
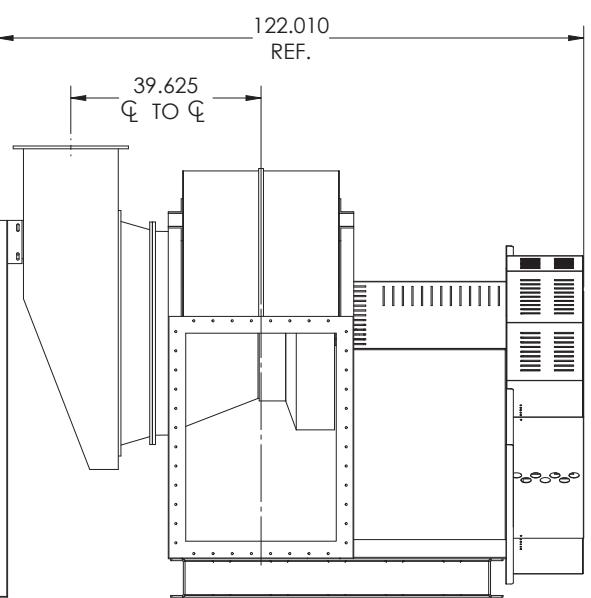
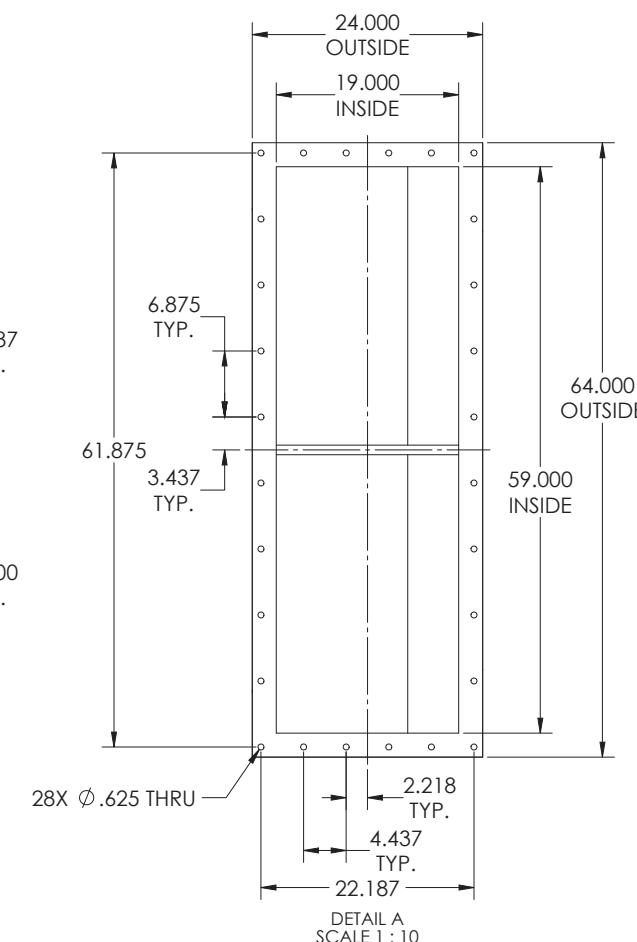
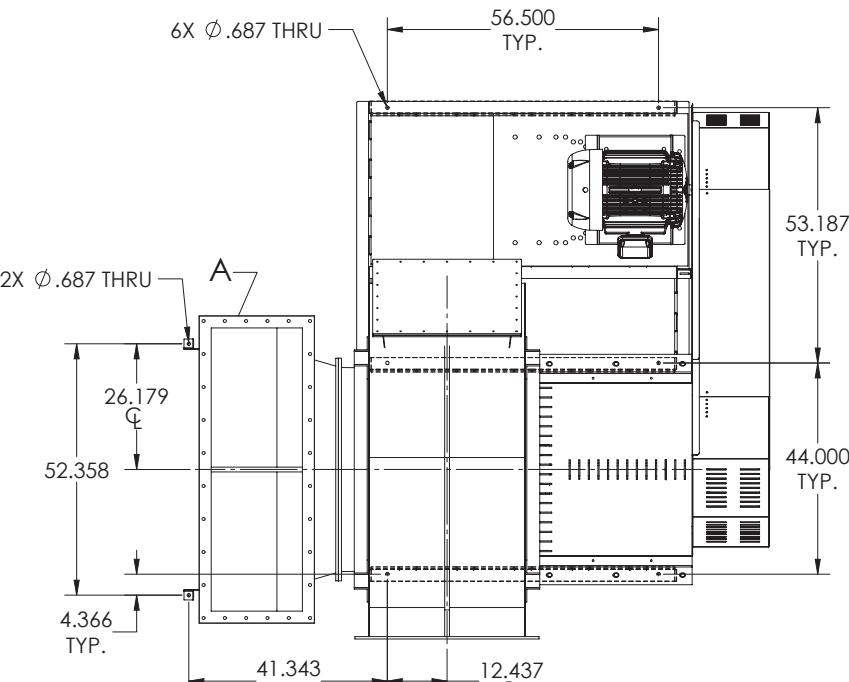
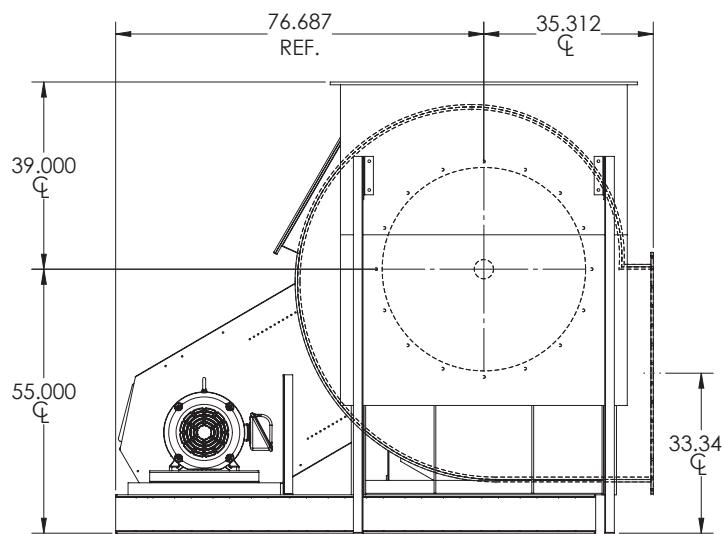
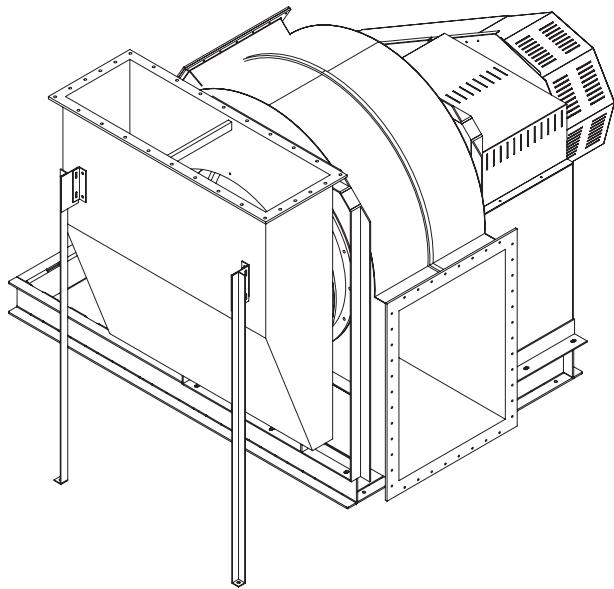
Spare set of bearings

Total Weight (approx.): 3276 lbs. (Each) (quoted items are not included in the weight.)

Blanket Qty: 0.00

Blanket Exp Date:

REV.	DESCRIPTION	DATE	CHANGE NO.
A	INITIAL RELEASE	06/02/2025	SDR-0045



CERTIFIED PRINT

BY Joe Hart DATE: 06/02/2025

SALES ORDER # 2521509
CUSTOMER PO # 24077-00083
FAN TAG # 07-FAN-1110/1120
APPROX. WEIGHT (lb): 3596

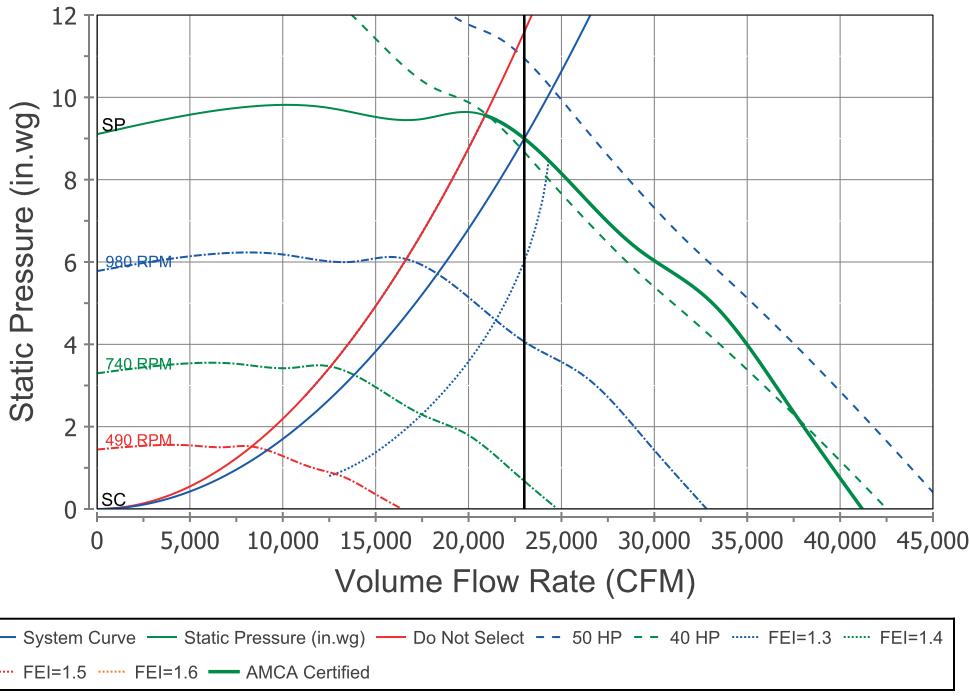
TYPE	PRODUCT SERIES	ARRANGEMENT / DUTY / COLOR			SIZE	# OF BLADES / CLASS	BLADE / WHEEL	BLADE ANGLE / WHEEL WIDTH	MATERIAL OF CONSTRUCTION	MOTOR ENCLOSURE	MOTOR HP/RPM	ADDITIONAL INFORMATION:						
		ARRANGEMENT	DUTY	COLOR								HP	RPM	MOTOR FRAME	BLADE OD	ROTATION	DISCHARGE	
A	41-	1			40	7	2	FA			100	FG	FQ	50	1750	326T	CW	BH

Hartzell
AIR MOVEMENT
PROPRIETARY AND CONFIDENTIAL

MATERIAL INFORMATION			UNLESS OTHERWISE SPECIFIED:		
MATERIAL SEE BOM	DIMENSIONS ARE IN INCHES			MATERIAL THICKNESS	DIMENSIONAL TOLERANCE = $\pm 1/8$
					ANGULAR = MACH. $\pm 5^\circ$ BEND $\pm 1^\circ$
WEIGHT					DIMENSIONS MARKED AS REF. ARE NOT SUBJECT TO TOLERANCE.
SURFACE AREA					
PERIMETER LENGTH					
FILE LOCATION: C:\Vault\Custom\ORDERS\252000\2521509\	NAME	DATE			
	NDW	6/2/2025			
	CHECKED				
	APPROVED				

Hartzell Air Movement
Piqua, Ohio 45356
TITLE: 41-40" 100% ARR. 1
FIBERGLASS BACKWARD
CURVED CENTRIFUGAL FAN
SIZE DWG. NO. D 41-2521509-01 REV A
DO NOT SCALE DRAWING SHEET 1 OF 1

Hartzell-FLOW™ v1.0.18 / February 2019
A41-1-402FA100FGFQT3



Fan Tag#: 07-FAN-1110/1120

Vol Flow Rate	23000
Pressure	9
Density (lbs/ft³)	0.075
Oper. Temp. (°F)	70
Fan RPM	1230
Max Safe RPM	1376
Operating Power	41.375
Standard Power	41.375
Static Efficiency	0.787
Outlet Velocity (fpm)	2439
Fan Energy Index (FEI)	1.31
Fan Efficiency Grade (FEG)	FEG85

Discharge Sound Power Levels referred to 10^-12 watts							
1	2	3	4	5	6	7	8
100	97	99	96	94	95	85	78

Radiated Sound Power Levels referred to 10^-12 watts							
1	2	3	4	5	6	7	8
96	90	89	85	82	82	72	65

Radiated Sound is not AMCA Licensed

Hartzell Air Movement certifies that the model shown is licensed to bear the AMCA Seal.
 The ratings shown are based on tests and procedures performed in accordance with AMCA publication 211 and AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program.
 FEI values are calculated in accordance with ANSI/AMCA Standard 208 and are based on four-pole TEFC motors of the size shown.
 Power rating BHP excludes transmission losses.
 Performance certified is for Installation Type D: Ducted Inlet, Ducted Outlet.
 AMCA Licensed for Sound and Air Performance.
 Performance ratings do not include the effects of appurtenances (Accessories).
 Sound ratings are based on sound level data obtained in accordance with AMCA Standard 300. The sound power level ratings shown are in decibels, referred to 10^-12 watts, calculated per AMCA Standard 301. Fan Outlet Sound Testing. Values shown are for outlet Lwo sound power levels for:
 Installation Type D: Ducted Inlet, Ducted Outlet.
 Ratings include the effects of duct end correction.

Discharge Sound Pressure = 89 dBA @ 5ft

Radiated Sound Pressure = 77 dBA @ 5ft

Discharge Sound Power = 100 LwA

Radiated Sound Power = 89 LwA

The A-weighted sound pressure level (dBA) is based on Hartzell Laboratory sound power tests, and is calculated in accordance with AMCA standard 303.

The FEG, dBA, LwA and radiated values are not AMCA International Licensed.

The calculation assumes a free field condition with a directivity factor for hemi-spherical radiation (Q=2).

The installed sound pressure levels are influenced by the installation and acoustic environment, and cannot be guaranteed. Use of this estimate level along for field acceptability test is not recommended.

Although the calculation can be done for any stated distance, the free field does not start until 20 to 50 ft from the equipment in most installations.

Contact Hartzell Air Movement for more information concerning dBA values.



BALDOR® • RELIANCE®

Customer information packet

ECP84115T-4

50HP, 1770RPM, 3PH, 60HZ, 326T, TEFC, F1

Class - CL1 GP A,B,C,D

Division - Division II

Specifications

Enclosure	TEFC
Frame	326T
Frame Material	Iron
Frequency	60.00 Hz
Haz Area Class and Group	CLI GP A,B,C,D
Haz Area Division	Division II
Motor Letter Type	Three Phase
Output @ Frequency	50.000 HP @ 60 HZ
Phase	3
Synchronous Speed @ Frequency	1800 RPM @ 60 HZ
Voltage @ Frequency	460.0 V @ 60 HZ
Agency Approvals	CCSA US CSA EEV NEMA PREMIUM NEMA_PREMIUM UR
Ambient Temperature	40 °C
Auxillary Box	No Auxillary Box
Auxillary Box Lead Termination	None
Base Indicator	Rigid
Bearing Grease Type	Polyrex EM (-20F +300F)
Blower	None
Constant Torque Speed Range	1
Current @ Voltage	57.000 A @ 460.0 V
Design Code	B
Drip Cover	No Drip Cover
Duty Rating	CONT
Efficiency @ 100% Load	94.5 %
Electrically Isolated Bearing	Not Electrically Isolated
Enclosure Modification	841
Feedback Device	NO FEEDBACK
Haz Area Temp Code	T3

Part detail

Revision	M
Type	AC
Mech. spec.	
Base	
Status	PRD/A
Elec. spec.	12WGX731
Layout	12LYG135
Eff. date	03-21-2025
CD Diagram	CD0006
Poles	04
Leads	3#8
Proprietary	False
Created date	12-12-2018

Heater Indicator	No Heater
High Voltage Full Load Amps	57.0 a
Insulation Class	F
Inverter Code	Inverter Duty
IP Rating	IP56
KVA Code	G
Lifting Lugs	Standard Lifting Lugs
Locked Bearing Indicator	Locked Bearing
Max Speed	2700 rpm
Motor Lead Termination	Ring Terminals
Motor Standards	NEMA
Motor Type	1272M
Mounting Arrangement	F1
Number of Poles	4
Overall Length	30.74 IN
Power Factor	87
Product Family	Chem Process S/P 32-8 IEEE 841
Pulley Face Code	Standard
Rodent Screen	None
Service Factor	1.15
Shaft Diameter	2.125 IN
Shaft Ground Indicator	No Shaft Grounding
Shaft Rotation	Reversible
Speed	1770 rpm
Speed Code	Single Speed
Starting Method	Direct on line
Thermal Device - Bearing	None
Thermal Device - Winding	None
Vibration Sensor Indicator	No Vibration Sensor
Winding Thermal 1	None
Winding Thermal 2	None

Nameplate

NP4332

STK.NO.	ECP84115T-4			P/N				ENCLOSURE	TEFC
SPEC.	12-0000-0367			CC	010A	FRAME	326T	S/N	
HP	50			CLASS	F	HZ	60	ODE BRG	6312
RPM	1770	RPM MAX	2700	PH	3	DES	B	D.E. BRG.	60BC03X30X
VOLT	460			KVA-CODE	G	O.D.E. BRG.		60BC03X30X	
AMP	57			MOTOR WEIGHT		679	GREASE	POLYREX EM	
RATING	40C AMB-CONT			MAX. KVAR		9.4	BLANK		
NEMA-NOM-EFF	94.5	# OF ROTOR BARS		40	SER.F.	1.15	IP	56	
G.MIN.EFF	93.6	# OF STATOR SLOTS		48	PF	87	INV.TYPE	PWM	
TEMP CODE	T3	INVERTER-TEMP-CODE			200				
TEMP =	200	C HP FR	60	C HP TO	90				
CT HZ FROM	1	CT HZ TO	60						
HTR-VOLTS		HTR-AMPS		HTR-WATTS		MAX. SPACE HEATER TEMP.		VT HZ FROM	O
								VT HZ TO	60

AC Induction Motor Performance Data

Record # 93262

Typical performance - not guaranteed values

Winding: 12WGX731-R055**Type:** 1272M**Enclosure:** TEFC**Nameplate Data**

Rated Output (HP)	50
Volts	460
Full Load Amps	57
R.P.M.	1770
Hz	60 Phase
NEMA Design Code	B KVA Code
Service Factor (S.F.)	1.15
NEMA Nom. Eff.	94.5 Power Factor
Rating - Duty	40C AMB-CONT
S.F. Amps	

**460 V, 60 Hz:
Single Voltage Motor**

Full Load Torque	148 LB-FT
Start Configuration	direct on line
Breakdown Torque	446 LB-FT
Pull-up Torque	183 LB-FT
Locked-rotor Torque	254 LB-FT
Starting Current	362.5 A
No-load Current	18.3 A
Line-line Res. @ 25°C	0.118 Ω
Temp. Rise @ Rated Load	61°C
Temp. Rise @ S.F. Load	75°C
Locked-rotor Power Factor	24.4
Rotor inertia	9.59 lb-ft²

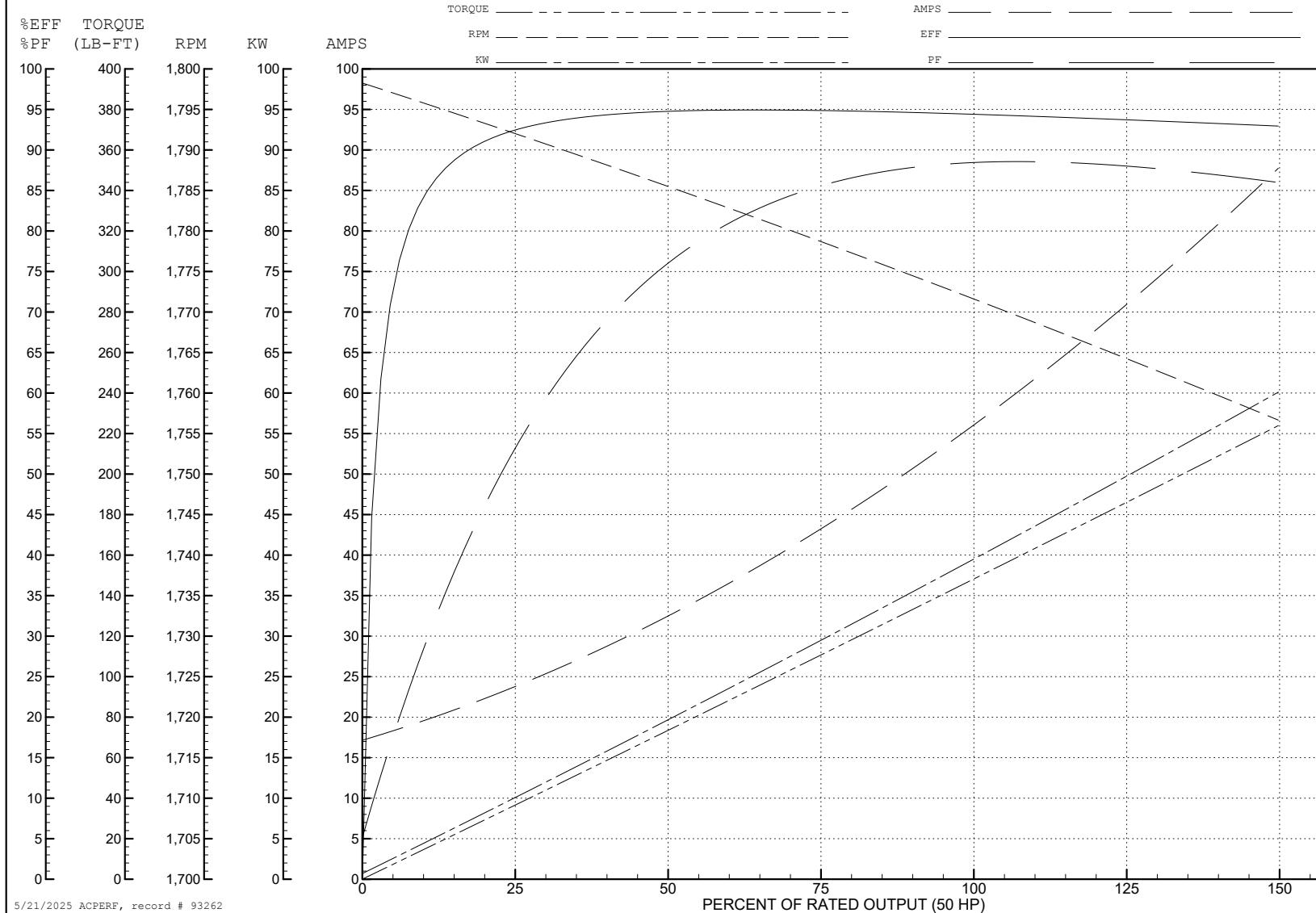
Load Characteristics 460 V, 60 Hz, 50 HP

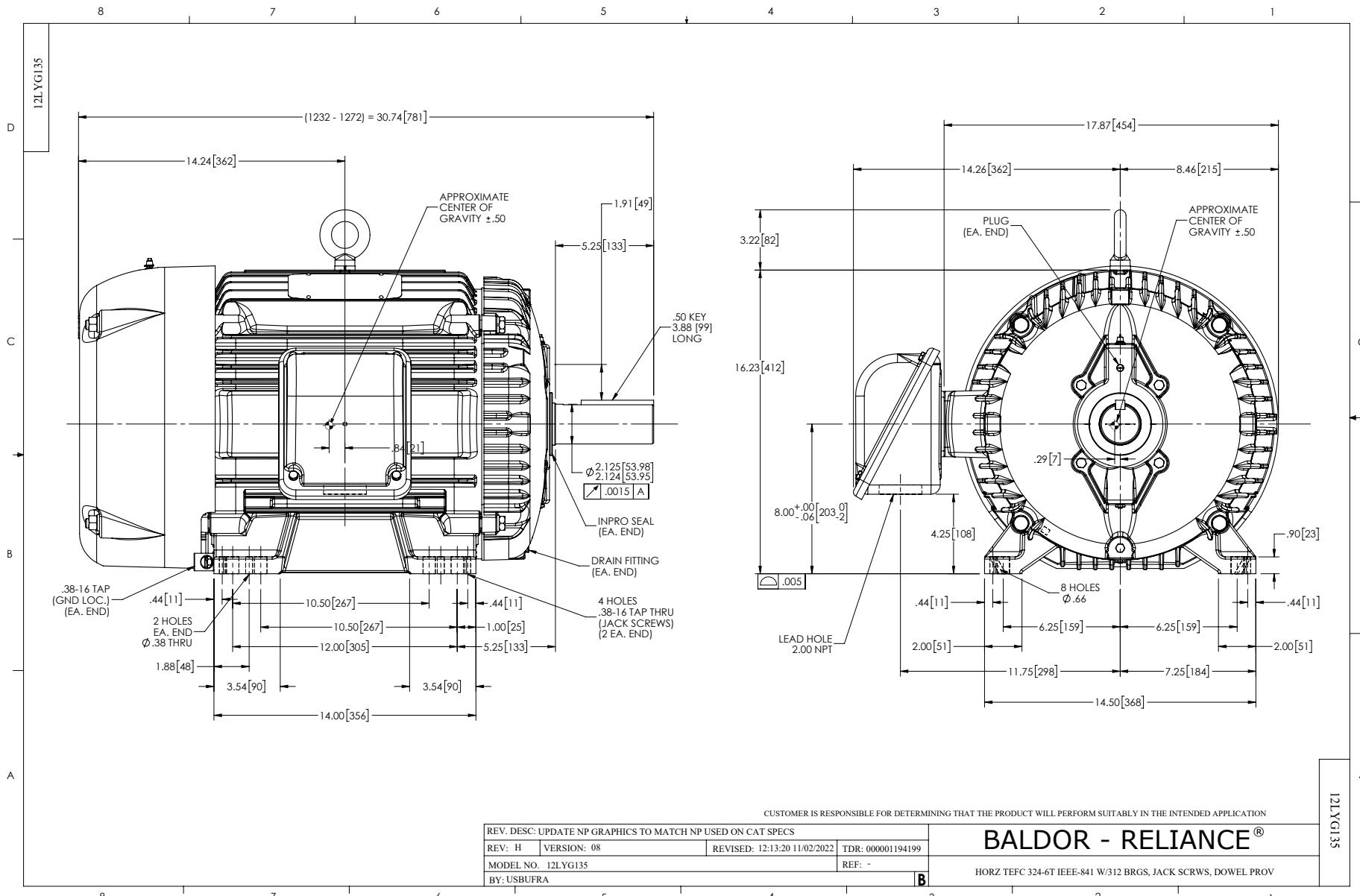
% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	58	78	85	87	87	87	88
Efficiency	92.1	94.7	94.9	94.5	93.9	92.9	94.1
Speed	1791	1785	1779	1772	1765	1756	1768
Line amperes	22.3	31.9	43.5	56.9	71.3	87.1	65.5

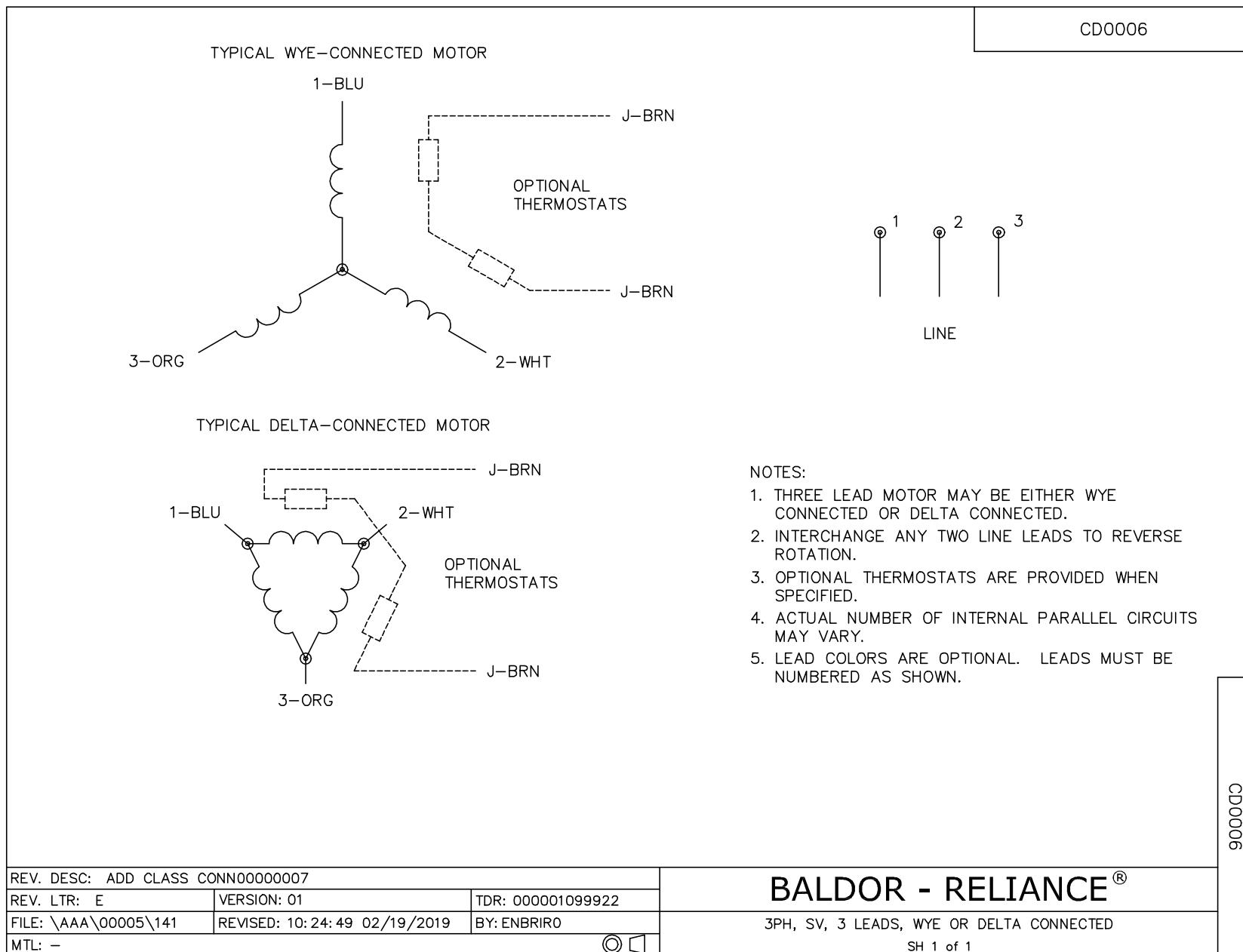
ABB Motors and Mechanical Inc.

WINDING # 12WGX731

Typical performance - not guaranteed values.

50 HP 3 PH 60 HZ 1770 RPM 460 V 1272M
TORQUES (LB-FT) : PO=446 PU=183 LR=254 LRA=362.5





Motor Mod Express®

Modification number	Motor Mod Express®
Balance	
M1A	Dynamic balance of rotors
Bearings	
M2A	Sealed
M2B	Ball to roller 1800 RPM or below
M2C	RPM AC ball to roller
M2F	Add isolated bearings NEMA 56 through 449T (SKF Insocoat or equivalent)
Brake motors	
M3D	Change stearns brake voltage
Conduit box	
M4A	Tap or provide additional lead hole
M4B	Rotate conduit box lead opening
M4F	Replace die cast aluminum conduit box
M4G	Add conduit box for thermostat or heater leads
Cord	
M5A	Install line cord in conduit box or terminal panel
M5B	Install 6 foot, 3 conductor, type SO cord with plug
Drains	
M7A	Add condensation drain holes
M7C	Close standard condensation drain holes
M7D	Add breather drains to cast iron explosion-proof motor
Dripcovers	
M8A	Install dripcover on TEFC or ODP
Leads	
M10A	Install terminal lugs
M10B	Reconnect motor from nine leads to three
M10C	Reconnect motor to high or low voltage in conduit box
M10D	Longer leads, additional leads added
Lubrication	
M11A	Install low temperature lubricant in bearings
M11B	Add high temperature grease
Seals	
M12A	install oil seals
M12B	Install Inpro/Seal® drive end only
M12C	Install V-ring seals to motor

Motor Mod Express®

Modification number	Motor Mod Express®
Mountings	
M13A	Add rigid base
M13B	Install NEMA C-face – steel band motor construction
M13C-1	Install NEMA C-face – cast iron construction
M13C-2	Install NEMA C-face – IEEE 841 motors
M13D	Add D-flange
M13E	Remove rigid base from foot mounted steel band motors
M13F-2	Convert mounting configuration for cast iron motor
M13G	Install C-Face to explosion-proof motors
M13I	Labor only to mount grinder or buffer onto a pedestal and package for shipment
Mounting drawings	
M44A	RPM AC mounting conversions
Export packaging	
M14A	Open crate packaging
M14B	Totally enclosed crate packaging
M14C	Motor and nameplate photograph
Nameplate	
M15A	Provide original nameplate for remote mounting
M15B	Replace nameplate
M15C	Laser engrave nameplate into stainless steel motor
M15E	Mail nameplates to customer
Blowers	
M16A	Add constant velocity blower unit
M16B	Convert from a 3 phase to a single phase blower
Paint	
M17A	Paint motor Baldor-Reliance® stock paint color
M17B	Paint motor or parts customer specified color
Lifting lugs	
M18A	Add lifting lugs up to a 326T frame size
Hardware	
M20A	Exchange plated hardware with stainless steel
Space heaters	
M21A	Add space heaters to TEFC or open motors
Thermal protectors	
M23A	Thermostats
Winding thermocouples	
M24A	Iron constantan (3 per motor)
Winding thermistors	
M25A	Thermistors

Motor Mod Express®

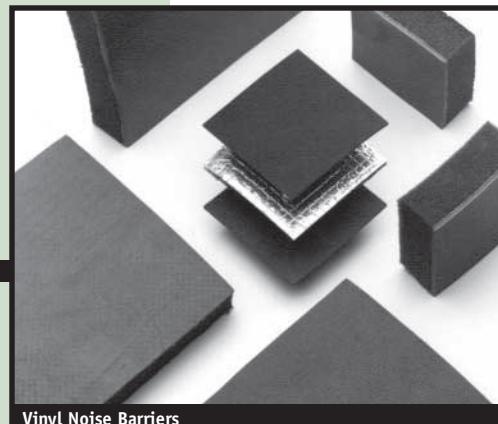
Modification number	Motor Mod Express®
Tropicalization	
M26A	Protection of windings and mechanical parts
Weatherproofing	
M27A	Treatment of windings and mechanical parts
Shaft modifications	
M29A	Drill and tap one hole in end of shaft or mill flat on shaft extension
M29B	Convert from TEFC to TEAO
M29C	Threading
M29D	Convert "T" frame to "U" frame shaft dimension or smaller (TS)
M29F	Shorten shafts without reducing the overall diameter
Tach and encoder mounting kits	
M31D	Add encoder kit to inverter duty V*S Master or RPM AC motor
M31E	Additional mounted encoder options for IDRPM motors
Testing	
M32A	CSA C390 method 1 equivalent to IEEE 112 method B performance testing
M33A	Short motor test
M33B	Routine motor test
M33C	Complete performance test
M33D	Calibration test
M33E	Sound measurement test
Terminal blocks	
M35A	Install IEC terminal blocks in conduit box and connect leads
Starters	
	Add magnetic or manual starter to grinder or buffer
M36A	Starter – single phase
M36B	Starter – three phase
M36C	Magnetic starter – three phase
M36D	Overload protection for dust control unit
Shaft grounding	
M39A	Shaft grounding systems
M39B-1	Shaft grounding ring - bearing protection
M39C	Baldor-Reliance® shaft grounding brush assembly
M39D	Add shaft grounding ring's colloidal silver shaft coating to shaft
Check Total Indicated Runout (TIR)	
M40A	Check Total Indicated Runout (TIR)
ABB Ability™	
M43A	Install ABB Ability™ Smart Sensor for motors

SOUNDSCREEN™ Vinyl Noise Barriers and Mats

a McGill AirSilence™ Product

Product Bulletin 4241

United McGill® products



Vinyl Noise Barriers

SOUNDSCREEN Vinyl Noise Barriers Effectively Block Airborne Noise

SOUNDSCREEN Vinyl Noise Barrier is flexible fused vinyl sheet material loaded with high density inert fillers. This combination of materials provides the limpness and mass necessary for the effective blocking of airborne noise. Easy to cut and install, the material may be laid on floors, draped over uneven surfaces or suspended as a curtain wall.

Standard Products

Reinforced Loaded Vinyl (LVR): The basic 1/8-inch-thick, 1 lb/sq ft density loaded vinyl is reinforced in the center with a polyester scrim. Use in all hanging or other applications where superior integral material strength is needed.

Clear Vinyl (LVC): Used as a transparent curtain or as a window in a curtain enclosure, SOUNDSCREEN standard LVC is 0.08 inches thick to 0.5 lb/sq ft density. Where required, 0.75 and 1 lb/sq ft densities can be furnished.

Plain Black Reinforced (LV): Our lowest-cost LV bonds to sheet metal or plywood to make machinery covers or walls. Lay it under rugs or over ceilings to cut down on noise transmitted into plant offices.

Floor Mat (FVM-1 or FVM-1S): Unreinforced black loaded vinyl with a 1/4-inch backing of decoupling foam fused to LV. It is used on floors, bulkheads, and side panels to cut down road, engine, and drive train noise. Plain surface model (FVM-1) is coated with a scuff-resistant vinyl to improve wear resistance (FVM-1S).

Installation

The 1/8-inch-thick loaded vinyl comes in rolls and can be easily cut with a knife, shears, or steel rule die. When suspended from an existing wall or partition, the vinyl should be pinched between bolted support strips and suspended from a suitable structural support.

For curtain applications, a grommeting kit (SOUNDSCREEN GK-1) containing a tool and grommets is available for economical self-installation. Grommets should be spaced on maximum 12-inch centers, and adjacent

sections can be overlapped 6 inches to reduce acoustical leakage.

A variety of methods can be used to acoustically seal overlapping seams. For flashing existing partitions up to a ceiling, the adjoining vinyl sheets can be riveted or bolted together. For custom-designed curtain enclosures and barriers, Velcro® strips can be sewn onto the vinyl edges to provide a positive sealing mechanism.

Loaded vinyl contains a plasticizer ingredient that can create adhesion problems. For applications where an adhesive seal is appropriate, using a two-part urethane is recommended.

Our vinyl noise barriers are easy to install. Materials may be laid on floors, draped over uneven surfaces or suspended as a curtain wall.

Products depicted in this specification sheet were current at the time of publication. As a quality-conscious manufacturer, McGill AirSilence is continually seeking ways to improve its products to better serve its customers. Therefore, all designs, specifications, and product features are subject to change without notice.

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Velcro® is a registered trademark of Velcro Industries B.V.

Acoustical Properties

Material	Typical Sound Loss in dB						STC
	125	250	500	1K	2K	4K	
1 lb/sq ft LV and LVR	15	19	21	26	33	37	27
0.5 lb/sq ft LVC	8	19	16	21	25	30	20

Physical Properties

Product	Thickness and Weight	Temperature Range (°F)	Color	Resistance (all products)
LVR	1/8", 1 lb/sq ft	0-180	black	water: excellent
LV	1/8", 1 lb/sq ft	0-180	black	petroleum: excellent
LVC	0.08", 0.5 lb/sq ft	0-120	clear	alkalis: good flame: meets MVSS 302

Product Availability

Model	Roll Size	Vinyl Description
LVR	54" x 60'	gray, reinforced vinyl
LVC	48" x 60'	clear vinyl
LV	54" x 60'	black, unreinforced vinyl
FVM-1	54" x 60'	black, vinyl floor mat
FVM-1S	54" x 60'	black, vinyl floor mat with scuff coating

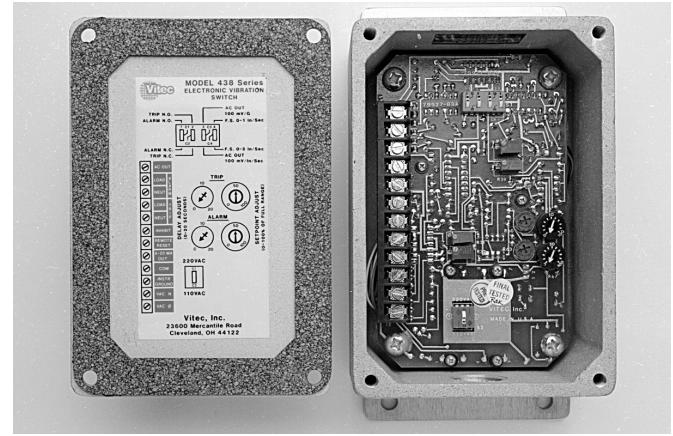
McGill AirSilence LLC

An enterprise of United McGill Corporation — Founded in 1951

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614/443-5520, Fax: 614/542-2620
E-mail: acoustics@mcgillairsilence.com
Web site: mcgillairsilence.com

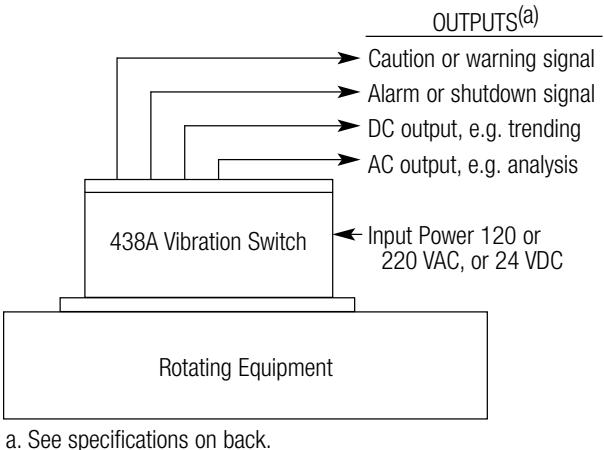


438A Vibration Switch



Applications

- Cooling Towers, Centrifuges, Hammer Mills, Compressors, Generators, Rolling Mills, Ball Mills
- Fans, Pumps, Motors, Coilers, Grinders, Conveyors, Mixers
- General Purpose Rotating Machinery



438A Lowers Operating Costs

The 438A helps lower your operating costs by giving advance notice of equipment problems and allowing you to plan your repairs in advance. The ability to schedule repairs reduces the cost of parts, overtime and, most significantly, lost revenues due to production downtime.

User Benefits

Helps Eliminate Catastrophic Equipment Failures

Should your equipment vibration level increase, the 438A gives you notification, and can also shut down the equipment, before major damage occurs.

Allows You to Plan Repairs in Advance

Trending the vibration level enables you to detect changes in vibration which allows you to schedule repairs to coincide with your normal maintenance schedule.

Compatible with Predictive Maintenance Programs

The 438A is compatible with most data collectors, analyzers and online analysis systems. Analyzing the vibration signatures allows you to find specific causes of high vibration such as imbalance, misalignment and bent shafts as well as faulty belts, bearings and gears.

Eliminates False Alarms

The 438A replaces mechanical vibration switches that can give false alarms, or trips, at machine startup, or when transient vibrations from external sources occur.

Easy Selection

The 438A is designed to be configured by the Customer in the field to fit a wide variety of applications. When ordering the 438A you only need to specify the type of enclosure and the power input required.

Corresponding Features

Dual Vibration Level Setpoints

Alarm and shutdown, or trip, contact closures are supplied, that activate when Customer specified vibration levels are reached or exceeded.

Analog Output

The 438A has a 4-20 mA DC analog output proportional to the vibration level, typically connected to a PLC, DCS or chart recorder.

AC Signal Output

An AC signal output, field selectable for 100 mV/g or 100 mV/in/sec, is standard. This output is available on a terminal block for connection to a Customer supplied remote connector.

Time Delays and Inhibit Functions

Each relay has a Customer adjustable time delay ranging from 0 to 20 seconds. An inhibit function is included, which eliminates relay operation during machine maintenance.

Multiple Configurations

The 438A comes in three different enclosure types: NEMA 4, NEMA 4X or explosion proof. It also has three different input powers: 120 or 220 VAC, or 24 VDC.

SPECIFICATIONS

Full-Scale Range:

0.0 – 1.0 in/sec or 0.0 – 3.0 in/sec (field selectable)

Frequency Response:

3 – 1,000 Hz

Dual Set Points:

Two Customer selectable, field adjustable from 5 to 100% of full scale

Time Delay:

Field adjustable from 0 – 20 seconds

Relays (solid-state triacs):

Two solid-state relays rated at 10 amp for either 120 or 220 VAC unit, and 1 amp for the 24 VDC unit.

Field selectable, normally open or normally closed below setpoints. Field selectable, latching or non-latching. Remote reset capability. Relay inhibit capability.

Input Power:

A 120 or 220 VAC, Customer selectable, or 24 VDC.

DC Analog Output:

4 – 20 mA DC, proportional to overall vibration

AC Signal Output:

Field selectable, velocity, 100 mV/in/sec, or acceleration, 100 mV/g, for analysis purposes

Temperature Range:

-25 to +160 F

Measurement Mode:

Velocity

Housing:

NEMA 4, cast aluminum

NEMA 4X, epoxy coated cast aluminum with a stainless steel mounting plate

Explosion proof, cast aluminum

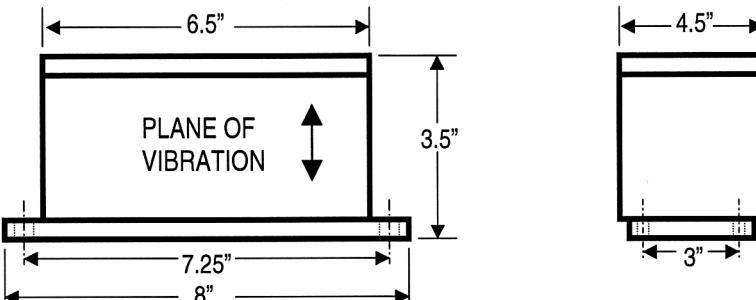
Weight:

5.5 Pounds, NEMA 4 and 4X

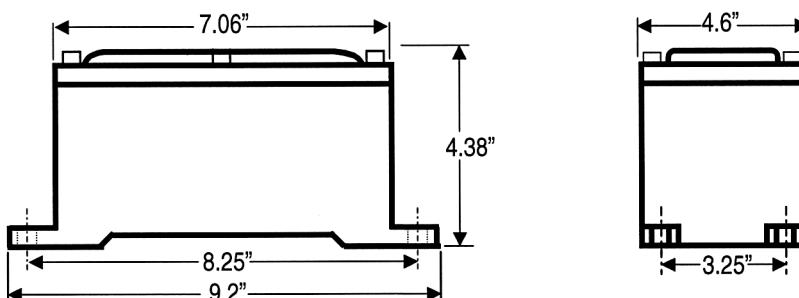
7.5 Pounds, Explosion Proof

DIMENSIONS:

NEMA 4 and NEMA 4X Enclosures



Explosion Proof Enclosure



- The NEMA 4 and 4X 438A should be mounted using four 1/4 – 20 UNC x 1/2 inch long bolts, washers and lock-washers.
- The explosion proof 438A should be mounted using four 5/16 – 18 UNC x 3/4 inch long bolts, washers and lock-washers.

Environmental Rating:

NEMA 4 – Weatherproof
NEMA 4X – Weatherproof and corrosion resistant

Hazardous Rating:

Explosion proof –
Class I, Divisions 1 and 2, Groups C and D, and Class II, Divisions 1 and 2, Groups E, F and G.

Vitec's Vibration Switch Categories:

438A Plate Mounting

- 120 and 220 VAC
- 24 VDC

480 Stud Mounting

- 120 and 220 VAC
- 24 VDC

438D

- Consists of transducer, cable assembly and electronics
- 120 and 220 VAC
- Low-pass, Bandpass, High-pass filter
- Multiple transducers
 - Acceleration
 - Velocity
- Multiple cable assemblies

438R

- Consists of transducer, cable assembly and electronics
- 120 and 220 VAC
- 24 VDC
- Multiple transducers
 - Acceleration
 - Velocity
- Multiple cable assemblies



Protecting the Machines of Production
for More than a Quarter-Century.



OPERATOR'S MANUAL

438A VIBRATION SWITCH: 24 VDC

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Vitec, Inc.
Cleveland, OH 44122
Phone: 216-464-4670 Fax: 216-464-5324



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LIST OF ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
C1	Circuit 1
C2	Circuit 2
C3	Circuit 3
C4	Circuit 4
F	Fahrenheit
FS	Full Scale
g	Vibration Units of Acceleration
Hz	Hertz, (Cycles per Second)
In/Sec	Inches/Second Vibration Units of Velocity
mA	Milliamp
Mils	Vibration Units of Displacement
mV	Millivolts
mV/g	Millivolt/g Force
PLC	Programmable Logic Controller
R60	Potentiometer No. 60 to adjust shutdown time delay
R63	Potentiometer No. 63 to adjust alarm time delay
R66	Potentiometer No. 66 to adjust shutdown setpoint
R67	Potentiometer No. 67 to adjust alarm setpoint
S1	Switch to field adjust the state of the relays, full scale range and AC out
S2	Switch to field adjust the voltage of the AC power in
sec	Second



List of Acronyms and Abbreviations - continued

TB	Terminal Block
TB1-1	Terminal Block 1, Location 1
TB1-7	Terminal Block 1, Location 7
TB1-8	Terminal Block 1, Location 8
TB1-9	Terminal Block 1, Location 9
UNC	Unified National Course
VAC	Volts Alternating Current
VDC	Volts Direct Current

LIST OF ENGINEERING SYMBOLS AND ABBREVIATIONS

A	Acceleration: g's peak
ALM	Alarm
AMP	Ampere
ANA	Analog
COM	Common
CPM	Cycles Per Minute
D	Displacement: Inches peak to peak
d	Displacement: Mils peak to peak
DC	Direct Current
g	Gravity
GND	Ground
Hz	Cycles per Second
INSTR	Instrument
In/Sec	Inches per Second
MAX	Maximum
NORM	Normally
Ω	Ohm
N	Neutral
\emptyset	Phase
REM	Remote
RPM	Revolutions Per Minute
Shut	Shutdown
Spt	Setpoint
VDC	Voltage, Direct Current
V	Velocity: Inches per second peak
W	Watt



1.0 INTRODUCTION

The Vitec 438A^(a) Vibration Switches are an economical approach to accurate and reliable vibration protection for rotating machinery. The 438A is a sophisticated vibration monitoring system and, therefore, requires some care during installation.

Installation and operation of this unit will be simple and easy if the instructions are followed.

READ THIS MANUAL THOROUGHLY TO AVOID
ANY INSTALLATION-RELATED PROBLEMS

2.0 PRODUCT DESCRIPTION

The 438A measures the vibration level of the machine to which it is mounted. It provides two solid state relay (transistor) closures when preset vibration levels are exceeded, thereby offering protection from excessive vibration. One provides an alarm or warning, the second provides for shutdown or “trip”.

The 438A incorporates a built-in vibration sensing element and electronics to measure the vibration in terms of the velocity of vibration. Those familiar with setpoints given in displacement (mils) can convert to velocity (in/sec) via the Setpoint Conversion Figure and Formulas Chart shown in Figure 1 on page 5.

The 438A also includes two electrical outputs that are very useful. A 4 - 20 mA signal proportional to the overall vibration level will allow the unit to be connected to a remote device for purposes of reading or recording the vibration level. Common applications include connections to meters, data loggers, recorders or Programmable Logic Controllers (PLC's).

An AC signal, switch selectable for either acceleration or velocity, is also provided. This signal is proportional to the actual vibration being measured by the transducer. Common applications for this signal include connection to an oscilloscope to view the raw transducer signal or connection to a real-time analyzer for analysis of the vibration being measured.

3.0 ELECTRICAL INSTALLATION

Proper electrical installation is essential. A little care here will assure a trouble-free installation.

Follow the wiring diagram shown in Figure 3 on page 7. Make special note of the following:

a. In this Manual, the Vitec 438A means the 24 VDC version.



1. The system requires a good instrument earth ground. Do not use the machine itself as a ground, as it normally will not provide proper grounding.

Do not use a ground that is common to other large pieces of electrical machinery. Electrical noise or surges from these machines can feed back into the 438A and cause false tripping.

2. The alarm and shutdown outputs are completely isolated from the monitor electronics. One or two separate sources of DC power can be used because of the isolation. The maximum load current is 1.0 amp with a 24-volt DC supply. There is no minimum current required for switch operation.
3. Make sure that the voltage input lines and the relay output lines are fused as noted on the wiring diagram in Figure 3 on page 7.
4. If the AC output signal is utilized, use a good grade of shielded twisted cable. Be sure to keep the cable separated from other AC or power cables.

Reread this section to ensure the electrical installation conforms to the Figure 3 wiring diagram. Any damage to the 438A due to incorrect wiring is not covered under warranty.

4.0 MECHANICAL INSTALLATION

Figures 4 and 5 on pages 8 and 9 show mounting dimensions and mounting procedures for the 438A NEMA 4 and Explosion Proof versions, respectively.

The 438A Vibration Switch is sensitive to vibration in one direction only. Make sure the unit is oriented properly to measure the type of vibration being monitored.

If the required mounting location is not known, the vibration switch should generally be mounted to measure the RADIAL vibration, meaning the axis of sensitivity is perpendicular to the rotating shaft. See Figure 6 on page 10 for typical mounting locations. Note that the mounting locations shown are only general in nature. The manufacturer of the equipment being monitored is the best source of mounting location information.

Mounting tips:

1. Be sure the vibration switch is mounted FIRMLY to the machine. A switch that is not mounted firmly to the machine will measure its own vibration, in addition to the vibration of the machine (see Figure 6).



2. Be sure to replace the cover AND gasket after installation. Water or moisture in the electronics will cause FAILURE of the unit! Water entry through the 3/4 inch cable entry hole due to condensation or other reasons can be just as catastrophic. Use proper procedures to seal the cable entry hole. Failures caused by improper sealing are NOT covered under warranty.
3. Try to orient the unit so that the alarm setpoint adjustments are accessible after the unit is mounted. Someone may want to change the setpoints in the future.
4. Make sure that the electrical connections are not putting excessive force on the terminal block or printed circuit card. Don't try to stuff excess wire into the box; trim the cable to proper length.

5.0 SETPOINT ADJUSTMENT

The ALARM and SHUTDOWN setpoints are adjusted via two potentiometers located on the printed circuit card (see Figure 2 on page 6, items marked R66 and R67). For alarm setpoint adjust R67; for shutdown setpoint adjust R66. Do not attempt to adjust the small square potentiometers that are also located on the printed circuit card; these potentiometers are used for calibration of the unit.

The setpoint adjustments are calibrated for 0 to 100% of full scale selected, meaning of the selected range, 0.0 to 1.0 or 0.0 to 3.0. Simply turn the potentiometer until the arrow lines up with the required setpoint level. Do not use excessive force. Do not try to turn the potentiometers beyond their stops. Both are single-turn potentiometers.

A 0 to 20 second adjustable time delay is built into the alarm and shutdown circuits to help avoid false trips. The unit is shipped with a 0 second time delay, but can be adjusted in the field for up to 20 seconds. Turn the potentiometer clockwise to increase the time delay. Adjust R63 for alarm time delay and R60 for shutdown time delay (see Figure 2 on page 6, items marked R63 and R60).

6.0 RELAYS

Both the alarm and shutdown solid-state relays (transistors) are set at the factory to be normally open below the setpoint. Think of them as single pole light switches that are normally off, or open, but turn on, or close, when the vibration level gets too high. To operate properly, the switched load must operate at 24 VDC, with a maximum current of 1 A.

The relays can be changed to normally closed below setpoint (open when the vibration setpoints are exceeded) using switch S1. When switch S1 is in positions 1 and 2, alarm and shutdown relays are normally open. Switching S1 to the opposite position makes the relays normally closed, see Figure 2, on page 6, items identified as S1.



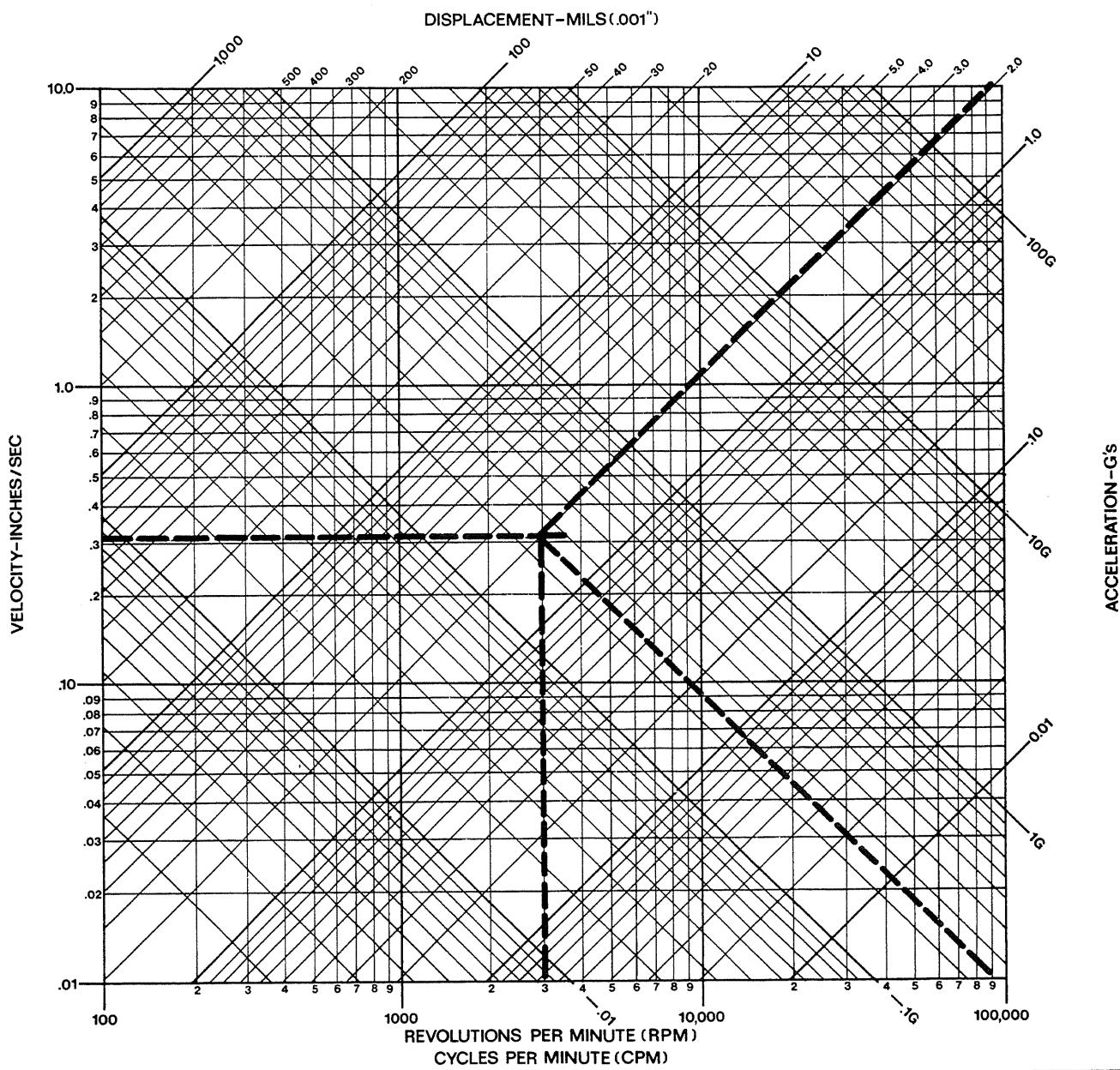
When shipped from the factory, the relays are LATCHING unless wired to be NON-LATCHING at the request of the Customer. Latching means that after the vibration returns to a normal level, the relays will NOT reset themselves. They must be manually reset via a remote reset switch which you, the Customer, must provide, since it does not come with the 438A.

The 438A can be changed to a NON-LATCHING configuration in the field by installing a jumper between terminal block points TB1-7 and TB1-9. With this jumper installed, the relays will automatically reset themselves when the vibration returns to a level less than the setpoint.

If desired, the relay action can be inhibited by connecting terminal points TB1-6 and TB1-9. This feature is normally only used during machine tests or repair procedures. BE AWARE that when you use this feature it totally eliminates operation of the relays. No vibration protection is available while this feature is in use.

7.0 SPECIFICATIONS

The 438A Vibration Switch Specifications are shown in Figure 7 on page 11.



CONVERSION FORMULAS

Symbols:

D = Displacement: Inches peak to peak
 d = Displacement: Mils peak to peak
 V = Velocity: Inches per second peak
 A = Acceleration: G's peak
 Hz = Cycles per second
 CPM = Cycles per minute

EXAMPLE: 2.00 Mils at 3000 RPM
 By Chart V = 0.3 inches per second

$$A = 0.25 \text{ G's}$$

$$\text{By Formula } V = (5.236) (10^{-5}) (3000) (2.00) = 0.31 \text{ inches per second}$$

$$A = (1.417) (10^{-8}) (3000)^2 (2.00) = 0.26 \text{ G's}$$

$$D = 0.318 \frac{V}{\text{Hz}}$$

$$D = 19.607 \frac{A}{(\text{Hz})^2}$$

$$V = \pi(\text{Hz})(D)$$

$$V = 61.440 \frac{A}{\text{Hz}}$$

$$A = 0.051 (\text{Hz})^2 (D)$$

$$A = 0.016 (V) (\text{Hz})$$

$$d = (1.910) (10^4) \frac{V}{\text{CPM}}$$

$$d = (7.059) (10^7) \frac{A}{(\text{CPM})^2}$$

$$V = (5.236) (10^{-5}) (\text{CPM}) (d)$$

$$V = (3.696) (10^3) \frac{A}{\text{CPM}}$$

$$A = (1.417) (10^{-8}) (\text{CPM})^2 (d)$$

$$A = (2.704) (10^{-4}) (\text{CPM}) (V)$$

FIGURE 1 SETPOINT CONVERSION FIGURE AND FORMULAS

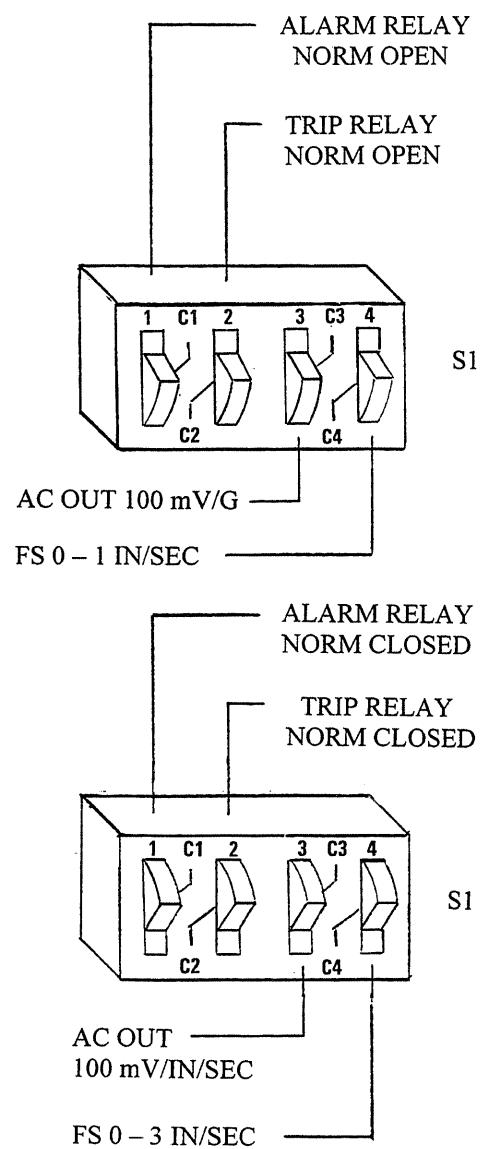
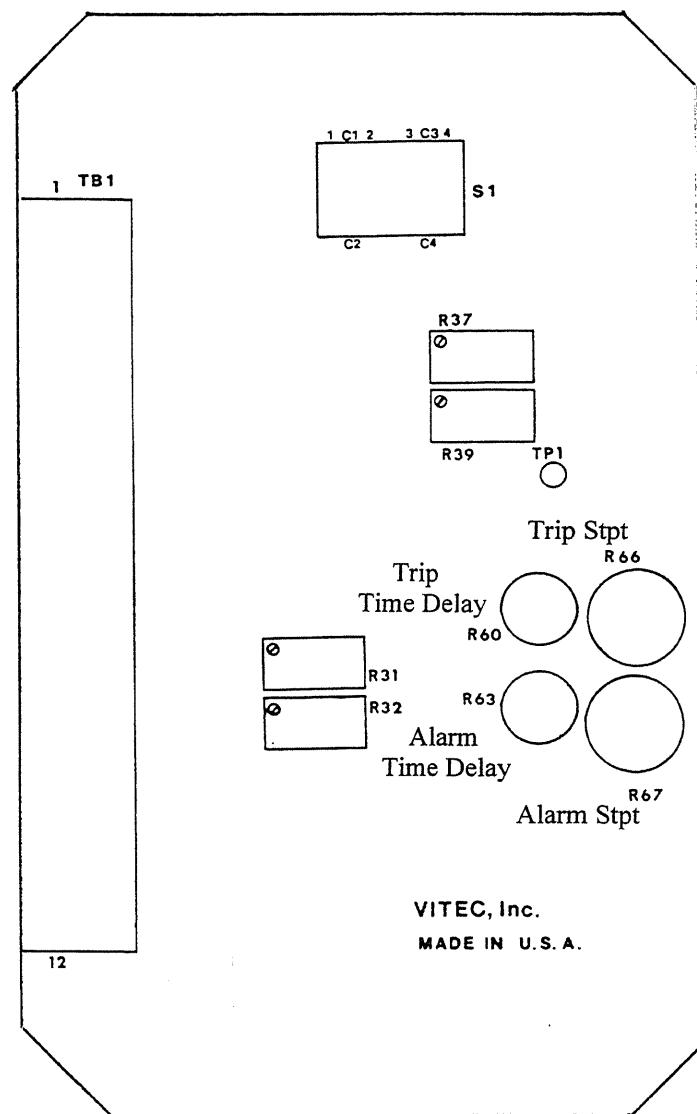


FIGURE 2 COMPONENT LOCATION AND IDENTIFICATION OVERVIEW

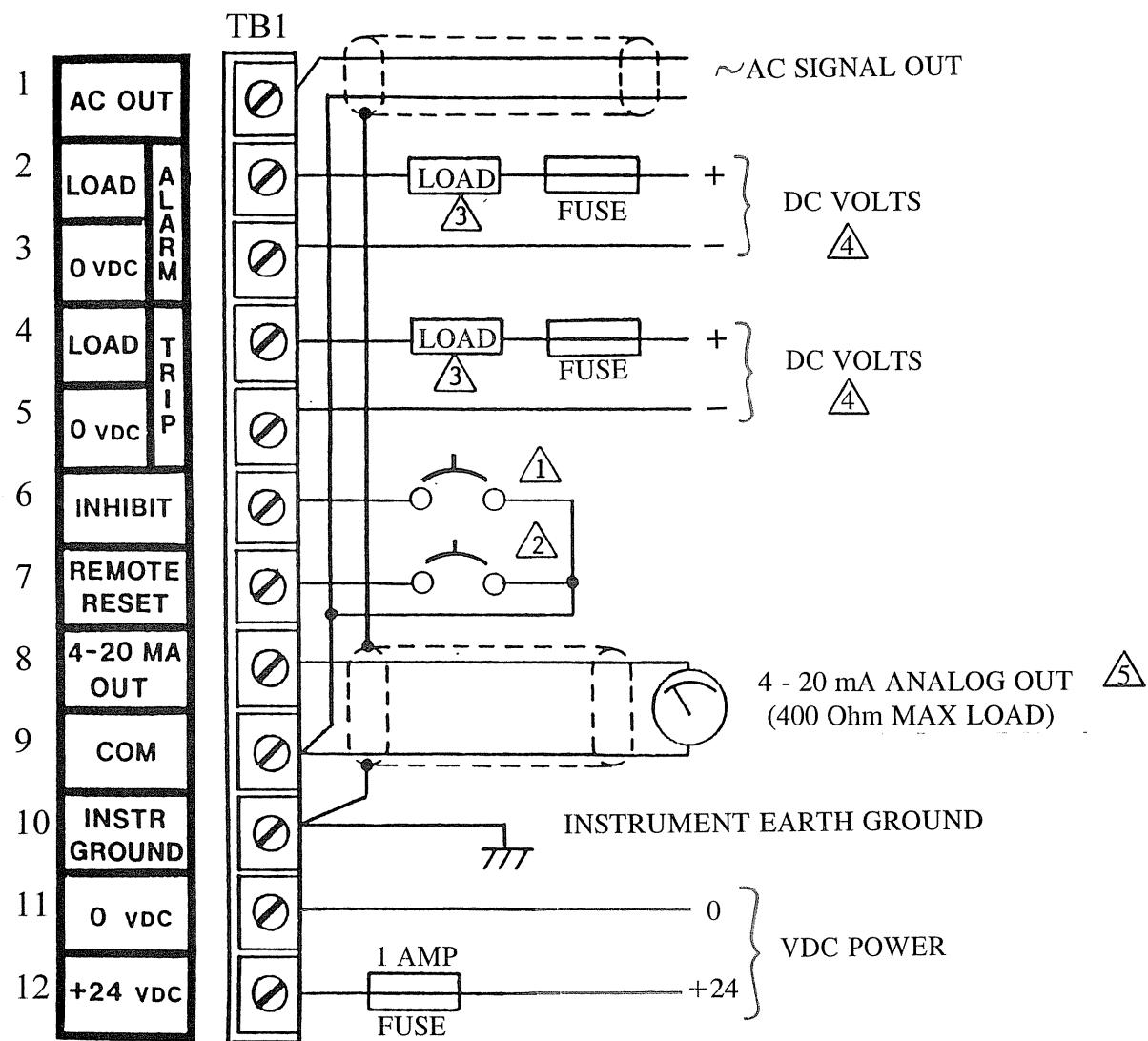


FIGURE 3 WIRING DIAGRAM FOR 24 VDC 438A VIBRATION SWITCHES

RECOMMENDED MOUNTING

1. Locate an easily accessible mounting surface for the switch. Points of contact with the base should be reasonably flat and smooth.
2. Drill No. 6 (.2040) approximately 9/16 inches deep (7/16 inches deep for bottoming tap) and tap 1/4 - 20 approximately 5/16 inches deep, typical four places.
3. Securely fasten switch to mounting surface with four each of 1/4-20 x 9/16 inch HHCS, 1/4 inch flat washer, 1/4 inch split lockwasher.
4. Make all necessary electrical connections.

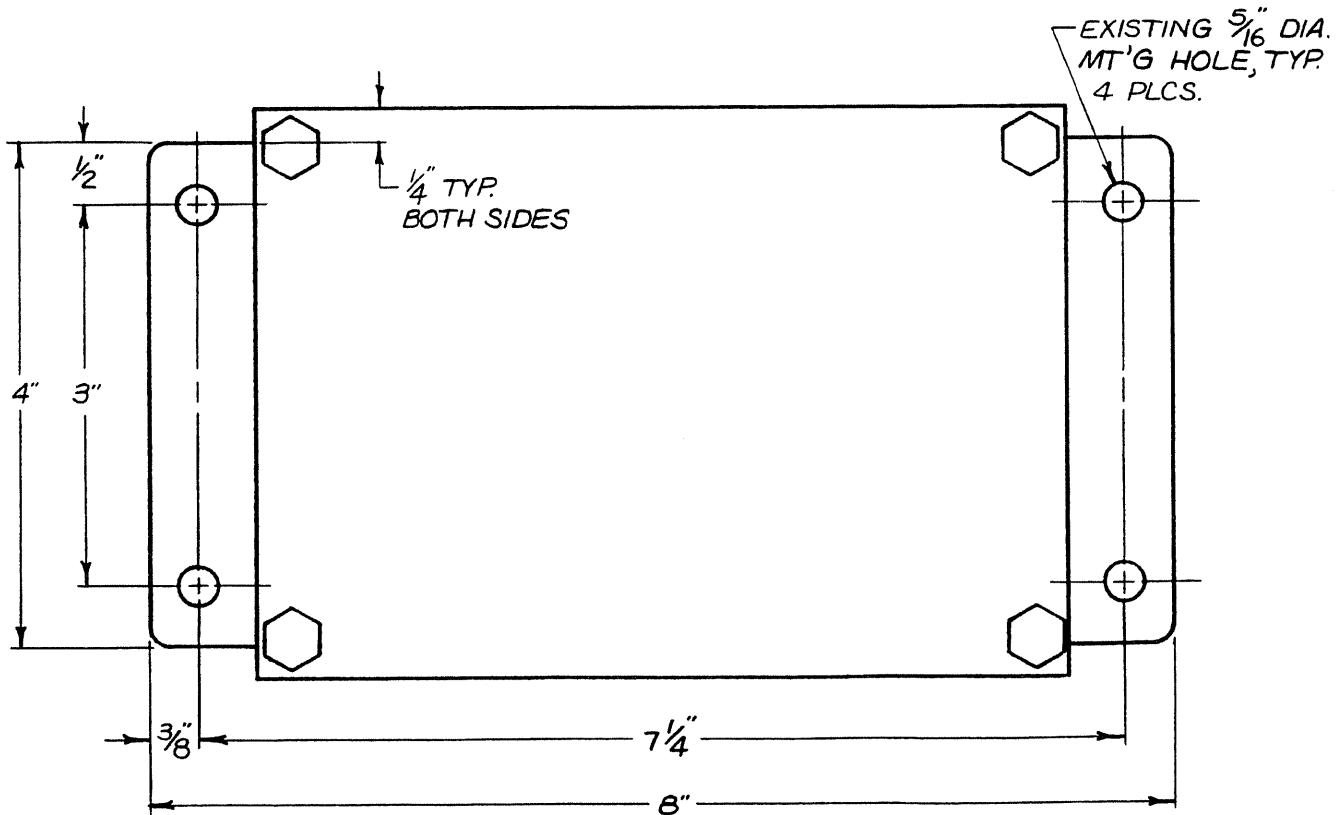
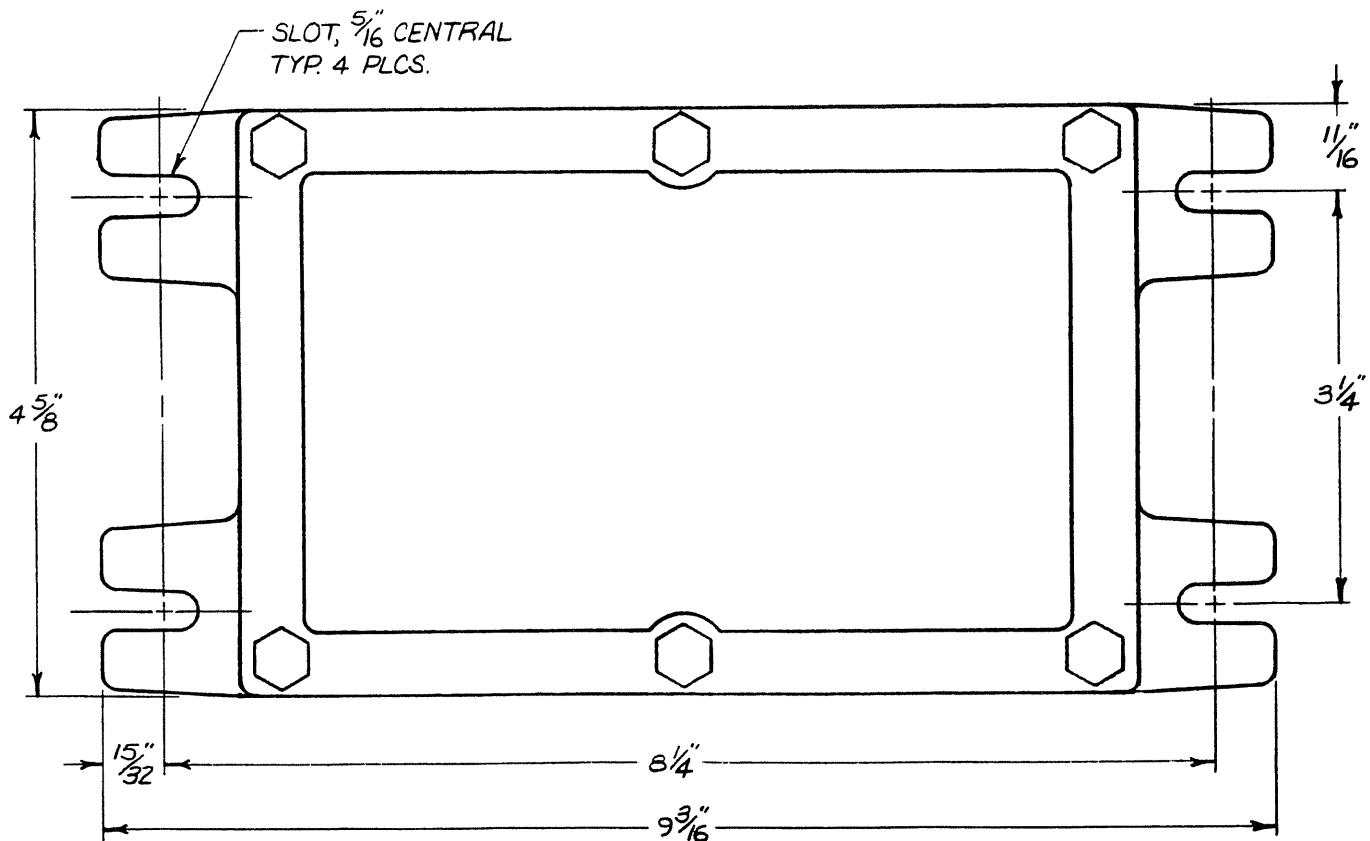


FIGURE 4 MOUNTING PROCEDURE FOR THE 438A NEMA 4 VIBRATION SWITCH

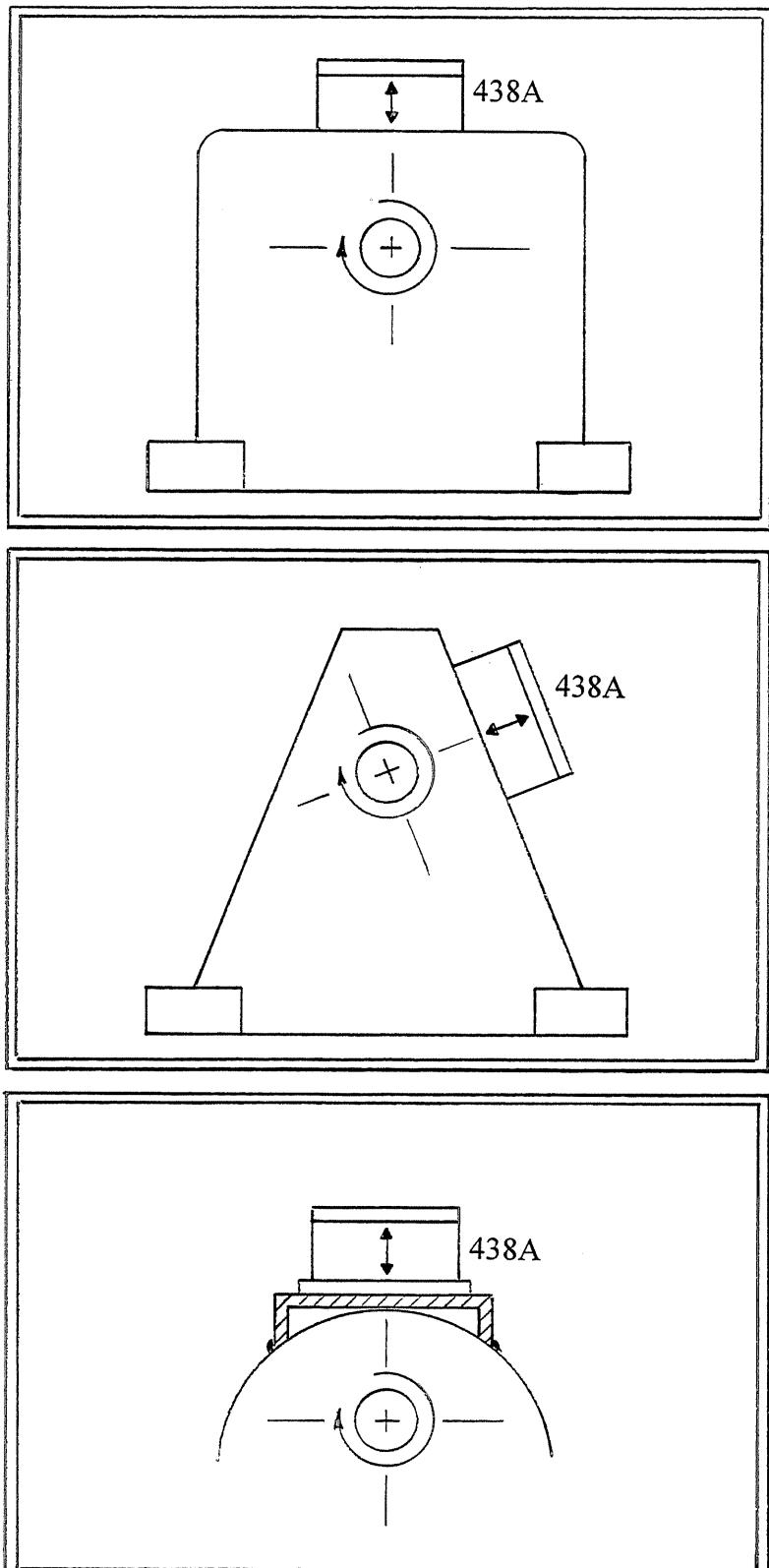
RECOMMENDED MOUNTING

1. Locate an easily accessible mounting surface for the switch. Points of contact with the base should be reasonably flat and smooth.
2. Drill No. 6 (.2040) approximately 9/16 inches deep (7/16 inches deep for bottoming tap) and tap 1/4-20 approximately 5/16 inches deep, typical four places
3. Securely fasten switch to mounting surface with four each of 1/4-20 x 9/16 inch HHCS, 1/4 inch flat washer, 1/4 inch split lockwasher.
4. Make all necessary electrical connections.



Overall Dimensions: $9\frac{3}{16}$ " L x $4\frac{5}{8}$ " W x $4\frac{1}{4}$ " H

FIGURE 5 MOUNTING PROCEDURE FOR THE 438A EXPLOSION PROOF VIBRATION SWITCH



Flat Mounting,
Vertical or
Horizontal

Angled
Surface
Mounting

Small or Curved
Surface.
Mounting plate
to be welded or
bolted solidly to
curved surface.

FIGURE 6 TYPICAL MECHANICAL MOUNTING LOCATIONS



438A Vibration Switches are shipped from the factory as follows:

Full Scale Range ^(a)	0-1 in/sec (S1 in position 4)
Input Power	24 VDC
Frequency Range	3 to 1,000 Hz
Setpoint Adjustability	5% to 100% of full scale
Time Delay Adjustability	0 to 20 seconds
Setpoint Accuracy	± 5% of full scale
Setpoint Repeatability	± 1% of full scale
Operating Temperature Range	-25 F to +160 F
Analog Output	4 - 20 mA proportional to full scale
AC Signal Output ^(a)	100 mV/g (S1 in position 3)
Solid State Relays ^(a)	<p>Transistors designated as Alarm and Shutdown 1 Amp maximum load current at 24 VDC Normally open below setpoint Closes and latches above setpoint Alarm: S1 in Position 1 Shutdown: S1 in Position 2</p>

a. Field Selectable Options:

- | | | |
|------------------------|--------------------------|---|
| 1. Full Scale Range | 0-3.0 in/sec | S1 in position opposite 4 |
| 2. AC Signal Output | 100 mV/in/sec | S1 in position opposite 3 |
| 3. Solid -State Relays | Alarm normally closed | S1 in position opposite 1 |
| | Shutdown normally closed | S1 in position opposite 2 |
| | Non-latching relays | Install jumper between
TB1-7 and TB1-9 |

FIGURE 7 438A VIBRATION SWITCH SPECIFICATIONS

SECTION 03.02

LINE ITEM TECHNICAL INFORMATION



Line No.: 2521509-02

Description: A41-0-271FA-66FGI8LT - Fiberglass Backward
Curved Centrifugal Fan

Tag: 02-EF-1330 & 02-EF-1340



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
Page 3 of 18

DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM

Ship Method: PPD CC

Salesman Code: 99WE

Piqua

Partial Ship: False

AR Terms: Per Invoice

Ship To : WILL ADVISE

WILL ADVISE

Contact Name:

WILL ADVISE

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
2	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

A41-0-271FA-66FGI8LT
41 - Fiberglass Backward Curved Centrifugal Fan

Tag: 02-EF-1330 & 02-EF-1340

Performance

Volume Flow Rate: 5025.0 cfm

SP: 3.5 in. w.g. / TP: 3.61 in. w.g.

RPM: 1168.0

Density: 0.075 lbs/ft^3

Operating Temp: 70 °F

OPwr: 3.652 hp / SPwr: 3.652 hp

Motor

HP: L - 5 HP

RPM/Volt/Hz/Phase: T - 1750, 460, 60, 3

Enclosure: I8 - TEFC IEEE841

Frame Size: 184T

Operating Voltage: 460

Vendor: BALDOR

Motor Accessories

Hermetically Sealed Thermostat

Space Heater - 115V/120V

Hartzell Motor P/N: 3109-0053-B-(MODIFIED), Mfct P/N: ECP83665T-4

Fan

Arrangement: 10

Rotation and Discharge: Up Blast (Clockwise)

Mounting Location: Floor

Motor Position: Standard

Material: Fiberglass

Construction: ASTM D4167 97 (Includes Single Veil & Electric Grounding)

Fan Coating: Hartkoate

Prop/Wheel: FA - Backward Airfoil Centrifugal Wheel - Fiberglass

Prop/Wheel Coating: Hartkoate & Electric Grounding



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

Page 4 of 18

DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date:	5/19/2025 8:45:57 AM	Ship Method:	PPD CC
Salesman Code:	99WE	FOB:	Piqua
Partial Ship:	False	AR Terms:	Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
Standard Accessories (Included)					
Water Slinger					
Inlet Support, Steel - Inorganic Zinc Coating w/ Epoxy Topcoat					
Additional Accessories					
Bolted Access Door, Fiberglass					
Drain, CPVC w/ CPVC Plug (Factory Installed)					
Extended Lube Lines to Fan Bearings, 316SS					
316SS Hardware to Complete Fan					
316SS Shaft					
Teflon Double Lip Seal in a 316SS Casing					
Drilled Inlet Flange, PS15-69					
Drilled Outlet Flange, PS15-69					
Inlet Box, Fiberglass w/ 316SS Support Legs ; 12:00 Orientation					
FAB Airfoil Backdraft Damper - Fiberglass: Max SP - 14.5: Max FPM - 4000					
Damper Style: Parallel					
Polycarbonate Jamb Seal for Damper					
EPDM Blade Seal for Damper					
FRP (Standard) Axle for Damper					
Both Flanges Drilled For Damper					

Seismically Restrained Spring Isolators

Inlet Support, Motor & Bearing Base, and Weather Cover to be 316 SS
Material of Construction: 316 SS,

ACCESS DOOR TO HAVE ONE PIECE NEOPRENE GASKET PUNCHED TO MATCH BOLT PATTERN

SPECIAL ARRANGEMENT 10 WEATHER COVER WITH CLEAR WINDOWS FOR BELT AND BEARING VIEWING

Inlet Box Drain, CPVC w/ CPVC Plug

2-Sets of Spare Belts (2 years worth)

ADDER FOR -- 15830 2.03 B 5 L10 100,000 hour bearings

Spare set of bearings

Total Weight (approx.): 1153 lbs. (Each) (quoted items are not included in the weight.)



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

Page 5 of 18

DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM

Ship Method: PPD CC

Salesman Code: 99WE

Piqua

Partial Ship: False

AR Terms: Per Invoice

Ship To : WILL ADVISE

WILL ADVISE

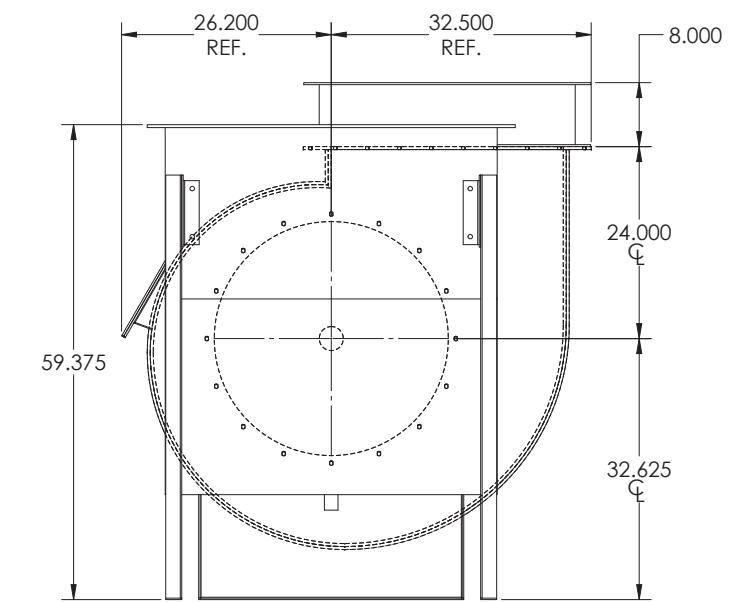
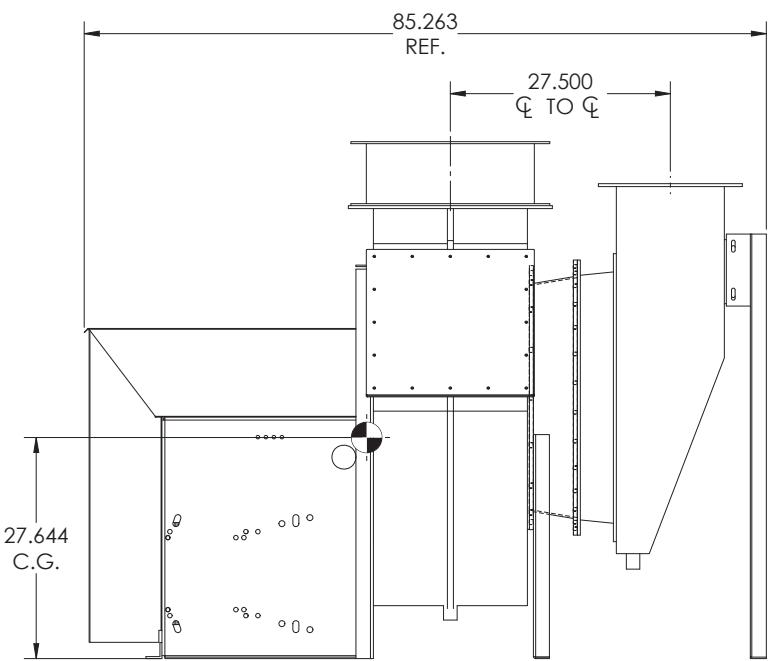
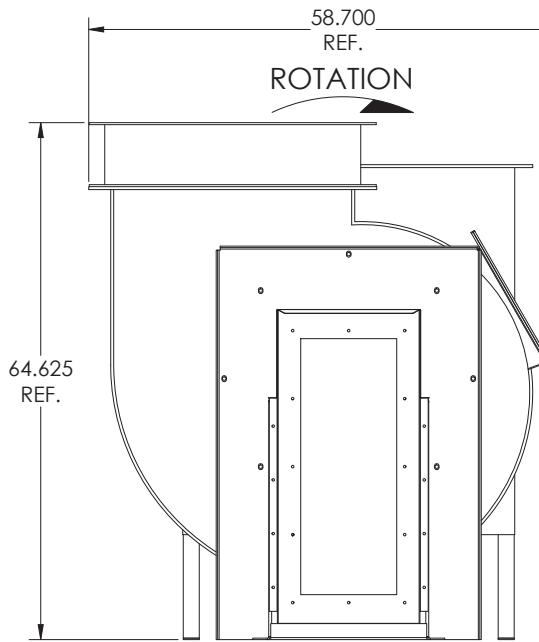
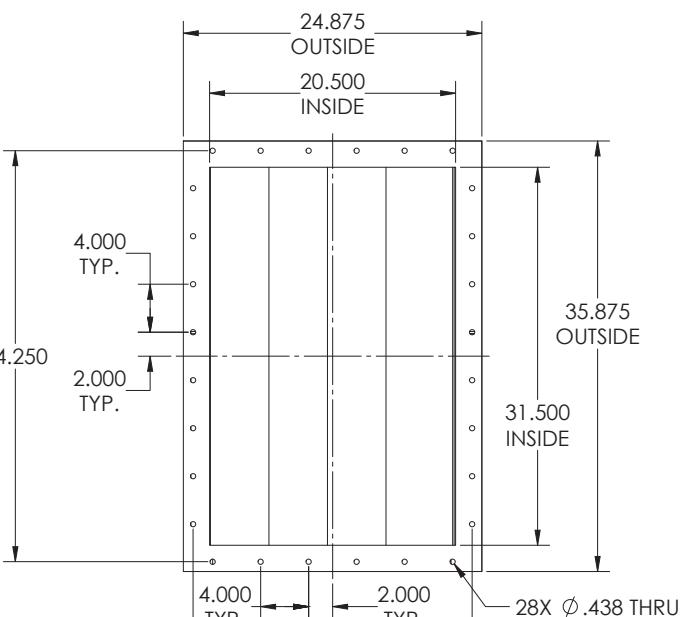
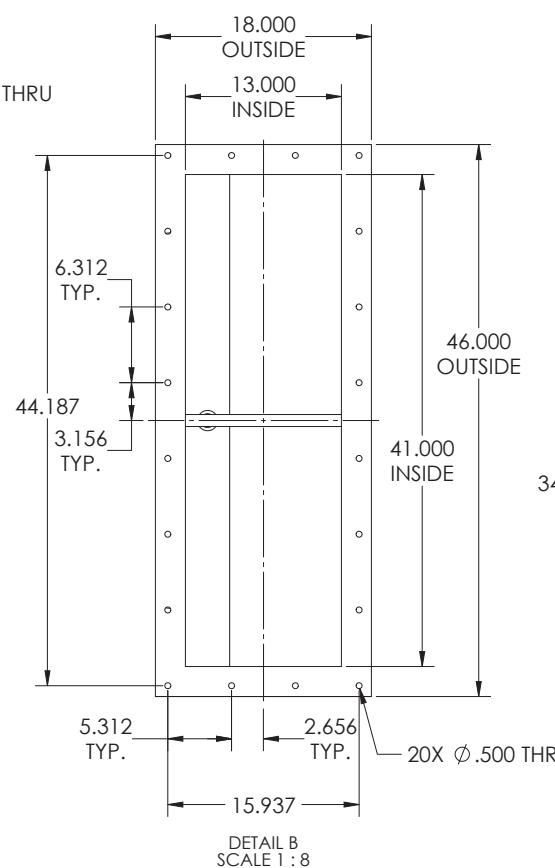
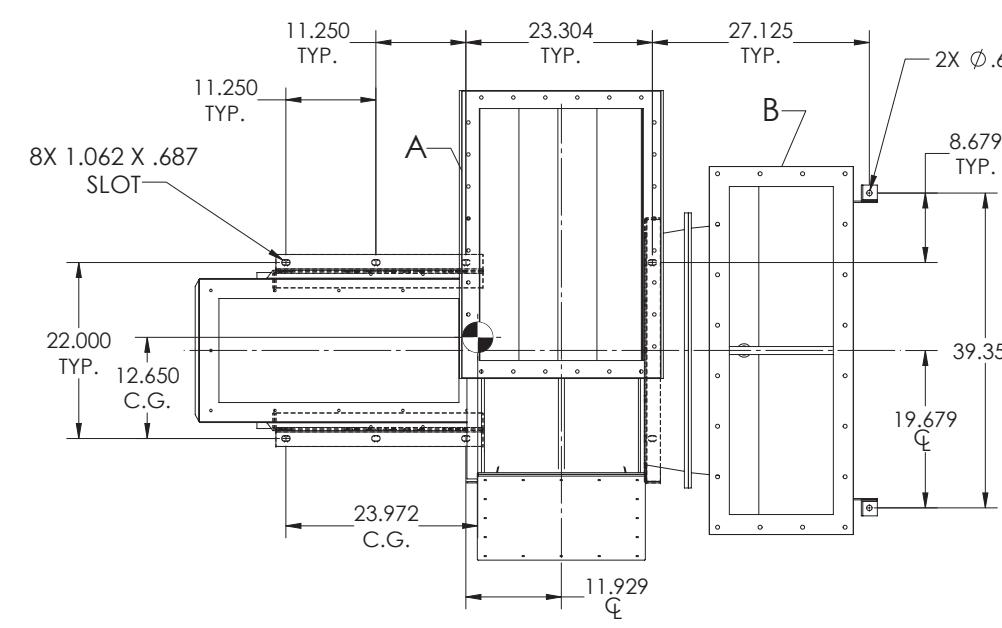
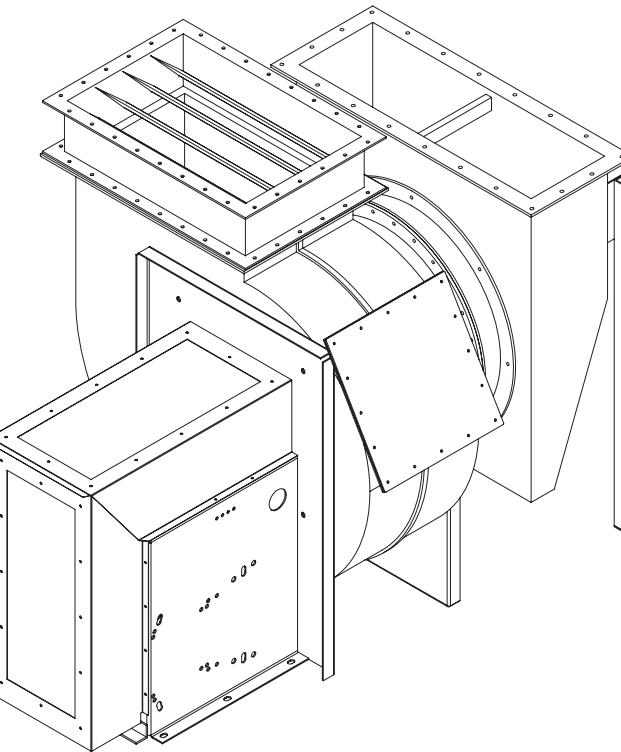
Contact Name:

WILL ADVISE

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
Item Name		Unit of Measure			
Blanket Qty: 0.00		Blanket Exp Date:			



DRIVE SIDE VIEW

FRONT VIEW

INLET SIDE VIEW

CERTIFIED PRINT

BY Joe Hertz DATE: 06/02/2025

SALES ORDER # 2521509
CUSTOMER PO # 24077-00083
FAN TAG # 02-EF-1330 & 02-EF-1340
APPROX. WEIGHT (lb): 1078

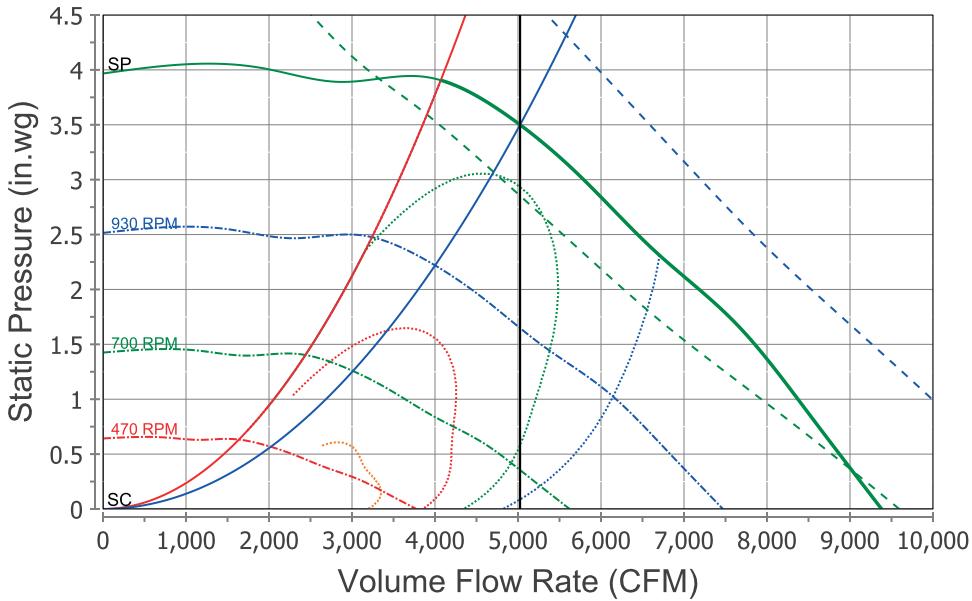
TYPE	PRODUCT SERIES	ARRANGEMENT / DUTY / COLOR			SIZE	# OF BLADES / CLASS	BLADE / WHEEL	BLADE ANGLE / WHEEL WIDTH	MATERIAL OF CONSTRUCTION	MOTOR HP/RPM	ADDITIONAL INFORMATION:				
		ARRANGEMENT	DUTY	COLOR							HP	RPM	MOTOR FRAME	BLADE OD	ROTATION
A	41-	10		1	27	7	1	FA	FG	18	5	1750	184T	CW	UB



MATERIAL INFORMATION			UNLESS OTHERWISE SPECIFIED:		
MATERIAL SEE BOM	DIMENSIONS ARE IN INCHES		MATERIAL THICKNESS	DIMENSIONAL TOLERANCE = $\pm 1/8$	
	ANGULAR = MACH. $\pm 5^\circ$ BEND $\pm 1^\circ$			NOT SUBJECT TO TOLERANCE.	
WEIGHT	DIMENSIONS MARKED AS REF. ARE			NOT SUBJECT TO TOLERANCE.	
1078	SURFACE AREA		5/155	NAME	DATE
	DRAWN BY NDW 6/2/2025			CHECKED	
	PERIMETER LENGTH			APPROVED	
	FILE LOCATION: C:\Vault\Custom\ORDERS\252000\2521509\				

Hartzell Air Movement
Piqua, Ohio 45356
TITLE: 41-27" 66% ARR. 10
FIBERGLASS BACKWARD
CURVED CENTRIFUGAL FAN
SIZE DWG. NO. D 41-2521509-02 REV. A
DO NOT SCALE DRAWING SHEET 1 OF 1

Hartzell-FLOW™ v1.0.18 / February 2019
A41-0-271FA-66FGI8LT



Fan Tag#: 02-EF-1330 & 02-EF-1340

Vol Flow Rate	5025
Pressure	3.5
Density (lbs/ft³)	0.075
Oper. Temp. (°F)	70
Fan RPM	1168
Max Safe RPM	1521
Operating Power	3.652
Standard Power	3.652
Static Efficiency	0.758
Outlet Velocity (fpm)	1347
Fan Energy Index (FEI)	1.37
Fan Efficiency Grade (FEG)	FEG80

Discharge Sound Power Levels referred to 10^-12 watts								
1	2	3	4	5	6	7	8	
87	85	84	85	80	79	70	61	

Radiated Sound Power Levels referred to 10^-12 watts								
1	2	3	4	5	6	7	8	
83	78	74	74	68	66	57	48	

Radiated Sound is not AMCA Licensed

Hartzell Air Movement certifies that the model shown is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 211 and AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program. FEI values are calculated in accordance with ANSI/AMCA Standard 208 and are based on four-pole TEFC motors of the size shown. Power rating BHP excludes transmission losses. Performance certified is for Installation Type D: Ducted Inlet, Ducted Outlet. AMCA Licensed for Sound and Air Performance. Performance ratings do not include the effects of appurtenances (Accessories). Sound ratings are based on sound level data obtained in accordance with AMCA Standard 300. The sound power level ratings shown are in decibels, referred to 10^-12 watts, calculated per AMCA Standard 301. Fan Outlet Sound Testing. Values shown are for outlet Lwo sound power levels for: Installation Type D: Ducted Inlet, Ducted Outlet. Ratings include the effects of duct end correction.

Discharge Sound Pressure = 75 dBA @ 5ft

Radiated Sound Pressure = 63 dBA @ 5ft

Discharge Sound Power = 86 LwA

Radiated Sound Power = 75 LwA

The A-weighted sound pressure level (dBA) is based on Hartzell Laboratory sound power tests, and is calculated in accordance with AMCA standard 303.

The FEG, dBA, LwA and radiated values are not AMCA International Licensed.

The calculation assumes a free field condition with a directivity factor for hemi-spherical radiation (Q=2).

The installed sound pressure levels are influenced by the installation and acoustic environment, and cannot be guaranteed. Use of this estimate level along for field acceptability test is not recommended.

Although the calculation can be done for any stated distance, the free field does not start until 20 to 50 ft from the equipment in most installations.

Contact Hartzell Air Movement for more information concerning dBA values.



BALDOR® • RELIANCE®

Customer information packet

ECP83665T-4

5HP, 1750RPM, 3PH, 60HZ, 184T, 0641M, TEFC, F1

Class - CL1 GP A,B,C,D

Division - Division II

Specifications

Enclosure	TEFC
Frame	184T
Frame Material	Iron
Frequency	60.00 Hz
Haz Area Class and Group	CLI GP A,B,C,D
Haz Area Division	Division II
Motor Letter Type	Three Phase
Output @ Frequency	5.000 HP @ 60 HZ
Phase	3
Synchronous Speed @ Frequency	1800 RPM @ 60 HZ
Voltage @ Frequency	460.0 V @ 60 HZ
Agency Approvals	CSA EEV NEMA PREMIUM NEMA_PREMIUM UR CCSA US
Ambient Temperature	40 °C
Auxillary Box	No Auxillary Box
Auxillary Box Lead Termination	None
Base Indicator	Rigid
Bearing Grease Type	Polyrex EM (-20F +300F)
Blower	None
Constant Torque Speed Range	1.7
Current @ Voltage	6.450 A @ 460.0 V
Design Code	B
Drip Cover	No Drip Cover
Duty Rating	CONT
Efficiency @ 100% Load	89.5 %
Electrically Isolated Bearing	Not Electrically Isolated
Enclosure Modification	841
Feedback Device	NO FEEDBACK
Front Face Code	Standard

Part detail

Revision	AG
Type	AC
Mech. spec.	06H759
Base	
Status	PRD/A
Elec. spec.	06WGX203
Layout	06LYH759
Eff. date	07-17-2024
CD Diagram	CD0006
Poles	04
Leads	3#16
Proprietary	False
Created date	04-04-2012

Front Shaft Indicator	None
Haz Area Temp Code	T3C
Heater Indicator	No Heater
High Voltage Full Load Amps	6.5 a
Insulation Class	F
Inverter Code	Inverter Duty
KVA Code	J
Lifting Lugs	Standard Lifting Lugs
Locked Bearing Indicator	Locked Bearing
Max Speed	2700 rpm
Motor Lead Exit	Ko Box
Motor Lead Quantity/Wire Size	3 @ 16 AWG
Motor Lead Termination	Ring Terminals
Motor Standards	NEMA
Motor Type	0642M
Mounting Arrangement	F1
Number of Poles	4
Overall Length	15.93 IN
Power Factor	81
Product Family	Chem Process S/P 32-8 IEEE 841
Pulley End Bearing Type	Ball
Pulley Face Code	Standard
Pulley Shaft Indicator	Standard
Rodent Screen	None
RoHS Status	ROHS COMPLIANT
Service Factor	1.15
Shaft Diameter	1.125 IN
Shaft Extension Location	Pulley End
Shaft Ground Indicator	No Shaft Grounding
Shaft Rotation	Reversible
Shaft Slinger Indicator	Shaft Slinger
Speed	1750 rpm
Speed Code	Single Speed
Starting Method	Direct on line

Thermal Device - Bearing	None
Thermal Device - Winding	None
Vibration Sensor Indicator	No Vibration Sensor
Winding Thermal 1	None
Winding Thermal 2	None

Nameplate

NP4328

CAT.NO.	ECP83665T-4					
SPEC.	06H759X203G2					
HP	5 TE		IP	56		
VOLTS	460					
AMPS	6.45					
R.P.M.	1750					
FRAME	184T	HZ	60	PH	3	
SER.F.	1.15	CODE	J	DES.	B	CLASS
RATING	40C AMB-CONT					
SN						
DE	6206	ODE	6206			
NEMA NOM. EFF.	89.5	P.F.	81			
GUAR. MIN. EFF.	87.5	CC	010A			
T. CODE	T3C	TEMP=	160			

NP3186

SPEC.	06H759X203G2		
ABMA DE BRG	30BC02X30X		
ABMA ODE BRG	30BC02X30X		
GREASE	POLYREX EM		
MOTOR WEIGHT	127	ROTOR BARS	28 STATOR BARS 36
MAX. R.P.M.	2700	MAX. KVAR	1
INV. TYPE	PWM		
T=	160		
CHP	60	TO	90
CT	1.7	TO	60
VT	-0	TO	60
HTR-VOLTS	N/A	HTR-AMPS	N/A
HTR-WATTS	N/A	MAX. SPACE HEATER TEMP.	N/A

AC Induction Motor Performance Data

Record # 92406

Typical performance - not guaranteed values

Winding: 06WGX203-R061**Type:** 0642M**Enclosure:** TEFC**Nameplate Data**

Rated Output (HP)	5
Volts	460
Full Load Amps	6.6
R.P.M.	1750
Hz	60 Phase
NEMA Design Code	B KVA Code
Service Factor (S.F.)	1.15
NEMA Nom. Eff.	89.5 Power Factor
Rating - Duty	40C AMB-CONT
S.F. Amps	

**460 V, 60 Hz:
Single Voltage Motor**

Full Load Torque	15 LB-FT
Start Configuration	direct on line
Breakdown Torque	53.9 LB-FT
Pull-up Torque	22.4 LB-FT
Locked-rotor Torque	31.8 LB-FT
Starting Current	46 A
No-load Current	3.02 A
Line-line Res. @ 25°C	2.63 Ω
Temp. Rise @ Rated Load	53°C
Temp. Rise @ S.F. Load	65°C
Locked-rotor Power Factor	40.5
Rotor inertia	0.391 lb-ft ²

Load Characteristics 460 V, 60 Hz, 5 HP

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	41	63	75	81	84	85	81
Efficiency	85.2	89.8	90.4	89.5	88.4	86.9	88.7
Speed	1789	1777	1765	1752	1737	1721	1739
Line amperes	3.35	4.14	5.21	6.45	7.91	9.47	7.52

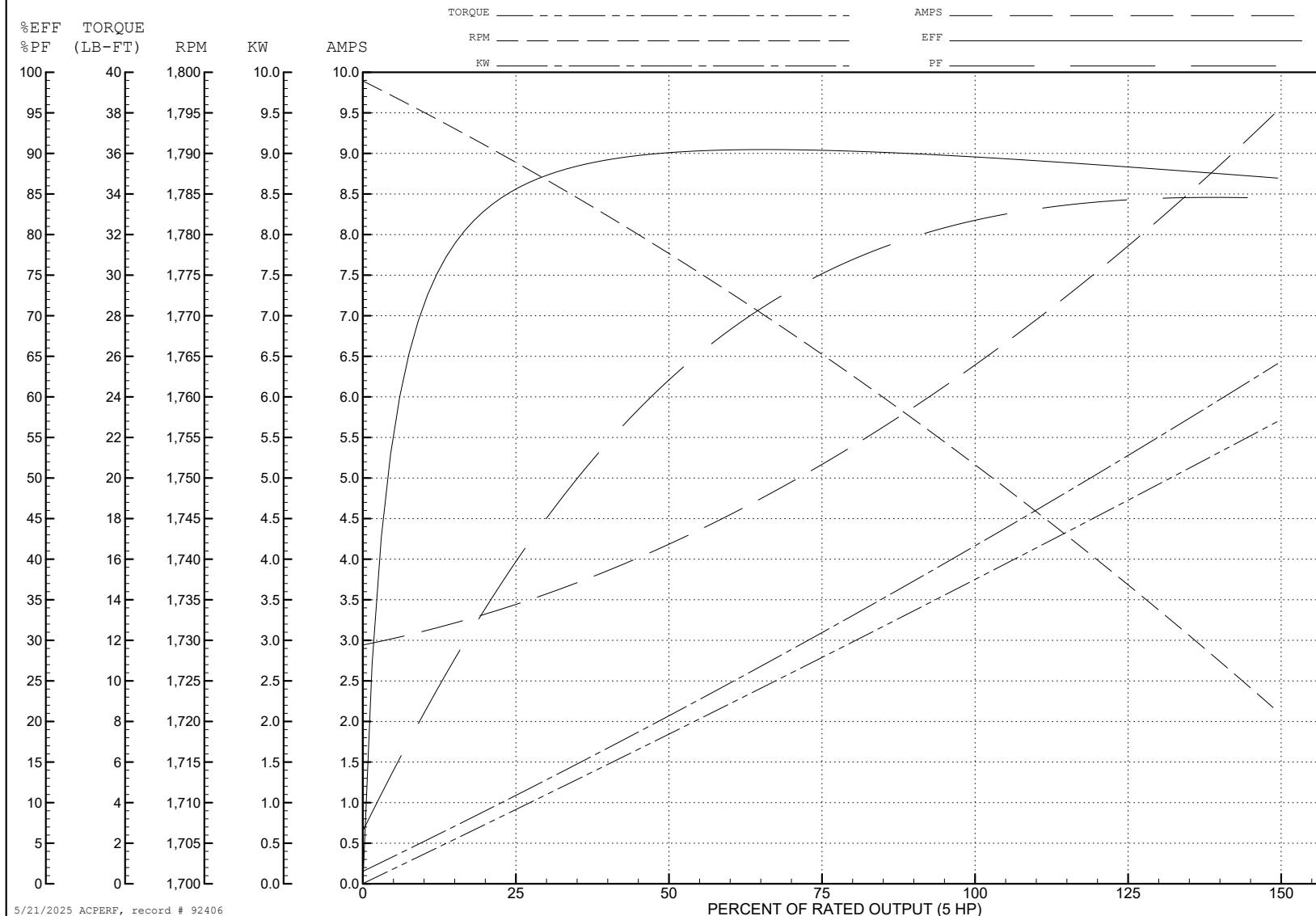
ABB Motors and Mechanical Inc.

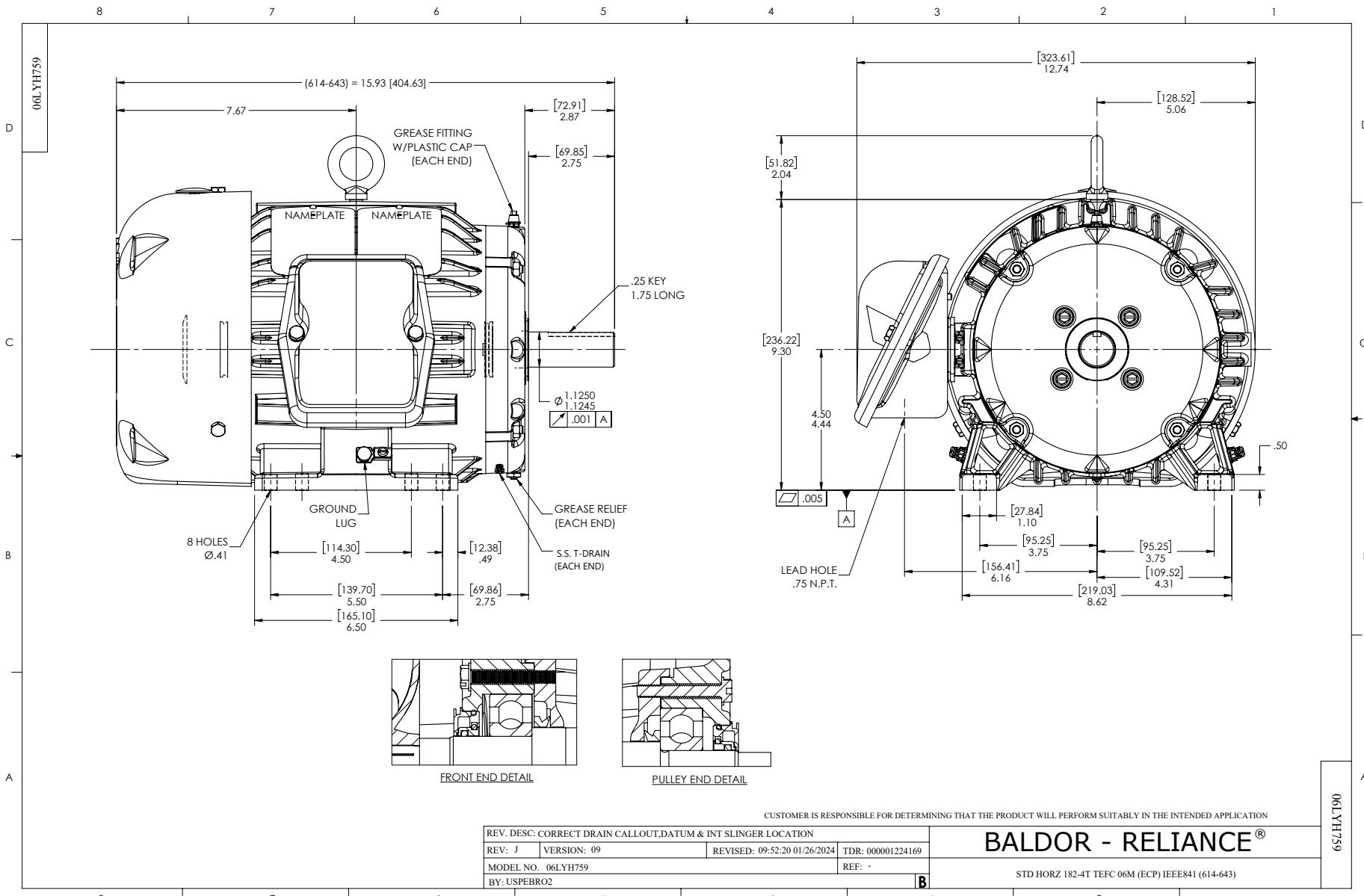
WINDING # 06WGX203

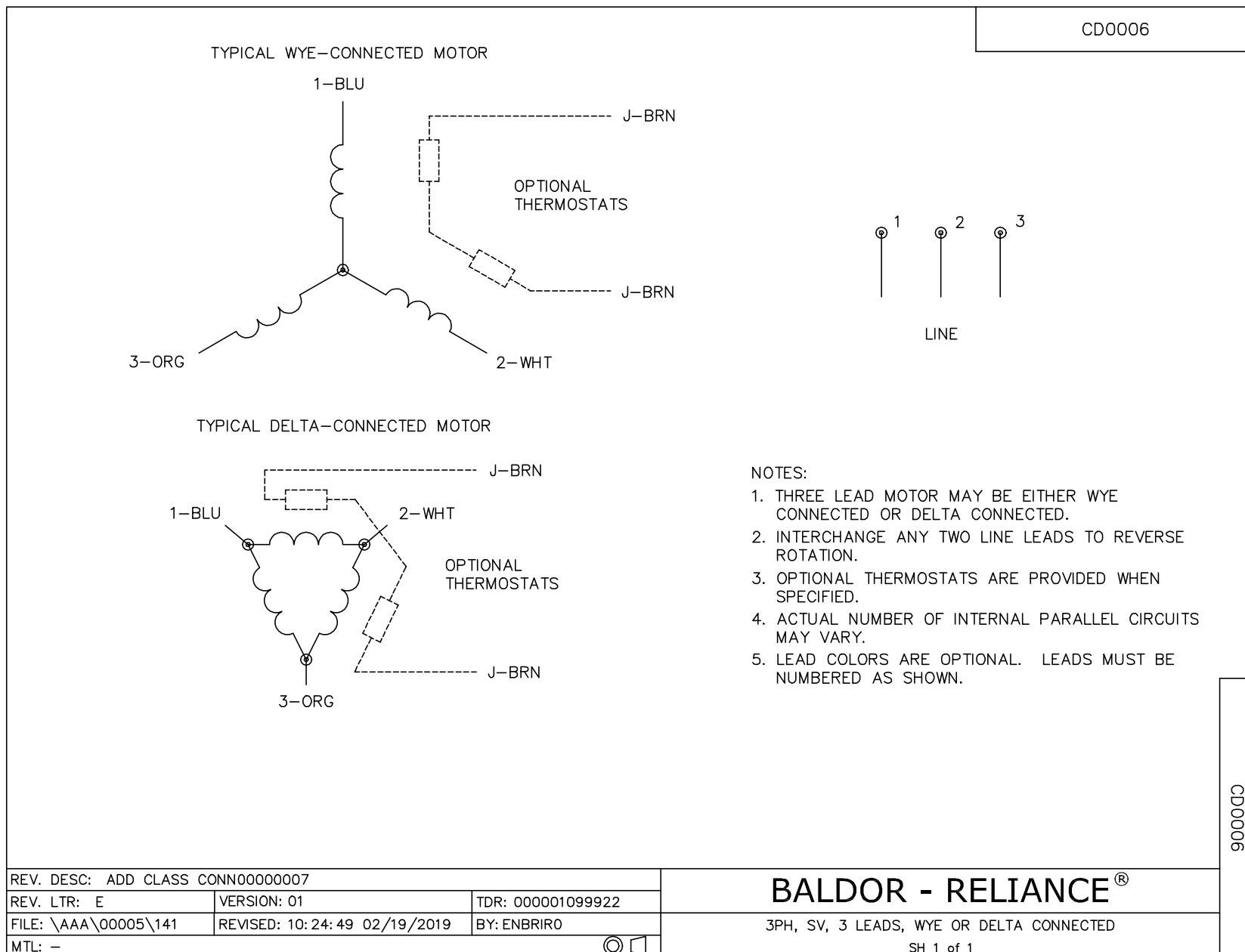
Typical performance - not guaranteed values.

5 HP 3 PH 60 HZ 1750 RPM 460 V 0642M

TORQUES (LB-FT): PO=53.9 PU=22.4 LR=31.8 LRA=46







Motor Mod Express®

Modification number	Motor Mod Express®
Balance	
M1A	Dynamic balance of rotors
Bearings	
M2A	Sealed
M2B	Ball to roller 1800 RPM or below
M2C	RPM AC ball to roller
M2F	Add isolated bearings NEMA 56 through 449T (SKF Insocoat or equivalent)
Brake motors	
M3D	Change stearns brake voltage
Conduit box	
M4A	Tap or provide additional lead hole
M4B	Rotate conduit box lead opening
M4F	Replace die cast aluminum conduit box
M4G	Add conduit box for thermostat or heater leads
Cord	
M5A	Install line cord in conduit box or terminal panel
M5B	Install 6 foot, 3 conductor, type SO cord with plug
Drains	
M7A	Add condensation drain holes
M7C	Close standard condensation drain holes
M7D	Add breather drains to cast iron explosion-proof motor
Dripcovers	
M8A	Install dripcover on TEFC or ODP
Leads	
M10A	Install terminal lugs
M10B	Reconnect motor from nine leads to three
M10C	Reconnect motor to high or low voltage in conduit box
M10D	Longer leads, additional leads added
Lubrication	
M11A	Install low temperature lubricant in bearings
M11B	Add high temperature grease
Seals	
M12A	install oil seals
M12B	Install Inpro/Seal® drive end only
M12C	Install V-ring seals to motor

Motor Mod Express®

Modification number	Motor Mod Express®
Mountings	
M13A	Add rigid base
M13B	Install NEMA C-face – steel band motor construction
M13C-1	Install NEMA C-face – cast iron construction
M13C-2	Install NEMA C-face – IEEE 841 motors
M13D	Add D-flange
M13E	Remove rigid base from foot mounted steel band motors
M13F-2	Convert mounting configuration for cast iron motor
M13G	Install C-Face to explosion-proof motors
M13I	Labor only to mount grinder or buffer onto a pedestal and package for shipment
Mounting drawings	
M44A	RPM AC mounting conversions
Export packaging	
M14A	Open crate packaging
M14B	Totally enclosed crate packaging
M14C	Motor and nameplate photograph
Nameplate	
M15A	Provide original nameplate for remote mounting
M15B	Replace nameplate
M15C	Laser engrave nameplate into stainless steel motor
M15E	Mail nameplates to customer
Blowers	
M16A	Add constant velocity blower unit
M16B	Convert from a 3 phase to a single phase blower
Paint	
M17A	Paint motor Baldor-Reliance® stock paint color
M17B	Paint motor or parts customer specified color
Lifting lugs	
M18A	Add lifting lugs up to a 326T frame size
Hardware	
M20A	Exchange plated hardware with stainless steel
Space heaters	
M21A	Add space heaters to TEFC or open motors
Thermal protectors	
M23A	Thermostats
Winding thermocouples	
M24A	Iron constantan (3 per motor)
Winding thermistors	
M25A	Thermistors

Motor Mod Express®

Modification number	Motor Mod Express®
Tropicalization	
M26A	Protection of windings and mechanical parts
Weatherproofing	
M27A	Treatment of windings and mechanical parts
Shaft modifications	
M29A	Drill and tap one hole in end of shaft or mill flat on shaft extension
M29B	Convert from TEFC to TEAO
M29C	Threading
M29D	Convert "T" frame to "U" frame shaft dimension or smaller (TS)
M29F	Shorten shafts without reducing the overall diameter
Tach and encoder mounting kits	
M31D	Add encoder kit to inverter duty V*S Master or RPM AC motor
M31E	Additional mounted encoder options for IDRPM motors
Testing	
M32A	CSA C390 method 1 equivalent to IEEE 112 method B performance testing
M33A	Short motor test
M33B	Routine motor test
M33C	Complete performance test
M33D	Calibration test
M33E	Sound measurement test
Terminal blocks	
M35A	Install IEC terminal blocks in conduit box and connect leads
Starters	
	Add magnetic or manual starter to grinder or buffer
M36A	Starter – single phase
M36B	Starter – three phase
M36C	Magnetic starter – three phase
M36D	Overload protection for dust control unit
Shaft grounding	
M39A	Shaft grounding systems
M39B-1	Shaft grounding ring - bearing protection
M39C	Baldor-Reliance® shaft grounding brush assembly
M39D	Add shaft grounding ring's colloidal silver shaft coating to shaft
Check Total Indicated Runout (TIR)	
M40A	Check Total Indicated Runout (TIR)
ABB Ability™	
M43A	Install ABB Ability™ Smart Sensor for motors

SECTION 03.03

LINE ITEM TECHNICAL INFORMATION



Line No.: 2521509-03

Description: A41-0-271FA100FGI8MT - Fiberglass Backward
Curved Centrifugal Fan

Tag: 02-EF-1390 & 02-EF-1396



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM

Ship Method: PPD CC

Salesman Code: 99WE

Piqua

Partial Ship: False

AR Terms: Per Invoice

Ship To : WILL ADVISE

WILL ADVISE

Contact Name:

WILL ADVISE

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Item Name	Req Date	Req Qty	Unit Price	Extended Price
					Unit of Measure	
3	HFA/PBA-FRP	HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

A41-0-271FA100FGI8MT
41 - Fiberglass Backward Curved Centrifugal Fan

Tag: 02-EF-1390 & 02-EF-1396

Performance

Volume Flow Rate: 6465.0 cfm

SP: 3.6 in. w.g. / TP: 3.75 in. w.g.

RPM: 1150.0

Density: 0.075 lbs/ft^3

Operating Temp: 70 °F

OPwr: 4.724 hp / SPwr: 4.724 hp

Motor

HP: M - 7.5 HP

RPM/Volt/Hz/Phase: T - 1750, 460, 60, 3

Enclosure: I8 - TEFC IEEE841

Frame Size: 213T

Operating Voltage: 460

Vendor: BALDOR

Motor Accessories

Hermetically Sealed Thermostat

Space Heater - 115V/120V

Hartzell Motor P/N: 3110-0040-B-(MODIFIED), Mfct P/N: ECP83770T-4

Fan

Arrangement: 10

Rotation and Discharge: Up Blast (Clockwise)

Mounting Location: Floor

Motor Position: Standard

Material: Fiberglass

Construction: ASTM D4167 97 (Includes Single Veil & Electric Grounding)

Fan Coating: Hartkoate

Prop/Wheel: FA - Backward Airfoil Centrifugal Wheel - Fiberglass

Prop/Wheel Coating: Hartkoate & Electric Grounding



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Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
Standard Accessories (Included)					
Water Slinger					
Inlet Support, Steel - Inorganic Zinc Coating w/ Epoxy Topcoat					
Additional Accessories					
Bolted Access Door, Fiberglass					
Drain, CPVC w/ CPVC Plug (Factory Installed)					
Extended Lube Lines to Fan Bearings, 316SS					
316SS Hardware to Complete Fan					
316SS Shaft					
Teflon Double Lip Seal in a 316SS Casing					
Drilled Inlet Flange, PS15-69					
Drilled Outlet Flange, PS15-69					
FAB Airfoil Backdraft Damper - Fiberglass: Max SP - 14.5: Max FPM - 4000					
Damper Style: Parallel					
Polycarbonate Jamb Seal for Damper					
EPDM Blade Seal for Damper					
FRP (Standard) Axle for Damper					
Both Flanges Drilled For Damper					
<hr/>					

Seismically Restrained Spring Isolators

Inlet Support, Motor & Bearing Base, and Weather Cover to be 316 SS

ACCESS DOOR TO HAVE ONE PIECE NEOPRENE GASKET PUNCHED TO MATCH BOLT PATTERN

SPECIAL ARRANGEMENT 10 WEATHER COVER WITH CLEAR WINDOWS FOR BELT AND BEARING VIEWING

Inlet Box Drain, CPVC w/ CPVC Plug

2-Sets of Spare Belts (2 years worth)

ADDER FOR ---15830 2.03 B 5 L10 100,000 hour bearings

Spare set of bearings

Total Weight (approx.): 1147 lbs. (Each) (quoted items are not included in the weight.)

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
4	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

Spare Sets of sheaves to be provided after final balancing and the belt sizes determined.
Reference Series and Size: 10-FAN-2230 FAN ONLY

Tag: Config-324164

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
5	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

Spare Sets of Belts (2 per fan) to be provided after final balancing and the belt sizes determined.
Reference Series and Size: A41-1-402FA100FGFQT3

Tag: Config-324163

Blanket Qty: 0.00 **Blanket Exp Date:**



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
6	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

2 sets of spare belts per fan (2 years worth)
Reference Series and Size: A41-0-271FA100FGI8MT

Tag: Config-324162

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
7	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

Spare Set of Belts (2 Years Worth)
Reference Series and Size: A41-0-271FA-66FGI8LT

Tag: Config-324270

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
8	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

Spare Set of Bearings
Reference Series and Size: A41-1-402FA100FGFQT3

Tag: Config-324272

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
9	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

Spare Set of Bearings
Reference Series and Size: A41-0-271FA100FGI8MT

Tag: Config-324268

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
10	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	2.00	Each	

Spare Set of Bearings
Reference Series and Size: A41-0-271FA-66FGI8LT

Tag: Config-324273

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
Page 15 of 18

DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
11	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	6.00	Each	

AMCA PERFORMANCE TEST TO BE PERFORMED AT HARTZELL CERTIFIED LAB
Description and Dimensions: AMCA 210

Tag: Config-324165

Blanket Qty: 0.00 **Blanket Exp Date:**



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083

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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
12	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	6.00	Each	

Field Service Trips five (6) total all detailed below

Description and Dimensions: Each Trip for a total of 6 Trips Per Section 15830 Fans & 15832 Odor Control Fans (all travel expenses included) and up to 2 service personnel. Trip 1 & 2 - Installation Assistance (3 days on site and 2 days in transit) X 2 Trips Trip 3 - Installation Inspection (3 days on site and 2 days in transit) X 1 Trip Trip 4 - Startup and performance testing assistance (3 days on site and 2 days in transit) X 1 Trip Trip 5 - Training and Final Acceptance Checkout (3 days on site and 2 days in transit) X 1 Trip Trip 6 - Floater Trip included per Section 15830 (3 days on site and 2 days in transit)

Tag: Config-324166

Blanket Qty: 0.00

Blanket Exp Date:



Hartzell Air Movement
1025 S Roosevelt Ave.
Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
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DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM **Ship Method:** PPD CC
Salesman Code: 99WE **FOB:** Piqua
Partial Ship: False **AR Terms:** Per Invoice

Ship To : WILL ADVISE WILL ADVISE
WILL ADVISE

Contact Name:

Ship To Phone:

Ship To Fax:

Line Nbr	Item ID	Req Date	Req Qty	Unit Price	Extended Price
	Item Name			Unit of Measure	
13	HFA/PBA-FRP HOLD FOR APPROVAL - PROGRESS BILLING ADVANCE	12/31/2025	1.00	Each	

Seismic Calcs Per Line (1 of each line item)

Tag: Config-324611

Blanket Qty: 0.00 **Blanket Exp Date:**



Hartzell Air Movement
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Piqua, Ohio 45356
PH: (937) 773-7411
FAX: (937) 773-8894

Sales Order Acknowledgement

Sales Order ID: 2521509
Customer Purchase Order ID: 24077-00083
Page 18 of 18

DUNS NO. 05-655-1039

Bill To : NAN INC
636 LAUMAKA STREET
HONOLULU, HI 96819
USA

Order Date: 5/19/2025 8:45:57 AM

Ship Method: PPD CC

Salesman Code: 99WE

FOB: Piqua

Partial Ship: False

AR Terms: Per Invoice



All fan products
eligible for the
5-Year Warranty

Website: www.hartzellairmovement.com/five-year-warranty

Total:

Sales Tax:

Estimated Ship Charges:

Estimated Tax Freight:

Sales Order Total:

Special Instructions: **HFA-PBA 05.19.25 JW**
CONTACT JYUN-CHENG JHUO JCHURO@NANHAWII.COM
PREPAID_ADD
SHIP VIA: Best Way
FREIGHT CONTACT: Jyun-Cheng Jhuo PHONE: 765.607.8397
AGENT ORDER #:
ATTN: Nan Inc.
MARK: 24077-00083
DWG: Yes- Certified - 0COPY FOR Hold For Approval
FREIGHT COMMENTS:
JW

Change Nbr: 6

Change Date:

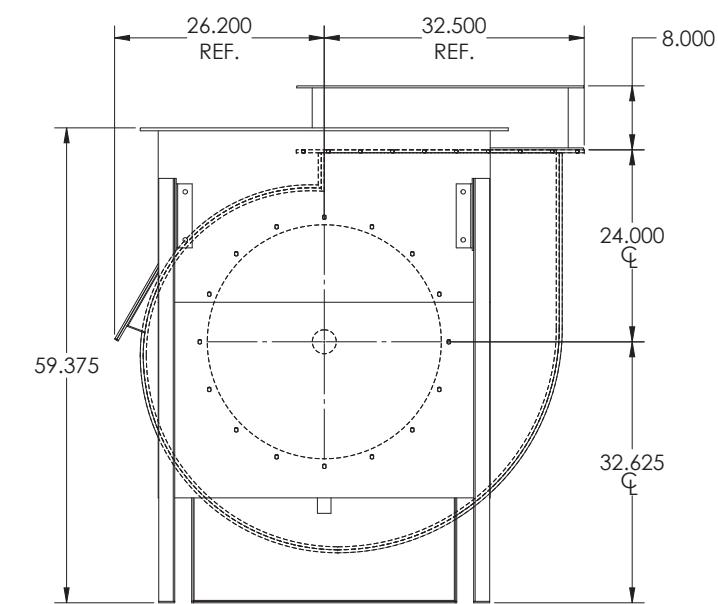
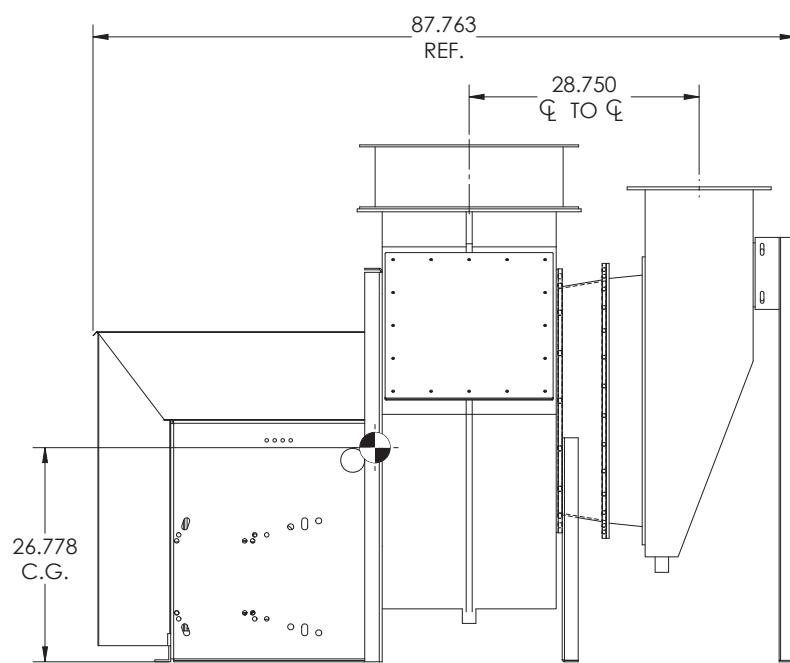
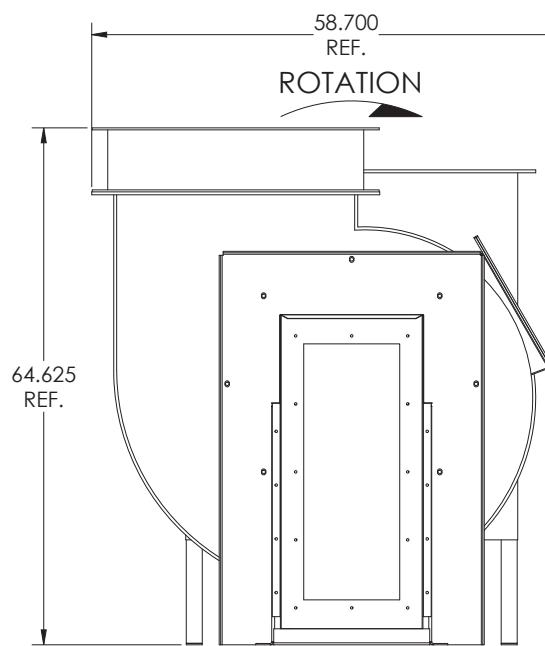
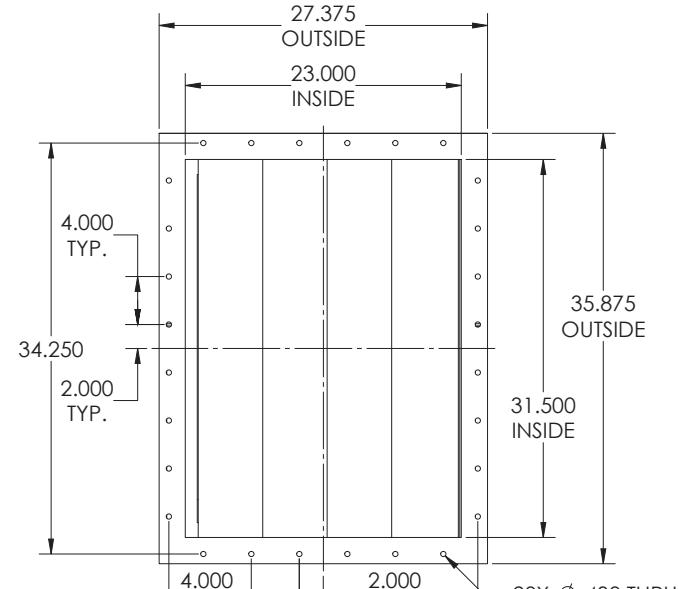
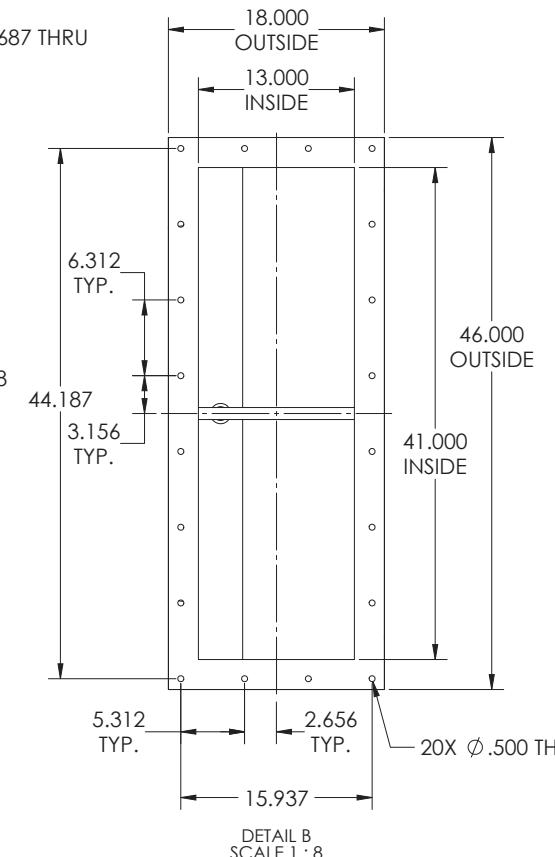
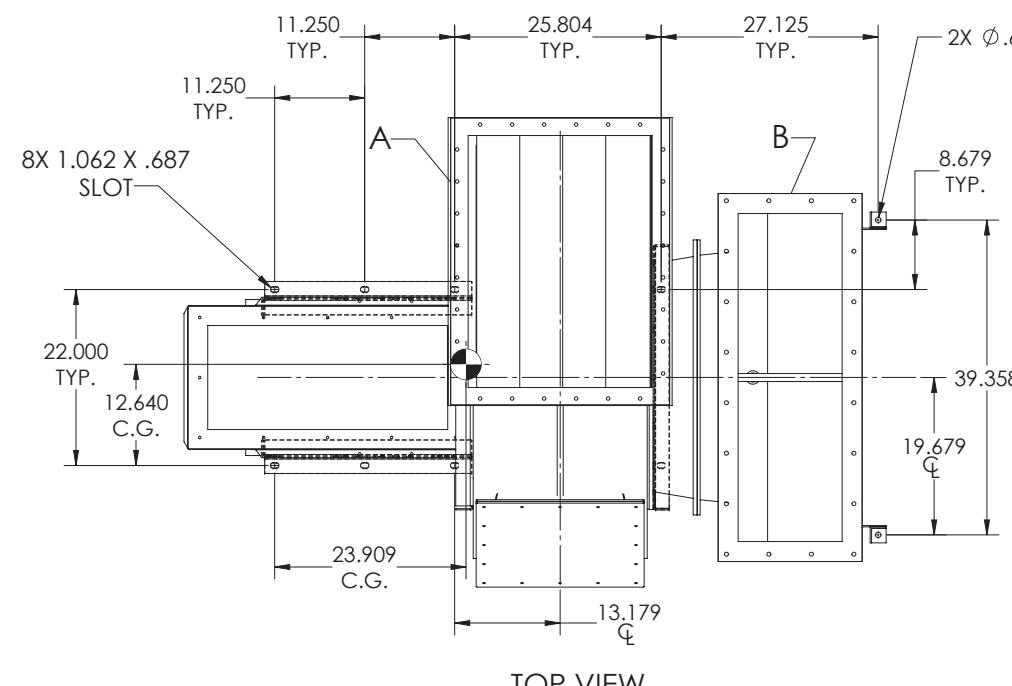
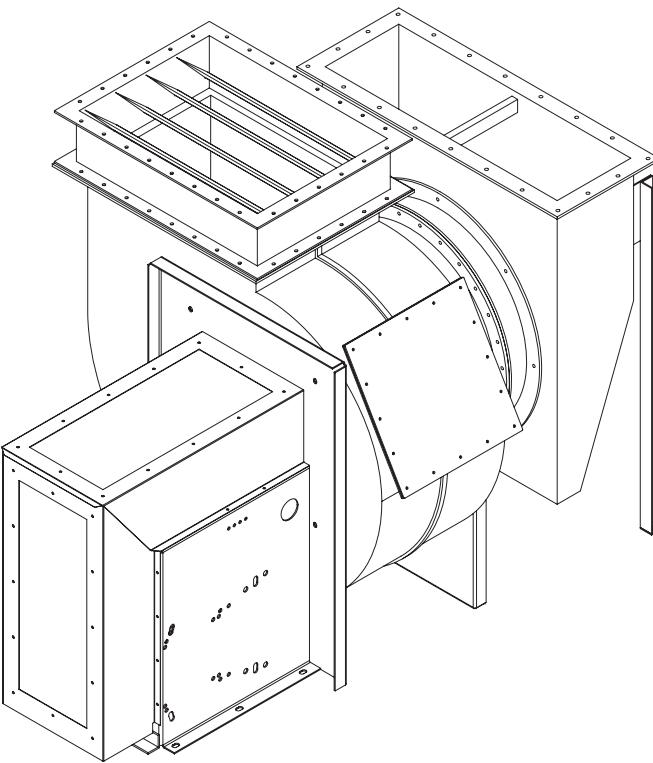
IMPORTANT: THE GOODS DESCRIBED ABOVE ARE SOLD AND SHIPPED ACCORDING TO THE CONDITIONS OF SALE SET FORTH ON THE LAST PAGE.

-----IMPORTANT PLEASE READ-----

The safe application and use of equipment supplied by Hartzell Air Movement is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

We hereby certify that these goods were produced in compliance with all applicable requirements of section 6, 7 and 12 of the Fair Labor Standards Act, as amended, and of regulations and orders of the United States Department of Labor issued under section 14, there of.

REV.	DESCRIPTION	DATE	CHANGE NO.
A	INITIAL RELEASE	06/02/2025	SDR-0045



CERTIFIED PRINT

BY *[Signature]* DATE: 06/02/2025

SALES ORDER # 2521509
CUSTOMER PO # 24077-00083
FAN TAG # 02-EF-1390 & 02-EF-1396
APPROX. WEIGHT (lb): 1163

TYPE	PRODUCT SERIES	ARRANGEMENT / DUTY / COLOR			SIZE	# OF BLADES / CLASS	BLADE / WHEEL	BLADE ANGLE / WHEEL WIDTH	MATERIAL OF CONSTRUCTION	MOTOR ENCLOSURE	MOTOR HP/RPM	ADDITIONAL INFORMATION:					
		ARRANGEMENT	DUTY	COLOR								HP	RPM	MOTOR FRAME	BLADE OD	ROTATION	DISCHARGE
A	41-	10		1	27	7	1	FA	FG	I8	7.5	1750	213T	CW	UB		

Hartzell AIR MOVEMENT		MATERIAL INFORMATION	UNLESS OTHERWISE SPECIFIED:
MATERIAL SEE BOM		DIMENSIONS ARE IN INCHES	
MATERIAL THICKNESS		DIMENSIONAL TOLERANCE = $\pm 1/8$	
WEIGHT		ANGULAR = MACH. $\pm 5^\circ$ BEND $\pm 1^\circ$	
SURFACE AREA		DIMENSIONS MARKED AS REF. ARE NOT SUBJECT TO TOLERANCE.	
PERIMETER LENGTH		ANY PART OF THE FAN WHICH IS CUT AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF HARTZELL AIR MOVEMENT IS PROHIBITED.	
FILE LOCATION: C:\Vault\Custom\ORDERS\252000\2521509\			

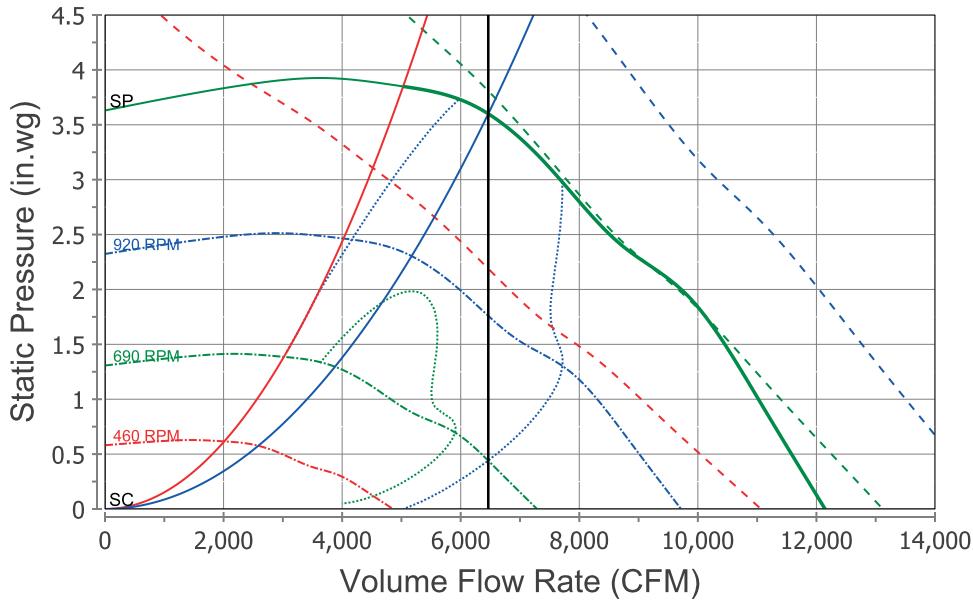
Hartzell Air Movement
Piqua, Ohio 45356

41-27" 100% ARR. 10 FIBERGLASS BACKWARD CURVED CENTRIFUGAL FAN

SIZE DWG. NO. D 41-2521509-03 **REV.** A

DO NOT SCALE DRAWING SHEET 1 OF 1

Hartzell-FLOW™ v1.0.18 / February 2019
A41-0-271FA100FGI8MT



Fan Tag#: 02-EF-1390 & 02-EF-1396

Vol Flow Rate	6465
Pressure	3.6
Density (lbs/ft³)	0.075
Oper. Temp. (°F)	70
Fan RPM	1150
Max Safe RPM	1521
Operating Power	4.724
Standard Power	4.724
Static Efficiency	0.775
Outlet Velocity (fpm)	1532
Fan Energy Index (FEI)	1.42
Fan Efficiency Grade (FEG)	FEG85

Discharge Sound Power Levels referred to 10^-12 watts							
1	2	3	4	5	6	7	8

Radiated Sound Power Levels referred to 10^-12 watts							
1	2	3	4	5	6	7	8

Radiated Sound is not AMCA Licensed

— System Curve	— Static Pressure (in.wg)	— Do Not Select	- - 7 1/2 HP	- - 5 HP	- - 3 HP	···· FEI=1.4
···· FEI=1.5	···· FEI=1.6	···· FEI=1.7	— AMCA Certified			

Hartzell Air Movement certifies that the model shown is licensed to bear the AMCA Seal.

The ratings shown are based on tests and procedures performed in accordance with AMCA publication 211 and AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

FEI values are calculated in accordance with ANSI/AMCA Standard 208 and are based on four-pole TEFC motors of the size shown.

Power rating BHP excludes transmission losses.

Performance certified is for Installation Type D: Ducted Inlet, Ducted Outlet.

AMCA Licensed for Sound and Air Performance.

Performance ratings do not include the effects of appurtenances (Accessories).

Sound ratings are based on sound level data obtained in accordance with AMCA Standard 300. The sound power level ratings shown are in decibels, referred to 10^-12 watts, calculated per AMCA Standard 301. Fan Outlet Sound Testing. Values shown are for outlet Lwo sound power levels for:

Installation Type D: Ducted Inlet, Ducted Outlet.

Ratings include the effects of duct end correction.

Discharge Sound Pressure = 76 dBA @ 5ft

Radiated Sound Pressure = 65 dBA @ 5ft

Discharge Sound Power = 87 LwA

Radiated Sound Power = 76 LwA

The A-weighted sound pressure level (dBA) is based on Hartzell Laboratory sound power tests, and is calculated in accordance with AMCA standard 303.

The FEG, dBA, LwA and radiated values are not AMCA International Licensed.

The calculation assumes a free field condition with a directivity factor for hemi-spherical radiation (Q=2).

The installed sound pressure levels are influenced by the installation and acoustic environment, and cannot be guaranteed. Use of this estimate level along for field acceptability test is not recommended.

Although the calculation can be done for any stated distance, the free field does not start until 20 to 50 ft from the equipment in most installations.

Contact Hartzell Air Movement for more information concerning dBA values.



BALDOR® • RELIANCE®

Customer information packet

ECP83770T-4

7.5HP, 1765RPM, 3PH, 60HZ, 213T, 0740M, TEFC, F

Class - CL1 GP A,B,C,D

Division - Division II

Specifications

Enclosure	TEFC
Frame	213T
Frame Material	Iron
Frequency	60.00 Hz
Haz Area Class and Group	CLI GP A,B,C,D
Haz Area Division	Division II
Motor Letter Type	Three Phase
Output @ Frequency	7.500 HP @ 60 HZ
Phase	3
Synchronous Speed @ Frequency	1800 RPM @ 60 HZ
Voltage @ Frequency	460.0 V @ 60 HZ
Agency Approvals	CCSA US CSA CSA EEV NEMA PREMIUM NEMA_PREMIUM UR
Ambient Temperature	40 °C
Auxillary Box	No Auxillary Box
Auxillary Box Lead Termination	None
Base Indicator	Rigid
Bearing Grease Type	Polyrex EM (-20F +300F)
Blower	None
Constant Torque Speed Range	1.2
Current @ Voltage	9.500 A @ 460.0 V
Design Code	B
Drip Cover	No Drip Cover
Duty Rating	CONT
Efficiency @ 100% Load	91.7 %
Electrically Isolated Bearing	Not Electrically Isolated
Enclosure Modification	841
Feedback Device	NO FEEDBACK

Part detail

Revision	BD
Type	AC
Mech. spec.	07K629
Base	
Status	PRD/A
Elec. spec.	07WGX814
Layout	07LYK629
Eff. date	05-12-2025
CD Diagram	CD0006
Poles	04
Leads	3#14
Proprietary	False
Created date	01-24-2006

Front Face Code	Standard
Front Shaft Indicator	None
Haz Area Temp Code	T3C
Heater Indicator	No Heater
High Voltage Full Load Amps	9.5 a
Insulation Class	F
Inverter Code	Inverter Duty
KVA Code	H
Lifting Lugs	Standard Lifting Lugs
Locked Bearing Indicator	Locked Bearing
Max Speed	2700 rpm
Motor Lead Exit	Ko Box
Motor Lead Quantity/Wire Size	3 @ 14 AWG
Motor Lead Termination	Flying Leads
Motor Standards	NEMA
Motor Type	0740M
Mounting Arrangement	F1
Number of Poles	4
Overall Length	19.50 IN
Power Factor	82
Product Family	Chem Process S/P 32-8 IEEE 841
Pulley End Bearing Type	Ball
Pulley Face Code	Standard
Pulley Shaft Indicator	Standard
Rodent Screen	None
RoHS Status	ROHS COMPLIANT
Service Factor	1.15
Shaft Diameter	1.375 IN
Shaft Extension Location	Pulley End
Shaft Ground Indicator	No Shaft Grounding
Shaft Rotation	Reversible
Shaft Slinger Indicator	Shaft Slinger
Speed	1765 rpm
Speed Code	Single Speed

Starting Method	Direct on line
Thermal Device - Bearing	None
Thermal Device - Winding	None
Vibration Sensor Indicator	No Vibration Sensor
Winding Thermal 1	None
Winding Thermal 2	None

Nameplate

NP4328

CAT.NO.	ECP83770T-4				
SPEC.	07K629X814				
HP	7.5 TE	IP	56		
VOLTS	460				
AMPS	9.5				
R.P.M.	1765				
FRAME	213T	HZ	60	PH	3
SER.F.	1.15	CODE	H	DES.	B
CLASS	F				
RATING	40C AMB-CONT				
SN					
DE	6307	ODE	6307		
NEMA NOM. EFF.	91.7	P.F.	82		
GUAR. MIN. EFF.	90.2	CC	010A		
T. CODE	T3C	TEMP=	160		

NP3186

SPEC.	07K629X814		
ABMA DE BRG	35BC03X30X		
ABMA ODE BRG	35BC03X30X		
GREASE	POLYREX EM		
MOTOR WEIGHT	199	ROTOR BARS	28
MAX. R.P.M.	2700	MAX. KVAR	1.3
INV. TYPE	PWM		
T=	160		
CHP	60	TO	90
CT	1.2	TO	60
VT	-0	TO	60
HTR-VOLTS	N/A	HTR-AMPS	N/A
HTR-WATTS		MAX. SPACE HEATER TEMP.	N/A

AC Induction Motor Performance Data

Record # 92344

Typical performance - not guaranteed values

Winding: 07WGX814-R056**Type:** 0740M**Enclosure:** TEFC**Nameplate Data**

Rated Output (HP)	7.5
Volts	460
Full Load Amps	9.5
R.P.M.	1765
Hz	60 Phase
NEMA Design Code	B KVA Code
Service Factor (S.F.)	1.15
NEMA Nom. Eff.	91.7 Power Factor
Rating - Duty	40C AMB-CONT
S.F. Amps	

**460 V, 60 Hz:
Single Voltage Motor**

Full Load Torque	22.32 LB-FT
Start Configuration	direct on line
Breakdown Torque	66.8 LB-FT
Pull-up Torque	30 LB-FT
Locked-rotor Torque	39.7 LB-FT
Starting Current	63.5 A
No-load Current	3.71 A
Line-line Res. @ 25°C	1.485 Ω
Temp. Rise @ Rated Load	54°C
Temp. Rise @ S.F. Load	67°C
Locked-rotor Power Factor	36.2

Load Characteristics 460 V, 60 Hz, 7.5 HP

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	46	68	78	82	84	85	83
Efficiency	88.6	92.1	92.4	91.7	90.7	89.3	91.1
Speed	1789.9	1782.7	1774.5	1765.4	1755.6	1743.7	1760
Line amperes	4.3	5.61	7.32	9.31	11.5	13.9	10.6

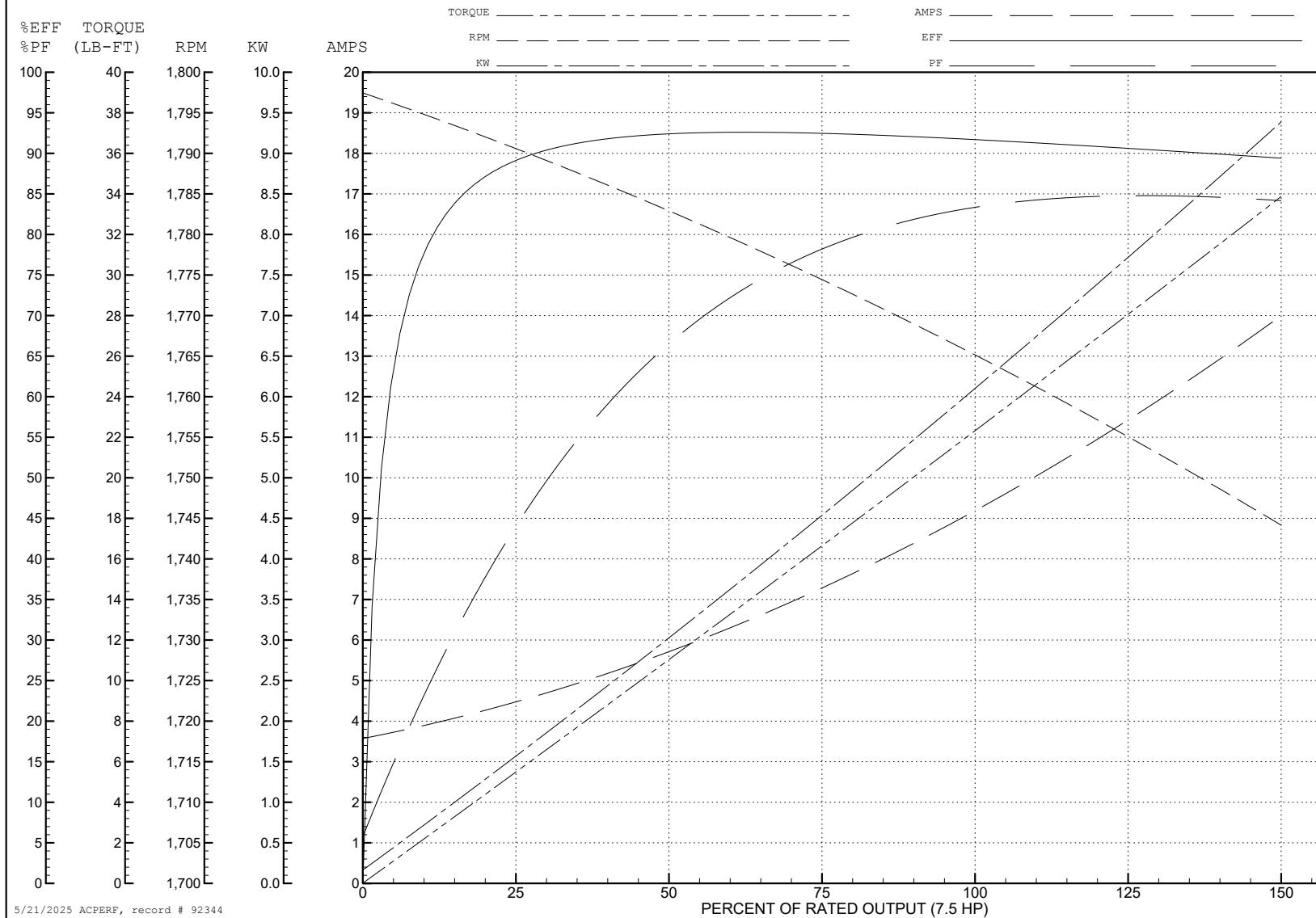
ABB Motors and Mechanical Inc.

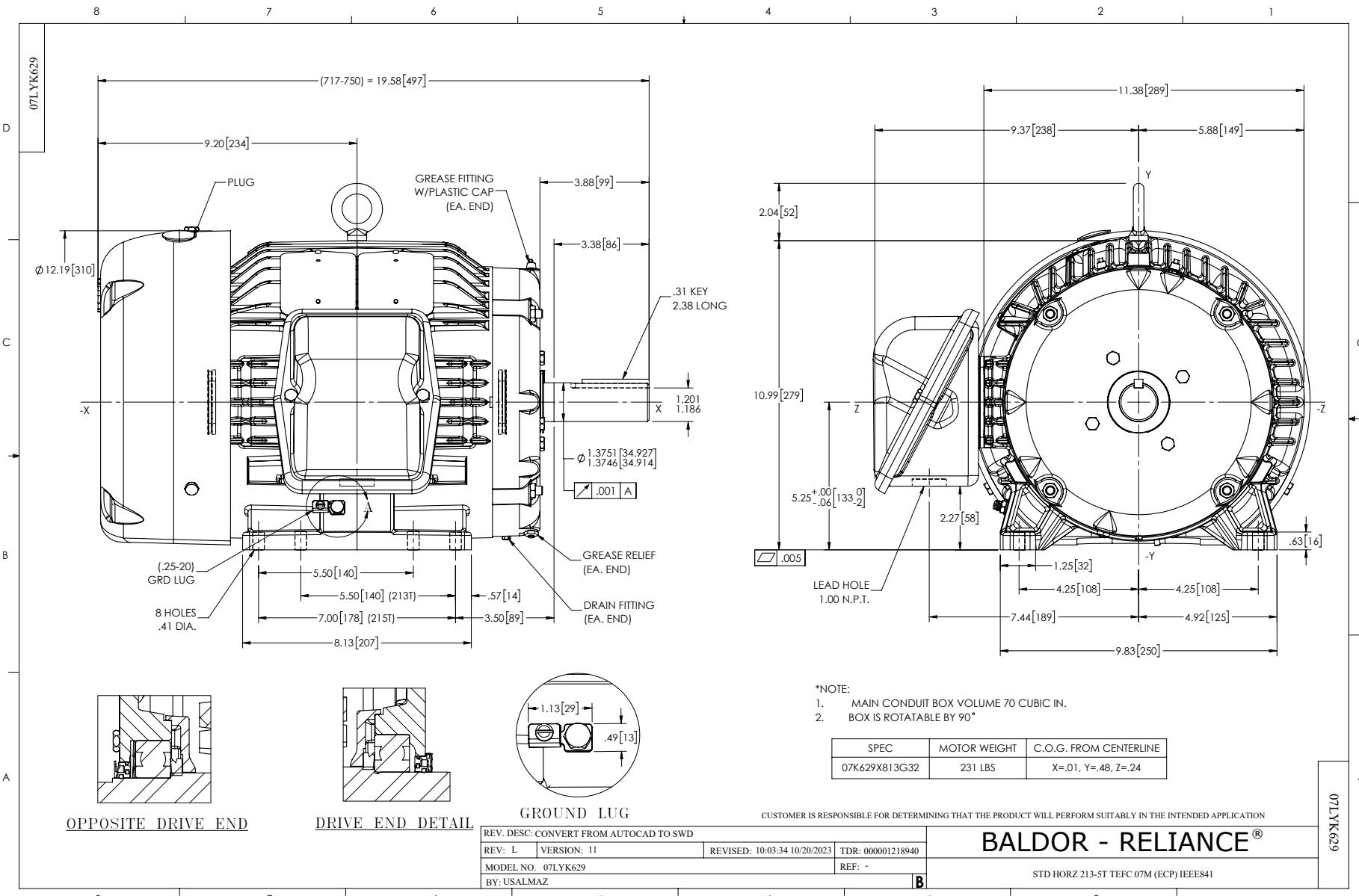
WINDING # 07WGX814

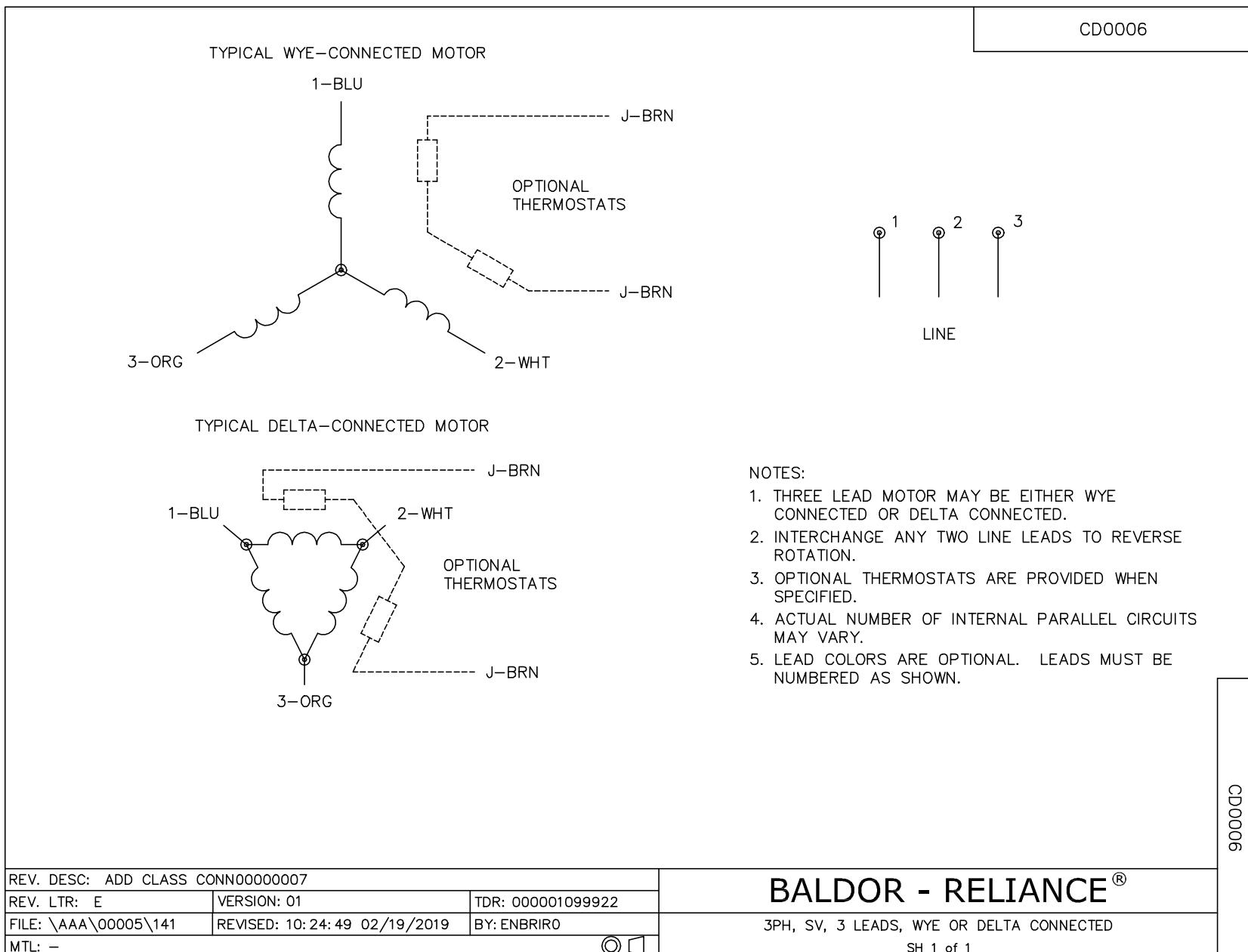
Typical performance - not guaranteed values.

7.5 HP 3 PH 60 HZ 1765 RPM 460 V 0740M

TORQUES (LB-FT): PO=66.8 PU=30 LR=39.7 LRA=63.5







Motor Mod Express®

Modification number	Motor Mod Express®
Balance	
M1A	Dynamic balance of rotors
Bearings	
M2A	Sealed
M2B	Ball to roller 1800 RPM or below
M2C	RPM AC ball to roller
M2F	Add isolated bearings NEMA 56 through 449T (SKF Insocoat or equivalent)
Brake motors	
M3D	Change stearns brake voltage
Conduit box	
M4A	Tap or provide additional lead hole
M4B	Rotate conduit box lead opening
M4F	Replace die cast aluminum conduit box
M4G	Add conduit box for thermostat or heater leads
Cord	
M5A	Install line cord in conduit box or terminal panel
M5B	Install 6 foot, 3 conductor, type SO cord with plug
Drains	
M7A	Add condensation drain holes
M7C	Close standard condensation drain holes
M7D	Add breather drains to cast iron explosion-proof motor
Dripcovers	
M8A	Install dripcover on TEFC or ODP
Leads	
M10A	Install terminal lugs
M10B	Reconnect motor from nine leads to three
M10C	Reconnect motor to high or low voltage in conduit box
M10D	Longer leads, additional leads added
Lubrication	
M11A	Install low temperature lubricant in bearings
M11B	Add high temperature grease
Seals	
M12A	install oil seals
M12B	Install Inpro/Seal® drive end only
M12C	Install V-ring seals to motor

Motor Mod Express®

Modification number	Motor Mod Express®
Mountings	
M13A	Add rigid base
M13B	Install NEMA C-face – steel band motor construction
M13C-1	Install NEMA C-face – cast iron construction
M13C-2	Install NEMA C-face – IEEE 841 motors
M13D	Add D-flange
M13E	Remove rigid base from foot mounted steel band motors
M13F-2	Convert mounting configuration for cast iron motor
M13G	Install C-Face to explosion-proof motors
M13I	Labor only to mount grinder or buffer onto a pedestal and package for shipment
Mounting drawings	
M44A	RPM AC mounting conversions
Export packaging	
M14A	Open crate packaging
M14B	Totally enclosed crate packaging
M14C	Motor and nameplate photograph
Nameplate	
M15A	Provide original nameplate for remote mounting
M15B	Replace nameplate
M15C	Laser engrave nameplate into stainless steel motor
M15E	Mail nameplates to customer
Blowers	
M16A	Add constant velocity blower unit
M16B	Convert from a 3 phase to a single phase blower
Paint	
M17A	Paint motor Baldor-Reliance® stock paint color
M17B	Paint motor or parts customer specified color
Lifting lugs	
M18A	Add lifting lugs up to a 326T frame size
Hardware	
M20A	Exchange plated hardware with stainless steel
Space heaters	
M21A	Add space heaters to TEFC or open motors
Thermal protectors	
M23A	Thermostats
Winding thermocouples	
M24A	Iron constantan (3 per motor)
Winding thermistors	
M25A	Thermistors

Motor Mod Express®

Modification number	Motor Mod Express®
Tropicalization	
M26A	Protection of windings and mechanical parts
Weatherproofing	
M27A	Treatment of windings and mechanical parts
Shaft modifications	
M29A	Drill and tap one hole in end of shaft or mill flat on shaft extension
M29B	Convert from TEFC to TEAO
M29C	Threading
M29D	Convert "T" frame to "U" frame shaft dimension or smaller (TS)
M29F	Shorten shafts without reducing the overall diameter
Tach and encoder mounting kits	
M31D	Add encoder kit to inverter duty V*S Master or RPM AC motor
M31E	Additional mounted encoder options for IDRPM motors
Testing	
M32A	CSA C390 method 1 equivalent to IEEE 112 method B performance testing
M33A	Short motor test
M33B	Routine motor test
M33C	Complete performance test
M33D	Calibration test
M33E	Sound measurement test
Terminal blocks	
M35A	Install IEC terminal blocks in conduit box and connect leads
Starters	
	Add magnetic or manual starter to grinder or buffer
M36A	Starter – single phase
M36B	Starter – three phase
M36C	Magnetic starter – three phase
M36D	Overload protection for dust control unit
Shaft grounding	
M39A	Shaft grounding systems
M39B-1	Shaft grounding ring - bearing protection
M39C	Baldor-Reliance® shaft grounding brush assembly
M39D	Add shaft grounding ring's colloidal silver shaft coating to shaft
Check Total Indicated Runout (TIR)	
M40A	Check Total Indicated Runout (TIR)
ABB Ability™	
M43A	Install ABB Ability™ Smart Sensor for motors

SECTION 04

INSPECTION &

TESTING PLAN



The safe application and use of equipment supplied by Hartzell Air Movement, Inc. is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

Sales Order ID: 2521509

| 910 S. Downing St., Piqua, OH 45356 | 800.336.3267 | info@hartzell.com | www.hartzell.com |

Submittal Rev 1

Document: QMS-0175 Rev: 2

No.	Activity Description	Location	References to Applicable Procedures	Acceptance Criteria	Verifying Document(s)	-----Inspection Codes-----		Client Name	Approval Type
						Definition Key	Approval Type		
1	Order Receipt created by Customer Service from the order entered into the iERP system per customer request	Hartzell Air Movement	WI-CSR.014 Entering Orders into iERP	Customer Review of Sales Order Acknowledgement	Sales Order Acknowledgement	R	On Approval, SOA sent to Customer	R	Notification to Manufacturer within 1 working day if not acceptable
2	Receiving Inspection inspection on receipt to Purchase Order & any non-conformances are to be tagged for correction before entering into inventory	Hartzell Air Movement	WI-NV.027 - Receiving Inspection	No outstanding non-conformances	Purchase Order / Item Drawing or Specification (internal only)	R	If not approved, will be flagged for Non-Conformance and rectified before proceeding		
3	In Process Inspection each workcenter reviews work to Job Packet & tags any non-conformances to be corrected before progressing forward to next workercenter	Hartzell Air Movement	P.8.6.A - In-Process Inspection P.8.7 - Control of Nonconforming Material	No outstanding non-conformances	Job Packet / Item Drawing or Specification (internal only)	R	If not approved, will be flagged for Non-Conformance and rectified before proceeding		
4	Impeller Balance dynamic balancing of impeller to ensure or bring within set tolerances	Hartzell Air Movement	ES 3.6.4 - Single Plan Dynamic Balancing ES 3.6.5 - Double Plane Dynamic Balancing	Within Tolerance per ES 3.6.7 - Fan Balance Engineering Standard	Balancer Report	R	On Approval, Balancer Report is attached per Fan & sent with paperwork	R	Review on Receipt with Product
5	Assembly Inspection review of job packet to actual product and inspected per form for consistency	Hartzell Air Movement	WI-MFG.063 - Assembly Flow of Fans F-MFG.002 - Assembly / Inspection Worksheet	Fan Complete per Job Packet / drawings / specifications	Assembly / Inspection Worksheet	A	Approval to be recorded on Assembly / Inspection Worksheet per Fan & sent with paperwork	R	Review on Receipt with Product
6	Functional Fan Test startup, run and measure vibration of fan	Hartzell Air Movement	P.8.6 - Release of Products and Services	Within Tolerance per ES 3.6.7 - Fan Balance Engineering Standard	Test Report	R	On Approval, Test Report is attached per Fan & sent with paperwork	R	Review on Receipt with Product
7	Final Quality Control Inspection review of job packet to actual product and inspected per form for consistency	Hartzell Air Movement	P.8.6 - Release of Products and Services F-MFG.002 - Assembly / Inspection Worksheet	No discrepancies found	Assembly / Inspection Worksheet	A	Approval to be recorded on Assembly / Inspection Worksheet per Fan & sent with paperwork	R	Review on Receipt with Product

Inspection codes:

R = REVIEW - Appropriate records of activity shall be provided for review. Where practical, review of records shall take place progressively throughout the manufacture and test process.

W = WITNESS - Work may proceed on schedule should the representative fail to show for the activity. Notification of Witness points shall be in writing within the agreed upon time limit.

H = HOLD - Work shall not proceed beyond this point without written confirmation of waiver. Notification of Hold points shall be in writing within the agreed upon time limit.

M = MONITOR - Access shall be provided to allow surveillance on site. Monitoring activities are not restricted to specifically identified monitor points.

A = APPROVE - Approve documents or procedures

SECTION 05

GENERAL STORAGE INFORMATION



The safe application and use of equipment supplied by Hartzell Air Movement, Inc. is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

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Submittal Rev 1

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GENERAL FAN STORAGE PROCEDURES:

If fans are stored for any length of time, they should be stored in a clean, dry location to prevent rust and corrosion. Outdoor storage is not recommended. When outdoor storage is necessary, they should be protected from the elements. Cover the fan inlet and outlet, grease the bearings, and keep motors dry and clean.

EXTENDED STORAGE:

Fans are to be stored in their original containers or equivalent protection and should be kept in a clean, dry, protected warehouse where exercised control over temperature, dust, dew point, shock, and vibration is reasonably maintained.

A) Temperatures: Between 50 degrees F and 120 degrees F.

B) Maximum relative humidity: 60%

C) Shock or vibration: 2 mils maximum to prevent bearings from brinelling.

Exceeding this limit will require vibration-dampening material under the units.

Motor bearings (and fan bearings on belt drive units) are to be greased at the time of going into extended storage. Motor shafts (and fan shaft on belt drive units) are to be manually rotated every month and additional grease added, purging some grease from the bearing cavity every six (6) months. ***Grease in bearings is to be purged at time of removal from storage, making sure that an ample supply of fresh grease is in each grease cavity. Grease used must be compatible with that already in motor and fan bearings.***

All motors with space heaters are to have the heaters connected if storage conditions exceed 60% relative humidity and/or if temperatures are below 50 degrees F.

Motor windings should be meggered at the time the equipment is put in storage. At the time of removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Contact Hartzell Air Movement Warranty and Service Department if the motor resistance is less than 50% of the initial reading.

NOTE: Motors in storage may absorb moisture in their windings resulting in a significant loss of insulation resistance. THE APPLICATION OF POWER TO A MOTOR WITH INSUFFICIENT INSULATION RESISTANCE MAY RESULT IN DAMAGE TO THE MOTOR OR OTHER EQUIPMENT.

Storage records complying with the above requirements should be maintained.

If an extended warranty is desired, contact your local sales representative for charges and details.

Hartzell Air Movement does not recommend outdoor storage.

When outdoor storage is unavoidable, the fans should still be protected from the elements.

Hartzell recommends the steps be taken below for outdoor storage

1. All motors must be meggered prior to going into storage and the readings recorded in each fans data packet.
2. Verify that the knockout on the motor conduit box is facing down - and a threaded plastic plug added in the knockout – small holes drilled in plastic plug for space heater wires.
3. Fans must be stored at least 8" off the ground, such as on rail road ties

4. VERY IMPORTANT: Motor space heaters must be powered for warranty purposes.
5. The fans must be stored in a temporary lean-to type structure that will keep the elements directly off the fan but allow some air circulation. Tarping or covering the fan is not recommended as it can trap moisture that can find its way into the fan & motor bearings.
6. Fans (blade & motor) needs to be rotated by hand on a monthly basis / At least 7 to 8 rotations per fan
7. Fan Bearing Cavity Needs to Be Full of Grease (not motor bearings) Fans should have grease added to the fan bearing cavity prior to going into storage – when adding grease, the shaft needs to be rotating and the excess grease will purge from the outer race of the bearings
8. every six (6) months / 2 to 3 shots of fresh grease in each fan bearing while the fan blade is being rotated

For Warranty purposes - Storage Records complying with the above requirements should be maintained and must be provided to Hartzell prior to a warranty claim.

Once the fans are removed from storage and ready for installation, the motors should be meggered and the fan bearings completely re-greased as indicated in the storage procedure.

Note: If fans are stored longer than 12 months - After motors are meggered please contact Hartzell, for start-up instructions on the motors.

SECTION 06

INSTALLATION, OPERATION & MAINTENANCE MANUAL



The safe application and use of equipment supplied by Hartzell Air Movement, Inc. is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

Document: QMS-0175 Rev: 2



INSTALLATION, OPERATION, & MAINTENANCE MANUAL

Quality at Every Turn

Hartzell Air Movement										Contact		Website		
910 S. Downing Street Piqua, OH 45356-0919										1-800-336-3267 info@hartzell.com		www.hartzellairmovement.com		
HARTZELL PROPELLER FAN CO. PIQUA, OHIO DIV. OF CASTLE HILLS CORPORATION										DIRECT DRIVE VANEAXIAL FLOWERS USED ON SHOP DWG		RLS APR PATT DATE 4388 10-5-64		
VA26 548-S	VA21 261135 FR184Y	REVISION DRAWN	SKETCH BY	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4

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Submittal Rev 1

Document: QMS-0175 Rev: 2

THE HARTZELL DIFFERENCE

Building the highest quality fans in America for generations!

QUALITY AT EVERY TURN.

Hartzell Air Movement exceeds the standard in the air movement industry, committed to delivering top-quality, reliable products. And our relationship with our customers, and our knowledgeable, inventive, flexible and hardworking employees are the reasons we've continued and thrived, right here in the USA, for six generations.

Customers choose Hartzell for our:

- Durability and high performance
- Low cost of ownership
- Leadership in performance testing and certification
- Advanced engineering and manufacturing processes
- Innovative design and manufacturing
- Trusted brand name

Experienced Hartzell team to assist you from design to shipping

ISO 9001:2015 Certification
AMCA Accredited Laboratory
Complete Fans and Blowers
Centrifugal Wheels
Airfoil Propellers

HARTZELL ADVANTAGES

A LIFETIME OF VALUE

- Industrial fans are field proven, 100% tested, with virtually no incident of return
- Energy efficient designs that provide a lower total cost of ownership

LEADERSHIP IN PERFORMANCE

- Products certified by AMCA that meet DOE recommended efficiencies
- Highly efficient industrial fan designs that are the quietest in the market
- Airfoil shape blades with industry leading measured efficiencies

ADVANCED ENGINEERING & MANUFACTURING

- Proven manufacturing techniques on state of the art equipment in ISO 9001:2015 registered facilities
- Engineering team utilizes the latest design tools in 3D CAD and other modeling software

CREATIVE DESIGN & MANUFACTURING TEAM

- Offering the greatest number of industrial fan design choices
- Building products to meet your rigorous application; no limiting catalog

TRUSTED BRAND NAME

- Extensive talent pool bringing over 145 years of knowledge and experience to you

5-YEAR WARRANTY

- The industry's first and only manufacturer that stands behind their products for a full 5-years



ISO
9001:2015
REGISTERED



For more information, contact your local Hartzell Sales Representative. info@hartzell.com

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HARTZELL WARRANTY

LIMITED WARRANTIES, LIMITATION OF LIABILITY, AND LIMITATION OF LIABILITY FOR BREACH OF WARRANTY

NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS

Hartzell does not warrant that said goods are of merchantable quality or that they are fit for any particular purpose. There is no implied warranty of merchantability and there is no implied warranty of fitness.

The details of the Hartzell warranty can be found at
<http://www.hartzellairmovement.com/warranty-service>



Performance Guarantee

You have high expectations. So does Hartzell Air Movement. We know you demand the most reliable and durable industrial air movement products available, so we're holding ourselves to a higher standard. We're so sure that our products will out-perform industry standards, we're backing that promise with the industry's first five-year warranty. Call your Hartzell Air Movement representative for assistance.

Register for your 5year warranty at
<https://www.hartzellairmovement.com/warranty-and-parts/five-year-warranty>



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www.hartzellairmovement.com

Safety Accessories, Application, and Use Warning

The safe installation and operation of equipment supplied by Hartzell Air Movement is the responsibility of the system designer, installer, maintainer, and user. Since the application and use of its equipment can vary greatly, Hartzell Air Movement offers various product types, optional safety accessories, and sound performance data per laboratory tests.

Hartzell Air Movement sells its equipment with and without safety accessories, and accordingly, it can supply such safety accessories only upon receipt of an order. The need for safety accessories will frequently depend upon the type of system, fan location and operating procedures being employed.

The proper protective safety accessories to meet company standards, local codes, and the requirements of the Occupational Safety and Health Act must be determined by the user since safety requirements may vary depending on the location and application of the equipment. If applicable local conditions, standard, codes or OSHA rules require the addition of the safety accessories, the user should specify and obtain the required safety accessories from Hartzell Air Movement and should not allow the operation of the equipment without them.

Owners, employers, users, and installers should read "**RECOMMENDED SAFETY PRACTICES FOR USERS AND INSTALLERS OF INDUSTRIAL AND COMMERCIAL FANS**" published by the Air Movement Control Association, International, 30 West University Drive, Arlington Heights, Illinois 60004. A copy of this publication is enclosed with each fan shipped from Hartzell Air Movement, and is available upon request at Hartzell's office in Piqua (937-773-8494).

Please contact Hartzell Air Movement or your local Hartzell representative for more information on product types, safety accessories, and sound performance estimates.

Remember, the selection of safety accessories and the safe installation, application and operation of equipment supplied by Hartzell Air Movement is your responsibility.
This warning supersedes all previous editions.



INSTALLATION, OPERATION & MAINTENANCE MANUAL

Introduction

The purpose of this manual is to aid in the proper installation and operation of fans manufactured by Hartzell Air Movement. These instructions are intended to supplement good general practices and are not intended to cover detailed instruction procedures, because of the wide variety and types of fans manufactured by Hartzell Air Movement.

The safe installation and operation of fans is the responsibility of the system designer, installer, maintainer, and user. From the initial system design through the life of the equipment, safety should be a foremost consideration. Some areas, which require some special attention, include system design, layout and construction, fan performance specifications, foundation and installation details,

storage procedures, start-up and commissioning procedures, operation, maintenance, and repair.

Handling and installation should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury.

Contact your local Hartzell representative for further assistance.

Shipment and Receiving

All equipment shipped from Hartzell Air Movement is prepared for shipment in accordance with the requirements of the commercial carrier and/or any special considerations required by the nature of the product.

The Bill of Lading or Express Receipt is an acknowledgment by the Transportation Company of the receipt in GOOD CONDITION, meeting the above requirements for the shipment covered by our invoice.

Our responsibility for the shipment has now ceased. We will not be responsible for loss or damage when you give the Transportation Company a clear receipt. (Standard conditions of sale are F.O.B. factory, unless other terms have been quoted and purchased).

Thoroughly inspect all shipments as soon as received.

Keep a record of all equipment received, including inspection details and date of receipt, because of the possibility of partial shipments.

If any of the items called for in the Bill of Lading or Express Receipt are short or damaged, do not accept them until the Freight or Express Agent makes a Damage or Short Shipment Notification on your freight bill or express receipt.

If any concealed loss or damage is discovered, **NOTIFY YOUR FREIGHT OR EXPRESS AGENT AT ONCE** and request an inspection. This is absolutely necessary. Unless you do this, the transportation companies will not entertain any claim for loss or damage. If the agent will not make an inspection, then you should make an Affidavit to the effect that you notified the agent on that particular date and the agent failed to show up. This, with your aforementioned documentation, will properly support your claim.

We will assist you in every possible manner in collecting claims for loss or damage, however, this does not make us responsible for collection of claims or replacement of material.

Handling

Handle your equipment with care. Some fans are provided with lifting lugs or holes for easy handling. Others must be handled using nylon straps or well-padded chains and cables, which protect the fan's coating and housing. Spreader bars should be used when lifting large parts.

Axial Fans

Axial fans should be lifted by using straps around the fan housing only.

DO NOT LIFT AXIAL FANS BY THE MOTOR, MOTOR BASE, PROP OR FLANGES.

Centrifugal Fans

Centrifugal fans are best lifted using one strap under the fan's scroll and another strap around the bearing base. **DO NOT LIFT CENTRIFUGAL FANS BY THE FAN SHAFT, WHEEL, FLANGES OR INLET SUPPORT.**

Roof Ventilators

Roof ventilators should be lifted by using straps around the fan housing or base only. Spreader bars should also be used to avoid damage to stack caps or hoods. **DO NOT LIFT ROOF VENTILATORS BY THE STACK CAP OR HOOD.**

Storage

If fans are stored for any length of time, they should be stored in a clean, dry location to prevent rust and corrosion. Outdoor storage is not recommended. When outdoor storage is necessary, they should be protected from the elements. Cover the fan inlet and outlet, grease the bearings, and keep motors dry and clean.

Extended Storage

Fans are to be stored in their original containers or equivalent protection and should be kept in a clean, dry, protected warehouse where exercised control over temperature, dust, dew point, shock, and vibration is reasonably maintained.

CONDITIONS

- Temperatures: Between 50° F. and 120° F. | Between 10° C. and 49° C.
- Maximum relative humidity: 60%.
- Shock or vibration: 2 mils maximum to prevent bearings from brinelling.
Exceeding this limit will require vibration-dampening material under the units.

Motor bearings (and fan bearings on belt drive units) are to be greased at the time of going into extended storage. Motor shafts (and fan shaft on belt drive units) are to be manually rotated every month and additional grease added, purging some grease from the bearing cavity every six (6) months. *Grease in bearings is to be purged at time of removal from storage, making sure that an ample supply of fresh grease is in each grease cavity.*
Grease used must be compatible with that already in motor and fan bearings (See Page 24).

All motors with space heaters are to have the heaters connected if storage conditions exceed 60% relative humidity and/or if temperatures are below 50 degrees F.

Motor windings should be meggered at the time the equipment is put in storage. At the time of removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Contact Hartzell Air Movement Warranty and Service Department if the motor resistance is less than 50% of the initial reading.

NOTE: Motors in storage may absorb moisture in their windings resulting in a significant loss of insulation resistance. THE APPLICATION OF POWER TO A MOTOR WITH INSUFFICIENT INSULATION RESISTANCE MAY RESULT IN DAMAGE TO THE MOTOR OR OTHER EQUIPMENT.

Storage records complying with the above requirements should be maintained.

If an extended warranty is desired, contact your local sales representative for charges and details.

Installation

Centrifugal Fans should always be mounted to a flat, level, and rigid structure. The fan base should be shimmed and leveled. Gaps between the foundation and fan base should be grouted. This will ensure permanent alignment and a smooth-running, vibration-free fan, as well as minimize maintenance costs. Failure to properly install the fan base can contribute to excessive vibration.

Poured concrete foundations are recommended, wherever practical, for floor mounted fans. If vibration isolators are required, they should be installed between the fan and the foundation. Tighten all mounting bolts securely with lock washers and lock nuts.

Fans mounted off ground level should be rigidly mounted to a structural platform and be placed as near as possible to or over, a solid wall or column. Supports for suspended fans must be cross-braced for live load support to prevent side sway.

For roof mounted fans, place the fan curb panel on the roof curb, level, and then anchor the unit to the curb using lag screws, neoprene washers, and flat washers. It is recommended that stacks be independently mounted to the roof and use guy wires to prevent side sway.

AVOID SUPPORTING A STACK DIRECTLY ON THE FAN FLANGE.

In both axial and centrifugal fans, inlet and outlet ducts should be independently supported, and never supported by the fan flanges. Flexible duct connections are recommended. These connections will also minimize noise. The independent mounting of stacks and ducts to the fan flanges will assure that the fan will not be subjected to external forces which may twist or deform the fan housing. This also will ensure that the impeller will not strike the housing or cause misalignment of the sheaves and bearings.

It is recommended that access doors be placed in ductwork just ahead of the fan inlet and just downstream from the fan outlet for ease of inspection and maintenance. Access doors in a duct system should never be opened with the fan running, to avoid possible equipment damage and personal injury.

No turns in ductwork should be closer than 2.5 fan diameters away from the inlet or outlet of a fan. Walls or flat surfaces should also not be closer than one fan diameter from the inlet side.

Branch entries into the main duct should be spaced such that they do not enter directly opposite each other. A maximum of 45 degree angle between main branch and entering branch should be used as a guideline. Avoid sudden changes in duct size. Use a 15 degree included angle, or less, in reducing a duct to a fan, and not more than 30 degrees included angle on the discharge. Elbow turns should be kept to a centerline radius of at least one and one-half diameters of the duct.

Electrical connections for the fan motor must be connected by a qualified electrician, conforming to the National Electrical code and local codes and practices. When making electrical connections, the motor must be connected following electrical characteristics as indicated by the motor nameplate, and adhere to the wiring diagram on the motor nameplate or in the motor terminal box. ***Motors may fail immediately if improperly connected.*** It is also recommended that an overload device to protect the motor be installed between the current supply and the motor. Recommended tolerances for overload devices should be plus 10% of the motor full load amperage rating, including the allowance for the motor service factor.

NOTE: It is common for motors to draw several times full load amperage during startup, for approximately fifteen seconds. Larger sized fans may require twenty seconds or longer.

Startup

- Lock out the primary and all secondary power sources.
- A complete inspection should be made of all ductwork and the fan interior.
Make certain there is no foreign material, which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures may include the use of goggles, respirators, or other personal protective devices.
- Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices.
- Check and tighten all bolts, fasteners, and set screws as necessary. **NOTE: Forces encountered during shipment, handling and rigging can disturb factory settings.**
- Check the fan assembly and bearings for proper grounding to prevent static electrical discharge. **NOTE: This is especially important when using FRP fans.**
- Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.
- Check bearings for recommended lubricant and lubrication amount.
- Clearance should be checked between the impeller and fan housing. Spin the impeller to determine whether it rotates freely, without hitting anything, and is not grossly out of balance. **NOTE: Prior to shipment, all fans have been thoroughly inspected and have passed stringent operation and balance tests.**
- Inspect the impeller for proper rotation for the fan design. Arrows to show direction of rotation and airflow are attached to the fan housings.
- Check the belt drive for proper sheave selection and installation. Make sure the sheaves are not reversed (excessive speeds could develop).
- Check alignment of drives and all other components.
- Properly secure all safety guards.
- Assure that all appropriate warnings have been put in place.
- Secure all access doors to the fan and ductwork.

Confirm all inlet and outlet dampers connected to the fan system are open before powering up the fan.

- Restore power and momentarily energize the fan to check the direction of rotation.
Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

- Switch on the electrical supply and allow the fan to reach full speed. **Check carefully for:**
 - (1) Excessive vibration; (2) Unusual noise; (3) Proper amperage, voltage, or power values.
If any problem is indicated, SWITCH OFF IMMEDIATELY. **NOTE: It is normal for belt drive fans to squeal briefly during startup.** If no problems are found, while the fan is running, add grease to the fan bearings until the grease purges from the outer seal.
- Lock out power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for cause of the trouble, correct as necessary, and repeat check list procedure. (Ref. Page 27 Trouble Shooting chart)

NOTE: *The fan should not need balancing, as it was balanced at the factory to be within stringent vibration levels before shipment. However, there are several things that may cause vibration, such as rough handling in shipment and erection, weak foundations, and alignments. It is recommended that the vibration levels be checked with a vibration analyzer to verify that the vibration is within levels recommended later in this manual. (See Page 23, Table 1).*

- Even if the fan appears to be operating satisfactorily, shut it down after a brief period, lock out the power supply, and re-check startup procedures, as the initial start-up may have loosened the bolts, fasteners, and set screws.
- The fan may now be put into operation, however during the first eight hour of operation, it should be closely observed and checked for excessive vibration and noise. At this time checks should be made of motor input current and motor bearing temperatures to ensure that they do not exceed manufacturer's recommendations.
- After eight hours of operation, the fan should be shut down and the power locked out. Recheck startup procedures and adjust, as necessary.
- After twenty-four hours of satisfactory operation, the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension (See Page 20).

Maintenance

Periodic inspection of all the fan parts is the key to long life and trouble-free fan operation. Frequency of inspection must be determined by the user and is dependent upon the severity of the application. Prepare a maintenance schedule and make sure it is strictly adhered to.

**NEVER SERVICE OR ADJUST ROTATING EQUIPMENT WHILE IT IS IN OPERATION.
LOCK OUT THE POWER SOURCE BEFORE PERFORMING MAINTENANCE.**

REGULAR FAN MAINTENANCE:

- Check the fan impeller for any buildup of foreign material or wear from abrasion. Both can cause excessive vibration which will lead to damage of the impeller and other fan components. Replace the impeller if excessive wear is noticed. Carefully clean the impeller of any foreign material.
- Check V-belt drives for proper alignment, tension, and excessive wear.
- Lubricate the fan bearings per the Hartzell Lubrication schedule.
- Lubricate the motor bearings per the motor manufacturers recommendations for grease type and intervals.
- Consult the trouble shooting guide for excessive vibration or noise, insufficient performance, or when the fan does not operate (See Page 27 Trouble Shooting Chart).
- Tighten all bolts and setscrews.

For arrangement 8 fans only: Lubricate the coupling per the coupling manufacturers recommendations for grease type and intervals. Also, check for proper alignment.

Bearings and Lubrication

All Hartzell belt drive fan bearings are heavy duty, self-aligning ball or roller type, selected for on the fan size, motor horsepower, and performance, and are re-lubricable for continuous service.

Selection of the correct bearing grease and greasing intervals depends on several factors. Extreme high or low temperatures, dirty or damp surroundings, and excessive vibration exceeding the "fair" levels in Table 1 are all things that will require more frequent greasing or special greases. (Refer to Page 24 for recommended greases and greasing intervals.)

The motor bearings and the fan bearings on the belt drive fans should be greased at regular intervals. Motor manufacturers' greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. Do not over-grease. Limit the use of hand guns to those with a rating of 40 psi or less. Rotate bearings during lubrication where good safety practice permits.

NOTE: *On motors with non-regreasable sealed bearings, no lubrication is required for life of the bearings.*

The most frequent causes of bearing failure are not greasing often enough, using incompatible greases or excessive belt tension. Excessive vibration, especially if the bearing is not rotating, will also cause bearings to fail. Bearings must also be protected from water and moisture to avoid internal corrosion.

NOTE: *It is typical for some anti-friction bearings to exhibit a running surface temperature in excess of 140 deg. F. This surface will be too hot to touch, but is not a cause for alarm.*

Bearing Replacement

Fan bearings on belt drive fans should not need to be replaced for many years if the above recommendations are strictly adhered to. However, use the following procedure when bearing replacement is necessary.

PROCEDURE:

- Lock out power source.
- Gain access to the fan bearings. On ducted axial flow fans, the fan probably will have to be removed from the duct system. Remove the bearing cover, if any.
- Loosen the belts by shifting the motor.
- Remove the impeller and disconnect the lube tubes.
- Remove the shaft and bearing assembly. Note the position of the bearing shims, if applicable.
- Measure the location of the bearing to the impeller end of the shaft and the bearing spacing.
- Loosen all bearing/shaft setscrews or other locking device.
- Remove bearings (may have to be pressed off the shaft).
- Polish the shaft with fine emery paper (240 Grit or finer) and file the setscrew dimples smooth.
- Install new bearings on the shaft, making sure that the collars are together, (i.e., facing each other on the shaft) and set screws are in line with each other. Lightly seat one setscrew on each bearing to hold in the approximate position from above.
- Mount the shaft/bearing assembly in the fan, on shims, with bolts.
Do not tighten yet - snug up only. Loosen the setscrews.
- Center the shaft in the housing (both ends) as closely as possible and shim where necessary.
The fan impeller may need to be temporarily installed to get the clearances equal.
- Tighten the bearing mounting bolts.
- With a soft-faced mallet, tap the shaft between the bearings while turning the shaft by hand to align the bearing races. The shaft must turn freely. Tighten all bearing setscrews. Spin the shaft again, making sure it turns freely.
- Reinstall the lube tubes.
- While rotating the shaft, purge bearings with fresh grease (Ref. Page 24).
- Install bearing cover, impeller, and belts, and adjust the motor to get proper belt tension.
Also, make sure that the sheaves are properly aligned. (See V-belt drives , Pages 17-19).

Carefully following this procedure will ensure trouble-free service.

V-Belt Drives

V-belts on Hartzell belt drive fans are oil, heat, and static resistant type, and oversized for continuous duty. With proper installation and maintenance, years of operating efficiency can be added to the life span of the V-belt drive.

V-belt drives must be completely guarded before applying power to the fan.

A noisy V-belt indicates the need for attention. V-belt noise can be caused by the slapping of the belts against the drive guard or other obstruction. Check for an improperly installed guard, loose belts, buildup of foreign material in the sheave grooves, or excessive vibration. The cause of excessive vibration should be determined and corrected. **NOTE:** *It is normal for belts to squeal briefly at startup.*

Check belt tension often. Ideal tension is the tension at which the belt will not slip under peak load conditions. Over-tensioning shortens belt and bearing life. Keep belts free from foreign material which may cause slipping. The use of belt dressing is not recommended (See Page 20 for recommended tensioning).

Inspect sheaves often. Keep all sheaves grooves smooth and uniform. Burrs and rough spots along the sheave rim can damage belts. Dust, oil, and other foreign matter can lead to pitting and rust, and should be avoided as much as possible. Badly worn grooves or a shiny groove bottom indicates that the sheave, belt, or both are badly worn. Replace any belts and worn sheaves.

Check the sheave alignment. Sheaves that are not aligned properly cause excessive belt wear and sheave wear.

V-Belt Drive Replacement

Whether you are just installing new belts or a completely new drive, worn bearings, bent shafts, or other components that might cause future problems should be replaced at this time. If installing belts only, check existing sheaves carefully for worn grooves or other damage.

Although alignment is not as critical in V-belt drives as in drive types, proper alignment is essential to long belt and sheave life. **NOTE: Loose belts or misalignment can cause fan vibration.**

First, make sure that drive shafts are parallel. *The most common causes of drive misalignment are nonparallel shafts and improperly located sheaves.* Where shafts are not parallel, belts on one side are drawn tighter and pull more than their share of the load. As a result, these belts wear out faster, requiring the entire set to be replaced before it has given maximum service. If misalignment is in the sheave, belts will enter and leave the grooves at an angle, causing excessive belt and sheave wear. (See Page 19, Figure 1).

Shaft alignment can be checked by measuring the distance between the shafts at three or more locations. If the distances are equal, then the shafts will be parallel.

To check the location of the sheaves on the shaft, a straightedge or a piece of string can be used. If the sheaves are properly lined up, the string will touch them at the points indicated by the arrows (See Page 19, Figure 2). Rotating each sheave a half revolution will determine whether the sheave is wobbly or the shaft is bent. Correct any misalignment.

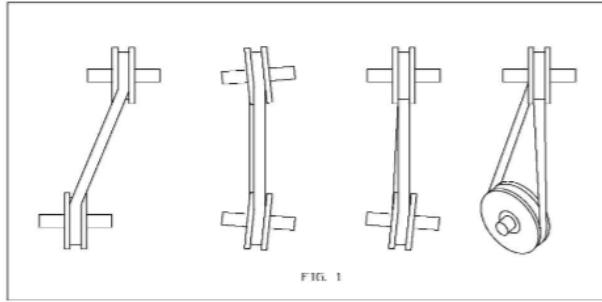
Always use matched belts and never mix new and used belts on a drive. Always replace belts with the right type of V-belt. Install belts correctly. When belts are forced into the sheave with a screwdriver or other wedge, the outer fabric is often ruptured and cords broken. It is well worth the time to move the driver unit closer so the V-belts can be slipped easily into the sheave groove without damage. Shorten the center distance between the driven and driver sheave so the belts can be put on without the use of force. While the belts are still loose on the drive, rotate the drive until all the slack is on one side. Then increase the center distance until the belts are snug. The drive is now ready for tensioning.

Tension the belts as indicated on Page 20. **NOTE:** Never "roll" or "pry" the belts into the sheave grooves. This can damage the belt cords and lead to belt turnover, short life, or actual breakage. Moreover, it is both difficult and unsafe to install belts this way. Keep take-up rails, motor base, or other means of center distance adjustment free of dirt, rust, and grit. Lubricate adjusting screws and slide rails from time to time.

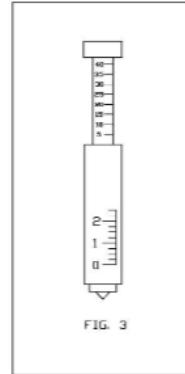
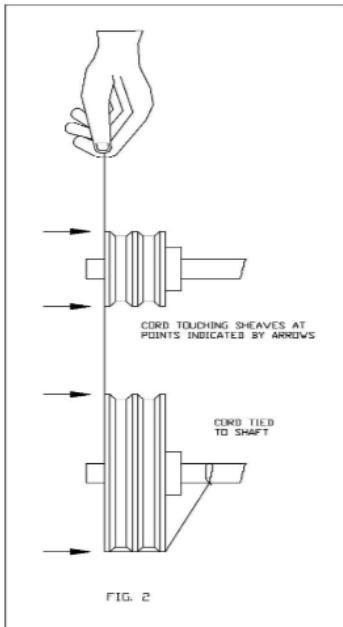
Tighten all sheave bolts and setscrews before reconnecting the power. **NOTE:** All sheave bolts, setscrews, and belts should be checked and tightened if necessary after two days of initial operation.

IMPORTANT:

DO NOT INCREASE THE FAN SPEED BEFORE FIRST CONTACTING THE HARTZELL FACTORY. ARBITRARILY SPEEDING UP THE FAN CAN CAUSE MOTOR OVERLOAD, FAILURE, AND POTENTIAL IMPELLER FAILURE.

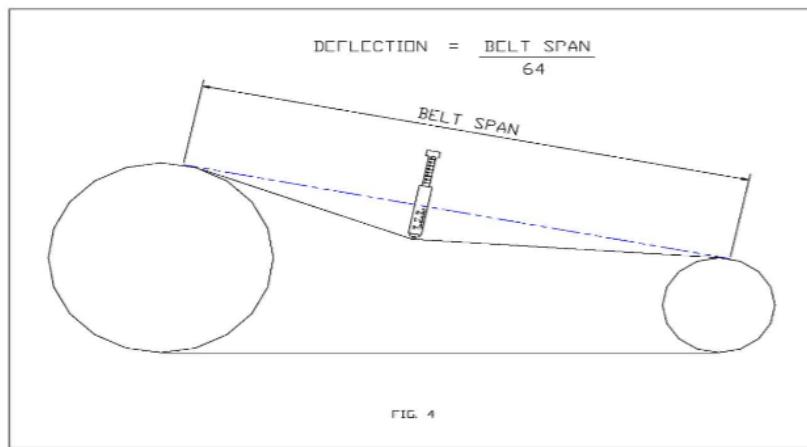


Sheave and Belt Alignment



Belt tensioning tool

Sheave and Belt Alignment



How to check for proper belt tension

Installing, Tensioning, and Checking V-Drives

GENERAL DRIVE TENSIONING GUIDELINES:

- Ideal tension at which the belt will not slip under peak load conditions.
- Over tensioning shortens belt and bearing life.
- Keep belts free from foreign material which may cause slipping.
- Make periodic V-Drive inspection, tension when slipping.
The use of belt dressing is not recommended.
- Before installing a new set of V-Belts, check the condition of the sheaves. Dirty or rusty sheaves impair the drives efficiency and abrade the belts, resulting in premature failure. Also, worn sheaves can shorten the belt life as much as 50%.
- Do not use a new or used belt as replacement for a unit of a set. If a belt breaks, a new set of matched belts is necessary. Always replace belts with the same kind as originally provided
- After properly tensioning the belts, double-check to be sure the sheave grooves are correctly aligned, and that all shafting is parallel.

INSTALLATION AND CHECKING METHODS

VISUAL METHOD

1. When installing belts, reduce the center distance so that the belts may be placed in the sheave grooves without forcing. Arrange the belts so that the top and bottom spans have about the same amount of sag. Apply tension to the belts by increasing the center distance until belts are snug and have a live springing action when struck with the hand.
2. Operate the drive a few minutes to seat the belts in the sheave grooves. Observe the operation of the drive under its highest load conditions (usually starting). A slight bowing of the slack side of the drive indicated adequate tension. If the slack side remains taut during the peak load, the drive is too tight
3. New drive tension should be checked several times during the first 24 hours of operation, by observing the slack side span.

INSTALLATION AND CHECKING METHODS CONT.

TENSION GAGE METHOD

When a tension gage is available and the center of the belt span is accessible, the following method may be used. To determine the pounds force required to properly tension a drive with a belt tensioner, proceed as follows:

1. Measure the belt span as shown and calculate the deflection inches using the given equation. Set the large O-Ring for calculated inches of deflection.
2. Set small O-ring at O and press down the belt tensioner at center of belt span as shown.
 - On a single belt drive, compress the belt tensioner until the large O-ring is even with bottom of a straight edge placed across the outside edge of the two sheaves.
 - On multiple belt drive, compress the belt tensioner until large O-ring is even with the top of the next belt. Average readings from all belts is the value to use in the tables below.
3. Remove tension gage and observe the new position of the small O-ring. Set at the number of deflection pounds for the set number of inches.
4. Compare this reading, or the average of several readings in the case of multiple belts, to the new/used values in the tables below for the proper belt cross section. If readings do not fall in this range, readjust the belt tension as described and repeat measurement.

Example:

1. Belt span = 64 in. and small sheave is 8 in. pitch diameter with Type B notched belts at 3000 RPM.
2. $64 \text{ in.} / 64 = 1"$ required deflection.
3. Set large O-ring at 1" on gage inch scale.
4. Set small O-ring at zero on plunger.
5. Press down on belts with gage until large O-ring is even with the next belt, or a straight edge, whichever the case may be. With multiple belts, several readings are needed to get an average.
6. Use the pound force reading or average of several readings required for 1" deflecting in the tables below.
7. The "B" belt table for 8" pitch diameter small sheave should have a deflection force between 7.3 lbs and 10.9lbs.
8. Increase or decrease the tension on belts until the deflection force is between 7.3 lbs and 10.9 lbs

Installing, Tensioning, and Checking V-Drives (REF. Pg 19)

Figure 3

CROSS SECTION	SMALLEST SHEAVE DIA. (in.)	RPM RANGE	BELT DEFLECTION FORCE			
			STD. BELTS		NOTCHED BELTS	
USED	NEW	USED	NEW			
3V , 3VX	2.0 - 2.4	1000-2500	-	-	3.3	4.9
		2501-4000	-	-	2.9	4.3
	2.65 - 3.65	1000-2500	3.6	5.1	4.2	6.2
		2501-4000	3.0	4.4	3.8	5.6
	4.12 - 6.90	1000-2500	4.9	7.3	5.3	7.9
		2501-4000	4.4	6.6	4.9	7.3
	4.4 - 6.7	500-1749	-	-	10.2	15.2
		1750-3000	-	-	8.8	13.2
		3001-4000	-	-	5.6	8.5
5V , 5VX	7.1 - 10.9	500-1740	12.7	18.9	14.8	22.1
		1741-3000	11.2	16.7	13.7	20.1
	11.8 - 16.0	500-1740	15.5	23.4	17.1	25.5
		1741-3000	14.6	21.8	16.8	25.0
8V	12.5 - 17.0	200-850	33.0	49.3	-	-
		851-1500	26.8	39.9	-	-
	18.0 - 22.4	200-850	39.6	59.2	-	-
		851-1500	35.3	52.7	-	-

Figure 4

CROSS SECTION	SMALLEST SHEAVE DIA. (in.)	RPM RANGE	BELT DEFLECTION FORCE			
			STD. BELTS		NOTCHED BELTS	
USED	NEW	USED	NEW			
A. AX	3 - 3.6	1000-2500	3.7	5.5	4.1	6.1
		2501-4000	2.8	4.2	3.4	5.0
	3.8 - 4.8	1000-2500	4.5	6.8	5.0	7.4
		2501-4000	3.8	5.7	4.3	6.4
B. BX	5.0 - 7.0	1000-2500	5.4	8.0	5.7	9.4
		2501-4000	7.4	7.0	5.1	7.6
	3.4 - 4.2	860-2500	-	-	4.9	7.2
		2501-4000	-	-	4.2	6.2
C. CX	4.4 - 5.6	860-2500	5.3	7.9	7.1	10.5
		2501-4000	4.5	6.7	7.1	9.1
	5.8 - 8.6	860-2500	6.3	9.4	8.5	12.6
		2501-4000	6.0	8.9	7.3	10.9
D	7.0 - 9.0	500-1740	11.5	17.0	14.7	21.8
		1741-3000	9.4	13.8	11.9	17.5
	9.5 - 16.0	500-1740	14.1	21.0	15.9	23.5
		1741-3000	12.5	18.5	14.6	21.6
	12.0 - 16.0	200-850	24.9	37.0	-	-
		851-1500	21.2	31.3	-	-
	18.0 - 20.0	200-850	30.4	45.2	-	-
		851-1500	25.6	38.0	-	-

Motors

The fundamental principle of electrical maintenance is **KEEP THE MOTOR CLEAN AND DRY**. This requires periodic inspection of the motor, the frequency of which depends upon the type of motor and the service.

Periodic checks of voltage, frequency, and current is recommended. Such checks assure the correct frequency and voltage applied to the motor, and yield an indication of the fan load. Comparison of this data with previous data will give an indication of the fan performance. Any serious deviations should be investigated and corrected.

Fractional motors usually have pre-lubricated sealed bearings with no grease fittings and are lubricated for life.

Lubricate integral horsepower motors per the motor manufacturer's recommendations. Lubrication frequency depends on the motor horsepower, speed, and service. Use compatible greases (See Page 24). Do not over grease.

If the motor is totally enclosed fan cooled (TEFC), non-ventilated (TENV), or air over (TEAO), it is recommended that the condensation drain plugs be removed. This is not necessary with motors equipped with automatic drains, which should be left in place as received.

Vibration

Excessive fan vibration can be caused by many things. **ALL POSSIBLE SOURCES OF THE EXCESSIVE VIBRATION MUST BE CHECKED OUT AND CORRECTIVE ACTION TAKEN IMMEDIATELY TO CORRECT THE PROBLEM.** See the fan trouble-shooting chart (Table 2) for possible causes of excessive fan vibration.

A vibration analyzer will be of great assistance in determining the amount of vibration. The following values give an indication of the fan vibration condition. Vibration readings should be taken on the fan bearings (if possible, on belt drive fans), or motor (on direct drive fans), or on the fan housing of ducted axial type fans. Horizontal, vertical, and axial readings should be taken. The following guidelines are based on AMCA Std. 205, Balance Grade BV-3.

Table 1

Vibration displacement in peak velocity, inches/sec (mm/s) - Filter out		
Condition	Rigidly Mounted	Flexibly Mounted
Start Up	0.25 (6.4)	0.38 (8.8)
Alarm	0.40 (10.2)	0.65 (16.5)
Shut-Down	0.50 (12.7)	0.70 (17.8)

NOTE: *The fan should not be operated if the vibration levels are at or above the Shut-Down range.*

Grease Lubrication Schedule

Lubrication guidelines for horizontal shaft, grease lubricated fan, blower or other high speed rotating equipment. Lubrication guidelines for vertical shaft -- see note below.

Bearing Lubrications: Linkbelt

Lubrication Schedule (Months)* - Spherical Roller Bearing - Solid Pillow Blocks									
Shaft DIA	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1" Thru 1 ^{7/16"} (25 - 35)	6	4	4	2	1	1	1	1	1/2
1 ^{11/16"} thru 2 ^{3/16"} (40 - 55)	4	2	1 ^{1/2}	1	1/2	1/2	1/2	1/2	1/2
2 ^{7/16"} thru 3 ^{7/16"} (60 - 85)	3	1 ^{1/2}	1	1/2	1/2	1/2	1/2		
3 ^{15/16"} thru 4 ^{15/16"} (90 - 125)	2 ^{1/2}	1	1/2	1/4					

*Suggested lubrication interval under ideal continuous operating conditions. Lubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on conditions of purged grease. Use one-half of listed interval or vertical shaft applications or for 24 hour operation. House of operation, temperature and surrounding conditions will affect the lubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 lithium-base grease (SEE BELOW)
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection
3. Any lubrication requirements noted on the general assembly drawing supersede requirements found here.

Lubrication Schedule (Months)* - Ball Bearing Pillow Blocks									
Shaft DIA	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1/2" Thru 1 ^{11/16"} (13 - 45)	6	6	5	3	3	2	2	2	1
1 ^{15/16"} thru 2 ^{7/16"} (50 - 60)	6	5	4	2	2	1	1	1	1
2 ^{11/16"} thru 2 ^{15/16"} (65 - 75)	5	4	3	2	1	1	1		
3 ^{7/16"} thru 3 ^{15/16"} (80 - 100)	4	3	2	1	1				

*Suggested lubrication interval under ideal continuous operating conditions. Lubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on conditions of purged grease. Use one-half of listed interval or vertical shaft applications or for 24 hour operation. House of operation, temperature and surrounding conditions will affect the lubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 lithium-base grease
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to avoid corrosion protection. Any lubrication requirements noted on the general assembly drawing supersede requirements found here.

Roller Bearing Units Series P-LB6800

Relubrication Interval			Operating Speed (RPM)				
Shaft Size Range		Amt. of Grease		Max RPM			
Inches	mm	Cu. In.	Cu. cm.	6 mos	4 mos	2 mos	1 mo
1 7/16 - 1 1/2	40	0.3	4.9	2400	3600	5000	5500
1 11/16 - 1 3/4	45	0.3	5.0	2200	3300	4500	5000
1 15/16 - 2	50	0.4	6.6	2000	3000	4000	4500
2 3/16 - 2 1/4	60	0.8	12.7	1700	2500	3400	3800
2 7/16 - 2 3/4	65	0.8	12.3	1450	2200	3000	3400
2 11/16 - 2 3/4	70	0.9	14.3	1350	2000	2800	3200
2 15/16 - 3	75	1.2	19.7	1300	1900	2600	3000
3 3/16 - 3 1/4	80	1.7	27.4	1200	1800	2400	2700
3 7/16 - 3 1/2	90	2.3	37.7	1100	1650	2200	2300
3 11/16 - 4	100	3.1	50	1000	1500	1950	2100
4 3/16 - 4 1/4	110	4.2	70	900	1350	1850	1900
4 7/16 - 4 1/2	115	5.5	90.1	840	1250	1700	1800
4 15/16 - 5	125	6.4	105	780	1150	1600	1700
Clean and repack intervals				5 yrs	3 yrs	2 yrs	1yr

*Suggested lubrication interval under ideal continuous operating conditions. Remove bearing cap and observe condition of used grease after lubricating. Adjust lubrication frequency as needed. Use one-half of listed interval for vertical shaft applications for 24 hour operation. Hours of operation, temperature and surrounding conditions will affect the lubrication frequency required. Clean and repack bearings annually. Remove old grease, pack bearing full and fill housing reservoir on both sides of bearings to bottom of shaft.

1. Lubricate with a high quality NLGI No. 2 lithium-base grease.
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.
3. Purge or remove old grease when changing lubrication brands or types
4. Any lubrication requirements noted on the general assembly drawing supersede requirements found here.

Static Oil Lubrication:

1. Use only high quality mineral oil with a VG grade indicated on the customer submittal drawing.
2. Static oil level should be at the center of the lower-most roller (do not overfill).
3. Complete lubrication change should be made annually.

Note:

1. These are general recommendations only; specific manufacturer's recommendations may vary slightly.
2. Assumes clean environment, -20°F. to 120°F.
 - A. Ambient temperature greater than 120°F. Will shorten bearing life.
 - B. Under extremely dirty conditions, lubricate more frequently.
3. Assumes horizontal mounting configuration. For vertically mounted applications, lubricate twice as frequency.
4. Lubrication intervals are based on 12 hr. per day operations at a maximum temperature of 160 F hosing temperature.
 - A. For 24 hour per day operation, the intervals shall be cut in half.
5. Any type of warranty claim must be accompanied with Maintenance Log and Maintenance Schedule.
6. During storage or long term shutdowns Fan shaft bearings are to be manually rotated every month and additional grease added, purging some grease from the bearing cavity every six (6) months. Grease in bearings is to be purged at the time of removal from storage, making sure that an ample supply of fresh grease is in each grease cavity. Grease used must be compatible with that already in fan bearing.
7. Refer to Assembly/Inspection worksheet for type grease used when assembled.

Sealmaster - **High Temp:** Mobilith SHC 220, Lithium Complex, NGLI #2, ISO 220 synthetic oil viscosity
Standard Application: Lithium Complex, NGLI #2 ISO 110-120 oil viscosity

Rexnord - **High Temp:** Exxon/Mobil SHC 100 which is also a NLGI 2 grade grease made with lithium complex base and synthetic oil up to 300F
Standard Application: Exxon/Mobil Ronex MP NLGI 2 grade lithium complex -40F to +225F.

For all other Bearing manufacturers, see Assembly and Inspection Sheet or contact Hartzell

Grease Lubrication Schedule Cont.

Lubricate with a premium quality NLGI 2 or 3 multi-purpose ball bearing grease having corrosion inhibitors, anti-oxidant additives and mechanical stability for high speed operation. The grease should also have a minimum base oil viscosity of 500 SUS at 100° F and be suitable to operate continuously at 225° F. Do not use a heavy, long fibered grease.

The bearings on this fan shaft have been greased at the factory for the following application:

- General Purpose (Shell Oil-Shell Gadas S2 V220 2)
- High Temperature (Shell Oil-Aeroshell #22 (-85° F. to 400° F. | -65° C. to 204° C)
- Low Temperature (Shell Oil-Aeroshell #22 (-85° F. to 400° F. | -65° C. to 204° C)
- Extreme Moisture (Shell Oil-Shell Gadas S2 V 220 2)
- Other: _____

(Replaces Shell Alvania Grease EP2)

These units are pre-lubricated (except Series P-LB6800) with a multi-purpose Lithium soap grease. When re-lubricating with greases of different types (especially synthetic soaps or oils), complete flushing is recommended.

The presence of dirt, moisture or chemical fumes around the bearings requires more frequent lubrication. Ambient temperatures below 20° F or above 200° F require special lubricants. Consult the machinery manufacturer for recommendations.

When vibration exceeds 0.15 in./sec., frequent lubrication is required and a need for equipment trim balancing may be indicated.

Fill bearings with lubricant prior to extended shutdown or storage. Rotate the shaft several revolutions each month during idle periods.

***Note: It is possible to dislodge the seals on these units if grease is added too fast.
It is preferable to use a hand gun or a regulated automatic system.***

Vertical Shafts:

For vertical applications more frequent re-lubrication is required. The above re-lubrication interval (and clean and re-pack interval for the Series P-LB 6800 bearings,) should be reduced by half.

Trouble-Shooting

Table 2

FAN TROUBLE-SHOOTING CHART

PROBLEM	POSSIBLE CAUSES
Excessive Vibration	<ul style="list-style-type: none"> - Accumulation of material on impeller - Worn or corroded impeller - Bent shaft - Impeller or sheaves loose on shaft - Motor out of balance - Impeller out of balance - Sheaves eccentric or out of balance - Bearing or drive misalignment - Mismatched belts - Belts too loose or too tight - Loose or worn bearings - Loose bearing bolts - Loose fan mounting bolts - Weak or resonant foundation - Foundation not flat and level - Structures not cross braced - System pulsation (DANGER) - Fan operation in a stall - Blades at different angles on adjustable pitch fans
Horsepower Too High	<ul style="list-style-type: none"> - Fan speed higher than design - Air density higher than design - Impeller rotating in the wrong direction - Angle set too high in adjustable pitch fans
Airflow Too Low	<ul style="list-style-type: none"> - Impeller rotating in the wrong direction - Fan speed lower than design - Actual system is more restrictive (more resistance to flow than expected) - Dampers or registers closed - Leaks or obstructions in duct work - Filters or coils are dirty or clogged - Inlet or outlet screens clogged - Restricted fan inlet or outlet - No straight duct at fan outlet - Shape elbows near fan inlet or outlet - Improperly designed turning vanes
Airflow Too Much	<ul style="list-style-type: none"> - Actual system is less restrictive (less resistance to flow) than expected - Fan speed higher than design - Filter not in place - Registers, grilles and/or dampers not installed
Fan Does Not Operate	<ul style="list-style-type: none"> - Blown fuses - Broken belts - Loose pulleys - Electricity turned off or not wired properly - Wrong voltage - Motor too small and overload protector has broken circuit

Table 2 (continued)

FAN TROUBLE-SHOOTING CHART	
PROBLEM	POSSIBLE CAUSES
Excessive Noise	<ul style="list-style-type: none">- Accumulation of material on impeller- Worn or corroded impeller- Bent shaft- Impeller or sheaves loose on shaft- Impeller hitting housing- Impeller out of balance- Bearing or drive misalignment- Mismatched belts- Belts or drive misalignment- Belts hitting guard- Loose or worn bearings- Belts worn- Belts oily or dirty- Defective or bad bearings- Bearings need lubrication- Loose bearing bolts- Loose fan- System pulsation or surge- Electrical noises- Noise from high velocity air system<ul style="list-style-type: none">- Duct work too small- Registers or grilles too small for application- Fan in stall condition (DANGER)- Rattle of components in high velocity air stream- Leaks in duct work- Vibrating duct work- Vibrating parts not isolated from building

It is recommended that the users and installers of this equipment familiarize themselves with AMCA publication #201, "Fans and Systems, and publication #202 "Trouble-Shooting", which are published by Air Movement and Control Association, International, 20 West University Drive, Arlington Heights, Illinois 60004.

Spare Parts:

Spare parts are not needed for the first year of operation. If spare parts are desired, then it is suggested that a spare motor and impeller be ordered for direct drive fans. For belt drive fans, in addition to the motor and impeller, it is suggested that a spare set of bearings, shaft, sheaves, and belts be ordered.

When ordering spare parts, specify the parts desired, the fan model number, and the fan serial number. Contact your local sales representative for price and delivery.



Performance Guarantee



You have high expectations. So does Hartzell Air Movement. We know you demand the most reliable and durable industrial air movement products available, so we're holding ourselves to a higher standard. We're so sure that our products will out-perform industry standards, we're backing that promise with the industry's first five-year warranty. Call your Hartzell Air Movement representative for assistance.

More than 50 Hartzell representative offices can provide specific performance and installation data to meet your requirements. Call your Hartzell Air Movement representative for assistance. Visit www.hartzellairmovement.com or call 800.336.3267 for the name of your representative.

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The safe application and use of equipment supplied by Hartzell Air Movement, Inc. is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

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SECTION 07

TERMS & WARRANTY



The safe application and use of equipment supplied by Hartzell Air Movement, Inc. is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

Document: QMS-0175 Rev: 2

TERMS AND CONDITIONS OF SALE OF HARTZELL FAN, INC. dba "HARTZELL AIR MOVEMENT"

These Terms and Conditions of Sale should be read carefully. Sale of any goods or services described or referred to herein is subject to these Terms and Conditions of Sale. Any order for or any statement of intent to purchase any goods or services, or any direction to proceed with engineering, procurement, manufacture or shipment, constitutes assent to these Terms and Conditions of Sale.

REJECTION OF DIFFERENT TERMS - This document is not an acceptance of any prior written or oral offer. If any such prior written or oral offer has been made, it is hereby rejected. These Terms and Conditions of Sale supersede any additional or different written or oral terms previously or subsequently communicated. Acceptance is expressly limited to these Terms and Conditions of Sale. Hartzell Air Movement hereby gives notification of its objection to and rejection of any proposed terms different from those contained herein whether communicated previously or subsequently and whether written or oral. This document is the complete and exclusive statement of the agreement between Hartzell Air Movement and Buyer.

DELIVERY - Shipping dates are approximate and are based upon prompt receipt of all necessary information.

Hartzell Air Movement is not liable for delays in delivery or in performance or failure to manufacture or deliver, due to (1) causes beyond its reasonable control, including errors in manufacture or (2) acts of God, acts of the Buyer, acts of civil or military authority, priorities, fires, strikes, or other labor disturbances, floods, epidemics, war, riot, delays in transportation or car shortage, or (3) inability on account of causes beyond its reasonable control to obtain necessary labor, materials, components or manufacturing facilities. In the event of any such delay, the date of delivery or of performances shall be extended for a period equal to the time lost by reason of delay.

START-UP SERVICE - On certain equipment start-up service is available from Hartzell Air Movement at per diem rates plus lodging and traveling expenses. Such start-up service is not included unless specifically quoted. There will be an additional charge for time used exceeding any number of days quoted.

ELECTRICAL EQUIPMENT - Equipment includes only the electrical components referred to in the proposal. Charges arising from any local, state, provincial or other regulations necessitating changes to electrical equipment will be paid by Buyer unless agreed otherwise in writing by Hartzell Air Movement.

CANCELLATION/TERMINATION/MODIFICATION - There can be no cancellation, termination or modification by Buyer without Hartzell Air Movement's prior written consent.

CLAIMS - Claims of shortages or errors or other basis for rejection must be made within five (5) days after delivery.

PRICING - Prices quoted are firm provided release to manufacture and shipment is completed by Hartzell Air Movement within three (3) months from the date of order entry. If shipment is delayed for reasons beyond control of Hartzell Air Movement and is not made within three (3) months from date of order entry, prices are subject to change at Hartzell Air Movement's option.

PAYMENT TERMS

TAXES - Any tax or other governmental charge now or hereafter levied upon the reproduction, sale, use or shipment of goods ordered or sold will be charged to and paid for by Buyer. Such taxes are not included in Hartzell Air Movement's price unless expressly so provided.

TERMS OF PAYMENT - Terms of payment are Net 30 days from the date of invoice. If shipment is delayed by the Buyer, date of readiness for shipment shall be deemed to be date of invoice for payment purposes. If, in Hartzell Air Movement's judgment, the Buyer's financial condition at any time does not justify normal payment terms, Hartzell Air Movement may require full or partial payment as a condition to commencing or continuing manufacture, or in advance of shipment, or, if shipment has been made, recover equipment from the carrier.

FREIGHT - All freight will be shipped Ex-Works Piqua, OH.

GOODS MANUFACTURED BY OTHERS - Hartzell Air Movement has no responsibility whatever with respect to goods sold but not manufactured by Hartzell Air Movement and Buyer's sole recourse is against the manufacturer of said goods. Hartzell Air Movement will assign to Buyer any pertinent warranty rights received by Hartzell Air Movement from manufacturer.

PATENTS - Hartzell Air Movement shall defend any suit or proceeding brought against the Buyer insofar as based on a claim that any goods sold by Hartzell Air Movement, or any part thereof constitutes an infringement of any patent of the United States, if notified promptly in writing and given to authority, information and assistance for the defense of same, and Hartzell Air Movement shall pay all damages and costs awarded

therein against the Buyer. In case said Hartzell Air Movement goods, or any part thereof, is in such suit held to constitute infringement and the use of said goods is enjoined, Hartzell Air Movement shall, at its own expense and at its option, either procure for the Buyer the right to continue using said goods; or replace same with non-infringing equipment; or modify it so they become non-infringing; or remove said goods and refund purchase price and the transportation and installation costs thereof. The foregoing states the entire liability of Hartzell Air Movement for patent infringement.

The preceding paragraph shall not apply to any goods or any part thereof not manufactured by Hartzell Air Movement or to any goods or any part thereof, manufactured to Buyer's design, nor for any use to which any such goods may be put as a part of any system, mechanism or process covered by patent rights of others. As to such goods or any part thereof, Hartzell Air Movement assumes no liability whatsoever for patent infringement. If any claim is asserted against Hartzell Air Movement that products manufactured by Hartzell Air Movement in compliance with Buyer's specifications or design infringes on any United States patent or copyright, then the buyer shall defend and indemnify Hartzell Air Movement for any damages and costs.

INTELLECTUAL PROPERTY - The design, performance information, construction detail of Hartzell Air Movement goods or any part thereof, is proprietary, and remains the valuable property of Hartzell Air Movement. Buyer agrees not to copy or duplicate the goods or any part thereof, or information related thereto provided without express written authorization from Hartzell Air Movement.

LIMITED WARRANTIES - Hartzell Air Movement warrants to Buyer that any goods to be delivered hereunder will be produced in compliance with the requirements of the Fair Labor Standards Act of 1938 as amended.

Hartzell Air Movement also warrants to Buyer its goods to be free from defects in workmanship and material under normal use and service for two (2) years after tender of delivery by Hartzell Air Movement. Subject to the following limitations and conditions, the warranty will be extended to five (5) years after tender of delivery, if Buyer registers the product on-line at www.hartzellairmovement.com/five-year-warranty within ninety (90) days after tender of delivery. If the five (5) year warranty applies, applicability of the warranty to any claim arising after two (2) years after tender of delivery is conditioned upon Buyer providing to Hartzell Air Movement maintenance records (prepared contemporaneously with the performance of the maintenance) demonstrating that the product has been maintained (from the time of tender of delivery to the time the warranty claim arises) in accordance with Hartzell Air Movement's Installation, Operation and Maintenance Manual.

Goods manufactured by a third party ("Third Party Product") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the goods manufactured by Hartzell Air Movement, including but not limited to, motors. Third Party Products are not covered by foregoing warranty. For the avoidance of doubt, SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD-PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE, OR OTHERWISE.

The only warranty applicable to a Third Party Product is the warranty, if any, of the manufacturer of the Third Party Product. Hartzell Air Movement will provide to Buyer information regarding submission of a warranty claim to the manufacturer of a Third Party Product, but Hartzell Air Movement does not represent or assure that the warranty, if any, of the manufacturer of the Third Party Product.

Any extension of any applicable warranty period beyond that indicated above is effective only if the extension is granted by Hartzell Air Movement in writing. No warranty extends to future performance of goods, and any claim for breach of warranty or otherwise accrues upon tender of delivery.

Replacement of belts and other parts as a result of ordinary wear and tear is not covered by this warranty and is the responsibility of the Buyer.

The foregoing constitute Hartzell Air Movement's sole and exclusive warranties and are in lieu of all other warranties, whether written, oral, express, implied or statutory.

LIMITATION OF LIABILITY FOR BREACH OF WARRANTY - Hartzell Air Movement's obligation for any breach of warranty is limited to repairing or replacing, at its option, without cost to Buyer at its factory any goods which shall, within such a warranty period, be returned to it with transportation charges prepaid, and

which its examination shall disclose to its satisfaction to have been defective. Any request for repair or replacement should be directed to Hartzell Air Movement, Inc., P.O. Box 919, Piqua, Ohio 45356. Hartzell Air Movement will not pay for any repairs made outside its factory without its prior written consent. Hartzell Air Movement has no obligation to repair or replace any Hartzell Air Movement goods which have failed as a result of faulty installation or abuse, or incorrect electrical connections or alterations made by others, or use under abnormal operating conditions or misapplication of the goods.

LIMITATION OF LIABILITY - To the extent the above limitation of liability for breach of warranty is not applicable, the liability of Hartzell Air Movement on any claim of any kind, including negligence, for any loss or damage arising out of or connected with, or resulting from the sale and purchase of the goods or services covered by these Terms and Conditions of Sale or from the performance or breach of any contract pertaining to such sale or purchase or from the design manufacture, sale, delivery, resale, installation, technical direction installation, inspection repair, operation or use of any goods or services covered by these Terms and Conditions shall, in no case exceed the price allocable to the goods or services which gave rise to the claim and shall terminate one year after tender of delivery of said goods or services, plus six months allowance for shipment to approved stocking dealers and distributors.

In no event whether as a result of breach of contract, or warranty or alleged negligence, defects, incorrect advice or other causes, shall Hartzell Air Movement be liable for special or consequential damages, including, but not limited to, loss of profits or revenue, loss of use of the equipment or any associated equipment, cost of substitute equipment, facilities or services, down time costs, or claims of customers of the Buyer for such damages. Hartzell Air Movement neither assumes nor authorizes any person to assume for it any other liability in connection with the sale of its goods or services.

NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS – HARTZELL AIR MOVEMENT DOES NOT WARRANT THAT SAID GOODS ARE OF MERCHANTABLE QUALITY OR THAT THEY ARE FIT FOR ANY PARTICULAR PURPOSE. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY AND THERE IS NO IMPLIED WARRANTY OF FITNESS.

REGULATORY LAWS AND/OR STANDARD - Hartzell Air Movement makes no promise or representation that its product will conform to any state or local laws, ordinances, regulations, codes or standards, except as particularly specified and agreed upon in writing. Hartzell Air Movement's prices do not include the cost of any related inspection permits or inspection fees.

EXCLUSIVE FORUM SELECTION CLAUSE - Any claims relating to these Terms and Conditions of Sale of the goods or services thereunder shall be brought (if subject matter jurisdiction exists) solely in the United States District Court for the Southern District of Ohio (Western Division). In the absence of subject matter jurisdiction in that Court, any such claims shall be brought solely in any Common Pleas Court of the State of Ohio within the area encompassed by the United States District Court for the Southern District of Ohio (Western Division).

NO DELEGATION - Buyer may not perform any duties under these Terms and Conditions of Sale through a delegate.

NO ASSIGNMENT - The rights of the Buyer hereunder cannot be assigned.

NO MODIFICATION, RESCISSION OR WAIVER - These Terms and Conditions of Sale are not subject to modification, rescission or waiver except by a writing signed by an officer of Hartzell Air Movement.

NO THIRD PARTY BENEFICIARY - These Terms and Conditions of Sale are for the benefit of Hartzell Air Movement and the Buyer and not for any other person.

GENERAL - All proposals are made and all orders are accepted by Hartzell Air Movement with the reference to the laws of the State of Ohio and the rights and duties of all persons and the construction and effect all provisions thereof shall be governed by the construed according to the laws of the State of Ohio.

The invalidity of any clause or provision of these Terms and Conditions of Sale shall not affect the validity or enforceability of any other clause or provision contained herein.

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SECTION 08 APPENDIX



The safe application and use of equipment supplied by Hartzell Air Movement, Inc. is the responsibility of the installer, user, owner and employer. To evaluate the safe application of this equipment, the following should be considered: the location of the installation, accessibility of employees and other persons to the equipment, any adjacent equipment, applicable building and safety codes, and requirements of OSHA. Since the application and use of its equipment can vary greatly, Hartzell Air Movement, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. An industry publication: "Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans" is available from Hartzell upon request.

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