Submittal #233423-001.0 233423 - HVAC Power Ventilators

Project: NCD23106.01 - Jenkins_SPCC Aseptic Training
Monroe, North Carolina USA

Distribution Summary

Distributed on 05/8/2025 by Kim Kelly **(IPS-Integrated Project Services, LLC)**

To: Kim Kelly **(IPS-Integrated Project Services, LLC)**, Nickolas Lash **(IPS-Integrated Project Services, LLC)**, Fara Kemelman **(Jenkins-Peer Architects (JENK001))**

Message: Please see Reviewer comments REVIEWED AS NOTED.

Additional Attachments:

NAME	RESPONSE	ATTACHMENTS	COMMENT
Kim Kelly **(IPS-Integrated Project Services, LLC)**	Reviewed as Noted		Please see Reviewer comments REVIEWED AS NOTED.
Thomas Belanger **(IPS-Integrated Project Services, LLC)**	Reviewed as Noted	23 34 23.1 - HVAC Power Ventilators - Fans - Product Data & Shop Dwgs.pdf	See reviewed submittal cover sheet and comments in reviewed submittal.

Power Ventilators Fans PD & SD

REVISION:	0	**SUBMITTAL MANAGER:**	Kim Kelly **(IPS-Integrated Project Services, LLC)**
STATUS:	Closed	**DATE CREATED:**	04/24/2025
ISSUE DATE:	04/24/2025	**SPEC SECTION:**	233423 - HVAC Power Ventilators
RESPONSIBLE CONTRACTOR:	Jenkins-Peer Architects (JENK001)	**RECEIVED FROM:**	Fara Kemelman
RECEIVED DATE:	04/24/2025	**SUBMIT BY:**	05/7/2025
FINAL DUE DATE:	05/7/2025	**LOCATION:**	
SUB JOB:		**COST CODE:**	
		TYPE:	
APPROVERS:	Thomas Belanger **(IPS-Integrated Project Services, LLC)**, Kim Kelly **(IPS-Integrated Project Services, LLC)**		
BALL IN COURT:			

DISTRIBUTION:
Kim Kelly **(IPS-Integrated Project Services, LLC)** , Nickolas Lash **(IPS-Integrated Project Services, LLC)**

DESCRIPTION:
Please find attached the Power Ventilators PD & SD for review. Comments are due back **08MAY2025**. Please let me know if you can't meet this date.

SUBMITTAL WORKFLOW

NAME	SENT DATE	DUE DATE	RETURNED DATE	RESPONSE	ATTACHMENTS	COMMENTS
General Information Attachments					23 34 23.1 - HVAC Power Ventilators - Fans - Product Data & Shop Dwgs.pdf	

Submittal #233423-001.0
233423 - HVAC Power Ventilators

NAME	SENT DATE	DUE DATE	RETURNED DATE	RESPONSE	ATTACHMENTS	COMMENTS
Thomas Belanger	04/24/2025	05/07/2025	05/07/2025	Reviewed as Noted	23 34 23.1 - HVAC Power Ventilators - Fans - Product Data & Shop Dwgs.pdf (Current)	See reviewed submittal cover sheet and comments in reviewed submittal.
Kim Kelly	05/07/2025	05/07/2025	05/08/2025	Reviewed as Noted		Please see Reviewer comments REVIEWED AS NOTED.

THIS SUBMITTAL HAS BEEN REVIEWED ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS.

IT IS THE CONTRACTOR'S CONTRACTUAL DUTY TO REVIEW AND ACT UPON SUBMITTALS, PRIOR TO THEIR SUBMISSION TO VERIFY THAT ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS HAVE BEEN MET OR IF THEY HAVE NOT BEEN MET TO SO NOTIFY THE DESIGN PROFESSIONAL OF RECORD IN WRITING. BY THE SUBMISSION OF THIS SUBMITTAL TO THE DESIGN PROFESSIONAL OF RECORD IT IS ASSUMED THE CONTRACTOR HAS FULFILLED THESE CONTRACTUAL DUTIES. REVIEW OF THIS SUBMITTAL BY DESIGN PROFESSIONAL OF RECORD DOES NOT RELIEVE THE CONTRACTOR OF THE DUTY TO MEET THE REQUIREMENTS OF THE CONTRACT DOCUMENTS AND THE APPLICABLE BUILDING CODES.

ANY COMMENTS NOTED OR CORRECTIONS REQUESTED ARE FOR CLARIFICATION TO THE GENERAL CHARACTER OF THE WORK. CORRECTNESS OF DETAILS, MEASUREMENTS, QUANTITIES, CONFORMITY WITH CONTRACT DOCUMENTS, TECHNIQUES OF CONSTRUCTION AND COORDINATION WITH OTHER TRADES SHALL REMAIN THE COMPLETE RESPONSIBILITY OF THE CONTRACTOR.

REVIEWED	
REVIEWED AS NOTED	**X**
REVISE AND RESUBMIT	
REJECTED	
RESUBMIT FOR RECORD	

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BY: **T. Belanger** **DATE:** **5/7/2025**

IPS - INTEGRATED PROJECT SERVICES

721 Arbor Way, Suite 100 Blue Bell, PA 19422
Phone: (610) 828-4090

PROJECT:	**Jenkins SPCC Aseptic**
PROJECT NO.:	**NCD23106.01**
SUBMITTAL NO.:	**233423-001 Revision 0**
SUBJECT:	**Power Ventilators**
	Fans PD & SD

COMMENTS:

1. **EF-2, COORDINATE MOTOR HP WITH ELECTRCIAL v. SCHEUDLED MOTOR HP.**
2. **EF-4 PROVIDE SCHEDULED MOTOR HP.**

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RODGERS
Our Passion is Building®

Submittal Record

Rodgers Builders, Inc.
PO Box 18446 (28218)
5701 North Sharon Amity Road
Charlotte, NC 28215

rodgersbuilders.com
704 537 6044 TELEPHONE
704 535 0055 FAX

Architect: Jenkins Peer Architects

Project: SPCC Aseptic Training Facility

Rodgers Project #: 2769

Form of Submittal

- [x] Product Data
- [x] Shop Drawings
- [ ] Mix Designs
- [ ] MSDS Sheets
- [ ] Physical Samples
- [ ] Manufacturer's Certification
- [ ] Test Reports
- [ ] Installation Instructions
- [ ] Letter of Affidavit / Compliance
- [ ] Welding Certificates
- [ ] Sample Warranty
- [ ] Other (Specify) - _____

Submittal No. 233423-001

Item: HVAC Power Ventilators -Fans

Drawing Number: M800-001

Spec. Section & Package No.: 233423-001

Manufacturer: Greenheck

Brand: _____

Submitted By: Facility System Services

Review Due Date: 05/13/2025

Rodgers Stamp

Rodgers Builders, Inc.

___ No Exception Taken ___ Make Corrections Noted

___ Rejected ___ Revise and Resubmit

___ Submit Specified Item ✗ Reviewed

Corrections and comments are only for general conformance with the design concepts of the project and general compliance with the information given in the contract documents. Action shown is subject to the requirements of the plans and specifications. This review does not relieve the subcontractor/vendor from compliance with requirements of the drawings and specifications. Subcontractor /vendor is responsible for dimensions which shall be confirmed and correlated at the job site, fabrication process, and techniques of construction: coordination of their work with that of all other trades and the satisfactory performance of their work.

KC
By

04/23/2025
Date

No. 233423-001

A/E Stamp

SUBMITTAL

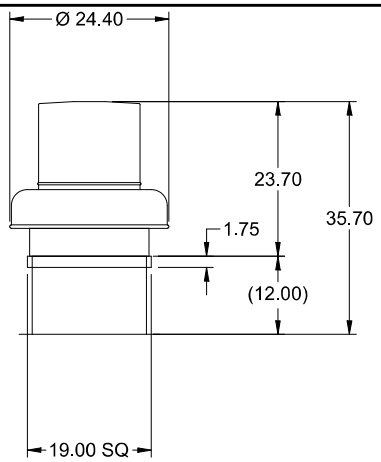
Job Name: **SPCC ASEPTIC TRAINING FACILITY**

Engineer: IPS
Contractor: FACILITY SYSTEMS SERVICES
Elevation: (ft) 768
Date: 3/27/2025
Submitted By: Brandy Wilhelm
Email: bwilhelm@hahnmason.com
Phone: (704)523-5000

HAHN MASON AIR SYSTEMS INC
4901 DWIGHT EVANS RD
STE 120
CHARLOTTE, NC 28217
US
Phone: (704)523-5000
Fax:
Email Address: bwilhelm@hahnmason.com

Model: G-099-VG

Direct Drive Centrifugal Roof Exhaust Fan



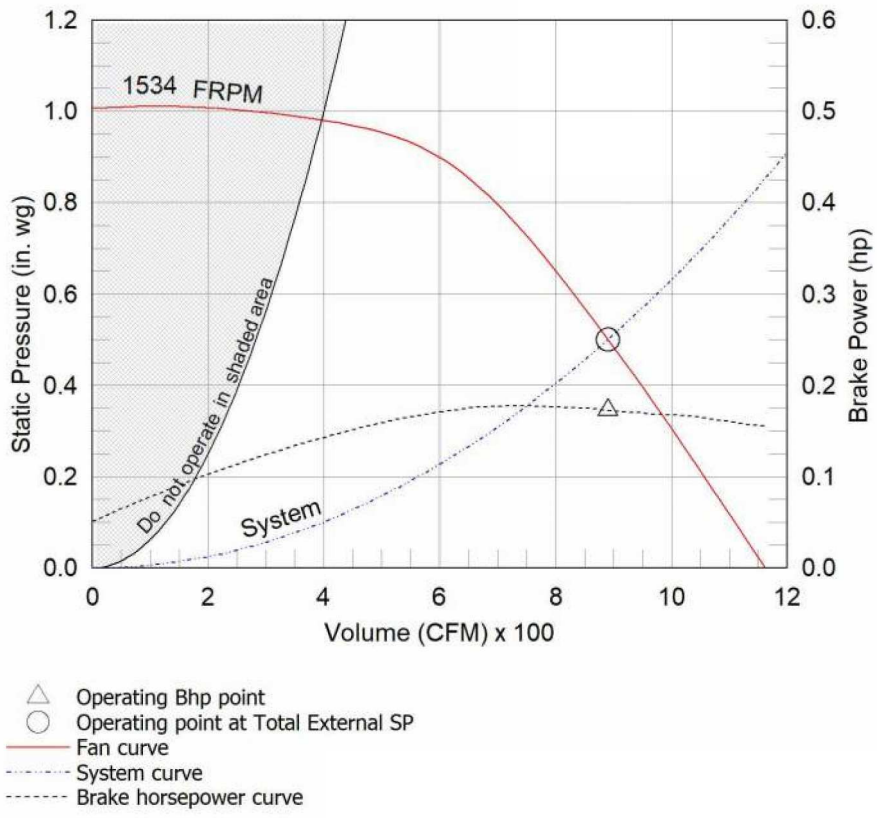
OVERALL HEIGHT MAY BE GREATER DEPENDING ON MOTOR, ADAPTER, AND/OR HINGE BASE.

Dimensional	
Quantity	1
Weight w/o Acc's (lb)	36
Weight w/ Acc's (lb)	43
Weight w/ Acc's and Curb (lb)	59
Standard Curb Cap Size (in.)	19 x 19
Optional Damper (in.)	12 x 12
Roof Opening (in.)	15.5 x 15.5

Performance	
Requested Volume (CFM)	890
Actual Volume (CFM)	890
Total External SP (in. wg)	0.5
Fan RPM	1534
Operating Power (hp)	0.17
Elevation (ft)	768
Airstream Temp.(F)	70
Air Density (lb/ft3)	0.073
Tip Speed (ft/min)	4,493
Static Eff. (%)	40

Misc Fan Data	
Fan Energy Index (FEI)	-
Outlet Velocity (ft/min)	927

Motor	
Motor Mounted	Yes
Size (hp)	1/4
Voltage/Cycle/Phase	115/60/1
Enclosure	TENV
Motor RPM	1725
Efficiency Rating	High
Windings	1
FLA (Amps)	2.85
Min. Circuit Ampacity (MCA)	4
Max. Overcurrent Protection (MOP)	15
Short Circuit Current Rtg (SCCR)	5 kA



Sound Power by Octave Band

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA	dBA	Sones
Inlet	73	76	76	68	64	63	57	51	72	61	10.6

Notes:

All dimensions shown are in units of in.
*NEC FLA, MCA and MOP are for reference only – based on tables 430.248 or 430.25 of National Electric Code 2020. Actual motor FLA may vary, for sizing thermal overload, consult factory. MCA and MOP values shown only account for the motor, not accessories (damper actuator, field supplied VFD, etc).
LwA - A weighted sound power level, based on ANSI S1.4
dBA - A weighted sound pressure level, based on 11.5 dB attenuation per Octave band at 5 ft - dBA levels are not licensed by AMCA International
Sones - calculated using ANSI/AMCA 301 at 5 ft

Model: G-099-VG

Direct Drive Centrifugal Roof Exhaust Fan

Standard Construction Features:

- Aluminum housing - Backward inclined composite (sizes 60-95) or aluminum (sizes 97-300) wheel - Aluminum curb cap with prepunched mounting holes - Birdscreen - Ball bearing motors (sizes 85-300 and all Vari Green), sleeve bearing motors (sizes 60-80) - Motor isolated on shock mounts - Corrosion resistant fasteners

Selected Options & Accessories:

Motor - Vari-Green EC motor
Control - Dial for balancing
Standard Curb Cap Size - 19 Square
UL/cUL 705 Listed - "Power Ventilators"
Switch, NEMA-1, Toggle,
Junction Box Mounted & Wired in weather-protected motor compartment
Foam Curb Seal (Factory Applied)
Birdscreen: Galvanized, nom. 84% Free Area
Conduit Chase Qty 1
Unit Warranty: 1 Yr (Standard)
Damper Shipped Loose, BD-100-PB-12X12, Gravity Operated, Not Coated, Nominal Size

Selected Sub Marks

See individual submittals for full details
GPI-19-12-G12

The Vari-Green Motor included in this order has a 'Multi-Voltage' ability. The red wire on the motor is called a 'Voltage Doubler', and when it is connected the motor can be powered by 115V.
If the Red wire is disconnected, then the motor can be powered with 208-230/277V. The motor will leave the factory with the voltage doubler wired per the order.

Vari-Green
Motor & Control Options

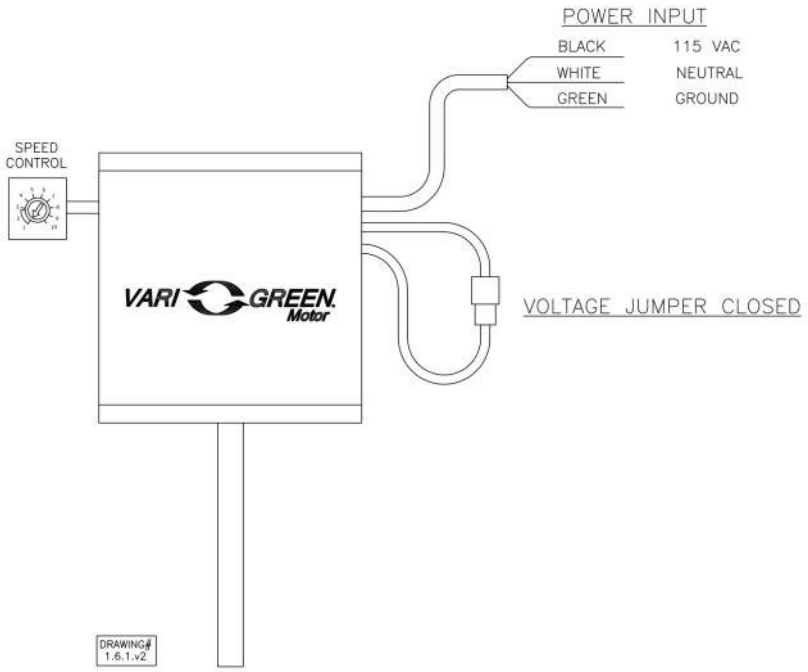
An EC motor that uses AC input power and internally converts it to DC power. Potentiometer (dial) mounted on the motor enclosure adjusts the speed (RPM) down 80%. Vari-Green motors feature a soft-start and inherent thermal and current protection built into each unit. Inrush current at start up is eliminated and the motor will automatically reduce speed or turn off if overloaded or it becomes too hot.

Motor Configuration

Input Voltage:	115
Speed Reference:	Dial on Motor
Permanent Dial:	Yes

Control Configuration

Control Type:	Dial on Motor
Transformer:	None



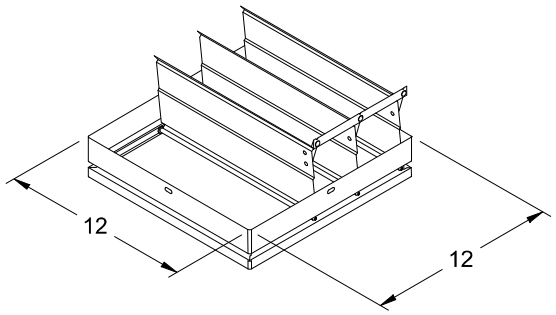
Horizontal Mount Exhaust Damper

Model: BD-100

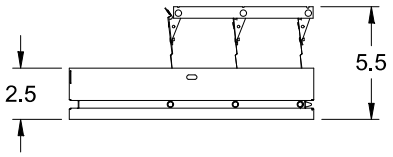
Standard Construction Features:

- Model BD-100 is a horizontal mount exhaust damper (air flow up) and is constructed of 24 ga galvanized steel with pre-punched mounting holes - Damper blades are 0.016 in. roll formed aluminum with vinyl seals on the closing edge, and spring assisted for ease of opening - Axle/bearing is constructed of fiberglass reinforced nylon

Greenheck Fan Corporation certifies that the models BD-100 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance Ratings.



DAMPER



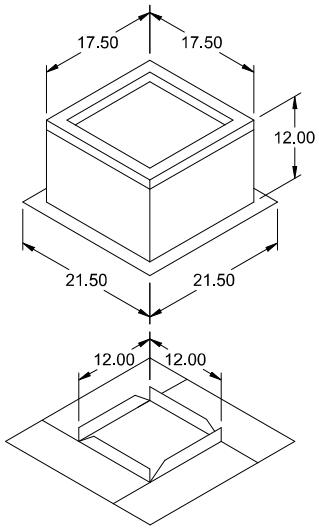
TYP. SECTION VIEW

Notes: All dimensions shown are in units of in.

AMCA

AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) does not include transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, Free outlet. Power rating (BHP/kW) does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories). The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per ANSI/AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal applies to sone ratings only.



Model: GPI

Roof Curb

Standard Construction Features:

- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure - Constructed of either 18 ga galvanized steel or 0.064 in. aluminum - Straight Sided without a cant - 2 in. mounting flange - 3 lb density insulation - Height - Available from 12 in. to 42 in. as specified in 0.5 in. increments. Notes: - The maximum roof opening dimension should not be greater than the "Actual" top outside dimension minus 2 in.. - The minimum roof opening dimension should be at least 2.5 in. more than the damper dimension or recommended duct size. - The Roof Opening Dimension may or may not be the same as the Structural Opening Dimension. - Damper Tray is optional and must be specified. Tray size is same as damper size. - Security bars are optional and must be specified. Frames and gridwork are all 12 ga steel.

General

Tag	Qty	Model	Sizing Method	Undersizing (in.)	Weight (lb)	Shipped Assembled	Union Label
	1	GPI-19	Nominal	1.5	16	Yes	No Preference

Dimensions

Curb Height (in.)	Nominal Outside Width (in.)	Nominal Outside Length (in.)	Actual Outside Width (in.)	Actual Outside Length (in.)	Actual Inside Width (in.)	Actual Inside Length (in.)	Hinge Base Width* (in.)	Hinge Base Length* (in.)
12	19	19	17.5	17.5	14	14	18	18

*May not be applicable

Damper Tray

Damper Tray Width (in.)	Damper Tray Length (in.)
12	12

Accessories

Material	Security Bars	Liner	Insulation (in.)	Insulation R Value
Galvanized	No	No	1	R4.3

Design Condition	
Number of Systems	1
Fans per System	1
Redundancy	None
System Type	Variable Volume
Lab Exh. Vol. (CFM)	550
Min Lab Exh. Vol. (CFM)	275
Add. BAP Air (CFM)	0
Wind Speed (MPH)	10.0

Selection Criteria - Normal [N] Oper.	
Volume (CFM)	550
Total External SP (in. wg)	2.022
Air Stream Temp (F)	70
Elevation (ft)	768
Drive Loss (%)	15.2

N Operating Fan Performance	
Fan RPM	3169
Max Fan RPM	3995
Operating Power (hp)	0.95
Required Power (hp)	0.95
Oper. Frequency (Hz)	60
Fan Energy Index (FEI)	0.76

N Operating Discharge Performance	
Nozzle OV (ft/min)	3,929
Effective Plume Ht. (ft)	17.35
Calculation Method	Momentum Flux

Fan Construction	
Spark Resistance	Spark B
Drive Type	Belt
Arrangement	9
Nozzle Size (in.)	5

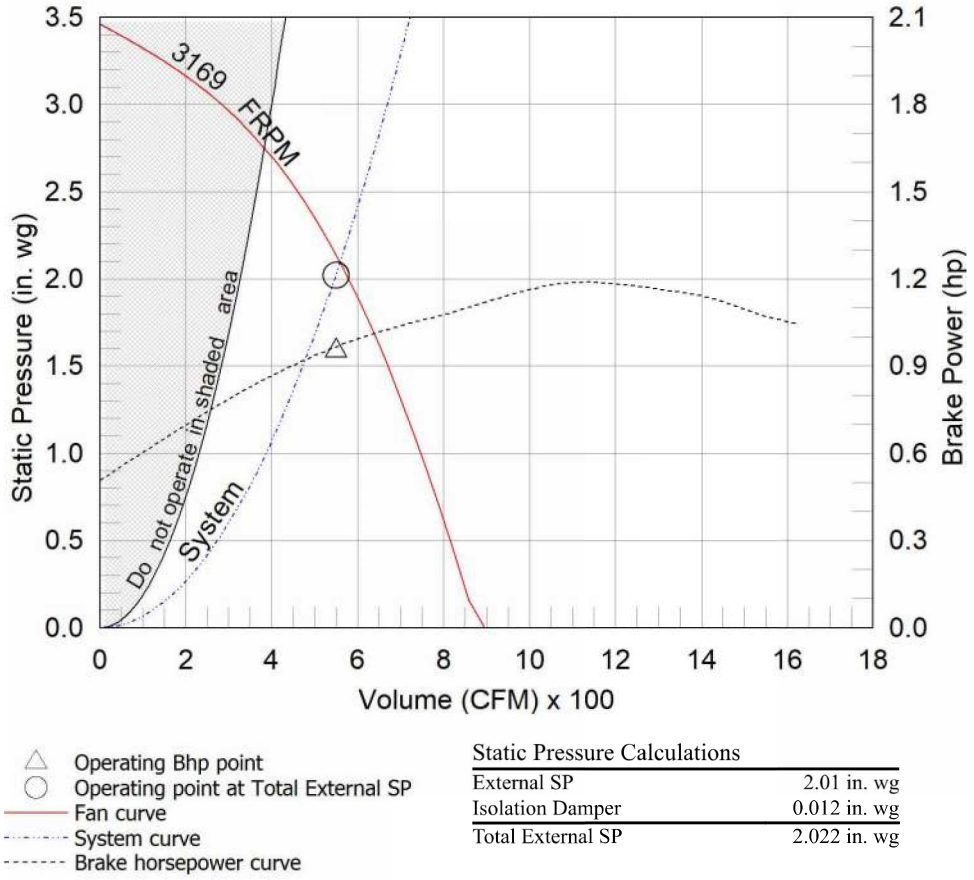
Plenum Configuration	
Bypass Air Plenum	Yes
Plenum Arrangement	Inline

Motor Specs	
Motor Size (hp)	1
RPM	3600
V/C/P	460/60/3
Enclosure	TEFC
Drives	Standard
Drive Service Factor	2

Weight Totals	
Fan Assembly (lb)	255
Plenum Assembly (lb)	183
Roof Curb (lb)	47
System Total (lb)	485

Model: VEKTOR-H-10

Fume Exhaust System



△ Operating Bhp point
○ Operating point at Total External SP
Fan curve
System curve
Brake horsepower curve

Static Pressure Calculations	
External SP	2.01 in. wg
Isolation Damper	0.012 in. wg
Total External SP	2.022 in. wg

COORD MOTOR SIZE WITH ELECTRICAL. SCHEDULED MOTOR IN SCO PACKAGE IS 3/4 HP.

Nameplate Model: VEKTOR-H-10-10-X

AMCA tested and certified performance data includes pressure losses from discharge nozzles. Additional losses internal to the system are for selected optional accessories.

Sound Power by Octave Band (Individual Fan Normal [N] Operating Condition)

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA	dBA
Inlet Sound	88	88	86	83	79	73	70	66	85	73

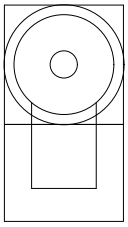
LwA - A weighted sound power level, based on ANSI S1.4. The AMCA Certified Ratings Seal applies to LwiA values only.
dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft- dBA levels are not licensed by AMCA International

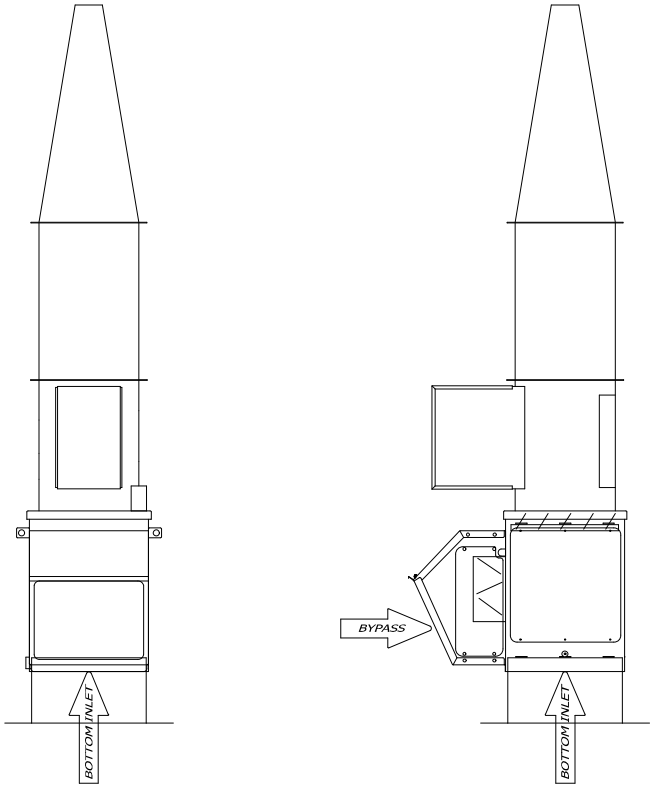
Selected Options & Accessories:

Motor VFD Rated
Motor with Shaft Grounding
Motor with Class B or Greater Insulation
Standard Drives
Bypass Air Plenum - Single Wall, Steel, Bottom Exhaust Intake
Coated with LabCoat, RAL7023, Entire Unit
Switch - NEMA-3R, Toggle, For Indoor or Outdoor Use, Mounted and Wired
UL/cUL-705 - "Power Ventilators"
Shaft Material - Turned and Polished Steel with Protective Coating
Bypass Damper - VCD-23, Galvaneal, Coated, 6 in. x 6 in., Qty: 1
Bypass Damper Act. - Electric, Modulating, w/o Transformer, 24 VAC, Model: AFB24-SR, Qty: 1
Isolation Damper - VCD-23, Galvaneal, Coated, 18 in. x 18 in., Parallel Blades, mounted in BAP, one per fan
Isolation Damper Act. - Electric, 24 VAC, 2 pos., SR, w/o Transformer, Model: AFBUP, Qty: 1
Sure-Aire Flow Station (No Electronics), Qty 1
Factory Vibration Test, 0.15 in/sec, peak, filter-in as measured at the fan RPM
Extended Lube Lines - Nylon
Motor Cover
Weatherhood over bypass damper with inlet screen
Unit Warranty: 1 Yr (Standard)

Model: VEKTOR-H-10

Fume Exhaust System

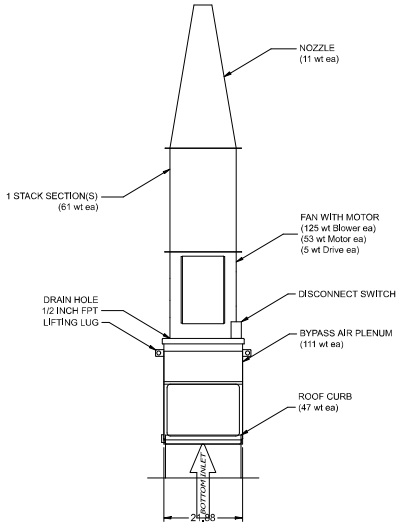




Notes: All dimensions shown are in units of in. and weights are shown in units of lb.
Drawings are not to scale. Drawings are of standard unit and do not include dimensions for accessories or design modifications.

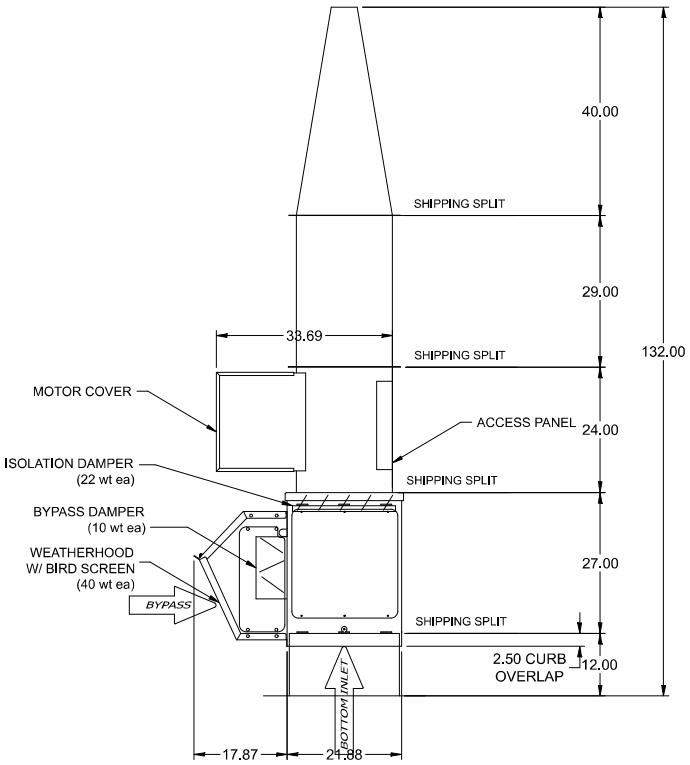
Model: VEKTOR-H-10

Fume Exhaust System



WEIGHT TOTALS	
FAN ASSEMBLY	255
FAN QTY	x1
PLENUM ASSEMBLY	183
ROOF CURB	47
SYSTEM TOTAL	485

WEIGHTS REFERENCED FROM ALL VIEWS



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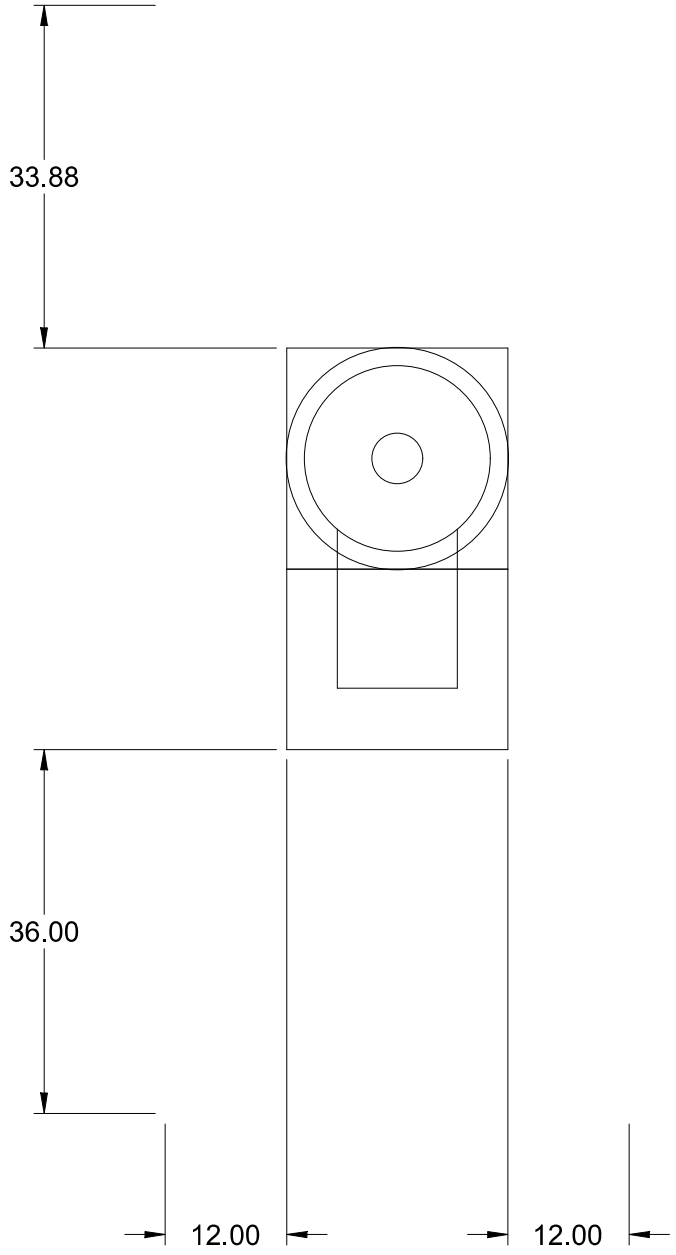
Model: VEKTOR-H-10

Fume Exhaust System

Recommended Service Clearances



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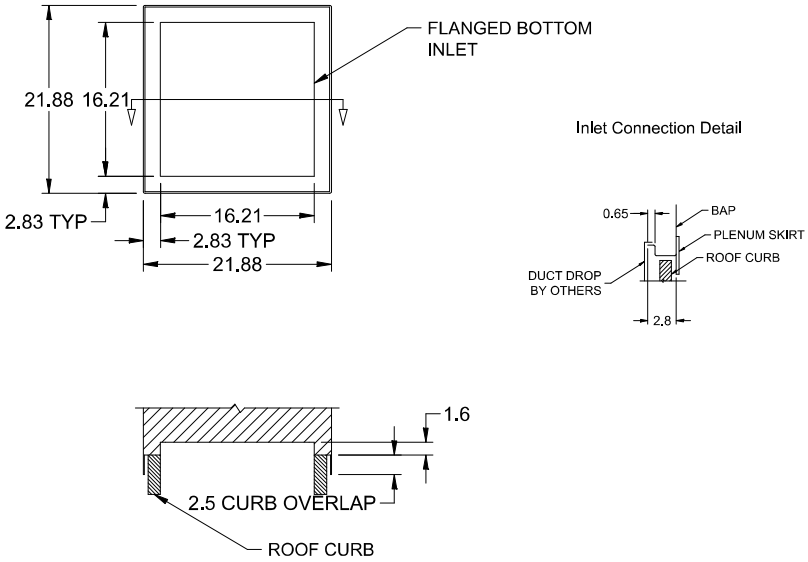
Model: VEKTOR-H-10

Fume Exhaust System



A MAXIMUM INLET VELOCITY OF 1500 FPM IS RECOMMENDED

Notes: All dimensions shown are in units of in. and weights are shown in units of lb.
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Sure-Aire Probes Only

Sure-Aire utilizes differential pressure across the inlet cone of the fan to allow accurate measuring of volumetric flow through the fan. The fan has connection points for attaching a user supplied pressure measuring device.

Flow equation from differential pressure:

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

Δ P = Measured differential pressure
P = Air density (0ft elevation and 70F, p = 0.075 lbm/ftF)

Model	VEKTOR-H
Size	10
K Value	202
Fan tubing Connections*	¼

*Recommended tube size is 0.25 in for runs 25 ft or less. For runs up to max 100 ft use 0.375 in or larger tubing.

Momentum Flux
Effective Plume Height Calculations

Effective Plume Ht. (ft) = Plume Rise (h_r) - Downwash (h_d) + Unit Height + Roof Curb Height

Effective Plume Ht. (ft) = 17.35

β	cap factor: 1.0 without cap, 0 with cap	1
x	distance downwind of stack, ft	120
V_e	stack exit velocity, ft/min	3,929
U_H	wind speed at building top, ft/min	880
H	building height above ground level, ft	32
z_0	surface roughness length, ft	0.03
d_e	exit diameter, ft	0.42

Atmospheric Boundary Layer Parameters	
Terrain Category	z_o, ft
Flat, water, desert	0.03
Flat, airport, grassland	0.16
Suburban	2.1
Urban	6.0

Plume Rise (h_r) Calculation:

Plume Rise vs Distance (ft) h_x = 10.1
Final Plume Rise (ft) h_f = 6.35

Plume Rise = $h_r = \min(\beta h_x, \beta h_f)$

plume rise vs. downwind distance $h_x = \left(\frac{3F_m x}{\beta_j^2 U_H^2}\right)^{1/3}$

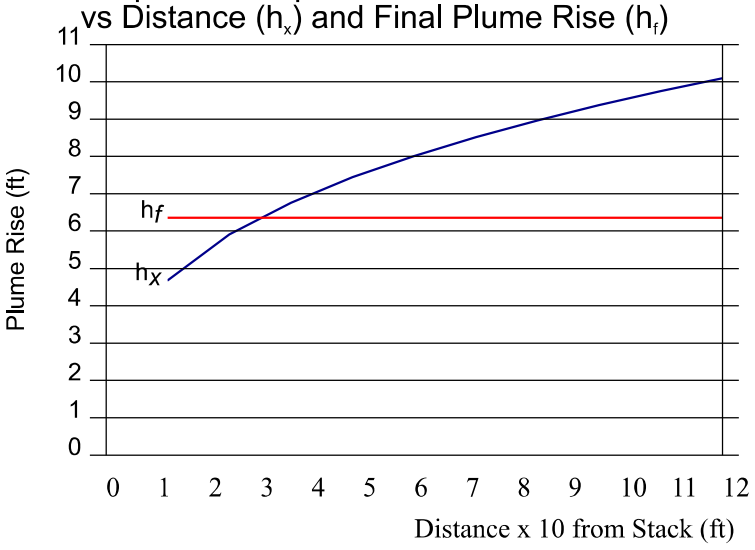
where: $F_m = V_e^2\left(\frac{d_e^2}{4}\right)$

$\beta_j = \frac{1}{3} + \frac{U_H}{V_e}$

Final Plume Rise: $h_f = \frac{0.9\left[F_m U_H / U_*\right]^{\frac{1}{2}}}{U_H \beta_j}$

logrithmic wind profile: $U_H / U_* = 2.5 \ln(H / z_o)$

Graphical Comparison of Plume Rise vs Distance (h_x) and Final Plume Rise (h_f)



Downwash (h_d) Calculation:

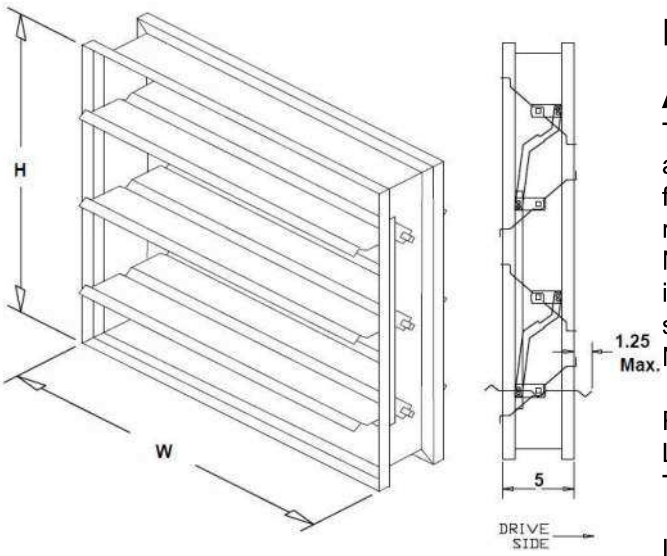
Downwash h_d = 0

$V_e / U_H \leq 3.0$ *there is downwash*

$h_d = d_e\left(3 - \beta V_e / U_H\right)$

$V_e / U_H > 3.0$ *then there is no downwash*

$h_d = 0$



VCD-23

Low Leakage Control Damper-Bypass

Application and Design

The model VCD-23 is a low leakage control for application as an automatic control or manual balancing damper. This model is intended for applications in low to medium pressure and velocity systems. A wide range of electric and pneumatic actuators are available.
Non-jackshafted dampers will be supplied with a blade drive lever for internal actuator mounting. When external actuator mounting is specified in which case an extension pin with clip kit will be provided. Note: The extension pin with clip kit includes the extension pin and clip.

RATINGS
Leakage: Class 1A @ 1 in. wg, Class 1 @ 4 in. wg
Temperature: 200.0 F - 250.0 F Consult factory for higher temperatures.

Installation instructions available at www.greenheck.com

Notes: All dimensions shown are in units of in..

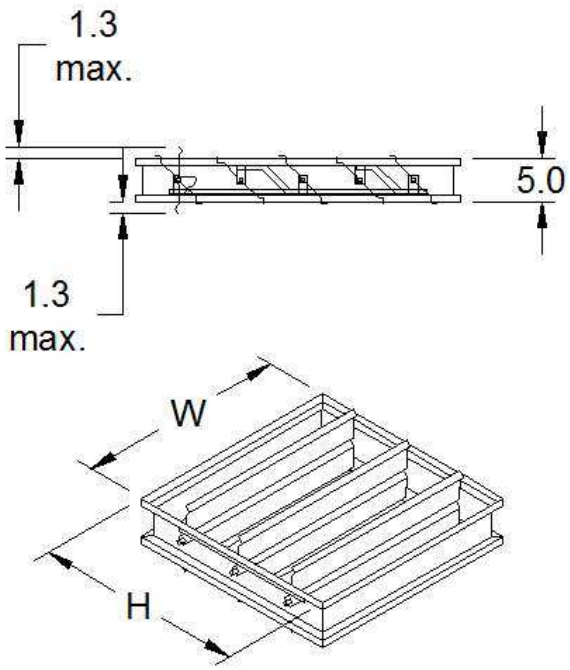
W and H furnished approximately 0.25 in. undersized and only refer to damper dimensions (sleeve thickness is not included).

Electrical accessory wiring terminates at the accessory.
Field wiring is required to individual components.

Construction Features

Temperature:	180	Frame Thickness (ga):	16	Coating Type:	Hi-Pro Polyester
Frame Material:	Galvaneal	Blade Thickness (ga):	16	Coating Thickness:	2-3 mils
Blade Action:	Opposed	Blade Seal:	Vinyl		
Jamb Seal Mat.:	304 SS	Actuator Mount:	External		
Axle Material:	Plated Steel				
Axle Bearings:	Synthetic				
Linkage Material:	Plated Steel				

Damper Qty	Damper Width in.	Damper Height in.	Total Actuator Qty	Actuator Model	Actuator Mfg.
1	6	6	1	AFB24-SR	Belimo



VCD-23

Low Leakage Control Damper-Isolation

Application and Design

The model VCD-23 is a low leakage control for application as an automatic control or manual balancing damper. This model is intended for applications in low to medium pressure and velocity systems. A wide range of electric and pneumatic actuators are available.
Non-jackshafted dampers will be supplied with a blade drive lever for internal actuator mounting. When external actuator mounting is specified in which case an extension pin with clip kit will be provided.
Note: The extension pin with clip kit includes the extension pin and clip.

RATINGS
Leakage: Class 1A @ 1 in. wg, Class 1 @ 4 in. wg
Temperature: 200.0 F - 250.0 F Consult factory for higher temperatures.

Installation instructions available at www.greenheck.com

Notes: All dimensions shown are in units of in.

W and H furnished approximately 0.25 in. undersized and only refer to damper dimensions (sleeve thickness is not included).

Electrical accessory wiring terminates at the accessory.
Field wiring is required to individual components.

Construction Features

Temperature:	180 F	Frame Thickness (ga):	14	Coating Type:	Hi-Pro Polyester
Frame Material:	Galvaneal	Blade Thickness (ga):	16	Coating Thickness:	2-3 mils
Blade Action:	Parallel	Blade Seal:	Vinyl		
Jamb Seal Mat.:	304 SS	Actuator Mount:	External		
Axle Material:	Plated Steel				
Axle Bearings:	Synthetic				
Linkage Material:	Plated Steel				

Damper Qty	Damper Width in.	Damper Height in.	Total Actuator Qty	Actuator Model	Actuator Mfg.
1	18	18	1	AFBUP	Belimo

AMCA

AMCA Licensed for Sound and Air Performance and FEI ratings. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to sound and air performance and FEI ratings only. Performance certified is for installation type A: Free inlet, free outlet. Power rating (BHP/kW) includes transmission losses. Performance ratings do not include the effects of appurtenances (accessories). Sound ratings do not include the effects of duct end correction. dBA levels are not licensed by AMCA International. The sound power level ratings shown are in decibels, referred to 10-12 watts, calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. The AMCA Certified Ratings Seal applies to LwA values only. The sound pressure shown in fan dBA are loudness values at 5 ft. in a hemispherical free field calculated per AMCA Standard 301.

System Configuration	
Number of Fans	1
Isolation Damper Control	Yes
Bypass Damper Control	Yes

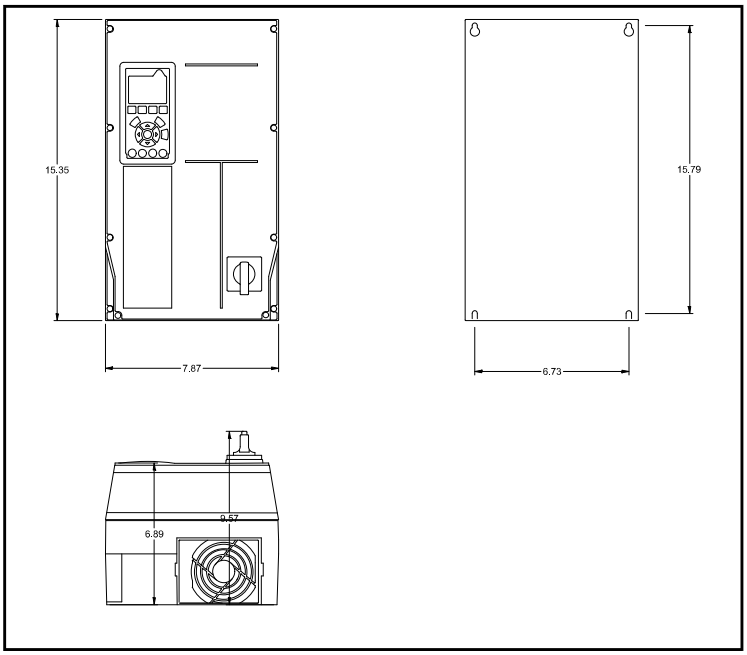
System Control	
System Redundancy	None
Lead / Lag	N/A
Setpoint Control	Duct Static
Communication Protocol	BACnet MSTP/IP

VFD Configuration	
VFD Quantity	1
VFD Manufacturer	Danfoss
VFD Enclosure	NEMA-3R
Overload Protection	Integral Fused
Disconnect	Integral
Motor HP	1
Motor RPM	3600
V/C/P	460/60/3

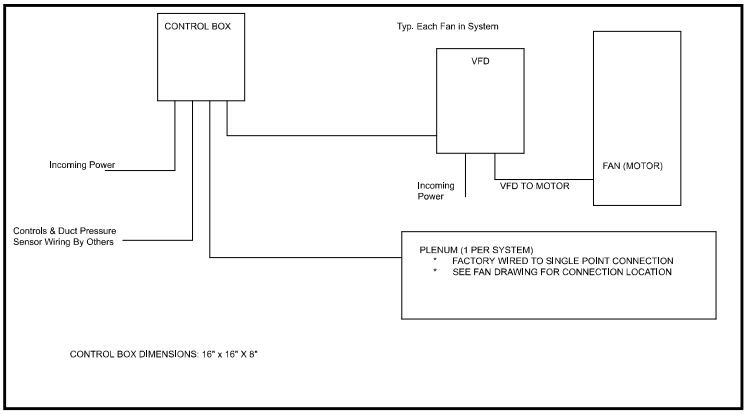
Warranty	
Warranty	1 Yr (Standard)

Model: VEKTOR-SYS-CONTROL
Vektor Control Package

VFD



Wiring Diagram



Selected Options & Accessories:

Control box, ship loose, field mounted
VFD, Danfoss, FC-102, 1 per fan, factory programmed, shipped loose
Setpoint Control - Duct Static, Factory Supplied
Isolation Damper Power and Control
Bypass Damper Power and Control
Multifan Control
System Redundancy - None
Communication Protocol - BACnet MSTP/IP
Unit Warranty: 1 Yr (Standard)

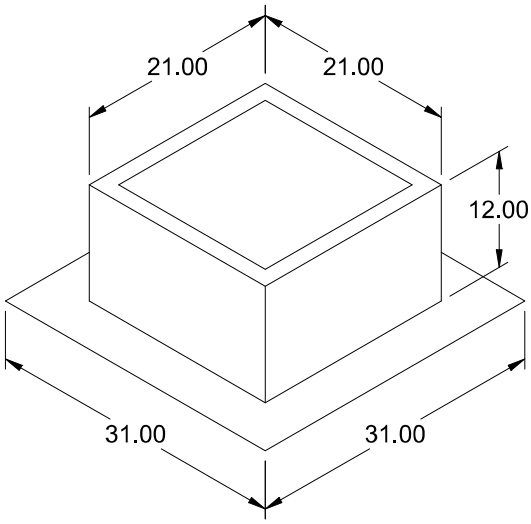
Model: VEKTOR-SYS-CONTROL
Vektor Control Package

Sequence of Operation

System Start
Upon signal for the system to start, bypass damper(s) will open, primary fan(s) will start, and isolation damper(s) associated with the primary fans will open. After a specified time, the setpoint control sequence will take over control.

Setpoint
- Duct Ps: System will maintain duct static pressure setpoint
- The controls will maintain setpoint by modulating bypass damper.

Redundancy
- The selected system does not have redundancy capabilities selected.



Model: GPFHL

Heavy Load Roof Curb

Standard Construction Features:

- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure - Constructed of galvanized steel (14 ga) - Straight Sided - Single roof flashing flange (5 in. width) - Insulated (1 in. thick, 3 lb density). NOTES: - Curb actual dimension is 0.5 in. smaller than cap dimension. - The maximum allowable roof opening dimension is actual minus 4 in.. - The Roof Opening Dimension may or may not be the same as the Structural Opening Dimension.

General

Tag	Qty	Model	Sizing Method	Undersizing (in.)	Weight (lb)	Shipped Assembled	Union Label
	1	GPFHL-21.5 x 21.5	Nominal	0.5	47	Yes	No Preference

Dimensions

Curb Height (in.)	Nominal Outside Width (in.)	Nominal Outside Length (in.)	Actual Outside Width (in.)	Actual Outside Length (in.)	Flange Width (in.)	Flange Length (in.)
12	21.5	21.5	21	21	31	31

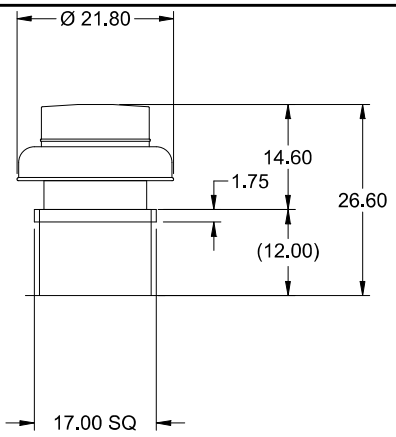
*May not be applicable

Accessories

Material	Security Bars	Liner	Insulation (in.)	Insulation R Value
Galvanized	No	No	1	R4.3

Model: G-080-VG

Direct Drive Centrifugal Roof Exhaust Fan



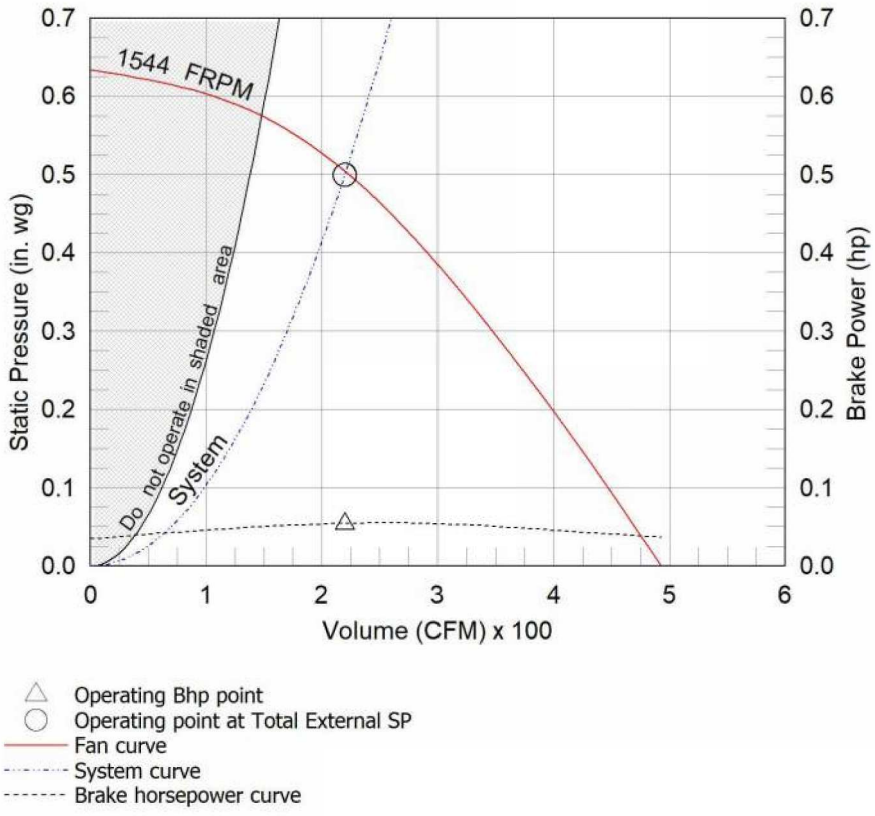
OVERALL HEIGHT MAY BE GREATER DEPENDING ON MOTOR, ADAPTER, AND/OR HINGE BASE.

Dimensional	
Quantity	1
Weight w/o Acc's (lb)	24
Weight w/ Acc's (lb)	30
Weight w/ Acc's and Curb (lb)	44
Standard Curb Cap Size (in.)	17 x 17
Optional Damper (in.)	10 x 10
Roof Opening (in.)	13.5 x 13.5

Performance	
Requested Volume (CFM)	220
Actual Volume (CFM)	220
Total External SP (in. wg)	0.5
Fan RPM	1544
Operating Power (hp)	0.05
Elevation (ft)	768
Airstream Temp.(F)	70
Air Density (lb/ft3)	0.073
Tip Speed (ft/min)	4,395
Static Eff. (%)	32

Misc Fan Data	
Fan Energy Index (FEI)	-
Outlet Velocity (ft/min)	550

Motor	
Motor Mounted	Yes
Size (hp)	1/10
Voltage/Cycle/Phase	115/60/1
Enclosure	TENV
Motor RPM	1725
Efficiency Rating	High
Windings	1
FLA (Amps)	1.38
Min. Circuit Ampacity (MCA)	2
Max. Overcurrent Protection (MOP)	15
Short Circuit Current Rtg (SCCR)	5 kA



Sound Power by Octave Band

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA	dBA	Sones
Inlet	71	74	68	62	60	58	50	47	66	55	7.6

Notes:

All dimensions shown are in units of in.
*NEC FLA, MCA and MOP are for reference only – based on tables 430.248 or 430.25 of National Electric Code 2020. Actual motor FLA may vary, for sizing thermal overload, consult factory. MCA and MOP values shown only account for the motor, not accessories (damper actuator, field supplied VFD, etc).
LwA - A weighted sound power level, based on ANSI S1.4
dBA - A weighted sound pressure level, based on 11.5 dB attenuation per Octave band at 5 ft - dBA levels are not licensed by AMCA International
Sones - calculated using ANSI/AMCA 301 at 5 ft

Model: G-080-VG

Direct Drive Centrifugal Roof Exhaust Fan

Standard Construction Features:

- Aluminum housing - Backward inclined composite (sizes 60-95) or aluminum (sizes 97-300) wheel - Aluminum curb cap with prepunched mounting holes - Birdscreen - Ball bearing motors (sizes 85-300 and all Vari Green), sleeve bearing motors (sizes 60-80) - Motor isolated on shock mounts - Corrosion resistant fasteners

Selected Options & Accessories:

Motor - Vari-Green EC motor
Control - Dial for balancing
Standard Curb Cap Size - 17 Square
UL/cUL 705 Listed - "Power Ventilators"
Switch, NEMA-1, Toggle,
Junction Box Mounted & Wired in weather-protected motor compartment
Foam Curb Seal (Factory Applied)
Birdscreen: Galvanized, nom. 84% Free Area
Composite Wheel Material
Conduit Chase Qty 1
Unit Warranty: 1 Yr (Standard)
Damper Shipped Loose, BD-100-PB-10X10, Gravity Operated, Not Coated, Nominal Size

Selected Sub Marks

See individual submittals for full details
GPI-17-10-G12

The Vari-Green Motor included in this order has a 'Multi-Voltage' ability. The red wire on the motor is called a 'Voltage Doubler', and when it is connected the motor can be powered by 115V.
If the Red wire is disconnected, then the motor can be powered with 208-230/277V. The motor will leave the factory with the voltage doubler wired per the order.

Vari-Green
Motor & Control Options

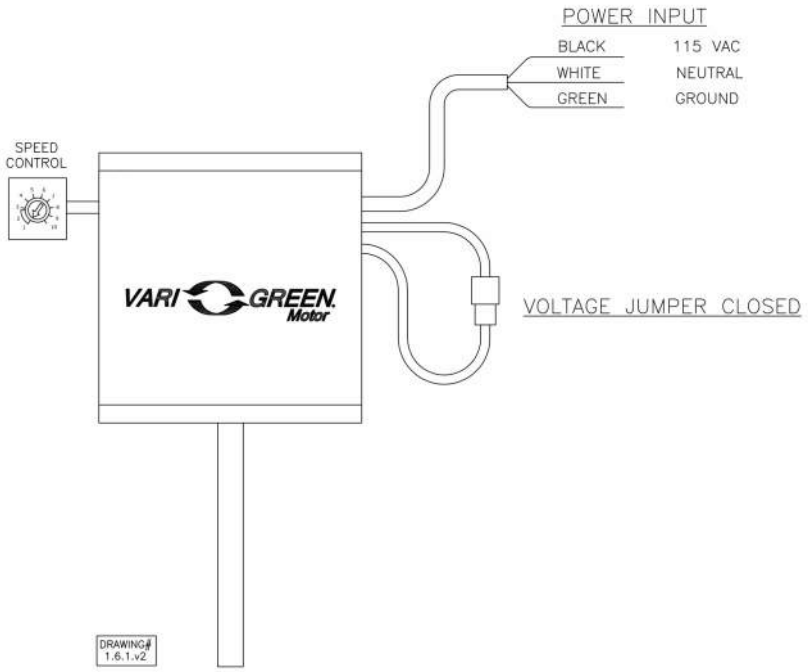
An EC motor that uses AC input power and internally converts it to DC power. Potentiometer (dial) mounted on the motor enclosure adjusts the speed (RPM) down 80%. Vari-Green motors feature a soft-start and inherent thermal and current protection built into each unit. Inrush current at start up is eliminated and the motor will automatically reduce speed or turn off if overloaded or it becomes too hot.

Motor Configuration

Input Voltage:	115
Speed Reference:	Dial on Motor
Permanent Dial:	Yes

Control Configuration

Control Type:	Dial on Motor
Transformer:	None



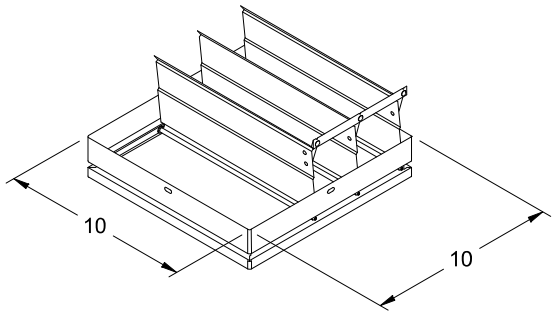
Horizontal Mount Exhaust Damper

Model: BD-100

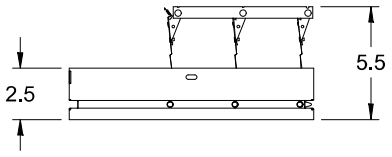
Standard Construction Features:

- Model BD-100 is a horizontal mount exhaust damper (air flow up) and is constructed of 24 ga galvanized steel with pre-punched mounting holes - Damper blades are 0.016 in. roll formed aluminum with vinyl seals on the closing edge, and spring assisted for ease of opening - Axle/bearing is constructed of fiberglass reinforced nylon

Greenheck Fan Corporation certifies that the models BD-100 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance Ratings.



DAMPER



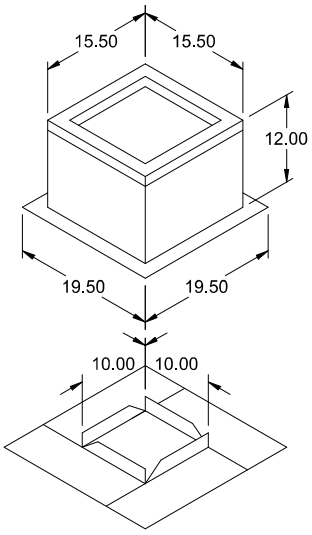
TYP. SECTION VIEW

Notes: All dimensions shown are in units of in.

AMCA

AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) does not include transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, Free outlet. Power rating (BHP/kW) does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories). The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per ANSI/AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal applies to sone ratings only.



Model: GPI

Roof Curb

Standard Construction Features:

- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure - Constructed of either 18 ga galvanized steel or 0.064 in. aluminum - Straight Sided without a cant - 2 in. mounting flange - 3 lb density insulation - Height - Available from 12 in. to 42 in. as specified in 0.5 in. increments. Notes: - The maximum roof opening dimension should not be greater than the "Actual" top outside dimension minus 2 in.. - The minimum roof opening dimension should be at least 2.5 in. more than the damper dimension or recommended duct size. - The Roof Opening Dimension may or may not be the same as the Structural Opening Dimension. - Damper Tray is optional and must be specified. Tray size is same as damper size. - Security bars are optional and must be specified. Frames and gridwork are all 12 ga steel.

General

Tag	Qty	Model	Sizing Method	Undersizing (in.)	Weight (lb)	Shipped Assembled	Union Label
	1	GPI-17	Nominal	1.5	14	Yes	No Preference

Dimensions

Curb Height (in.)	Nominal Outside Width (in.)	Nominal Outside Length (in.)	Actual Outside Width (in.)	Actual Outside Length (in.)	Actual Inside Width (in.)	Actual Inside Length (in.)	Hinge Base Width* (in.)	Hinge Base Length* (in.)
12	17	17	15.5	15.5	12	12	16	16

*May not be applicable

Damper Tray

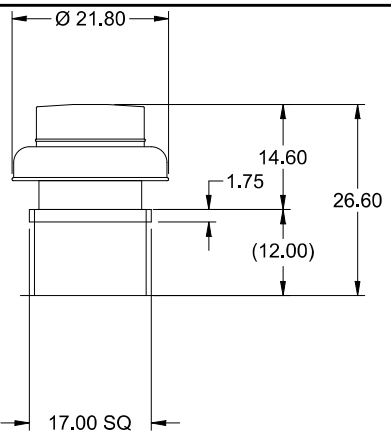
Damper Tray Width (in.)	Damper Tray Length (in.)
10	10

Accessories

Material	Security Bars	Liner	Insulation (in.)	Insulation R Value
Galvanized	No	No	1	R4.3

Model: G-080-VG

Direct Drive Centrifugal Roof Exhaust Fan



OVERALL HEIGHT MAY BE GREATER DEPENDING ON MOTOR, ADAPTER, AND/OR HINGE BASE.

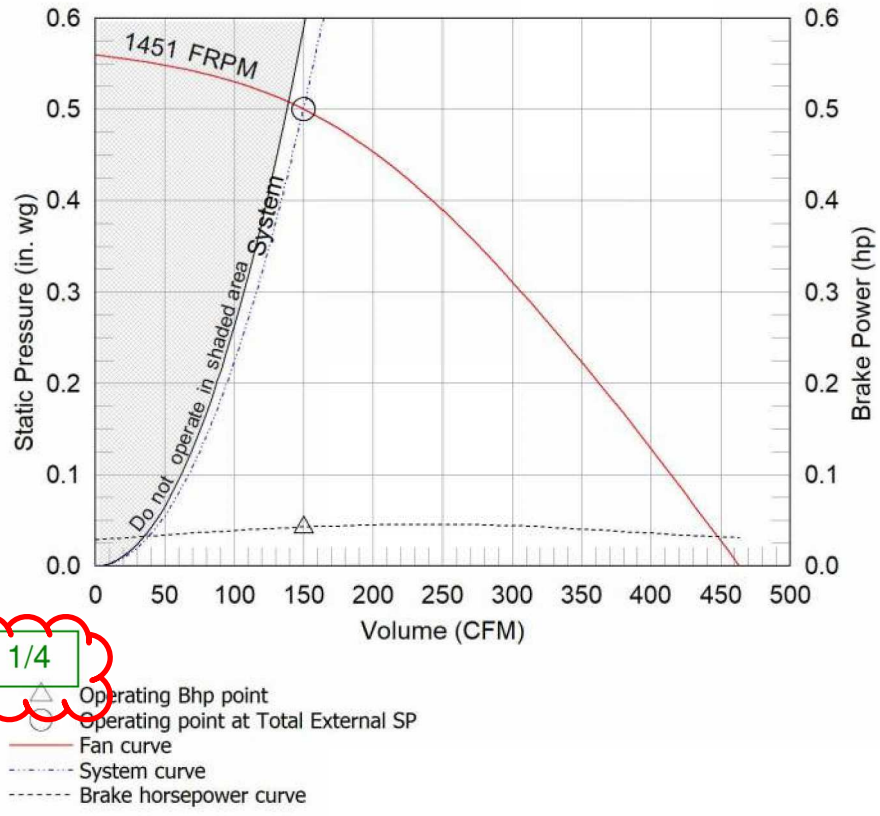
Dimensional	
Quantity	1
Weight w/o Acc's (lb)	24
Weight w/ Acc's (lb)	30
Weight w/ Acc's and Curb (lb)	44
Standard Curb Cap Size (in.)	17 x 17
Optional Damper (in.)	10 x 10
Roof Opening (in.)	13.5 x 13.5

Performance	
Requested Volume (CFM)	150
Actual Volume (CFM)	150
Total External SP (in. wg)	0.5
Fan RPM	1451
Operating Power (hp)	0.04
Elevation (ft)	768
Airstream Temp.(F)	70
Air Density (lb/ft3)	0.073
Tip Speed (ft/min)	4,132
Static Eff. (%)	28

Misc Fan Data	
Fan Energy Index (FEI)	-
Outlet Velocity (ft/min)	375

Motor	
Motor Mounted	Yes
Size (hp)	1/10
Voltage/Cycle/Phase	115/60/1
Enclosure	TENV
Motor RPM	1725
Efficiency Rating	High
Windings	1
FLA (Amps)	1.38
Min. Circuit Ampacity (MCA)	2
Max. Overcurrent Protection (MOP)	15
Short Circuit Current Rtg (SCCR)	5 kA

1/4



Sound Power by Octave Band

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA	dBA	Sones
Inlet	73	74	67	61	57	55	46	44	65	53	7.1

Notes:

All dimensions shown are in units of in.
*NEC FLA, MCA and MOP are for reference only – based on tables 430.248 or 430.25 of National Electric Code 2020. Actual motor FLA may vary, for sizing thermal overload, consult factory. MCA and MOP values shown only account for the motor, not accessories (damper actuator, field supplied VFD, etc).
LwA - A weighted sound power level, based on ANSI S1.4
dBA - A weighted sound pressure level, based on 11.5 dB attenuation per Octave band at 5 ft - dBA levels are not licensed by AMCA International
Sones - calculated using ANSI/AMCA 301 at 5 ft

Model: G-080-VG

Direct Drive Centrifugal Roof Exhaust Fan

Standard Construction Features:

- Aluminum housing - Backward inclined composite (sizes 60-95) or aluminum (sizes 97-300) wheel - Aluminum curb cap with prepunched mounting holes - Birdscreen - Ball bearing motors (sizes 85-300 and all Vari Green), sleeve bearing motors (sizes 60-80) - Motor isolated on shock mounts - Corrosion resistant fasteners

Selected Options & Accessories:

Motor - Vari-Green EC motor
Control - Dial for balancing
Standard Curb Cap Size - 17 Square
UL/cUL 705 Listed - "Power Ventilators"
Switch, NEMA-1, Toggle,
Junction Box Mounted & Wired in weather-protected motor compartment
Foam Curb Seal (Factory Applied)
Birdscreen: Galvanized, nom. 84% Free Area
Composite Wheel Material
Conduit Chase Qty 1
Unit Warranty: 1 Yr (Standard)
Damper Shipped Loose, BD-100-PB-10X10, Gravity Operated, Not Coated, Nominal Size

Selected Sub Marks

See individual submittals for full details
GPI-17-10-G12

The Vari-Green Motor included in this order has a 'Multi-Voltage' ability. The red wire on the motor is called a 'Voltage Doubler', and when it is connected the motor can be powered by 115V.
If the Red wire is disconnected, then the motor can be powered with 208-230/277V. The motor will leave the factory with the voltage doubler wired per the order.

Vari-Green
Motor & Control Options

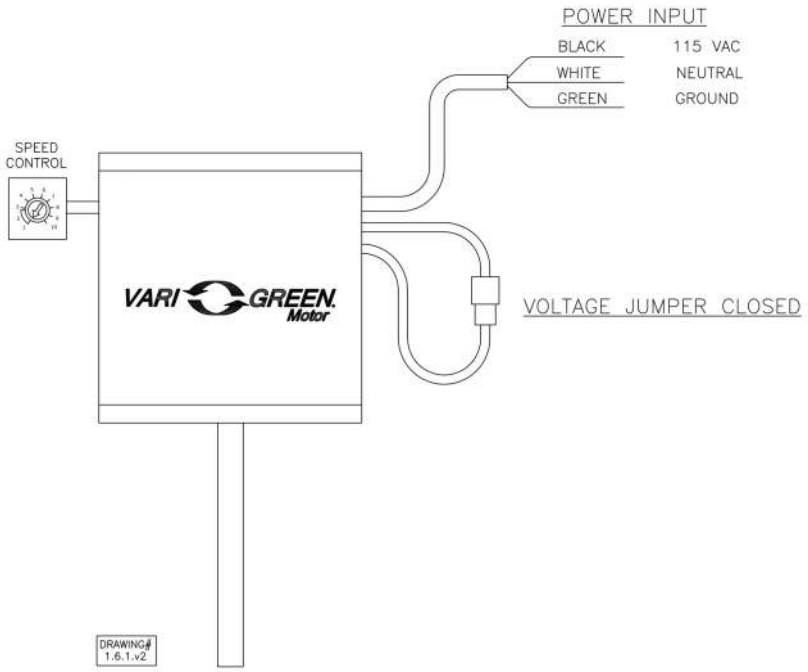
An EC motor that uses AC input power and internally converts it to DC power. Potentiometer (dial) mounted on the motor enclosure adjusts the speed (RPM) down 80%. Vari-Green motors feature a soft-start and inherent thermal and current protection built into each unit. Inrush current at start up is eliminated and the motor will automatically reduce speed or turn off if overloaded or it becomes too hot.

Motor Configuration

Input Voltage:	115
Speed Reference:	Dial on Motor
Permanent Dial:	Yes

Control Configuration

Control Type:	Dial on Motor
Transformer:	None



Horizontal Mount Exhaust Damper

Model: BD-100

Standard Construction Features:

- Model BD-100 is a horizontal mount exhaust damper (air flow up) and is constructed of 24 ga galvanized steel with pre-punched mounting holes - Damper blades are 0.016 in. roll formed aluminum with vinyl seals on the closing edge, and spring assisted for ease of opening - Axle/bearing is constructed of fiberglass reinforced nylon

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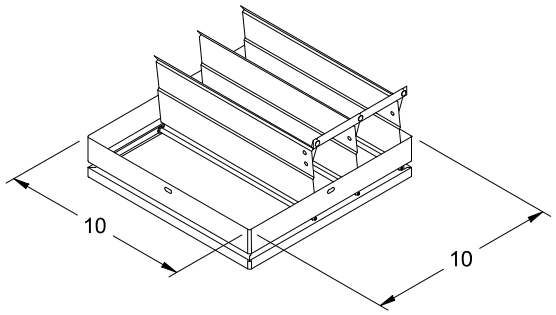
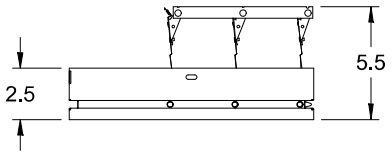


DAMPER



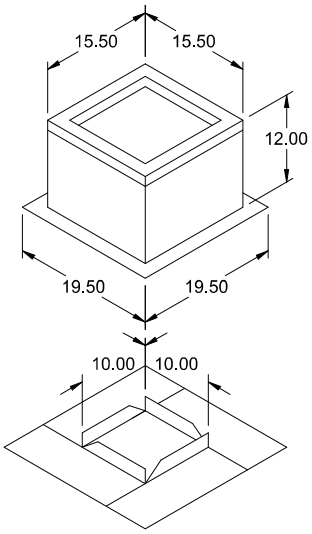
TYP. SECTION VIEW

Notes: All dimensions shown are in units of in.

AMCA

AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) does not include transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, Free outlet. Power rating (BHP/kW) does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories). The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per ANSI/AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal applies to sone ratings only.



Model: GPI

Roof Curb

Standard Construction Features:

- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure - Constructed of either 18 ga galvanized steel or 0.064 in. aluminum - Straight Sided without a cant - 2 in. mounting flange - 3 lb density insulation - Height - Available from 12 in. to 42 in. as specified in 0.5 in. increments. Notes: - The maximum roof opening dimension should not be greater than the "Actual" top outside dimension minus 2 in.. - The minimum roof opening dimension should be at least 2.5 in. more than the damper dimension or recommended duct size. - The Roof Opening Dimension may or may not be the same as the Structural Opening Dimension. - Damper Tray is optional and must be specified. Tray size is same as damper size. - Security bars are optional and must be specified. Frames and gridwork are all 12 ga steel.

General

Tag	Qty	Model	Sizing Method	Undersizing (in.)	Weight (lb)	Shipped Assembled	Union Label
	1	GPI-17	Nominal	1.5	14	Yes	No Preference

Dimensions

Curb Height (in.)	Nominal Outside Width (in.)	Nominal Outside Length (in.)	Actual Outside Width (in.)	Actual Outside Length (in.)	Actual Inside Width (in.)	Actual Inside Length (in.)	Hinge Base Width* (in.)	Hinge Base Length* (in.)
12	17	17	15.5	15.5	12	12	16	16

*May not be applicable

Damper Tray

Damper Tray Width (in.)	Damper Tray Length (in.)
10	10

Accessories

Material	Security Bars	Liner	Insulation (in.)	Insulation R Value
Galvanized	No	No	1	R4.3

GREENHECK
Building Value in Air.

Installation, Operation and Maintenance Manual

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

Table of Contents

Reference part number listed in chart to locate specific motor information page number.

HP	Voltage	* RPM Range	Encl.	FLA	Control Method	Motor Part No.	Pg.
1/15	115-120/ 208-230	300-1750	TENV	1.3/0.65	0-5V Only	328447	5
					Pot Only	328448	5
1/10	115	300-1725	TENV	1.5	Pot/0-10V	318003	4
	115/208-230/277	300-1750	ODP	1.38/ 0.84/0.73	Pot/0-10V	319356	4
	115/208-230/277	350-1750	TENV	1.5/1.1/ 0.9	Pot/0-10V	328128	4
1/6	115/208-230/277	300-1750	ODP	2.2/1.3/ 1.1	Pot/0-10V	319357	4
	115/208-230/277	350-1750	TENV	2.3/1.5/ 1.2	Pot/0-10V	328129	4
	115	300-1750	TENV	2.6	Pot/0-10V	318004	4
				3.1	0-10V Only	311352	3
				3.1	Pot Only	311353	
				3.1	Pot/0-10V	311731	3
				2.45		312359	
						313712	
						317886	
	208-240	300-1750	TENV	1.6	Pot/0-10V	313233	3
						313713	
	277	350-1750	TENV	1.15	Pot/0-10V	316495	3
1/4	115/208-230/277	300-1750	ODP	2.85/ 1.7/1.5	Pot/0-10V	318013	4
	115/208-230/277	350-1750	ODP	4.2/2.6/ 2.4	Pot/0-10V	328130	4
	115	300-1725	ODP	3.9	0-10V Only	310107	3
					Pot Only	310108	
				3.5	Pot/0-10V	311377	3
						313714	
						317887	
	208-240	300-1725	ODP	2.3	Pot/0-10V	313234	3
						313715	
	277	300-1725	ODP	1.8	Pot/0-10V	316496	3
1/3	115/208-230/277	300-1750	ODP	4.4/2.6-2.4/2.2	Pot/0-10V	320587	4
	115/208-230/277	350-1200	TENV	4.75/ 2.95/2.4	Pot/0-10V	328173	4
	115/208-230/277	350-1550	TENV	4.1/2.4 2.2	Pot/0-10V	328174	4
1/2	115	300-1725	ODP	6.2	0-10V Only	309025	3
				5.5	Pot Only	309028	
				6.2	Pot/0-10V	311812	3
	208-240	300-1725	ODP	4.2	Pot/0-10V	313235	3
	277	350-1725	ODP	3.3	Pot/0-10V	316497	3

HP	Voltage	* RPM Range	Encl.	FLA	Control Method	Motor Part No.	Pg.
1/2	115	300-2500	ODP	4.0	0-10V Only	310307	3
				6.5	Pot Only	310476	
				6.9	Pot/0-10V	312360	3
	208-240	350-2500	ODP	4.9	Pot/0-10V	317706	3
	277	350-2500	ODP	3.27	Pot/0-10V	317707	3
	115/208-230/277	300-1750	ODP	6.4/3.8-3.6/3.2	Pot/0-10V	320588	4
	115/208-230/277	350-1750	ODP	6.2/4.0/ 3.2	Pot/0-10V	328131	4
	115/208-230/277	350-2500	ODP	6.6/4.0/ 3.25	Pot/0-10V	328178	4
3/4	115	300-1725	ODP	10.1	0-10V Only	309026	3
				10.1	Pot Only	309029	
				10.6	Pot/0-10V	311388	3
						312619	
	208-240	300-1725	ODP	6.6	Pot/0-10V	314534	3
	277	350-1725	ODP	5.4	Pot/0-10V	316498	3
	115	300-2200	ODP	11.3	0-10V Only	310306	3
				11.3	Pot Only	310475	
				11.3	Pot/0-10V	312361	3
	208-240	350-2200	ODP	5.6	Pot/0-10V	317708	3
	277	350-2200	ODP	4.7	Pot/0-10V	317709	3
	115/208-230/277	300-1750	ODP	8.8/5.4-5.0/4.8	Pot/0-10V	320589	4
	115/208-230/277	350-1750	ODP	11.0/ 7.0/6.3	Pot/0-10V	328132	4
	115/208-230/277	350-2200	ODP	10.5/ 6.5/5.0	Pot/0/10V	328179	4
1	115	300-1725	ODP	12.4	Pot/0-10V	310359	3
						312362	
	115/ 208-240	300-1725	TEFC	12.0/6.0	Pot/0-10V	311156	5
	208-240	300-1725	ODP	8.6	Pot/0-10V	314945	3
	277	350-1725	ODP	7.3	Pot/0-10V	316499	3
	115/208-230/277	300-1750	TENV	11.5/7.0-6.5/5.8	Pot/0-10V	320590	4
	115/208-230/277	350-1750	ODP	13.0/ 8.0/6.7	Pot/0-10V	328133	4
2	208-240	300 - 1725	TEFC	12.0	Pot/0-10V	310420	5

*Actual maximum RPM may vary. See RPM column in chart on page 11 for specific motor and fan combinations.

Vari-Green® Motor

The Vari-Green Motor is an electronically commutated (EC) motor that uses AC input power and internally converts it to a DC power supply which provides an 80% turndown capability and increased energy savings.

NOTE

When using a clamp meter to measure input amp draw, the meter must be capable of reading a non-linear current. Erroneous readings will occur otherwise.

WARNING

To reduce the risk of fire or electric shock, do not use this motor with any solid-state speed control device.

Features, Operation and Wiring, and Troubleshooting

Features

Soft start – All motors feature soft-start technology which eliminates inrush current at start-up. The motors will reliably start at any speed setting.

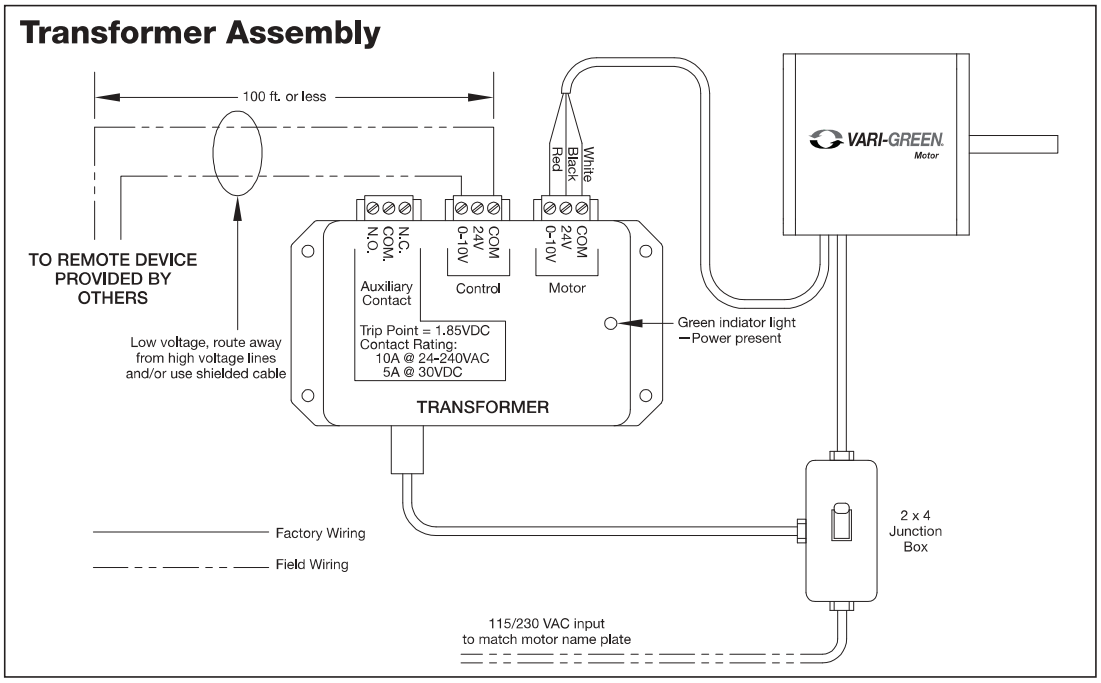
Overload protection – If the motor becomes overloaded, it will automatically reduce its speed until it is no longer overloaded. This means that the motor will never operate in the "service factor" which is possible with many AC motors.

Locked rotor protection – If the motor ever encounters a locked-rotor scenario, the motor will automatically shut itself down. It will try to restart up to 3 times, and if after the 3rd time the motor will still not rotate, the motor will not attempt to start again until power is cycled.

Thermal protection – The motors have a one-shot fuse thermal protector. This is meant to protect the motor from a severe temperature rise. Additionally, the motors have on-board temperature sensors which will reduce the speed of the motor should it become too hot. The fuse is used as a last resort to prevent a fire.

RPM measurement – The motors have a small shaft extension on the end of the motor to measure motor RPM with either a contact or optical tachometer.

Fig. 1 **0-10 VDC External connection with factory mounted transformer (See page 4 for details)**



Operation and Wiring
- Potentiometer Dial Only

Part Numbers Covered in this Section				
309028	309029	310108	310475	310476
311353				

These motors feature a potentiometer dial on the motor for speed adjustment. A small screwdriver can be used to make the speed adjustment. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise.

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate.

These motors cannot be converted to receive a remote control signal – a different motor is needed. Please consult the factory.

Operation and Wiring
- 0-10V Input Only

Part Numbers Covered in this Section				
309025	309026	310107	310306	310307
311352				

These motors will accept a 0-10 VDC control signal for speed control. From 0-1.9V, the motor will be off, and will operate in the 2-10V range. 24 VAC/DC power is also required for operation. The motor will consume 0.7VA at 24 VAC or 25mA at 24 VDC. A factory mounted transformer is available to supply this voltage. (See Fig. 1)

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate, along with the 0-10 VDC and 24V signal for speed control.

NOTE: The motor will not operate without the proper control voltages.

Operation and Wiring
- Potentiometer Dial and 0-10V Input

Part Numbers Covered in this Section				
310359	311731	311377	311388	311812
312359	312360	312361	312362	312619
313233	313234	313235	313712	313713
313714	313715	314534	314945	316495
316496	316497	316498	316499	317706
317707	317708	317709	317886	317887

These motors have both a potentiometer dial on the motor for speed adjustment AND have the ability to accept a 0-10 VDC signal for remote speed control.

There is a 4 second delay between the application of power and the motor starting.

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate. If remote control is desired, connect the 0-10 VDC and 24V signal for remote speed control.

Dial on Motor – A small screwdriver can be used to make the speed adjustment. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise. There is no need to connect the control wires.

0-10 VDC signal – The dial on the motor must be rotated fully clockwise to achieve the full speed range. If this is not done, the dial will act as a maximum speed limiter.

From 0-1.9V, the motor will be off, and will operate in the 2-10V range. 24 VAC/DC power is also required for operation. The motor will consume 0.7VA at 24 VAC or 25mA at 24 VDC. A factory mounted transformer is available to supply this voltage. (See Fig. 1, page 2)

A low voltage wiring harness is needed to supply the 0-10V signal to the motor. This harness is available from the factory if conversion is necessary.

Low Voltage Harness Part Numbers			
Type	**Use with Motor**	**18 in. long**	**36 in. long**
3-pin	311731, 310359	384431	384432
9-pin	311377, 311812, 311388, 312359, 312360, 312361, 312362, 312619, 313233, 313234, 313235, 313712, 313713, 313714, 313715, 314534, 314945, 316495, 316496, 316497, 316498, 316499, 317706, 317707, 317708, 317709, 317886, 317887	384804	384805

NOTE

The 9-pin connector on the motor contains 6 wires. The red, black and white wires are used for the external control signal and the other three are used for factory initialization and programing.

0-10V Analog input connection	
Red	+ 0-10 VDC
White	Common*
Black	+24 VAC/DC
*Common is shared between both 24V power and 0-10V signal.	
The impedance of 0-10V circuit is 12KΩ	

Troubleshooting

Motor does not operate

1. Check all wiring connections to ensure they are correct and secure.
2. Verify that all voltages are present at the motor, including 24V and 0-10 VDC, if applicable.
3. Make sure that the fan wheel will rotate freely and there are no foreign objects in the wheel. If fan wheel does not rotate freely, disconnect power from the motor and adjust the wheel or housing until the wheel can freely rotate. Apply power and the motor should restart.
4. If motor has both the dial on the motor and 0-10 VDC control option, control wiring issues can be tested by disconnecting the control wires from the motor. The motor should then operate using the dial on the motor for speed control.

Motor will not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 10 VDC, if applicable.
3. There are some motor/fan combinations where the motor may not reach nameplate RPM. See Max RPM table on page 11 for the maximum motor speed for your application.

Factory Mounted Transformer (Fig. 1, page 2)

A factory mounted transformer is available to supply 24 VDC power to the motor when the 0-10V signal is by others. This transformer has the capability to power a remote device if desired. The power available to a remote device is 400mA at 24 VDC. If the remote device is powered by a different source, connect the analog output to the 0-10V and COM terminals of the transformer. This will pass the signal through to the motor.

WARNING

Do not connect an external 24V supply to the transformer's control terminal labeled 24V. If the external device providing the 0-10V signal is powered elsewhere, this terminal can remain unused.

Operation and Wiring

- Potentiometer and 0-10V Input

Part Numbers Covered in this Section				
318003	318004	318013	319356	319357
320587	320588	320589	320590	328128
328129	328130	328131	328132	328133
328173	328174	328178	328179	

These motors have the ability to accept a plug-in potentiometer for speed adjustment AND the ability to accept a 0-10V signal for remote control.

There is a 4 second delay between the application of power and the motor starting.

Motor part numbers 318003, 318004 – The motor is prewired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate.

Motor part numbers 318013, 319356, 319357, 320587, 320588, 320589, 320590, 328128, 328129, 328130, 328131, 328132, 328133, 328173, 328174, 328178, and 328179 – The motor is prewired at the factory and can operate on 115v up to 277v. Operating voltage is changed via voltage red jumper wire.

Voltage jumper – For 115v the red jumper wire on the side of the motor must be connected (closed). For 208v-277v operation the red jumper must be disconnected (open). If disconnected, red jumper wire has 120 VAC potential. Ensure leads are capped/covered.

Dial on Motor – A potentiometer (PN 385806) can be plugged into the 9-pin connector of the motor. To increase speed, rotate the dial clockwise. To decrease speed, rotate the dial counterclockwise.

0-10 VDC Signal – From 0-1.9V, the motor will be off, and will operate in the 2-10V range. A low voltage wiring harness is needed to supply the 0-10V signal to the motor. The harness is available from the factory if conversion is necessary.

0-5 VDC Signal – From 0-0.9V, the motor will be off and will operate in the 1-5V range. A low voltage wiring harness is needed to supply the 0-5V signal to the motor. The harness is available from the factory if conversion is necessary.

Low Voltage Harness Part Numbers			
Type	Use with Motor	18 in. long	36 in. long
9-pin	318003, 318004, 318013, 319356, 319357, 320587, 320588, 320589, 320590, 328128, 328129, 328130, 328131, 328132, 328133, 328173, 328174, 328178, 328179	385821 (0-10 VDC only) 386518 (0-5 VCD and 0-10V DC compatible)	385822 (0-10 VDC only) 386519 (0-5 VCD and 0-10V DC compatible)

NOTE

The 9-pin connector on the motor contains 6 wires. The yellow, orange, red and white wires are used for external control. The other two wires are used for factory initialization and programming.

0-10V Analog Input Connection	
Red	+ 0-10 VDC
White	Common
Green	+0-5 VDC Signal
Black	5 VDC Supply

Troubleshooting

Motor does not operate

1. Verify the motor is wired correctly and all connections are secure.

2. If using dial on motor, verify the potentiometer is fully seated in the 9-pin connector.
3. If using 0-10 or 0-5 VDC, verify that all voltages are present at the motor.

Motor does not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 10 or 5 VDC, if applicable.
3. There are some motor/fan combinations where the motor may not reach nameplate RPM. See Max RPM table on page 11 for the maximum motor speed for your application.
4. Make sure black wire is disconnected when using 0-10 VDC.

Operation and Wiring

- 0-5V Input

Part Numbers Covered in this Section	
328447	328448

Motor PN 328447 has the ability to accept 0-5V signal for speed adjustment via a 0-5V dial on fan, PN 386512.

Motor PN 328448 has the ability to accept a 0-5V signal for speed adjustment via a plug-in potentiometer PN 385806.

There is a four second delay between the application of power and the motor starting.

Motor part numbers 328447, 328448 - the motor is prewired at the factory and can operate at single phase 115-120V or 208-230V. The motor detects the incoming voltage and automatic switches adjust for it inside the motor. All that is required is to connect single phase power at the voltage listed on the nameplate.

Dial on Motor – A potentiometer (PN 385806) can be plugged into the 9-pin connector of the motor. To increase speed, rotate the dial clockwise. To decrease speed, rotate the dial counterclockwise.

0-5V Dial on Fan – From 0-1V, the motor will be off and will operate in the 2-5V range. The low voltage wiring harness is built into the design of the motor PN 328447.

NOTE
The 9-pin connector on the motor contains 3 wires. The green, white and black wires in the white jacketing are used for external control.

0-10V Analog Input Connection	
Green	+0-5 VDC Signal
White	Ground
Black	5 VDC Supply

Troubleshooting

Motor does not operate

1. Verify the motor is wired correctly and all connections are secure.
2. If using dial on motor, verify the potentiometer is fully seated in the 9-pin connector.
3. If using 0-5V dial on fan controller, verify that all voltages are present at the motor.

Motor does not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 5 VDC.

Part Numbers Covered in this Section	
310420	311156

Features

Speed control - These motors can be controlled by either a dial on the motor or a 0-10 VDC signal for remote control.

Soft start – All motors feature soft-start technology which eliminates inrush current at start-up. The motors will reliably start at any speed setting. There will be up to a 30 second delay between the application of power and the motor starting. The motor will "rock" back and forth upon startup as part of its normal operation.

Overload protection – If the motor becomes overloaded, it will automatically shut itself down. The maximum programmed motor speeds have been selected to prevent this from happening in normal operation.

Locked rotor protection – If the motor encounters a locked-rotor scenario, it will automatically shut itself down. It will try to restart up to 3 times, and if after the 3rd time the motor will still not rotate, the motor will not attempt to start again until power is cycled.

Thermal protection – The motors have an automatic reset thermal protector. This is meant to protect the motor from a severe temperature rise.

RPM measurement – The motor RPM can be measured by removing the cooling fan cover and using a contact or optical tachometer. Be sure to replace the cooling fan cover when finished.

Reversible rotation – The motor direction has been pre-set at the factory for the rotation of the fan but can be reversed if necessary.

Operation and Wiring

These motors can be controlled by either a dial on the motor or a 0-10 VDC signal for remote control. The motor will be supplied from the factory with the correct accessory depending on what was ordered.

Dial on Motor - Turn the dial with your fingers to adjust. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise. Turning the dial full Counter Clock Wise will turn the motor off.

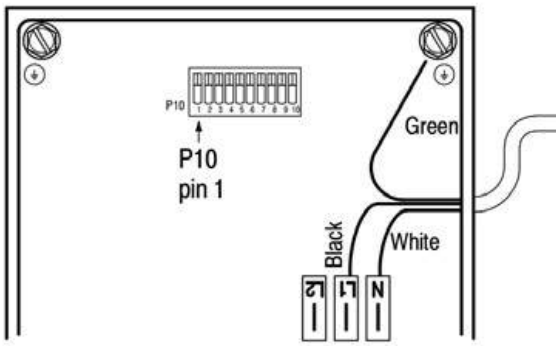
0-10 VDC Signal - From 0-1.9V, the motor will be off, and will operate in the 2-10V range. This motor does not require 24V power for operation.

0-10V Analog Input Connection	
Red	+ 0-10 VDC
White	Ground

Wiring

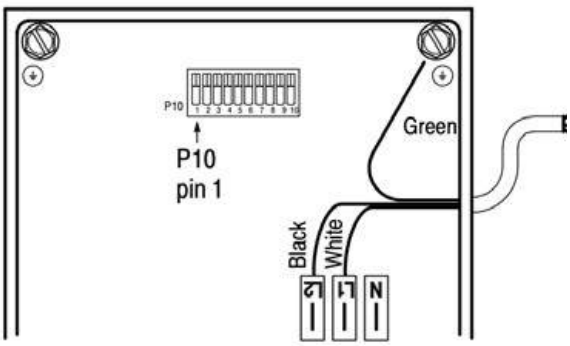
1. All high and low voltage wiring connections are made inside the motor control box at the factory. Normally, there is no reason to enter the control box of the motor. If there is a need to enter the control box, disconnect power and wait at least five minutes to allow the capacitors to discharge.
2. The motors are factory wired for the ordered voltage. If the factory wired voltage does not match the desired voltage, the voltage can be changed, with exception of the 2HP motor (310420), which is 208-240V only.

115V: Connect 115 VAC to L1, connect Neutral to N. The L2 terminal remains empty. Connect ground to grounding stud.



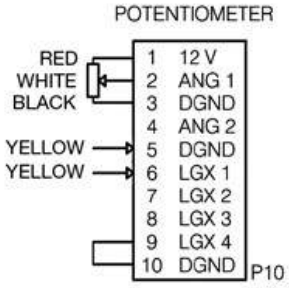
115V Connection inside control box

208-240V - Connect line voltage to L1 and L2. The N terminal remains empty. Connect the ground to the grounding stud.



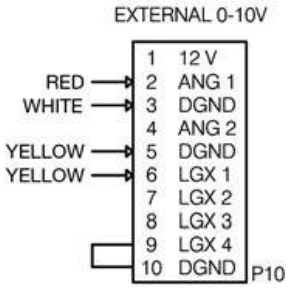
208-240V Connection inside control box

Dial on Motor - the dial is factory-wired into the low voltage terminal block inside the control box. The wires are connected as shown.



Dial on motor connection inside control box

0-10 VDC Signal - a two-wire pigtail is factory-wired into the low voltage terminal block. The wires are connected as shown.

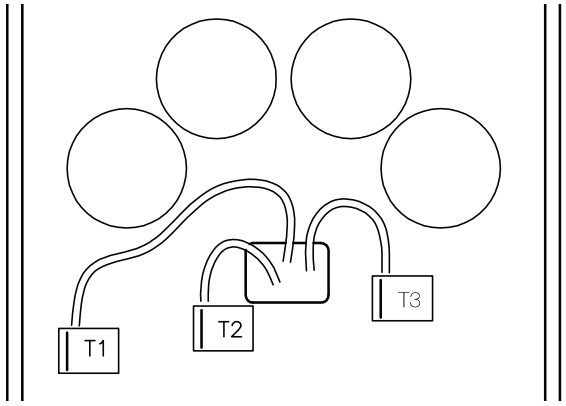


0-10 VDC signal connection inside control box

If the motor needs to be tested before the 0-10 VDC signal is available, a jumper can be placed between terminals 1 and 2. This will force the motor to run at full speed.

Motor Rotation

To reverse the rotation of the motor, swap any two of the red, black and blue wires connecting the control board to the motor at terminals T1, T2 and T3. Note that motor warranty is void if motor is rotating in the wrong direction. See fan instruction manual for correct rotation direction.



Rotation selection wires inside control box

Troubleshooting

These motors have a diagnostic red LED on the circuit board inside the control box, or on the exterior of the control box, that will be solid (not flashing) when power is applied to the motor and the motor is operating normally. The LED may be solid even if the motor is not spinning, such as when power is applied but the motor may be commanded to be off with a 0-1.9V VDC signal.

1. If external LED is not present, to view the status of the LED the control box cover must be removed while power is applied to the motor. If the control box cover is removed while power is applied, extreme care must be taken not to touch any of the components inside the box.
2. If a fault occurs, the LED will blink a specific number of times to identify the fault that has occurred. The fault indications are as follows:

Number of Blinks	Indicated Fault
2	Hardware Fault
3	Overvoltage
4	Undervoltage
5	Communication Error
6	Sync Loss
7	Spin Fault
8	Motor Overload
9	Motor Over Temperature

3. When the LED is blinking, it will consecutively blink from 2 to 9 times, followed by a pause, and repeat the blink sequence. It is best to count the number of flashes 2 or 3 times to ensure accuracy.
4. Under most fault conditions the motor will automatically restart. If a motor overload fault occurs more than 10 times in one hour, the motor will shut down and require a power cycle to reset.
5. If the fault persists, consult the factory.

Motor does not operate

1. Verify the motor is wired for the correct voltage.
2. Verify that the dial on the motor is properly connected to the control board - or - verify that the 0-10 VDC wires are properly connected to the control board.
3. Verify that the Status LED is solid red.
4. Verify that a jumper is in place between terminals 9 and 10. The motor will not run without this jumper in place.
5. Verify that the two yellow wires coming from the motor are in place on terminals 5 and 6.

Controls: Operation, Wiring and Troubleshooting

Remote Dial/Touch Remote and 2-Speed Control

Remote Dial

Installation Overview: The remote dial is provided with the fan, shipped loose for remote installation. It also includes a factory mounted 24 VDC transformer.

1. Disconnect power to the fan.
2. Identify where the remote dial will be mounted.
3. Mount a standard single-gang 2x4 junction box.
4. Run a 3-wire control cable from the remote dial to the fan motor compartment. The maximum distance from the fan to the remote dial is 100 feet. If a greater distance is required, signal loss may occur and cause the fan to operate erratically.
5. Connect control cable to transformer mounted inside fan motor compartment. Connect control cable to remote dial.
6. Secure remote dial to 2x4 junction box.

Remote Dial with Min/Max Setting

Remote dials (PN 385803) are capable of setting minimum and maximum voltage limits. Setting voltage limits will require a multi-meter. To set a voltage span:

1. Install and wire remote dial as previously instructed.
2. Install multi-meter probes into the red (0-10v) and black (ground) connectors.
3. To set maximum voltage limit, apply power to the motor, transformer and remote dial. With remote dial set to zero (0), hold the Upper Limit button down and turn the dial until the desired voltage is displayed on your multi-meter. Release button to save max voltage setting.
4. To set lower voltage, turn remote dial back to zero (0). Hold down Lower Limit button while turning dial to desired voltage on your multi-meter. Release button to set minimum voltage limit.
5. To reset to default (0-10v) limits, hold both Upper and Lower limit buttons down simultaneously until the LED indicator lights up. Then release buttons and default levels will be restored.

   NOTE: Upper voltage limit must be set prior to setting lower voltage limit. Upper and lower limits can only be within 0.5v of each other.

Touch Remote

Follow installation instructions for remote dial above. After power is applied to the system, operate as follows:

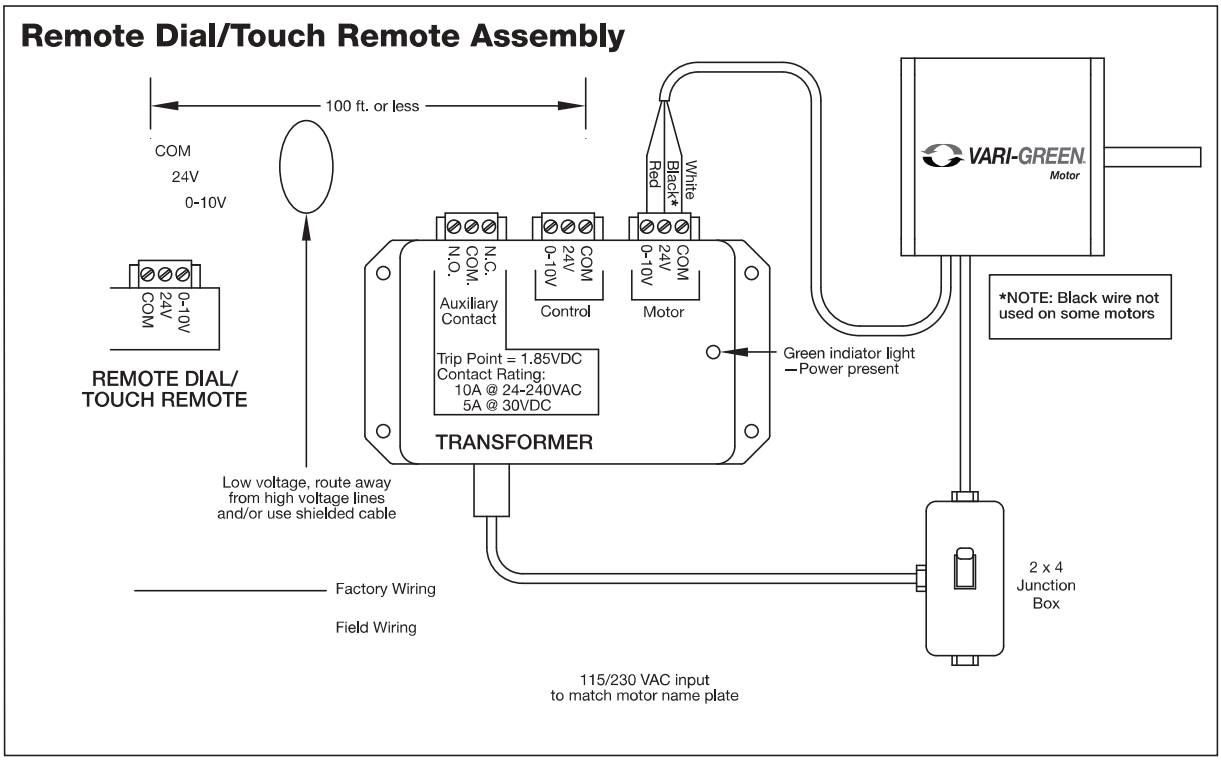
1. Touch power button to turn fan on.
2. Touch UP/DOWN arrow to increase/decrease speed.
3. Subsequent touches of the power button will start the countdown timer of 90, 60, 30 or 10 minutes.
4. LED's will turn off after a period of inactivity.
5. To lock/unlock buttons, hold the UP and DOWN arrows for 3 seconds. When locked, the power button will light up red.

Other Vari-Green® controls, such as the Constant Pressure and Air Quality families of controls, have their own manual that ship with the controller. They can also be found on Greenheck.com. See table on page 11 for document numbers.

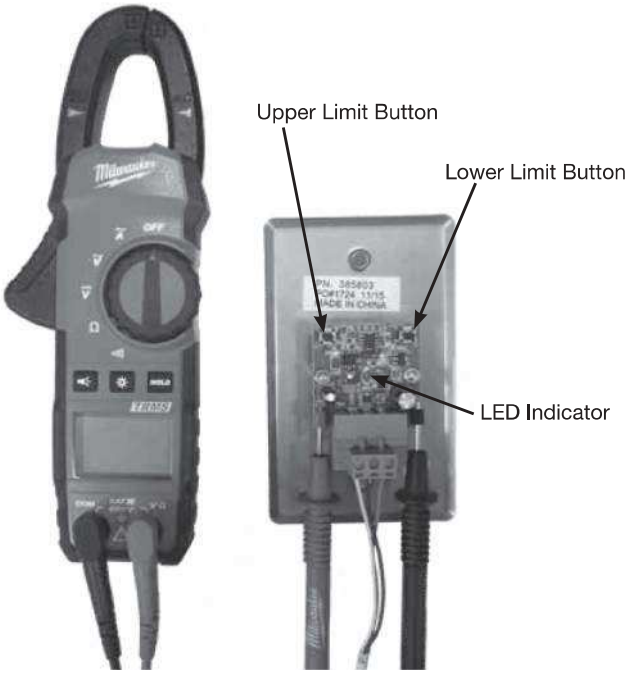
CAUTION

Even though the motor may not be operating, high voltage power may still be present at the motor. Make sure to disconnect power to the fan before servicing.

Remote Dial/Touch Remote Assembly



Remote Dial with Min/Max Setting



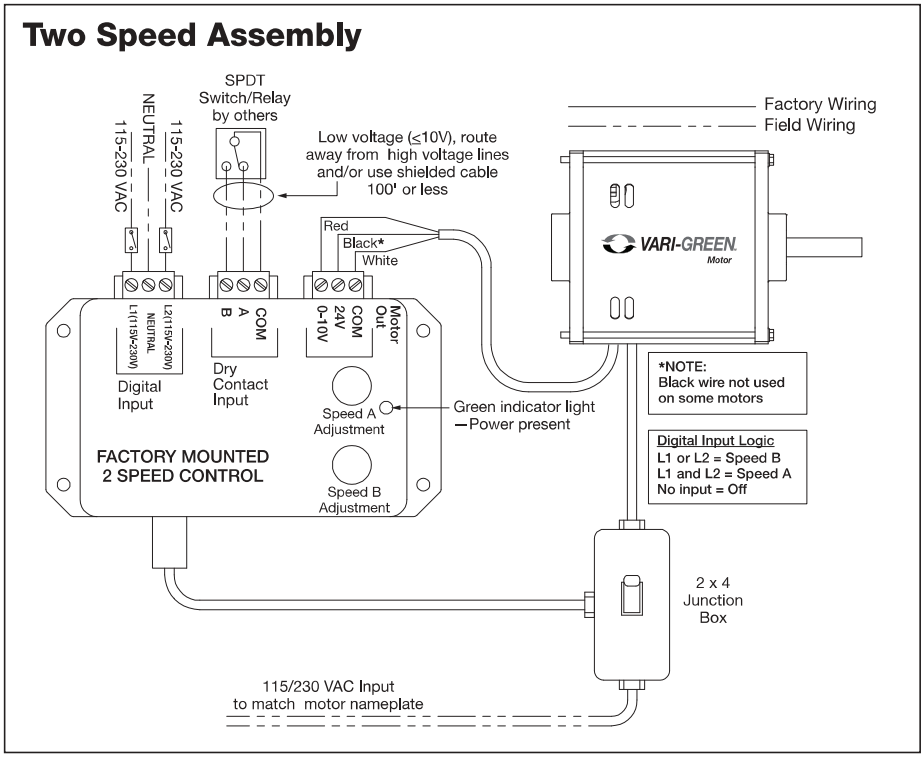
Troubleshooting - Remote Dial/Touch Remote

Remote Dial does not adjust motor RPM

1. Check voltage to ensure the motor and transformer are receiving the correct line voltage.
2. Check voltage at the remote dial. 24 VDC should be present across the 24V and COM terminals. 0-10 VDC should be present across the 0-10V and COM terminals.
3. Verify all of the connections at the transformer and make certain that they are secure.
4. Touch remote: Verify that the touch remote is unlocked.
5. To reset to default (0-10v) limits, hold both Upper and Lower limit buttons down simultaneously until the LED indicator lights up. Then release buttons and default levels will be restored.

Terminals	Desired Voltage
24V-COM	24 VDC Nominal
0-10V-COM	0-10 VDC (varies with dial position)

Two Speed Assembly



Two Speed Control

Installation Overview: The two speed control is factory mounted to the fan and may be set to provide any two speeds the application requires. It also includes a 24 VDC transformer. A green LED will be illuminated when the 2-speed control is powered.

1. There are two methods of toggling between speed A and speed B:
   a. **Dry contact input** - this utilizes an external switching device such as a relay or SPDT switch to toggle between the two speeds.
      - Connect terminal “A” to “COM” for speed A.
      - Connect terminal “B” to “COM” for speed B.

      If no contact is made between either terminal the motor will be off.
   b. **AC digital input** - this input allows an AC voltage signal to be fed directly into the 2-speed control to change speeds.
      - Send 115-230V AC to L1 **OR** L2 for speed B.
      - Send 115-230V AC to L1 **AND** L2 for speed A.

      If no voltage is applied to either terminal, the motor will be off.
   c. DO NOT CONNECT BOTH DRY CONTACT AND DIGITAL INPUTS SIMULTANEOUSLY.
2. To test fan operation before the external control devices are installed, a jumper wire can be connected between the COM and A or B terminal on the dry contact input for fan operation.

Troubleshooting - Two Speed Control

1. Check all wiring connections to ensure they are correct and secure.
2. Verify AC line voltage is present at the motor and 2-speed control.
3. Verify 24 `VDC is present at the 24V and COM terminals of the "Motor" terminal block.
4. Measure DC voltage between the 0-10V and COM terminals of the "Motor" terminal block. This voltage should match the dial position of the active dial.
   a. If using dry contact input - ensure contact closure is connecting the proper terminals.
   b. If using AC digital input - disconnect connector from 2-speed control and measure voltage between L1 and Neutral or L2 and Neutral.

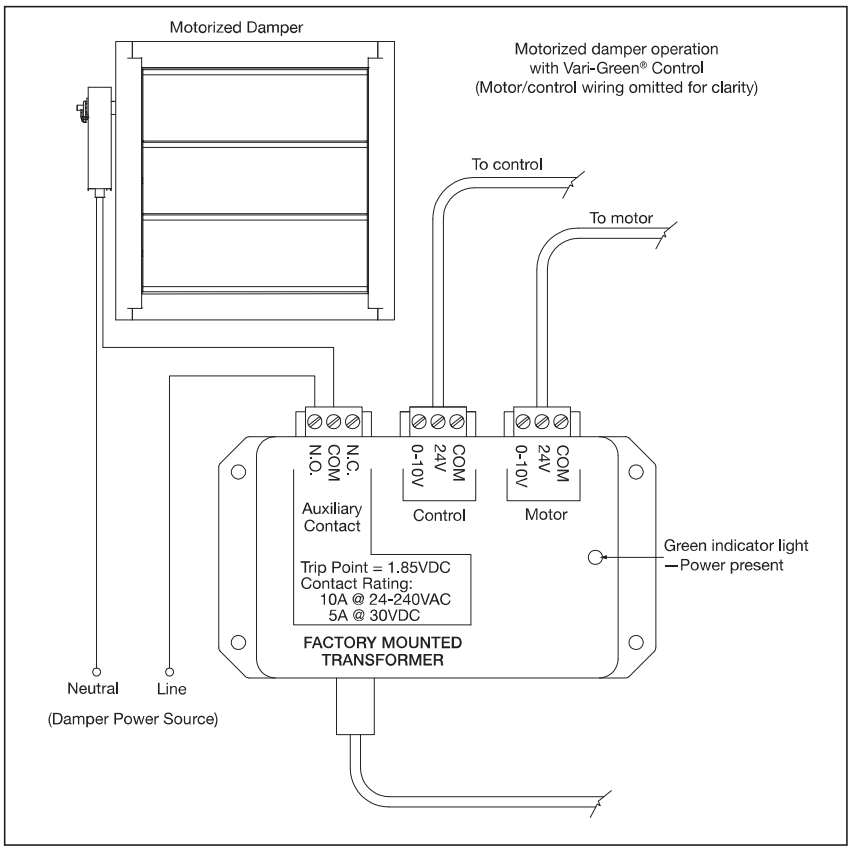
Motorized Backdraft Damper Control

The available factory mounted transformer (PN 385253) has the ability to signal a motorized back draft damper to open/close as the motor starts/stops.

A N.O./N.C. set of contacts is provided which will change state when above or below a control voltage of 1.85 VDC. See wiring diagram for example.

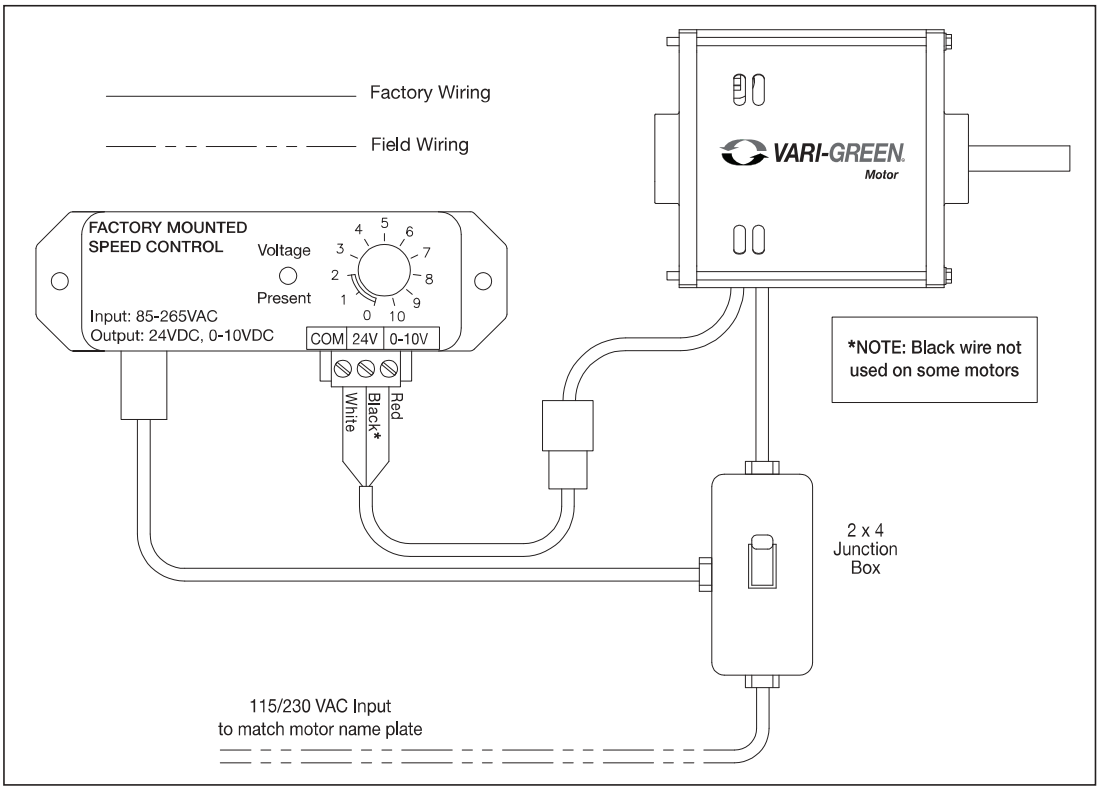
Contact Rating:

- 10A @ 24-240 VAC
- 5A @ 30 VDC



Fans Where Dial on Motor is Not Accessible

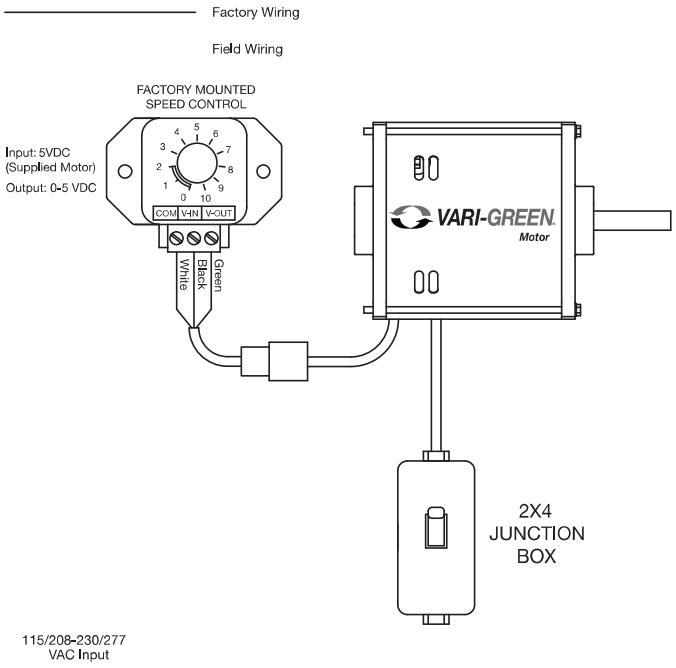
A control is available to mount on the outside of a fan where the dial on motor may be difficult to access (model SQ). This control is powered by the line voltage entering the fan and will send 24 VDC and 0-10 VDC to the motor. Control Part Number is 385611



Alternative: Fans Where Dial on Motor is Not Accessible

A control is available to mount on the outside of a fan where the dial on motor may be difficult to access (model SQ). In many cases, the tri-voltage platform of VG motors can work off either 0-5V signal or a 0-10V signal. This control is powered by 5VDC output signal wire of the motor and will send a 0-5VDC to the motor to adjust the speed. Control PN 386512.

Control	Compatible Motor P/N
386512	328447, 319356, 328128, 319357, 328129, 318013, 328130, 320587, 320588, 328131, 320589, 328132, 320590, 328133 328173, 328174



Multiple Motors on One Control

Refer to the table below for the recommended number of motors to be driven from one controller. Note that the controllers do not have the ability to distinguish between more than one motor, therefore all motors will receive the same control voltage. Control voltage must be wired in parallel to all motors.

Controls	Max. Motor Quantity
Remote Dial	4
2-speed	6
Constant Pressure/Airflow	4
Temperature/Humidity	2
VOC	2

Maintenance

Vari-Green® motors use brushless technology with sealed bearings. No routine maintenance is required other than keeping any debris from accumulating on the motor and controls.

Other Vari-Green® Control Instruction Manuals

Description	Document Number
Indoor Air Quality - VOC	475407
Indoor Air Quality - Temperature/Humidity	475573
Constant Pressure Control	474766
Generation 2 Constant Pressure/Airflow Control	479653

Maximum RPM Table

This table will show the available motor and fan combinations with the correlating maximum motor RPM for each combination.

CUE/CW	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
99	1725	1/4
101	1725	1/4
101HP	1725	1/4
	2500	1/2
121	1400	1/4
	1725	1/2
131	1200	1/4
	1450	1/2
	1725	3/4
141	1000	1/4
	1300	1/2
	1550	3/4
	1725	1
141HP	1450	1/4
	1725	1/2
	2200	3/4
161	1000	1/2
	1200	3/4
	1300	1
	1725	2
161HP	1300	1/2
	1650	3/4
	1725	1
180	875	3/4
	1000	1
	1325	2

SQ	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
97	1725	1/4
	2500	1/2
98	1725	1/4
	2200	3/4
99	1725	1/4
	2200	3/4
100	1725	1/4
120	1725	1/2
130	1725	3/4
130HP	1250	1/4
	1450	1/2
	1950	3/4
140	1500	3/4
	1725	1
140HP	1100	1/2
	1450	3/4
	1725	1
160	1140	3/4
	1300	1
	1725	2
160HP	850	1/2
	1000	3/4
	1600	1
	1725	2

USF	Max RPM	Motor HP
4	1660	1/4
	1725	1/2
	1725	3/4
6	1660	1/4
	1725	1/4
	1725	1/2
	1725	3/4
7	1140	1/4
	1725	1/2
8	1660	1/4
	1725	1/2
	1725	3/4
10	1660	1/4
	1725	1/2
	1725	3/4
13	1370	1/4
	1725	1/2
	1725	3/4
15	1110	1/4
	1400	1/2
	1600	3/4
16	910	1/4
	1150	1/2
	1320	3/4
18	740	1/4
	940	1/2
	1050	3/4

LD/LDP	Max RPM	Motor HP
80-90	1725	1/10
95	1725	1/6
100	1725	1/4
120	1725	1/2

SP/CSP	Max RPM	Motor HP
510	1275	1/6
710	1450	1/4
700	1750	1/3
1050	1225	1/3

G	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
97-99	1725	1/4
103	1725	1/4
103HP	1725	1/4
	2500	1/2
123	1200	1/4
	1725	1/2
133	1150	1/4
	1550	1/2
	1725	3/4
143	900	1/4
	1200	1/2
	1300	3/4
	1725	1
143HP	1500	1/4
	1725	1/2
	2200	3/4
163	750	3/4
	1200	1
	1725	2
183	900	3/4
	1000	1
	1325	2

SE1/SS1	Max RPM	Motor HP
8-440*	1725	1/15
8-440*	1725	1/10
10-440*	1725	1/15
10-440*	1725	1/6
12-426	1725	1/4
12-432	1725	1/4
12-436	1725	1/4
14-432	1725	1/4
14-436	1725	1/2
14-440	1725	1/2
16-421	1725	1/2
16-426	1725	1/2
16-428	1725	3/4
16-436	1725	3/4
18-424	1725	3/4
18-429	1725	3/4
20-420	1725	1
***SE1 Model Only**		

Our Commitment

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

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Document 471558
Model G and GB
Downblast Centrifugal Roof Exhaust

Installation, Operation and Maintenance Manual

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

Direct Drive Downblast Centrifugal Exhaust

These fans are specifically designed for roof mounted applications exhausting relatively clean air. The maximum continuous operating temperature is 130°F *(54ºC)*. Direct drive models are made with nominal wheel diameter ranging from 8 to 30 inches *(203 to 762 mm)* (060-300 unit sizes). Each fan shall bear a permanently affixed manufacturer's embossed metal nameplate containing the model number and individual serial number. All fans are UL/cUL Listed Standard 705.

Belt Drive Downblast Centrifugal Exhaust

These fans are specifically designed for roof mounted applications exhausting relatively clean air. The maximum continuous operating temperature is 180°F *(82ºC)*. Belt drive models are made with nominal wheel diameters ranging from 11 to 54 inches *(279 to 1372 mm)* (097-540 unit sizes). Each fan shall bear a permanently affixed manufacturer's embossed nameplate containing the model number and individual serial number. All fans are UL/cUL Listed Standard 705.

General Safety Information

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

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

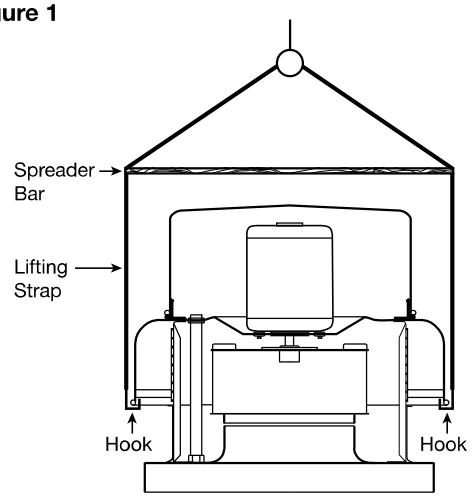
Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of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

Handling

Belt and Direct Drive Units

Lift Direct Drive unit on to the roof utilizing hooks under the lip of the shroud. Evenly space the hooks around the shroud using a minimum of four lifting straps. Use a spreader bar to ensure the straps do not come in contact with the unit (see Figure 1).

Figure 1



When lifting a belt drive unit on to the roof, use either the four lifting points on the drive frame or the two lifting points on the bearing plate if present (see Figure 2 for lifting points). Access to the drive frame is accomplished by removing the screws identified in Figure 3. The cover can then be removed and placed on a flat surface in an area protected from strong winds.

When direct and/or belt drive unit is on the roof, move fan to desired location using lifting points and fasten securely through mounting holes in base. Shims may be necessary depending upon roofing material thickness.

The motor amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. For direct and/or belt drive installations, the electrical supply should be routed through the conduit chase located between the curb cap and the bottom of the motor compartment. Wiring must conform to local and national codes.

Figure 2

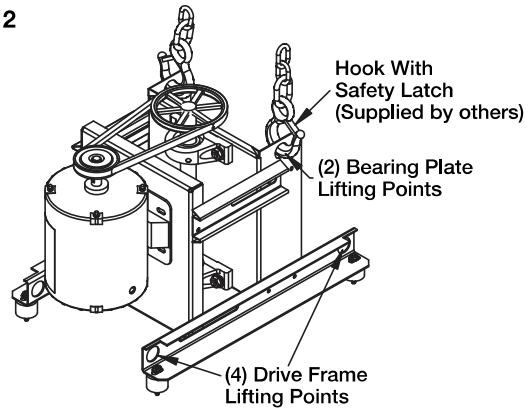
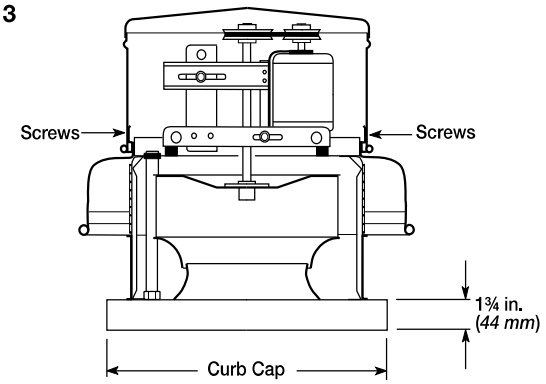


Figure 3



Storage

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

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

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

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

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

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

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

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

Inspection and Maintenance During Storage

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

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

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

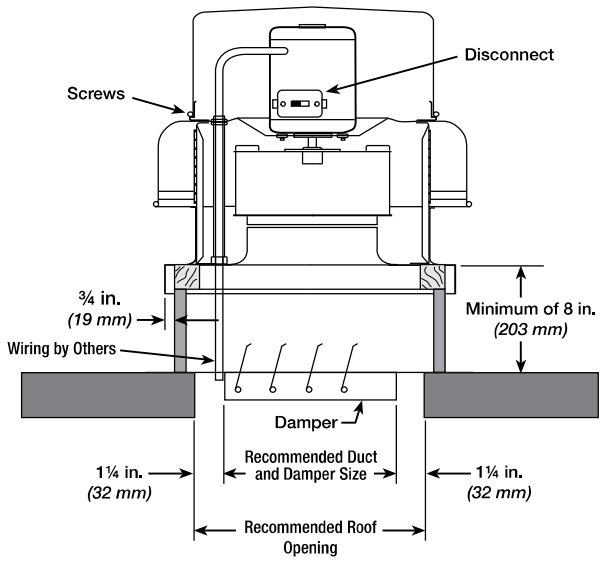
Removing From Storage

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

Dimensional Data

Direct Drive

Figure 4 - Typical Roof Mounting Installation

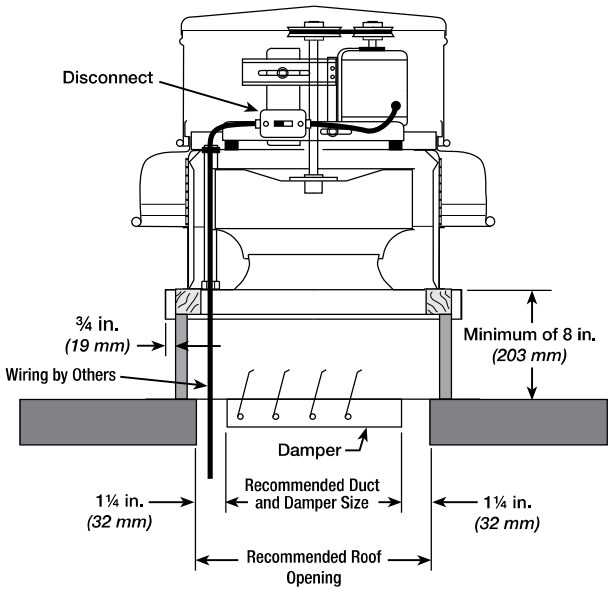


Model Size	Curb Cap	Damper	Roof Opening	**Approx. Weight
060, 070	17 *(432)*	8 *(203)*	13½ *(343)*	18 *(8)*
080, 090, 095	17 *(432)*	10 *(254)*	13½ *(343)*	26 *(12)*
097, 098, 099	19 *(483)*	12 *(305)*	15½ *(393)*	57 *(26)*
100, 103*, 100HP, 103HP*	19 *(483)*	12 *(305)*	15½ *(393)*	62 *(28)*
120, 123*	19 *(483)*	12 *(305)*	15½ *(393)*	65 *(30)*
130, 133*	19 *(483)*	12 *(305)*	15½ *(393)*	66 *(30)*
140, 143*, 140HP, 143HP*	22 *(559)*	16 *(406)*	18½ *(470)*	76 *(35)*
160, 163*	22 *(559)*	16 *(406)*	18½ *(470)*	80 *(36)*
180, 183*	30 *(762)*	24 *(610)*	26½ *(673)*	119 *(54)*
200, 203*, 200HP	30 *(762)*	24 *(610)*	26½ *(673)*	130 *(59)*
240	34 *(864)*	24 *(610)*	30½ *(775)*	158 *(72)*
300	40 *(1016)*	34 *(864)*	36½ *(927)*	320 *(145)*

- All dimensions are in inches *(millimeters)*.
- * Previous size, no physical product change with new size
- ** Approximate weight shown in pounds *(kilograms)* is the largest cataloged open drip proof motor.
- "Curb Cap" is the inside dimension of the curb cap.
- The roof curb should be 1½ in. *(38 mm)* less than the curb cap to allow for roofing and flashing.
- Roof opening is a square dimension

Belt Drive

Figure 5 - Typical Roof Mounting Installation



Model Size	Curb Cap	Damper	Roof Opening	**Approx. Weight
071*, 097, 081*, 098, 091*, 099	19 *(483)*	12 *(305)*	15½ *(393)*	58 *(26)*
100, 101*, 100HP, 101HP*	19 *(483)*	12 *(305)*	15½ *(393)*	63 *(29)*
120, 121*	19 *(483)*	12 *(305)*	15½ *(393)*	66 *(30)*
130, 131*	19 *(483)*	12 *(305)*	15½ *(393)*	67 *(30)*
140, 141*, 140HP, 141HP*	22 *(559)*	16 *(406)*	18½ *(470)*	83 *(38)*
160, 161*, 160HP, 161HP*	22 *(559)*	16 *(406)*	18½ *(470)*	89 *(40)*
180, 180HP	30 *(762)*	24 *(610)*	26½ *(673)*	125 *(57)*
200, 200HP	30 *(762)*	24 *(610)*	26½ *(673)*	138 *(63)*
220, 220HP, 240, 240HP	34 *(864)*	24 *(610)*	30½ *(775)*	158 *(72)*
260	40 *(1016)*	34 *(864)*	36½ *(927)*	305 *(138)*
300, 300HP	40 *(1016)*	34 *(864)*	36½ *(927)*	320 *(145)*
330	46 *(1168)*	40 *(1016)*	42½ *(1080)*	385 *(175)*
360, 360HP	46 *(1168)*	40 *(1016)*	42½ *(1080)*	403 *(183)*
420	52 *(1321)*	46 *(1168)*	48½ *(1232)*	495 *(225)*
480	58 *(1473)*	52 *(1321)*	54½ *(1384)*	623 *(283)*
500	64 *(1626)*	58 *(1473)*	60½ *(1537)*	687 *(312)*
540	64 *(1626)*	58 *(1473)*	60½ *(1537)*	748 *(339)*

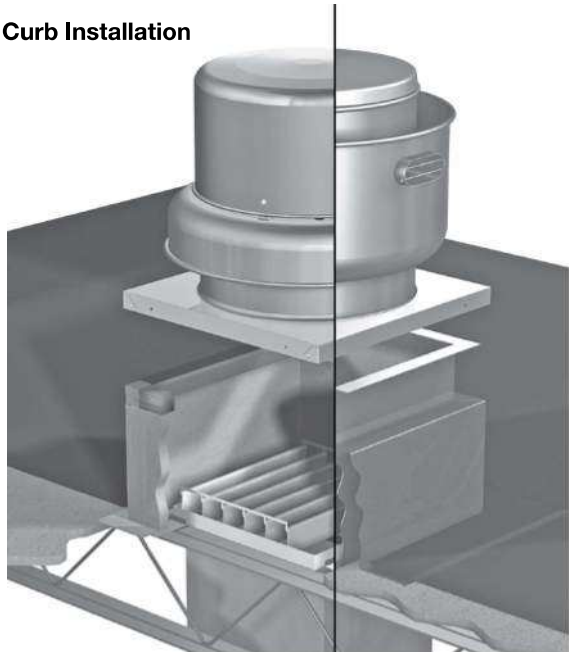
- All dimensions are in inches *(millimeters)*.
- * Previous size, no physical product change with new size
- ** Approximate weight shown in pounds *(kilograms)* is the largest cataloged open drip proof motor.
- "Curb Cap" is the inside dimension of the curb cap.
- The roof curb should be 1½ in. *(38 mm)* less than the curb cap to allow for roofing and flashing.
- Roof opening is a square dimension

Installation

Typical Roof Mounting Installation

1. On the roof surface, cut an appropriate sized hole and follow manufacturer's instructions on curb installation. Caulk and flash the curb to ensure a water tight seal.

Roof Curb Installation



2. If unit is equipped with a backdraft damper, it should be installed now.
3. Remove motor cover. Access to the motor compartment is accomplished by removing the screws as shown in Figure 3, page 2.
4. On **belt drive** fans, use the lifting lugs on the drive frame or bearing plate to lift and place the unit on top of roof curb. Refer to Figure 2, page 2.
5. On **direct drive** fans, lift and place the unit on top of roof curb using hooks under the lip of the shroud. Refer to Figure 1, page 2.
6. Secure fan to curb using a minimum of eight lag screws, metal screws or other suitable fasteners. Shims may be required depending upon curb installation and roofing material.
7. Verify power line wiring is de-energized before connecting fan motor to power source.
8. Connect power supply wiring to the motor as indicated on the motor nameplate or terminal box cover. Check the power source for compatibility with the requirements of your equipment.
9. Check fan wheel for free rotation, recenter if necessary. Check setscrew(s) for tightness.
10. Check all fasteners for tightness.
11. Mount and wire safety disconnect switch under motor cover. Wire control switches at ground level, refer to Figure 6.
12. Replace motor cover.

Typical Wiring Diagram

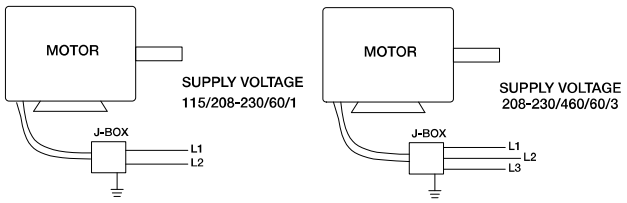


Figure 6

Vari-Green Wiring

For Vari-Green wiring, refer to the Vari-Green Motor and Controls Installation, Operation and Maintenance Manual for complete wiring and operation instructions.

IMPORTANT

Installation, troubleshooting and parts replacement are to be performed only by qualified personnel. Consult and follow all applicable national, state and local codes. They will supersede this document.

Pre-Starting Checks

1. Check all fasteners and setscrews for tightness. The wheel should rotate freely and be aligned as shown in Figure 7.

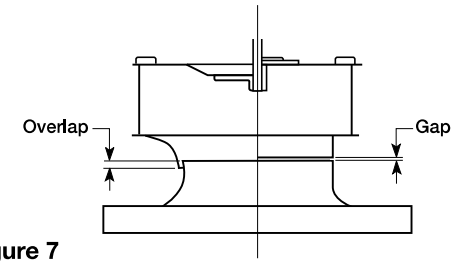


Figure 7

Model Type		Size	Overlap in. *(mm)*	Gap in. *(mm)*
Direct	Belt			
X	—	060-095	—	3/32 *(2)*
X		097-163	1/4 *(6)*	—
	X	071-161	1/4 *(6)*	—
X	X	180-240	3/8 *(10)*	—
X	—	300	1/2 *(13)*	—
—	X	260-540	1/2 *(13)*	—

2. Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment and realignment may be necessary.
3. **Belt Drive**: Centering wheel across the inlet can be accomplished by loosening the bolts holding the drive frame to the vibration isolators and repositioning the drive frame.

   Direct and Belt Drive: If further alignment is needed, loosen shroud bolts and move shroud and motor to align wheel over inlet properly.

   Wheel and inlet cone overlap can be adjusted by loosening the setscrews in the wheel hub and moving the wheel to the desired position. For both **direct and belt drive** models with wheel hubs and shaft pulleys utilizing a tapered bushing interface, reference page 8 for the tapered bushing removal and move the wheel to the desired position.

   Fan RPM should be checked and verified with a tachometer.
4. Check wheel rotation (viewing from the shaft side) by momentarily energizing the unit. Rotation should be clockwise as shown in Figure 8 and correspond to rotation decal on the unit.

   If wheel rotation is incorrect, reverse two of the wiring leads or check motor wiring for single phase. Fan RPM should be checked and verified with a tachometer.

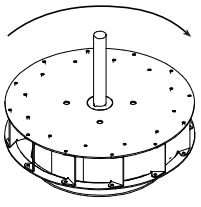


Figure 8

WARNING

Correct direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible motor burnout.

AVERTISSEMENT

La turbine doit impérativement tourner dans le bon sens. Une rotation en sens inverse entraînerait de mauvaises performances de soufflage, une surcharge du moteur voire un grillage du moteur.

IMPORTANT

The fan has been checked for mechanical noises at the factory prior to shipment. If mechanical noise should develop, suggested corrective actions are offered in the Troubleshooting section.

IMPORTANT

Over tightening belts will cause excessive bearing wear and noise. Too little tension will cause slippage at startup and uneven wear.

Belt Drive Pre-Starting Belt Tension Checks

5. Always loosen tension enough to install belts without stretching. Do not force belt(s) see Figure 9. Forcing belts will break the cords and cause belt failure.

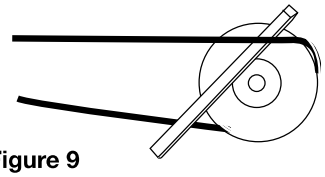


Figure 9

6. For units with two groove pulleys, adjust so the tension is equal in both belts.
7. If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise and power loss, see Figure 10.

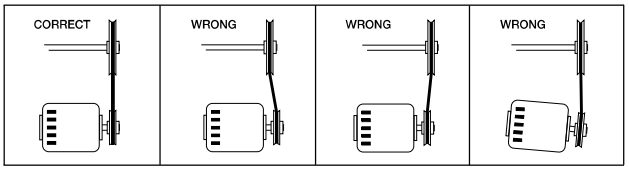


Figure 10

8. Belt tension can be adjusted by loosening four fasteners on the drive frame, see Figure 11. The motor plate slides on the slotted adjusting arms and drive frame angles in the same manner.

   Four (4) fasteners in total.

   Identical fasteners on opposing side must also be loosened.

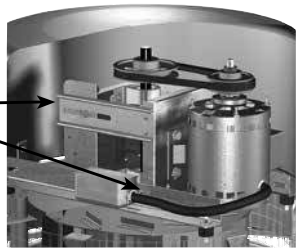


Figure 11

9. **Sizes 097-160:** Belts should be tensioned just enough to prevent slippage at full load. Belts should have a slight bow on the slack side while running at full load, see Figure 12a.

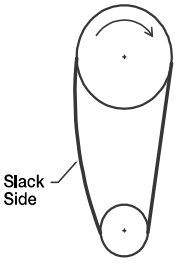


Figure 12a

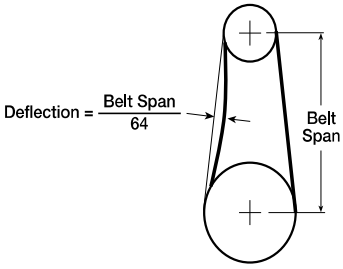


Figure 12b

   Sizes 180-540: Belt tension should be adjusted to allow 1/64 in. *(0.397 mm)* of deflection per inch of belt span. For example, a 15 in. *(381 mm)* belt span should have 15/64 in. *(5.95 mm)* (or about 1/4 in. *(6 mm)*) of deflection with moderate thumb pressure at mid-point between pulleys, see Figure 12b.

10. The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor pulley.
11. Any increase in speed represents a substantial increase in the horsepower required by the unit.
12. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

Operation

1. Before starting up or operating fan, check all fasteners for tightness. In particular, check the setscrews in the wheel hub (or the tapered bushing and pulleys if applicable).
2. While in the OFF position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking the venturi or any obstacle.
3. Start the fan and shut it off immediately to check rotation of the wheel with directional arrow in the motor compartment, see Figure 8.
4. When the fan is started, observe the operation and check for any unusual noises.
5. With the system in full operation and all ductwork attached, measure current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Keep inlets and approaches to fan clean and free from obstruction.

IMPORTANT

Adjust (tighten) belt tension after the first 24-48 hours of operation.

Inspection

Inspection of the fan should be conducted at the first 30 minute and 24 hour intervals of satisfactory operation.

30 Minute Interval: Inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

24 Hour Interval: Check all internal components. On belt drive units only, inspect belt alignment and tension. Adjust and tighten as necessary.

Maintenance

DANGER

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

DANGER

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

WARNING

This unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off).

AVERTISSEMENT

L’appareil doit être rendu non opérationnel lors du nettoyage de la turbine ou du caisson (fusibles retirés, sectionneur verrouillé).

IMPORTANT

Uneven cleaning of the wheel will produce an out of balance condition that will cause vibration in the fan.

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations and who are experienced with this type of equipment.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling.

Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated after installation. Motors supplied with grease fittings should be greased in accordance with manufacturer’s recommendations. Where motor temperatures do not exceed 104ºF *(40ºC)*, the grease should be replaced after 2,000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs, the wheel and housing should be cleaned to ensure smooth and safe operation.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

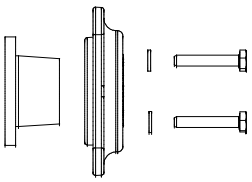
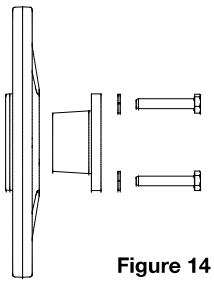
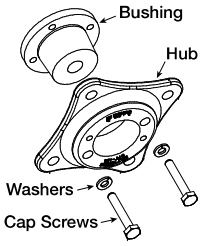
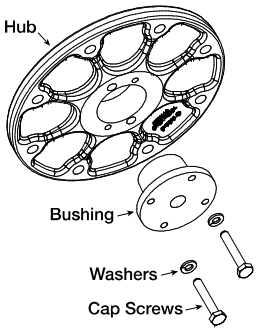
A proper maintenance program will help these units deliver years of dependable service.

Tapered Bushing Hub Installation and Removal

For wheel hubs and shaft pulleys utilizing a tapered bushing interface, follow this procedure for installation and removal. There are two possible setups for the tapered bushing, both have the same procedure, but orientation of the hub varies.

Tapered Bushing Removal:

1. If present, loosen the setscrew holding the bushing and shaft key in place.
2. Loosen and remove the socket head cap screws which fasten the bushing to the hub as shown in the section views and examples of Figures 13-16.

Standard Mounting	Reverse Mounting
 Figure 13	 Figure 14
	
 **Figure 15** Standard Bushing Orientation	 **Figure 16** Reverse Bushing Orientation

3. **Standard Mounting:** Take the two socket head cap screws that were removed and install them into the visibly threaded holes on the wheel hub.
   Reverse Mounting: Install the two socket head cap screws into the visibly threaded holes of the bushing flange.
4. Once both socket head cap screws are installed, tighten them an eighth of a turn at a time, alternating between the two until the hub comes loose from the bushing.

Bushing Installation:

1. Clean all surfaces of hub and bushing to remove any oil or residue present. Do not use any lubricant to install bushing into the hub. For both standard and reverse mounting styles, the socket head cap screws are adjustable from the inlet of the fan.
2. **Standard Mounting:** Slide the bushing and shaft key onto the fan shaft followed by the wheel and hub assembly. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the hub with the threaded holes of the tapered bushing.
   Reverse Mounting: Slide the wheel and hub assembly on to the fan shaft followed by the bushing and shaft key. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the tapered bushing with the threaded holes of the hub.
3. Install the two bushing socket head cap screws into the aligned holes by hand (or without excessive torque) until the heads of the socket head cap screws are seated against the mating surface.
4. Adjust the height of the wheel in the fan relative to the inlet venturi then tighten the two socket head cap screws an eighth turn at a time in an alternating fashion and reach a torque of 10 ft-lbs.

Belt and Bearing Maintenance

1. Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit.
2. Matched belts should always be used on units with multi-groove pulleys.
3. For belt replacement, loosen the tensioning device enough to allow removal of the belt by hand.
4. Once installed, adjust belts as shown in "Pre-Starting Checks."
5. To ensure tightness, check pulley setscrews. Proper keys must be in keyways.
6. Fan RPM should not be readjusted. Only use pulleys of identical size and type when replacing pulleys.
7. Shaft bearings can be classified in two groups: relubricating and non-relubricating. All non-relubricating bearings on belt drive fans are factory lubricated and require no further lubrication under normal use (between -20° to 180°F *(-29° to 82°C)* in a relatively clean environment).
8. On belt drive fans, the standard cast pillow block bearings are factory lubricated and are provided with external grease fittings. Annual lubrication is recommended, or more frequently if needed. See Table 2. Do not over-grease. Use only one or two shots of lubricant with a hand gun. Maximum hand gun rating is 40 psi. Rotate bearings during lubrication where good safety practice permits. Caution should be employed to prevent over packing or contamination.
9. Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent over packing or contamination.
10. Grease fittings should be wiped clean. The unit should be in operation while lubricating bearings. Extreme care should be used around moving parts.
11. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease should be used. See Table 3.
12. During the first few months of operation, check bearing setscrews periodically to ensure tightness.
13. If unit is to be left idle for an extended period, remove belts and store in a cool, dry place to avoid premature belt failure.

Bearing Lubrication Schedule

NOTE: If unusual environment conditions exist (extreme temperature, moisture or contaminants) more frequent lubrication is required.

A good quality lithium base grease, conforming to NLGI Grade 2 consistency, such as those listed in Table 3 may be used.

Table 2: Suggested Fan Bearing Lubrication Intervals

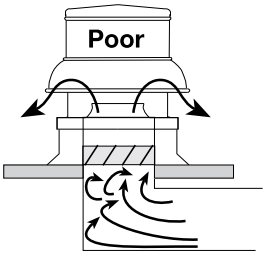
Interval (months)	Type of Service
1 to 3	Heavy duty in dirty, dusty locations; high ambient temperatures; moisture laden atmosphere; vibration.
3 to 6	12 to 24 hours per day, heavy duty, or if moisture is present
6 to 12	8 to 16 hours per day in clean, relatively dry atmosphere
12 to 18	Infrequent operation or light duty in clean atmosphere

Table 3: Grease Manufacturers

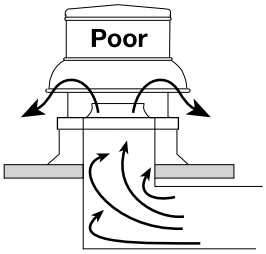
Manufacturer	Grease (NLGI #2)
U.S. Electric Motors	Grease No. 83343
Chevron U.S.A. Inc	Chevron SRI Grease #2
Mobil Oil Corporation	Mobilith
	Mobil 532
Texaco, Inc.	Premium BRB #2
	Texaco Multifak #2
Amoco Oil Co.	Rykon Premium #2
Exxon	Unirex N2
Shell	B Shell Alvania #2

Fan Inlet Connections

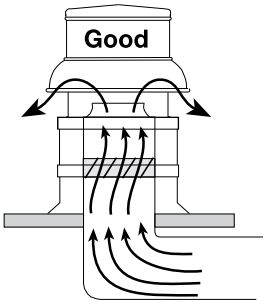
In order to ensure proper fan performance, caution must be exercised in fan placement and connection to the ventilation system. Obstructions, transitions, poorly designed elbows, improperly selected dampers, etc., can cause reduced performance, excessive noise and increased mechanical stress. For performance to be as published, the system must provide uniform and stable airflow into the fan.



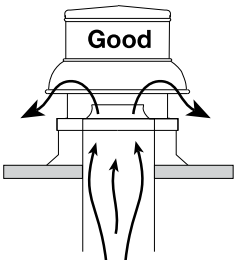
Dampers must open fully. Use motorized dampers in low airflow applications to reduce losses.



Avoid sharp turns or entrance conditions which cause uneven flow. Use turning vanes in elbows to reduce adverse effects.



Provide uniform airflow at fan inlet and through the damper to ensure optimum performance. Curb cap should be three wheel diameters from the radius. Use turning vanes in duct when possible.



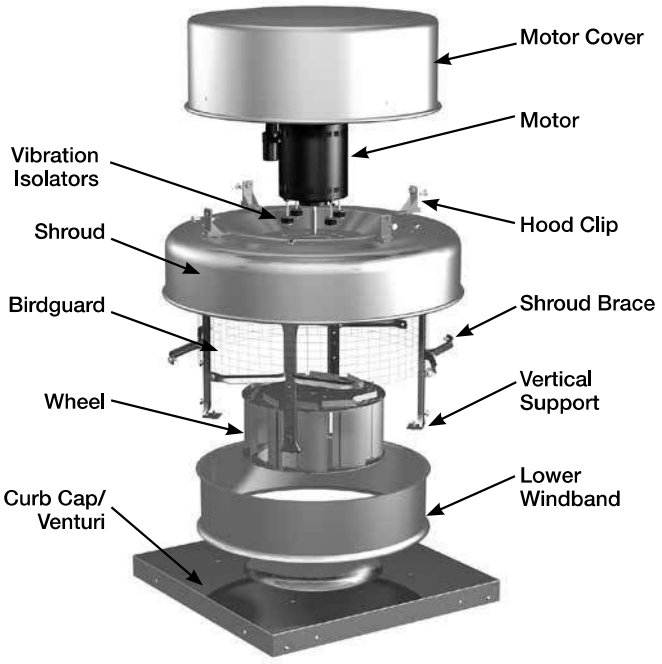
Provide uniform airflow at fan inlet to ensure optimum performance.

Parts List

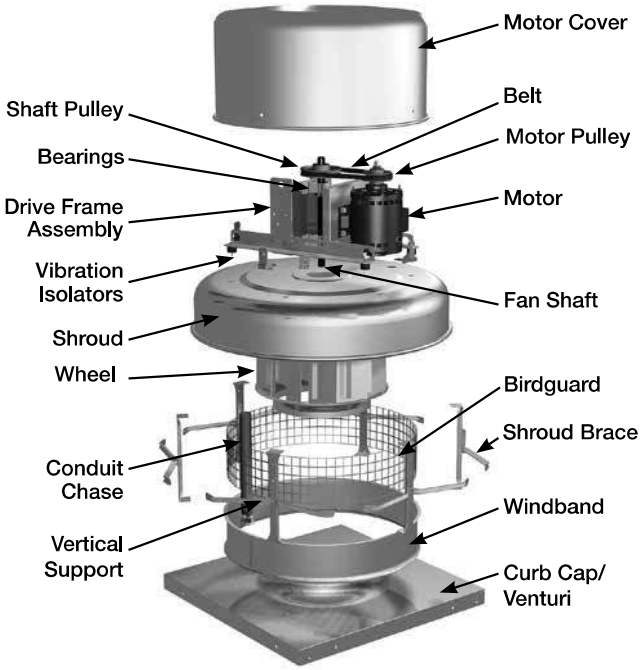
Each fan bears a manufacturer's nameplate with model number and serial number. This information will assist the local representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

CAUTION
A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing mark for the fans approved usage.
CAUTION
La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

Direct Drive



Belt Drive



Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

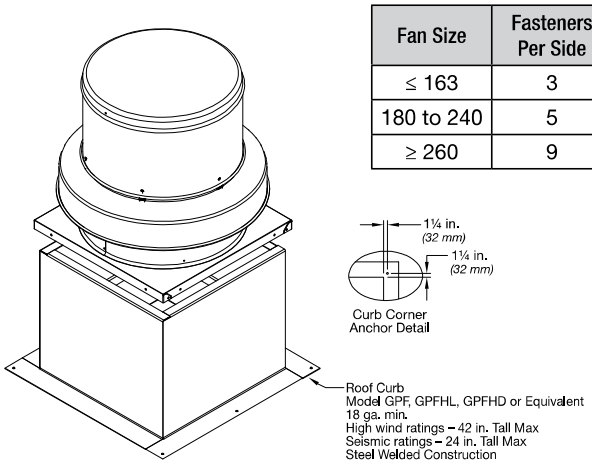
AVERTISSEMENT

Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Excessive noise or vibration	Wheel rubbing inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-belt drive	Tighten pulleys on motor/fan shaft. Adjust belt tension. Align pulleys properly, see page 6, Figures 9 and 10. Replace worn belts or pulleys.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
	Belts too tight or too loose	Adjust tension, see page 7, Figure 12a-b.
	Wheel improperly aligned and rubbing	Center wheel on inlet, see page 6, Figure 7.
	Loose drive or motor pulleys	Align and tighten. See "Pre-Starting Checks", see page 6 and 7.
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
	Fan base not securely anchored	Secure properly.
	Motor hood loose and rattling	Tighten fasteners to secure the motor hood.
	Defective or loose motor bearings	Replace motor with same frame size, RPM-HP.
High horsepower	Fan	Check rotation of wheel, see page 6, Figure 8. Reduce fan speed.
	Duct system	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan does not operate	Electrical supply	Check fuses/circuit breakers. Check for switches off. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys or belts.
	Motor	Ensure motor is correct horsepower and not tripping overload protector.
Motor overloads or overheats	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
	Belt slippage	Adjust tension or replace bad belts, see pages 6 and 7.
	Over/Under line voltage	Contact power company.
	Incorrect wheel rotation	Check motor wiring, see page 5, Figure 4. Confirm wheel rotation, see page 6, Figure 8.
	Wheel RPM too high	Check drives or slow down fan by opening variable pitch pulley on motor shaft.
	Undersized motor	Check motor ratings with catalog speed and air capacity chart.
	Motor wired incorrectly	Check motor wiring to wiring diagram located on fan motor.
Reduced airflow	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, clean dirty filters.
	Unit running backwards	Correct as shown on page 6, Figure 8.
	Excessive dirt buildup on wheels	Clean wheel.
	Improper wheel alignment	Center wheel on inlet, see "Pre-Starting Checks" on page 6.
	Dampers closed	Inspect and repair.
	Blocked duct/clogged filter	Clean or replace.
	Belt slippage	Replace and adjust tension.
	Speed too slow	Check for correct drives.

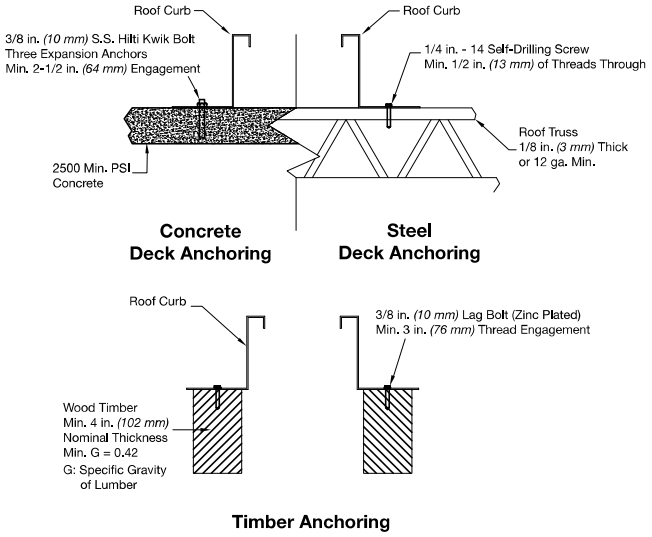
Mounting for Severe Duty Installations

Fan to Curb Mounting: 5/16-inch self-drilling fasteners are to be installed on each side of fan with one fastener 4 inches from each edge and one fastener in the center. Fasteners are to be equally spaced.



Fan Size	Fasteners Per Side
≤ 163	3
180 to 240	5
≥ 260	9

Curb to Deck Mounting: Fasteners need to be located on all four sides of the curb.



	High Wind Ratings					Seismic Ratings		
				Fasteners			Fasteners	
	Fan Size	Curb Cap Size	Self-Drilling Screw Size	Per Side	Total	Fan Size	Per Side	Total
Concrete	≤ 143	17x17 to 22x22 *(432x432 to 559x559 mm)*	3/8”	3	12	060-300	2	8
	> 143	26x26 to 40x40 *(660x660 to 1016x1016 mm)*		3	12	330-540	3	12
Steel	≤ 143	17x17 to 22x22 *(432x432 to 559x559 mm)*	1/4” - 14	3	12	060-300	2	8
	> 143	26x26 to 40x40 *(660x660 to 1016x1016 mm)*		4	16	330-540	3	12
Timber	≤ 143	17x17 to 22x22 *(432x432 to 559x559 mm)*	3/8”	3	12	060-300	2	8
	> 143	26x26 to 40x40 *(660x660 to 1016x1016 mm)*		4	16	330-540	3	12

All dimensions are in inches *(millimeters)*.

NOTE: Installation instructions for seismic ratings are only recommendations.

Final design must be determined by Structural Engineer of Record (SEOR) including requirements for curb construction, mounting of unit to curb and mounting of curb to structure.

Our Commitment

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

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

Greenheck Centrifugal Roof Downblast Exhaust Fans catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

GREENHECK
Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

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Document 486121
Vektor® System Control
Electrical Controls Information
v1.20

Installation, Operation and Maintenance Manual

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

Table of Contents

General Safety Information

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

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace cord immediately if damaged.
3. Verify the power source is compatible with the equipment.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

General Safety Information (cont.)

Receiving

Upon receiving the components, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your local sales representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

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

Handling

Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish to parts may reduce ability of unit to resist corrosion.

Storage

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

INDOOR - The ideal environment for the storage of units and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained between 30°F *(-1°C)* and 110°F *(43°C)* (wide temperature swings may cause condensation and “sweating” of metal parts). All accessories must be stored indoors in a clean, dry atmosphere. Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts, allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to eliminate any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection. The unit should be stored at least 3-1/2 in. *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Inspection and Maintenance during Storage

While in storage, inspect equipment once per month. Keep a record of inspection and maintenance performed. If moisture or dirt accumulations are found on parts, the source should be located and eliminated.

Removed From Storage

As units are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the equipment goes into operation. Prior to installing the unit and system components, inspect the unit assembly to make sure it is in working order. Check all fasteners and accessories for tightness.

Vektor System Control (VSC) Components

Programmable Logic Controller (PLC)
Control Box
(1 per fan system)

Variable Frequency Drive (VFD)
(1 per fan)

VFD Brand and Model may vary from image.

Pressure Transducer
(1 per fan system)

Pressure Tubing
(25 feet)

Pressure Probe
(1 per fan system)

5 Pin, 16.4 feet *(5 meter)* cable
[2 per fan]
8 Pin, 32.8 feet *(10 meter)* cable
[3 per fan system]

Customer-Supplied System Components

- Control wiring and conduit from pressure transducer to control box
- Mounting hardware for all components
- Power wiring and conduit to controller box, VFD(s) and from VFD(s) to motor(s).

Variable Frequency Drive Operation

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

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

NOTE

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

Quick Installation Guide

System Mounting & Wiring

Steps 2, 3, 7 and 9 need to be repeated for multiple fan systems.

All wiring done by others to be per local code (see figure 1).

1. Mount control box upright with connectors down on structural support within 50 ft *(15.2 m)* of fan plenum. Note: control box is labeled with a fan mark. This must match the fan mark on the fan system being connected.
2. Mount Variable Frequency Drive(s) (VFD) within 20 ft *(6.1 m)* of control box (1 per fan). Note: VFD is labeled with a fan mark. This must match the fan mark on the fan system.
3. Connect 5 pin cable from VFD1 to control box VFD1. Maintain 12 inches from all high power cables when routing.
4. Connect 8 pin cable from damper junction box on fan plenum to control box connection labeled Plenum.
5. Wire static pressure transducer to control box. Plumb pressure probe to pressure transducer-port.
6. Wire optional connections on terminal strip, see **Optional Hardwire Connections Digital Input** section.
7. Wire incoming power to VFD1.
8. Wire incoming power to control box.
9. Wire from VFD1 to motor on FAN1.

Start-up:

1. Confirm incoming voltage and motor nameplate data match the VFD(s) label.
2. Confirm the fan mark on the VFD(s) and control box match the fan mark on the fan.
3. Apply power to VFD(s).
4. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
5. Set the VFD Modbus address for Fan 1 to 1 and for Fan 2 to 2. See **System Startup and Testing** section.
6. Press the *Auto On* button on the VFD(s) keypad.
7. Apply power to the control box.
8. Confirm pressure transducer is powered on; the digital display on the pressure transducer will illuminate.
9. Configure optional wire connections. See **Optional Hardwire Connections Digital Input** for details.
10. Confirm the system can be turned on safely without damage to duct work.
11. Using CAREL® keypad located in control box, use *Up* and *Down* arrows to navigate to System *On/Off*. Press *Enter* button to turn the system on.
12. Follow the System Startup and Testing section to properly start and test the system.
13. The system is factory preset to start up and maintain 1 in. wg; this will need to be adjusted to the user desired static pressure setting.

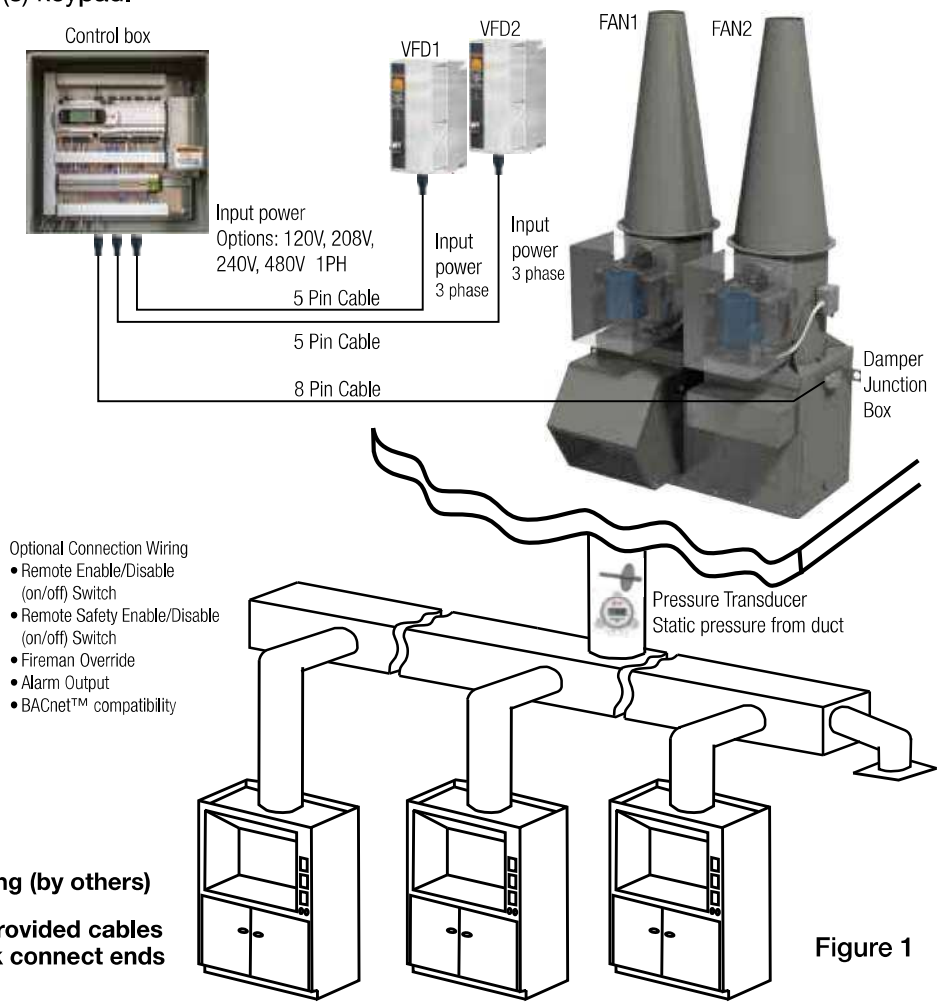


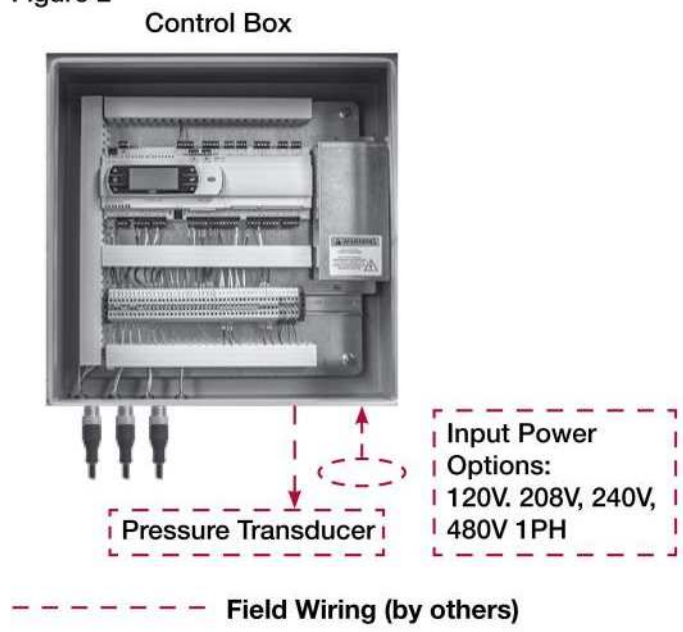
Figure 1

Vektor System Control (VSC) Function Overview

Vektor System Control (VSC) is a complete factory controls package for use in controlling the dampers and motors on a Vektor fan system. Hardware includes a control box, pressure transducer, and variable frequency drive(s) (VFD) for field mounting. The system operates by receiving an input signal from a duct static pressure sensor and depending on the relation to the set point, adjusts the fan speed and dampers. This system can control up to one bypass and one isolation damper per fan.

Each VSC package will come with one control box that is preprogrammed, ready to control the fan system it was ordered with (see figure 2). A multi-tap transformer will accept single phase 120V, 208V, 240V or 480V input power field wired to a terminal strip. The connections to the VFD(s), isolation damper(s), and bypass damper(s) are made easy with quick connect cables. The pressure transducer connection will be field wired to the terminal strip located in the control box. Systems may not have isolation or bypass dampers; the control box will be programmed accordingly.

Figure 2



Quick Connect Cabling

Each VSC package will come with one VFD per fan that is preprogrammed to communicate with the PLC, ready to control the fan motor it was ordered with (see figure 3). Incoming power and output power to the fan motor will be field wired. The connection from the control box to the VFD is made easy with a quick connect cable.

Figure 3

Each VSC package will come with one pressure transducer that is preprogrammed, ready to control the fan system it was ordered with (see figure 4). Three wires will be field wired from the control box terminal strip to the pressure transducer terminal strip. The pressure transducer will receive power from the control box, no additional power source is required. A static pressure probe and tubing to connect the probe to the pressure transducer is factory supplied.

Figure 4

Component Mounting

Mounting the Vektor System Control (VSC) Box

- Mount VSC box upright with connectors down on structural support within 50 ft *(15.2 m)* from center of fan plenum.
- Cables and wiring will be connected to the bottom of the box. It must have a minimum of 12 in. *(305 mm)* of clearance from any obstructions.
- VSC control box is a NEMA-3R enclosure suitable to be mounted indoors or outdoors.

Mounting of Variable Frequency Drive(s) (VFD)

- The mounting hole pattern can be found in the manual supplied with the VFD.
- Place the VFD(s) within 20 ft *(6.1 m)* of the VSC control box.
- Place the VFD(s) as near to the motor as possible, keeping the motor cables as short as possible. Maximum motor cable length to be less than 100 ft *(30.5 m)*.
- Mount the VFD(s) vertically to a solid structure; always use the provided sheet metal backing plate.
- A minimum clearance of 9 in. *(229 mm)* above and below, 3 in. *(76 mm)* on each side is required.

VFD Weathershield Mounting

The weathershield is only required if the VFD is the Danfoss brand and mounted outdoors.

- Weathershield attaches to the top of the VFD using M6x1 fasteners (supplied).

1. Slide the bracket between the VFD mounting surface and the back of the VFD (see figure 5).
2. Tighten the upper mounting bolts to secure the bracket and VFD(s).
3. Slide the shield onto the bracket (see figure 6).
4. Fasten the shield to the bracket with supplied screws.

Pressure Transducer Mounting

- The pressure transducer is housed in a NEMA-4X rated enclosure suitable to be mounted indoors or outdoors.
- Locate the pressure transducer within 100 ft *(30.5 m)* of the VSC control box. Two hundred feet is the maximum control wire length for this pressure transducer.
- The pressure transducer should be mounted on a flat vertical surface with the connections directed down to prevent moisture from entering either the pressure ports or the electrical cable entry. The diaphragm must be vertical to minimize gravity effects on the diaphragm.
- The pressure transducer should be mounted higher than the static pressure probe to ensure that any moisture or condensation drains back into the duct.
- Pressure transducer plumbing options:

  Negative static pressure measurement.

  Connect the pressure probe to the negative (-) port, as indicated on the transmitter. Leave positive (+) port open to atmosphere.

Figure 5

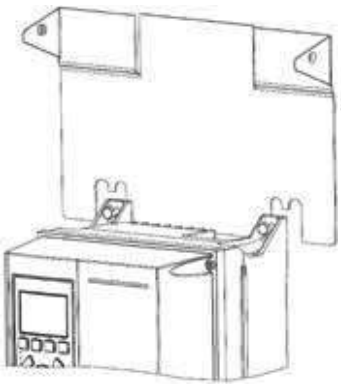


Figure 6

Component Hardwiring

System Wiring

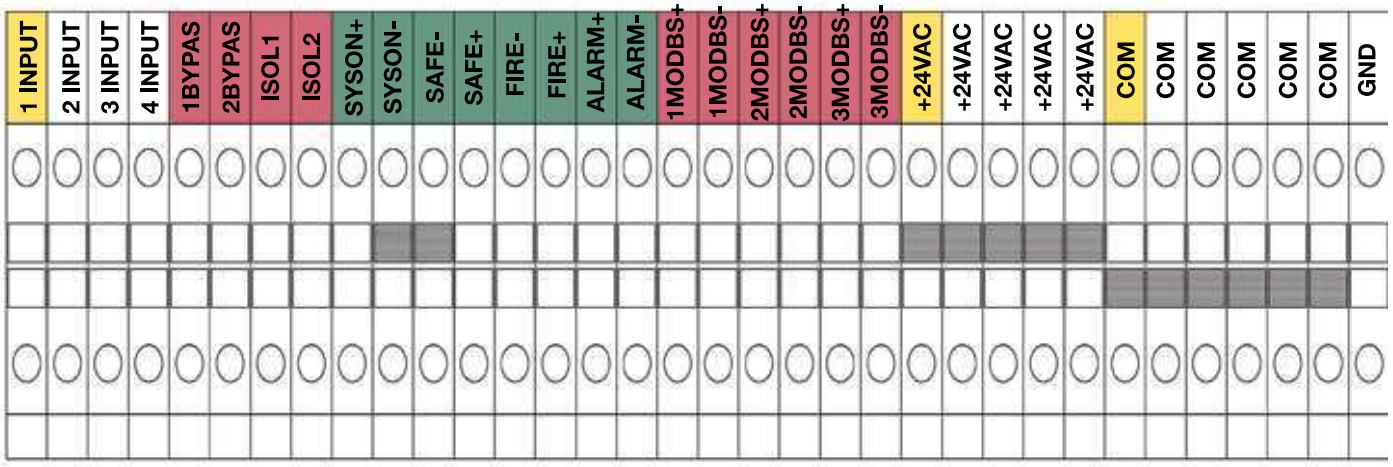
Greenheck supplied cable connections

- Control box to fan plenum
  - 8 pin cable
  - Qty. 3, 32.8 ft (*10 m*) each. Daisy chain to the length required.
- Control box to VFD(s)
  - 5 pin cable
  - Qty. 2, 16.4 ft (*5 m*) each. Daisy chain to the length required.

Contractor supplied cable/connections

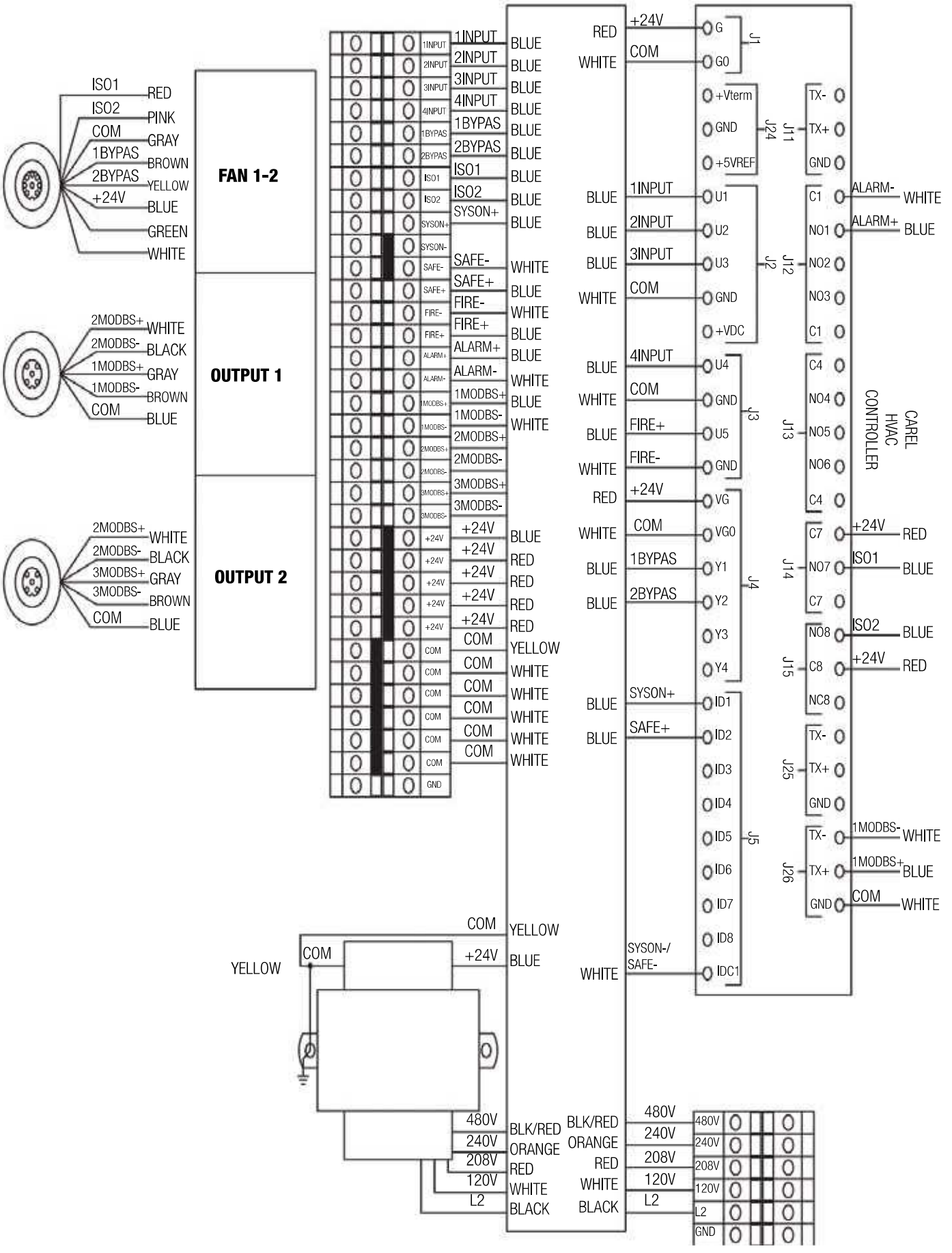
- To VFD and Motor
  - Power to each VFD (selected motor voltage), grommet location in bottom of VFD.
  - Power from VFD to motor/disconnect on fan.
- Power to control box
  - Control box has built-in transformer for 24V power to PLC, sensors and actuators.
  - Contractor to drill hole in PLC box and connect conduit per installation location and local codes.
  - To power connect 120V, 1-phase or 1 leg of 3-phase power.
    - (Accepts: 120V, 208V, 230V or 460V)
- Control wiring
  - Recommend using 18-20 ga. wire. Local codes and standards may require other gauge.
  - Contractor to drill hole in the control box and connect conduit per installation location and local codes.
  - Required (yellow highlights on terminal strip image)
    - Duct static pressure sensor to control box. Transducer provided by Greenheck.
    - 24 volt power from control box transformer.
  - Optional hardwire connections (green highlights on terminal strip image)
    - Remote enable/disable (on/off) switch (switch by others)
    - Remote safety enable/disable (on/off) switch (switch by others)
    - Fireman's override (switch by others) Field configured for either ON or OFF.
    - Alarm Output
    - BACnet™ MSTP or BACnet™ IP to Building Management System (BMS)
  - DO NOT connect to red highlights on terminal strip image.

Control box wiring terminal strip:

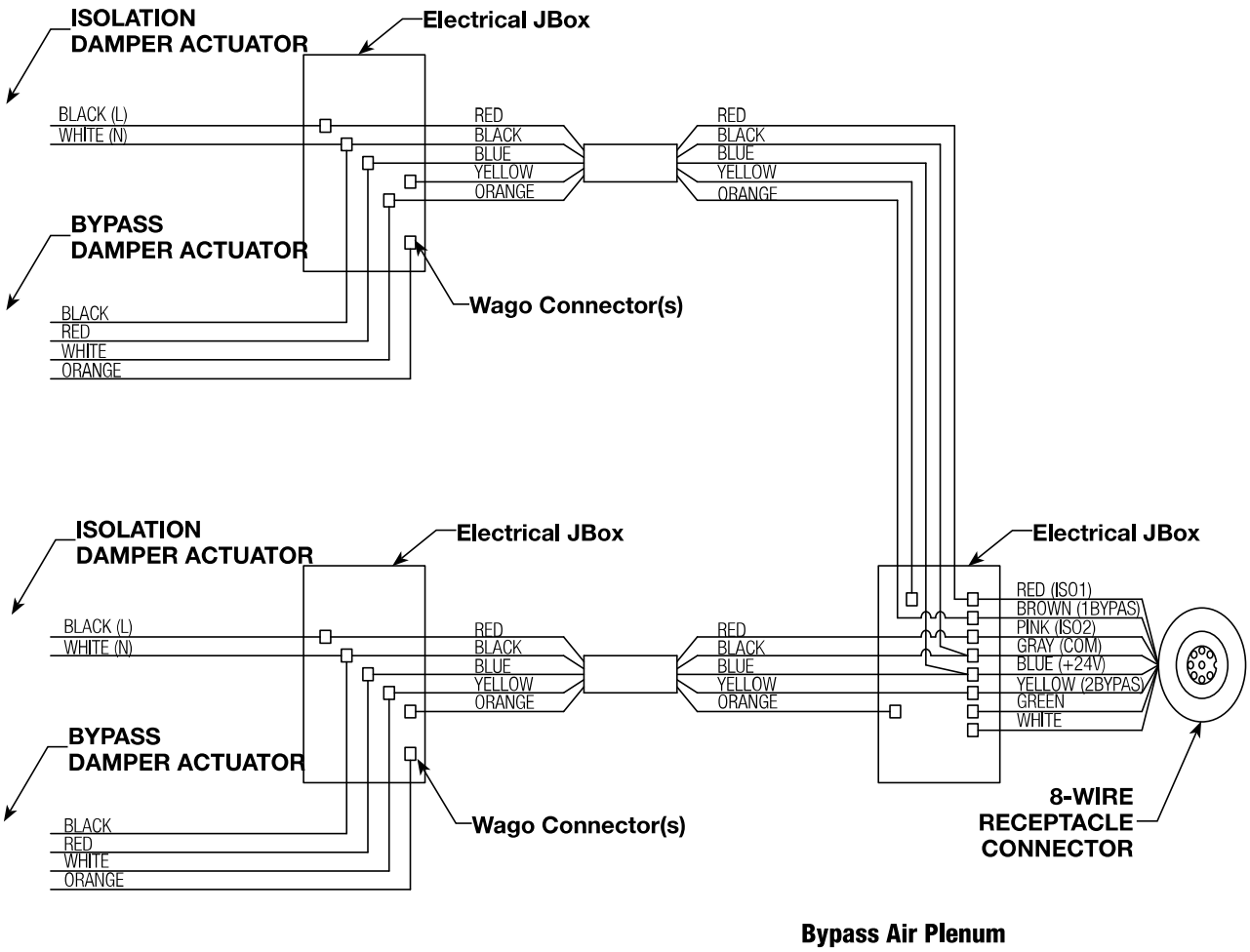


Component Hardwiring (continued)

Control box wiring diagram:



Damper junction box wiring diagram:



NOTE
All field installation and wiring of electrical equipment must be done to meet NEC, CEC and local codes.
Be sure to use appropriately sized wire for the full load amp draw.
Once the following hardwiring is complete, please refer to the **Building Management System (BMS) Settings** menu for details on programming the BMS to communicate with the Vektor System Control via the hardwire connections.

Make sure the numbering of the fans is consistent during the entire wiring installation; fan 1 will require wiring specific to fan 1, fan 2 will require specific wiring, if applicable.

Control Box Incoming Power

(hardwire connections)

The control box will function on 120, 208, 240 or 480V single-phase 50/60 Hz AC. Each control box will draw a maximum of 2 amps. Remove the metal cover located on the right side of the control box to access the terminal strip for incoming power (reference wire diagram for details on terminal strip landing points). Once the wiring is complete, reinstall the metal cover.

Control Box to VFD Quick Connect

Connect the factory supplied 5 pin cable (shipped in the control box) to the 5 pin threaded bulkhead on the bottom of the control box; connect the other end to the 5 pin threaded bulkhead on bottom of the VFD(s). Each fan is provided with two (2) – 5 meter cables that can be connected together to extend the length; use as required per fan.

NOTE
Repeat this step for fan 2, if applicable.

Control Box to Damper Junction Box

Connect the factory supplied 8 pin cable (shipped in the control box) to the 8 pin threaded bulkhead on bottom of the control box; connect the other end to the 8 pin threaded bulkhead on the damper junction box that is mounted on the fan plenum. Each fan is provided with three (3) - 10 meter cables that can be connected together to extend the length; use as required.

Control Box to Pressure Transducer

(hardwire connections)

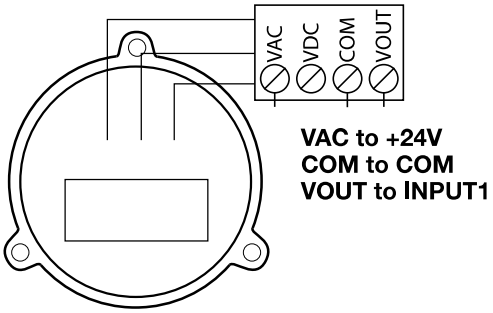
Keep control wires as short as possible [100 ft (*30.5 m*) or less] and separate from high power cables to minimize interference.

Remove the face cover of the pressure transducer by rotating the face cover counterclockwise and pulling outward to access the wiring terminals.

Remove the display by pulling outward noting the orientation of the display. If the display is reinstalled upside down, the numbers will be upside down.

- Connect INPUT1 on the control box terminal strip to the VOUT on the pressure transducer.
- Connect COM on the control box terminal strip to the COM terminal on the pressure transducer.
- Connect +24V on the control box terminal strip to the VAC terminal on the pressure transducer.

Pressure Transducer



VFD to Motor Wiring Procedure

(hardwire connections)

Danfoss FC102 3R:

Remove the eight fasteners on the cover of the VFD using T20 Torx® or flat head screwdriver. An extension may be needed to reach the fasteners. Remove the cover.

- Connect incoming 3-phase AC input power to terminals T1, T2 and T3 on the master disconnect.
- Connect the 3-phase motor wiring to terminals 96 (U), 97 (V) and 98 (W).
- Connect ground wire to the nearest grounding terminal located on the body of the enclosure.
- Use a cable clamp to relieve pressure from connections.
- Replace VFD cover reusing fasteners.

NOTE

Repeat this step for fan 2, if applicable.

VFD to Motor Wiring Procedure

(hardwire connections)

ABB ACH580:

Remove the cover of the VFD to access the terminal strips.

- Connect incoming 3-phase AC input power to terminals L1, L2 and L3 on the master disconnect.
- Connect the 3-phase motor wiring to terminals T1/U, T2/V and T3/W.
- Connect ground wire to the nearest grounding terminal located on the body of the enclosure.
- Use a cable clamp to relieve pressure from connections.
- Replace VFD cover reusing fasteners.

NOTE

Repeat this step for fan 2, if applicable.

Optional Hardwire Connections Digital Input

NOTE
All field installation and wiring of electrical equipment must be done to meet NEC, CEC and local codes.
Be sure to use appropriately sized wire for the full load amp draw.
Once the following hardwiring is complete, please refer to the **BMS Settings** menu for details on programming the BMS to communicate with the Vektor System Control via the hardwire connections.

Remote Enable/Disable (on/off) Switch

(Customer supplied switch; hardwire connections)

A switch can be wired to the control box to remotely enable or disable the Vektor System Control (VSC). Wiring this switch is optional; if remote enable/disable is not required, no action is required and the system can be enabled and disabled on the Programmable Logic Controller (PLC) in the control box.

Wiring remote switch:

- Connect SYON+ on the control box terminal strip to one side of the remote switch.
- Connect +24V to the other side of the remote switch.
- Connect SYON- on the control box terminal strip to COM on the terminal strip.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

Remote Safety Enable/Disable (on/off) Switch

(Customer supplied switch; hardwire connections)

A safety switch can be wired to the control box to remotely enable/disable the VSC. This feature is primarily used for emergency stop buttons or duct static pressure safety switches; if the static pressure in the duct work is too high, the switch will open or close to disable the fan system. Wiring this switch is optional; if remote safety enable/disable is not required, no action is required.

Wiring remote safety switch:

- Connect SAFE+ on the control box terminal strip to one side of the remote safety switch.
- Connect +24V to the other side of the safety switch.
- Connect SAFE- on the control box terminal strip to COM on the terminal strip.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

Fireman Override

(Customer supplied switch; hardwire connections)

A fireman override switch can be wired to the control box to remotely adjust the fan speed. In the event of a fire, the VSC can receive an input from the fireman override switch and force the fan system to a user adjustable setpoint between 0 and 100%. Wiring this switch is optional; if fireman override is not required, no action is required.

Fireman override switch:

- Connect FIRE+ on the control box terminal strip to one side of the fireman override switch.
- Connect FIRE- on the control box terminal strip to other side of the fireman override switch.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

Alarm Output

(Hardwire connections)

If a component of the VSC triggers an alarm, a relay within the CAREL will close or open (user adjustable) a dry contact to alert the Building Management System (BMS). The alarm can be diagnosed on the CAREL PLC in the control box; BACnet™ can also be used to diagnose the issue.

Wiring alarm output:

- Connect ALRM+ on the control box terminal strip to BMS.
- Connect ALRM- on the control box terminal strip to BMS.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

BACnet™

(Hardwire connections)

BACnet™ IP and BACnet™ MS/TP are both supported by the VSC.

BACnet™ IP:

- Use CAT-5 STP shielded cables
- The PLC has two Ethernet ports that are connected internally, making it easy to daisy-chain units together.
- See the **BMS Settings** menu section of this manual for additional details.

BACnet™ MS/TP:

- The J25 BMS2 connector on the PLC is used to connect the BACnet™ MS/TP.
- To improve immunity against electromagnetic interference, the serial connection cable should be a 3-wire shielded twisted pair.
- Connect the twisted pair wires to the J25 BMS2 connector - and + on the PLC to the appropriate BMS connections.

Optional Hardwire Connections Digital Input (continued)

- The third wire of the shielded twisted cable should be used to connect the J25 BMS2 GND connection to the BMS RS485 ground reference.
- The shielding on the twisted pair 3-wire cable should only be connected to ground on one end of the cable; the green/yellow GND terminal in the VSC box is a suitable location to ground the shielding of the cable.
- See the **BMS Settings** menu section of this manual for additional details.

NOTE
This PLC does not contain any internal terminating resistors.
Do not connect BACnet to VFD(s); all BACnet communication is transmitted through the CAREL® controller.

Vektor System Control Menu Tree

System Overview
Home Screen
System Setup
System On/Off

→

Login
Insert Password:
9998

→

Main Menu		
System Set	Remote On/Off	
	Fireman Input	
	Safety Input	
	Alarm Output	
	Alarm Failsafe	
	Fan Rotation	
	Rotation Phase	
BMS Settings	Protocol	
	Settings	
Test & Balance	Test & Balance On/Off	
	Fan Test & Balance	
	Input Calibrate	
Factory Setup **Note:** The Factory Setup menu is read only.	Factory Setup	
	VFD Select	
	Info – software	
	Factory Settings - Save/Restore	
	Advanced	Step Control
		Damper/Fan Settings
		Start-up Settings
		Shutdown Settings
		Fieldbus to VFD
Alarm Logs	Data Logger	
Utilities	Date/Time	Date/Time change
		Timezone
	Language	Language
	Unit of Measure	Unit of Measure
	Initialization	Alarm Initialization
		Default Initialization
		Info – software
		Info – board
		Info – memory
		Info – run hours
		Info – blackout
	Parameters	Import/Export
		Alarm Export

Digital Input Programming

Programmable Logic Controller (PLC) Introduction and Tutorial

The VSC Programmable Logic Controller (PLC) is located in the main control panel. The PLC has factory set points that can be modified to configure the system for job specific functions. The directions for the setup screens are shown in this section.

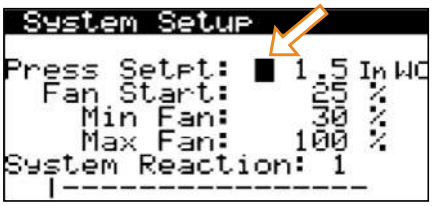
The face of the controller has six buttons, allowing the user to view unit conditions and alter parameters. The PLC is pre-programmed with easy-to-use menus.

Operator Interface and Keypad Navigation

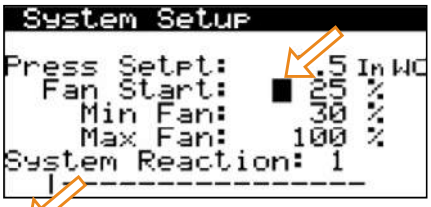
Keypad Navigation		
↩	Escape	Allows the user to exit the current menu, jumping to the Main Menu.
↑ ↓	Up | Down	The arrow buttons allow the user to scroll through different screens and adjust parameters.
⚠	Alarm	Button will blink red, indicating an alarm condition. Press to review current alarms. To review previous alarms, access the DATA LOGGER through the main menu.
↵	Enter	A. In screens with adjustable parameters, pressing the Enter button moves the cursor from the upper left corner of the screen to the parameter. The arrow buttons can then be used to adjust the parameter. B. To move to the next parameter on the same screen, press the Enter button. C. To save the change, press the Enter button until the cursor moves back to the upper left corner of the screen.
◎	Program	Pressing the Program button allows the user to enter the Main Program Menu.

Parameter Adjustment

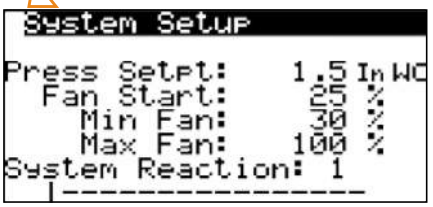
The cursor begins in the upper left corner of the display and will be blinking. Press the *Enter* button to advance the cursor down to make a change to a setting.



Once the cursor has reached the desired setting to be changed, use the arrow keys to adjust the value. Press *Enter* to save the value.



Continue to press *Enter* to advance the cursor through the remaining settings.



Stop pressing *Enter* when the cursor is back in the upper left corner. If *Enter* is not pressed after making a change, the change will not be saved.

System Overview

The controller will revert to a default main menu loop. This loop includes several screens to view the operating conditions and status of the system and fans. Scroll through the menu screens with the up and down arrows.

Home Screen

The initial menu will display the overall system status and main operating conditions. Fan speed percentage, measured pressure, pressure setpoint, bypass percentage open, and overall unit status are shown.

System Setup

The system setup menu will display and will allow changing of values for common operational values.

Press Setpt - duct static pressure system is to monitor and maintain.

Fan Start % - provides an initial speed setting for fans when starting up.

Min Fan % - minimum fan speed. If pressure is higher than setpoint as the fans are at the minimum speed, the bypass dampers (if equipped) will begin to open.

Max Fan % - maximum allowable speed that the fan will operate at.

System Reaction - used to tune the system response to changes. 1 is slower response, 9 is a faster response.

System On/Off

To turn the system and fans to ON, press the *Enter* button to change to ON. The system will start up after a 10 second delay. Use the *Enter* button to turn the system off.

Main Menu

The controller is equipped with several menus to help guide users with operating the system and altering parameters. The following menus can be accessed by pressing the ⊙ button. To enter the desired menu, press the enter button.

Login — The Login menu allows access to additional menus for parameter adjustments.

Press the ⊙ button to access the Login menu and press *Enter*.

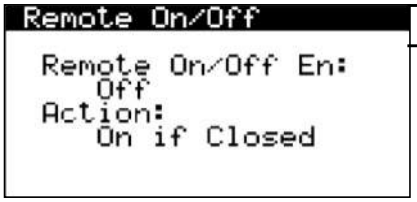
Note: To see the menu options, one must login.

Login

Using the *Up* and *Down* arrows and *Enter* to advance the cursor, enter the service level password of 9998. This will provide read/write access to the additional menus with the exception of the Factory Setup menu, which will be read only. Consult the factory if Factory Setup changes are required.

System Set — The System Set menu allows the user to configure I/O, alarms, and fan rotation.

Press the ⊙ button, login with the password 9998, and scroll to the System Set menu and press *Enter* to access it.



Remote On/Off

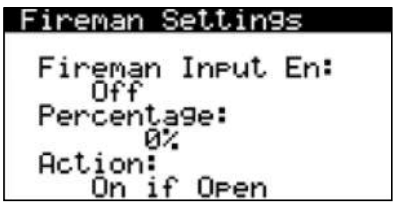
To utilize a hardwired remote on/off switch, enable the functionality by changing Off to On via the Enter and arrow keys. Select the desired switch action.

Note: In order for the digital remote input to turn the system on, the System On/Off must be turned to On, otherwise Off by Keypad will be displayed in the main unit status line of the home screen.

On if Open = remote On when switch is open
On if Closed = remote On when switch is closed

Refer to the **Component Hardwiring** section to make wiring connection needed for the remote On/Off switch. On the terminal strip wire:

- From 24 VAC to connection on On/Off switch.
- From SYSON+ to second connection on On/Off switch
- Jumper from SYSON- to COM



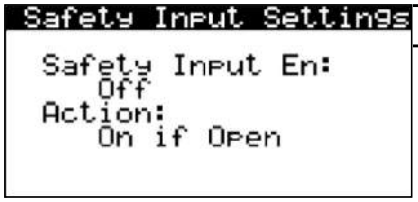
Fireman Settings

To utilize a fireman's override switch, enable the functionality by changing OFF to On via the Enter and arrow keys. Select the desired fan speed percentage and switch action. Factory default is 0%.

On if Open = fireman override speed is active when switch is open
On if Closed = fireman override speed is active when switch is closed

Refer to the **Component Hardwiring** section to make wiring connection needed for the Fireman switch. On terminal strip wire:

- From Fire+ to connection on switch.
- From Fire- to second connection on switch



Safety Input Settings

To utilize a hardwired safety switch, enable the functionality by changing Off to On via the enter and arrow keys. Select the desired switch action.

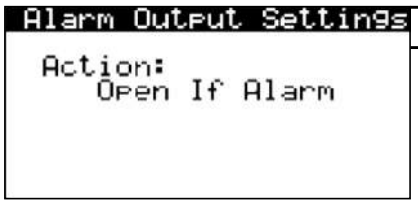
On if Open = safety is on/active (system is off) when switch is open
On if Closed = safety is on/active (system is off) when switch is closed

Refer to the **Component Hardwiring** section to make wiring connection needed for Safety switch. On terminal strip wire:

- From 24VAC to connection on safety switch.
- From SAFE+ to second connection on safety switch
- Jumper from SAFE- to COM

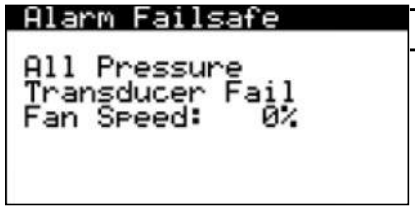
NOTE

It is highly recommended a static pressure safety switch be used to measure fan plenum static pressure and wired to this Safety Input to prevent accidental damage to ducts due to over pressurization.



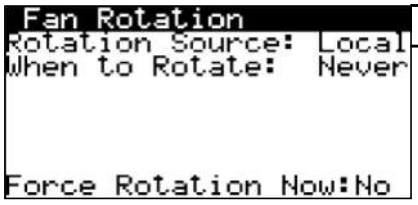
Alarm Output Settings

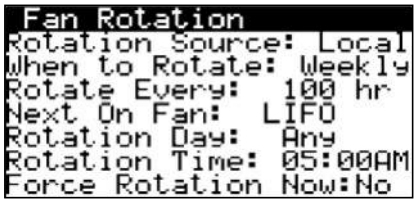
To utilize a dry contact for alarm notification, wire to ALRM- and ALRM+ on the terminal strip. Select the desired contact action when an alarm triggers.

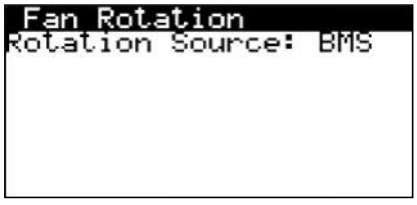


Alarm Failsafe

This screen sets the fan(s) speed in the case of a pressure transducer failure. Upon transducer failure or loss of signal, the fan will be commanded to the Alarm Failsafe percentage. Factory default is 0%.







Fan Rotation

Fan Rotation is the switching of the primary fan when operating a system with a standby fan so that equal run is achieved on both fans. Note: Fan rotation is only available when a standby fan is present.

The fan rotation source can be set to Local or BMS.

When to Rotate can be set to Never, Weekly, or Daily. A rotation can be manually forced by changing Force Rotation to Yes.

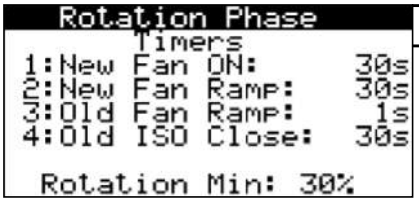
With When to Rotate set to Daily or Weekly, additional settings appear. The duration, rotation type, day, and time of the rotation can be set.

Once the fan that is scheduled to rotate out accumulates the user adjustable rotation hours, the system will wait until the user adjustable time. If set to *Daily*, it will rotate at the time set in the controller. If set to *Weekly*, it will rotate at the time and day set in the controller.

When rotation source is Local, the Next On Fan rotation type can be set to:

- LIFO (last in, first out),
- FIFO (first in, first out), or
- Lowest hrs.

With Rotation Source set to BMS, send a value of 1 to Binary Value 4, FanRotation_ForceRotate, when you want to rotate the fans. With BMS as the source for fan rotation, the BMS controls when to force rotate the fans and is not scheduled in the controller.



Rotation Phase

New Fan On: New fan is at rotation minimum fan speed for this time with isolation damper closed. After this timer expires, the new fan isolation damper is commanded open.

New Fan Ramp: New fan will ramp from rotation minimum fan speed for this duration while old fan maintains static pressure using PID control. At the end of this timer, PID control is transferred to the new fan and the old fan enters the old fan ramp timer.

Old Fan Ramp: Time for old fan to ramp down from current speed to rotation minimum fan speed.

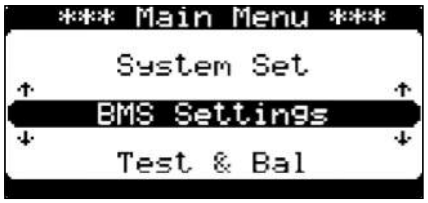
Old ISO Close: This is the time the old fan continues to run after its isolation damper is commanded to close account for the time for the damper to close.

Rotation Min: Minimum fan speed that can occur during a fan rotation. Adjusting the Rotation Min to 20% less than the normal operating percentage will provide optimal performance.

End of Menu

BMS Settings

The BMS Setting menu is where BMS communications are configured.



Press the ⊙ button, login with the password 9998, and scroll to the BMS Settings menu and press *Enter* to access it.

Supervisory/BMS

The communication protocol is selected here. Options exist for:

- BACnet™ MS/TP
- None
- BACnet™ IP

After making a change to the protocol, press *Enter* to accept the change.

The controller will automatically restart to implement the changes. After restart, the service level password will need to be re-entered to access the menus.

Supervisory/BMS – BACnet™ MSTP Settings

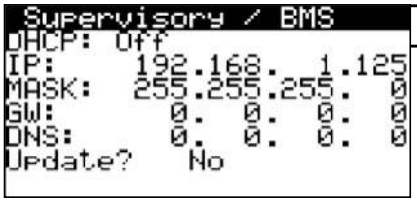
The Device Instance is displayed on this screen and is adjustable. Address, Baud Rate, Max Master, and Max Info Frames information is displayed here and is adjustable.

Note: The settings shown here are the default settings for BMS communications.

The controller will automatically restart to implement the changes. After restart, the service level password will need to be re-entered to access the menus.

Supervisory/BMS – Advanced BACnet™ MSTP

Timeouts are displayed on this screen and are adjustable. Error status is displayed.



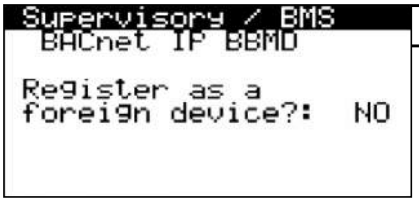
Supervisory/BMS – BACnet™ IP Settings

If BACnet™ IP is selected as the protocol, this screen will allow for setting of the address and subnet mask.

After making changes, change Update to Yes.

Supervisory/BMS – BACnet™ IP Settings

If BACnet™ IP is selected as the protocol, timeouts are displayed on this screen and are adjustable. Error status is displayed.

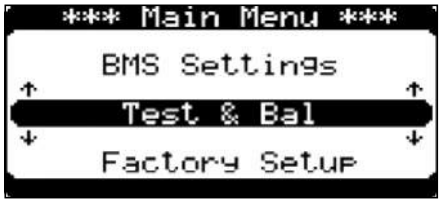


Supervisory/BMS – BACnet™ IP Settings

If BACnet™ IP is selected as the protocol, BACnet™ Broadcast Management Device is setup on this screen.

End of Menu

Test & Bal	The Test & Bal menu allows for overrides for testing and transducer calibration.



Press the ⊙ button, login with the password 9998, and scroll to the Test & Balance menu and press *Enter* to access it.

NOTE

Running the VFD(s) in hand mode will not open the fan's isolation damper. Use the Test&Bal feature in the Carel to operate the fans.

Test & Balance

To enter Test & Balance mode, the unit must be off. This screen will be displayed if the controller is currently ON.

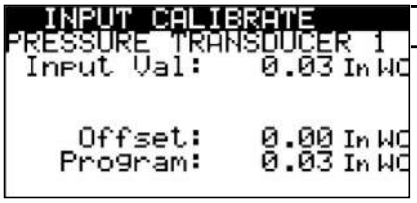
To start Test and Balance mode, press *Enter* to change TEST OFF to TEST ON.

Fan Test & Balance

CAUTION

Fan and system will operate as set in this screen regardless of duct pressure. Damage may occur if fan/system is commanded to incorrect speed or incorrect operation.

Fan operation, fan speed and damper positions can be manually overridden. Press *Enter* to advance the cursor and use the *Up* and *Down* arrows to make changes. Press *Enter* to accept the changes. Changes to command operation will occur immediately after pressing *Enter*.



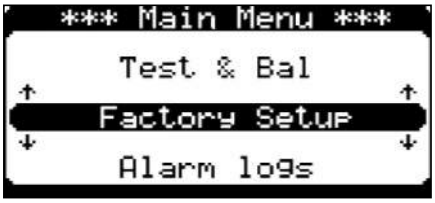
Input Calibrate

This screen allows for a positive or negative offset to be applied to the input value for the duct static pressure sensor to ensure accurate readings at the controller. Adding a negative offset would offset a high input value and a positive offset would offset a low input value.

End of Menu

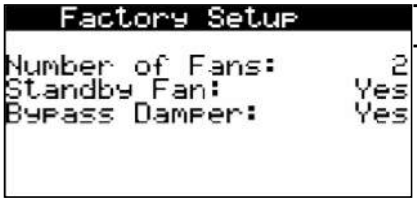
Factory Setup

The Factory Setup settings can only be viewed with the service password.



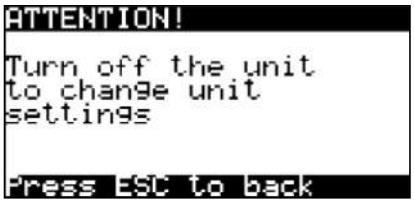
Press the ⊙ button, login with the password 9998, and scroll to the Factory Setup menu and press *Enter* to access it.

Note: The Factory Setup menu can only be viewed with the service level password. Consult the factory for changes to the Factory Setup.



Factory Setup – Fans

This screen is used to set the number of fans in the system and to configure the system for use of a standby fan and/or bypass dampers.

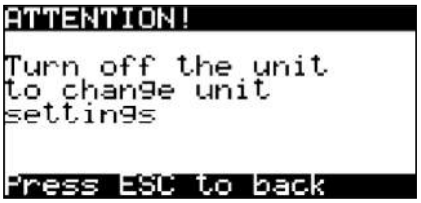


Note: Unit must be off to make changes.

Note: System will automatically reboot after a change is made.

VFD Select

This screen is used to set the VFD model that is being used for the fans.

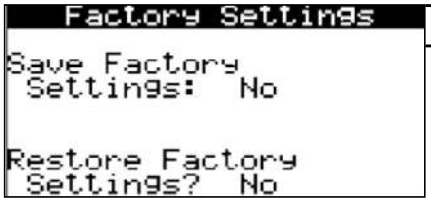


Note: Unit must be off to make changes.

Note: System will automatically reboot after a change is made.

Info

This screen displays software information. The SW ver. is the software version installed in the controller.



This screen is used to save and restore factory settings

Advanced Settings

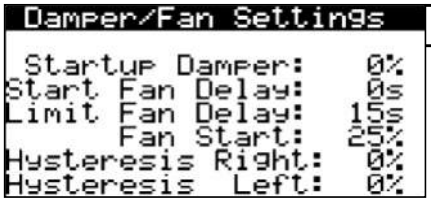
The menus under the Advanced Settings set the parameters for the control of the system and should only be changed under the direction of the factory. Improper settings may result in unstable and erratic fan behavior.

Step Control Settings

For factory use only.

Step Control Settings

For factory use only.



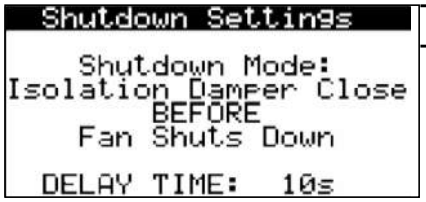
Damper/Fan Settings

This screen sets the initial bypass damper position during startup, fan delays, fan start speed and hysteresis.

Note: This screen is only displayed when the system has a bypass damper.

Start-Up Settings

This screen configures the isolation damper operation during start-up. The isolation damper can start After or When the fan starts with an adjustable delay.



Shutdown Settings

This screen configures the isolation damper operation during shutdown. The isolation damper can start Before or When the fan starts with an adjustable delay.

Fieldbus to VFD

This screen configures the Modbus® communication to the VFDs.

Fieldbus to VFD

This screen configures the Modbus® communication to the VFDs.

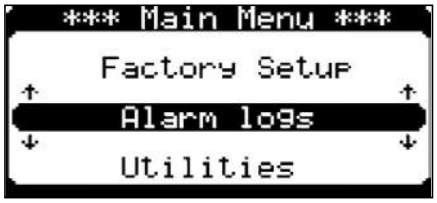
Fieldbus to VFD

This screen configures the Modbus® communication to the VFDs.

End of Menu

Alarm Logs

The Alarm Logs menu displays historical alarm information.



Press the ⊙ button, login with the password 9998, and scroll to the Alarm logs menu and press *Enter* to access it.

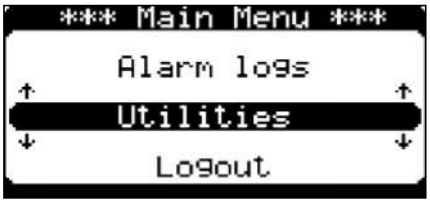
Note: After entering the menu, pushing the *Down* arrow will scroll through the most recent alarms.

Data Logger Recording

This screen will display the alarm number, date and time of the alarm, a verbal description of the alarm, and the resulting event impact to the system.

Utilities

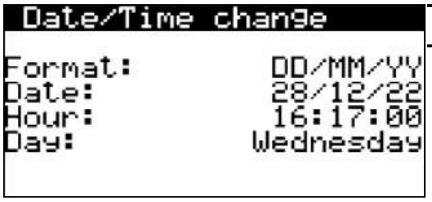
The Utilities menu allows the user to configure various controller attributes.



Press the ⊙ button, login with the password 9998, and scroll to the Utilities menu and press *Enter* to access it.

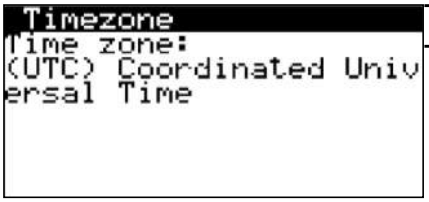
Note: The Utilities menu has sub-menus under it, each with their own setup screens. After entering the menu, pushing the *Down* arrow will scroll through the available sub-menus.

Date/Time sub-menu



Date/Time Change

This screen is used to set the format, date, time and day for the controller.



Timezone

This screen is used to set the local time zone.

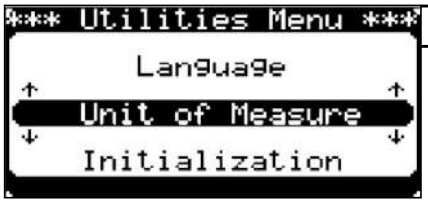
End of Menu

Language – sub-menu

The language displayed on the controller can be changed in this sub-menu.

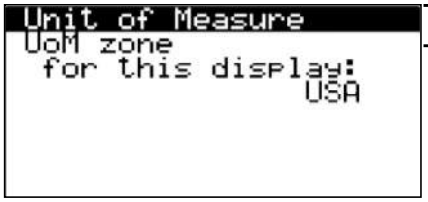
Language

Use this screen to change the language displayed.



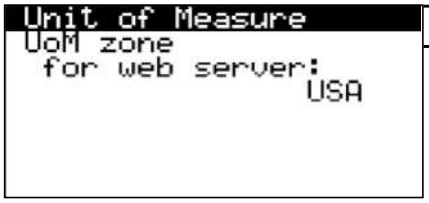
Unit of Measure

This sub-menu set the unit of measure.



Unit of Measure

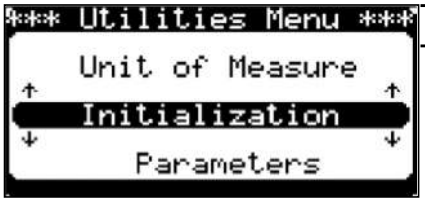
Unit of measure zone for the display.



Unit of Measure

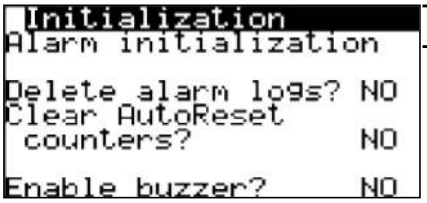
Unit of measure zone for the web server.

End of Menu



Initialization – sub-menu

This sub-menu is used for hardware/software information and memory resets.



Initialization – Alarms

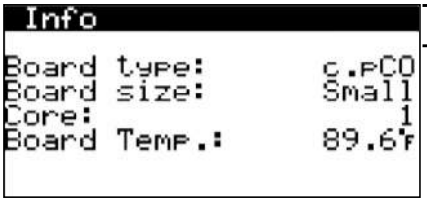
This screen allows for deletion of alarm logs, clearing auto-reset counters, and enabling a buzzer on the controller when in alarm.

Initialization – Default Installation

This screen is used for clearing various memory within the controller.

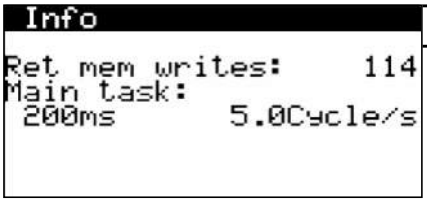
Info

This screen displays the controller code number and software versions.



Info – Board

This screen displays the controller hardware and controller temperature.



Info

This screen displays the memory writes and timing.

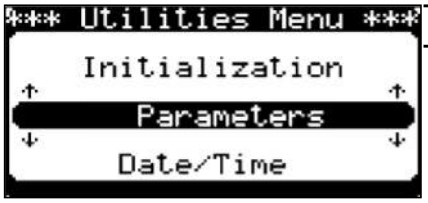
Work Hours

This screen displays the fan run time.

Info

This screen records the last loss of power event.

End of Menu



Parameters – sub-menu

This sub-menu is used for importing or exporting information from the controller.

Unit Configuration – Import/Export

This screen is used to import/export unit configuration parameters.

Unit Configuration – Alarm Export

This screen is used to export the alarm log to a USB.

Unit Configuration – Log Export

This screen is used to export the data log to a USB.

End of Menu

System Startup and Testing

The System Startup and Testing section of this manual will provide a step-by-step procedure to set up the VFD(s) Modbus address, incoming power and fan wheel rotation direction. This system can be ordered with an ABB VFD or a Danfoss VFD. Use the instructions for your specific model VFD. Also included in this section is the setup of the bypass damper(s) and isolation damper(s). There is a check list at the end of this section that can be filled out to document the settings and proper function of the VSC components.

Wire and Configure Optional Connection Wiring:

Prior to applying power to the Vektor System Control (VSC) components review the **Optional Hardwire Connections Digital Input** section of this manual. The optional hardwire connections are not required to operate the VSC; BMS is not required to run the VSC.

NOTE

It is highly recommended that a static pressure safety switch be installed in the plenum of the fan system, and wired to the Remote Safety Enable/Disable (on/off) Switch terminals on the terminal strip. This safety switch should open the electrical connection in the event that the static pressure is too high in the fan plenum; this will turn the fan system off prior to damaging the duct work. If the switch is installed, see the **Digital Input Programming** section of this manual for details on enabling this feature.

1. Optional Connection Wiring include:
   - Remote Enable/Disable (on/off) Switch
   - Remote Safety Enable/Disable (on/off) Switch
   - Fireman Override
   - Alarm Output
   - BACnet™
2. See **Digital Input Programming** section of this manual for details on enabling these features.

System Startup Prechecks:

Prior to applying power to the Vektor System Control (VSC) components perform the following checks to avoid damage to the components:

Confirm the following:

1. Incoming voltage and motor nameplate data match the VFD(s) label.
2. Fan Mark on the VFD(s) and the Control Box match the Fan Mark on the fan.
3. 5 and 8 pin cables have been connected.
4. 5 and 8 pin cables are routed at least 12 inches from power cables.
5. Pressure transducer has been wired and plumbed.
6. System can be turned on safely without damage to the duct work. If the duct system is closed off completely and the fan system is turned on, the duct work may be damaged.

VFD Setup

Danfoss VFD Model:

1. Apply power to the VFD(s).
2. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
3. Complete the following steps for optimal system performance and to avoid startup issues:

NOTE
The fan farthest from the Damper Junction Box with the quick connect on the fan plenum is Fan 1; trace the wire connection from the fan motor to the VFD to confirm which VFD is Fan1.
Skip Modbus Address Setting for one fan systems.

Danfoss FC102 Modbus Address Setting:

1. Press *Quick Menu* key
2. Use *Up* and *Down* arrows to display My Personal Menu
3. Press *OK* key
4. Use *Up* and *Down* arrows to display 8-31 Address
5. Press *OK* key
6. Use *Up* and *Down* arrows to set the address to 1 for Fan 1
7. Press *OK* key
8. The address is now set, press *Status* key
9. Repeat for Fan 2 with the exception that the Modbus address will be 2 for Fan 2

Danfoss FC102 Motor and Incoming Power Settings:

1. Press *Quick Menu* key
2. Use *Up* and *Down* arrows to display My Personal Menu
3. Press *OK* key
4. Use *Up* and *Down* arrows to display the following parameters. Edit any parameters that are not correct:
   a. 1-21 Motor Power [HP]
   b. 1-22 Motor Voltage
   c. 1-23 Motor Frequency
   d. 1-25 Motor Nominal Speed
5. The VFD is now configured for the motor and incoming power, press *Status* key
6. Repeat for Fan 2

Danfoss FC102 Automatic Motor Adaptation:

NOTE
Running the Automatic Motor Adaptation will tune the VFD for the specific motor connected to the VFD. This can make the system more efficient, and in some cases, solve motor run issues.

1. Press *Quick Menu* key
2. Use *Up* and *Down* arrows to display My Personal Menu
3. Press *OK* key
4. Use *Up* and *Down* arrows to display 1-29 Automatic Motor Adaptation (AMA)
5. Press *OK* key
6. Use *Up* and *Down* arrows to select [1] Enable complete (AMA)
7. Press *OK* key
8. Follow the on-screen instructions. The test runs automatically and will indicate when it is complete.
9. The VFD will take several minutes to perform the AMA. The motor will not turn during AMA.
10. Some motors may be unable to run the complete AMA version of the test. If the complete AMA fails, select [2] Enable reduced AMA and run the reduced AMA.
11. The VFD is now optimized for the motor, press *Status* key.
12. Repeat for Fan 2.

ABB VFD Model:

1. Apply power to the VFD(s).
2. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
3. Complete the following steps for optimal system performance and to avoid start up issues:

NOTE
The fan farthest from the Damper Junction Box with the quick connect on the fan plenum is Fan 1; trace the wire connection from the fan motor to the VFD to confirm which VFD is Fan 1.
Skip Modbus Address Setting for one fan systems.

ABB ACH580 Modbus Address Setting:

1. Press Menu key.
2. Use *Up* and *Down* arrows to highlight Parameters.
3. Press *Select* key.
4. Press *Select* key to select the complete list.
5. Use *Up* and *Down* arrows to highlight 58 Embedded fieldbus.
6. Press *Select* key.
7. Use *Up* and *Down* arrows to highlight 58.03 Node address.
8. Press *Edit* key.
9. Use *Up* and *Down* arrows to set the address to 1 for Fan 1.
10. Press *Save* key.
11. Repeat for Fan 2 with the exception that the Modbus address will be 2 for Fan 2.

ABB ACH580 Motor and Incoming Power Settings:

1. Press Menu key.
2. Use *Up* and *Down* arrows to highlight Parameters.
3. Press *Select* key.
4. Press *Select* key to select the complete list.
5. Use *Up* and *Down* arrows to highlight 99 Motor data.
6. Press *Select* key.
7. Use *Up* and *Down* arrows to highlight 58.03 Node address.
8. Use *Up* and *Down* arrows to display the following parameters; edit any parameters that are not correct:
   a. 99.06 Motor nominal current
   b. 99.07 Motor nominal voltage
   c. 99.08 Motor nominal frequency
   d. 99.09 Motor nominal speed
   e. 99.10 Motor nominal power
9. The VFD is now configured for the motor and incoming power. Press *Back* and *Exit* to return to the Main Menu.
10. Repeat for Fan 2.

System Component Set:

When the system arrives, there will be factory default parameters that will need to be edited to configure the system to properly function. Perform the following steps to ensure proper function of the entire system.

1. With the fan off, remove fan wheel inspection cover. The fan rotation will be checked during this procedure.
2. Apply power to the VFD(s).
3. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
4. Press *Auto* button on VFD(s).
5. Apply power to the Control Box. Do not start the fans.
6. Complete the following steps for optimal system performance and to avoid start up issues:

Confirm Fan Wheel Rotation Direction and Isolation Damper Function:

1. Start at the Home Screen. Press the ◎ on the CAREL® keypad.
2. Press *Enter* key to Log in.
3. Use *Up* and *Down* arrows to change number. Use *Enter* key to cycle to the next number; enter in password: 9998.
4. Press *Enter* key.
5. Use *Up* and *Down* arrows to highlight “Test & Bal”.
6. Press *Enter* key.
7. Press *Enter* key to change TEST OFF to TEST ON.
8. Press *Down* arrow.
9. Confirm the system can be turned on safely without damage to duct work. If the duct system is closed off completely and the fan system is turned on, the duct work may be damaged.
10. Press *Enter* key multiple times to highlight Fan 1: “%”. Use *Up* and *Down* arrows to set it to 30%.

NOTE

The fan speed must be above the Min Fan speed %. Factory default Min Fan speed is 30%.

11. Press *Enter* key multiple times to cycle back to Fan 1: OFF.
12. Use *Up* arrow to toggle it to ON. Fan 1 will begin to spin.
13. Confirm fan wheel rotation matches the rotation noted on the fan.
    a. If fan wheel rotates in the correct direction, use *Down* arrow to turn fan OFF and proceed to the next step.
    b. If fan is rotating backwards, use *Down* arrow to turn the fan OFF. Follow proper electrical lock out tagout procedures to ensure electrical power is off and flip flop two of the motor wires in the VFD. Repeat the above steps to ensure the fan is rotating the correct direction.
14. Press *Enter* key multiple times to cycle to Iso Damper1: “Close”.
15. Use Up arrow to toggle it to “Open”. Fan 1 isolation damper will begin to open.
16. Confirm that the isolation damper opened for the Fan 1 (the fan just tested for wheel rotation).
    a. If the correct isolation damper opened, use *Down* arrow to close the isolation damper and continue to next step.
    b. If the isolation damper opened for the opposite fan, use the Down arrow to close the isolation damper and then flip flop the Modbus addresses in the VFDs to assign the proper VFD to the isolation damper (see **VFD Setup – Address Setting** sections of this manual for details on Modbus addressing). Then restart at step 1 of **Confirm Fan Wheel Rotation Direction and Isolation Damper Function**.
17. Press *Enter* key to cycle to Bypass Damper 1: “%”.
18. Confirm the Bypass Damper 1: is set to 0%.
19. Visually inspect the bypass damper(s) to confirm it (they) are closed.
    a. If the bypass damper(s) are closed, continue to next step.
    b. If the bypass damper(s) are open, measure the DC voltage at the terminal strip between 1BYPAS and COM.
        i. If DC voltage is less than 0.3 VDC, then rotate the reversal switch located on the bypass actuator and continue to the next step.
        ii. If DC voltage is above 0.3 VDC, then contact factory.
20. Use *Up* and *Down* arrows to set Bypass Damper 1: to 100%.

21. Visually inspect the bypass damper(s) to confirm it (they) are open.

NOTE
Bypass damper can take up to 2-1/2 minutes to open from 0 - 100%.

a. If the bypass damper(s) open to 100%, use the *Down* arrow to set Damper 1: to 0%. Press *Enter* key and continue to next step.

b. If the bypass damper(s) are closed, measure the DC voltage at the terminal strip between 1BYPAS and COM.

   i. If DC voltage is above 9 VDC, then trace the wires connecting the 1BYPASS and COM to the actuator.

   ii. If DC voltage is less than 9 VDC, then contact factory.

22. Use *Up* arrow to cycle to Test & Balance screen.

23. Press *Enter* key to change TEST ON to TEST OFF.

24. Press *Escape* key multiple times to return to the Home Screen.

The above steps will ensure the system is set up correctly. It is ready for Test and Balance.

System Setup:

System Setup can be used to fine tune the system operation to enable the fan to start at a set speed. This will allow the system to stabilize faster at start up. The fans minimum and maximum speed can also be adjusted in the System Setup menu to aid in system stabilization and minimize fan speed hunting. System Reaction setting will increase/decrease the rate at which the system reacts to changes in demand. Setting this to 1 is a slower response, 9 is a faster response. Use this to fine tune the reaction time of the system to eliminate fan hunting. Prior to adjusting these parameters, the systems minimum and maximum fan speed will need to be determined along with the most common steady state fan speed.

Recommended starting points for settings:

- Fan start % = Ten percent less than the most common stead state fan speed
- Min Fan % = Ten percent less than the minimum fan speed required to meet system demand
- Max Fan % = Ten percent more than the maximum fan speed required to meet system demand
- System Reaction = 1

1. Start at the Home Screen. Use *Up* and *Down* arrows on the CAREL® keypad, located in Control Box, to navigate to System Setup.
2. Press *Enter* key to highlight Press Setpt.
3. Use *Up* and *Down* arrows to select the desired set point.
4. Press *Enter* key to save and advance to “Fan Start %”.
5. Use *Up* and *Down* arrows to select the desired set point.
6. Press *Enter* key to save and advance to “Min Fan %”.
7. Use Up and Down arrows to select the desired set point.
8. Press *Enter* key to save and advance to “Max Fan %”.
9. Use *Up* and *Down* arrows to select the desired set point.
10. Press *Enter* key to save and advance to “System Reaction”.
11. Use *Up* and *Down* arrows to select the desired set point. 1 is slowest, 9 is fastest.
12. Press *Enter* key to save and return the cursor to top of screen.
13. Press *Escape* key to return to the Home Screen.

Building Management System (BMS) Communication Protocol Setup:

BACnet IP and BACnet MS/TP are supported by the Vektor System Control.

NOTE

Fans must be off to adjust BMS communication protocols. As soon as a BMS variable is edited, the controller will begin to count down from 5 seconds. Selecting and editing another BMS parameter will restart the timer. Once the last parameter has been adjusted and 5 seconds has elapsed, the controller will automatically restart.

1. Start at the Home Screen. Press the ⓞ on the CAREL® keypad.
2. Press *Enter* key to Log in.
3. Use *Up* and *Down* arrows to change the number. Use *Enter* key to cycle to the next number; enter in the password: 9998.
4. Press *Enter* key.
5. Use *Up* and *Down* arrows to highlight “BMS Settings”.
6. Press *Enter* key.
7. Press *Enter* key to edit the “Protocol Type”.
8. Use *Up* and *Down* arrows to set desired protocol type.
9. Press Enter key. The controller will start a 5 second countdown to automatically restart.
10. Use Up and *Down* arrows and *Enter* key to access and edit the parameters required to configure the BMS

BACnet™ Objects

The following objects are available through BACnet™.

Type	Instance	Name	Access	Parameter Notes [Units]
Binary Value	1	OnOffUnitMng.BmsOnOff_Enabled (Binary_Value:1)	Read/Write	Disable/Enable – If enabled, the BMS On/Off variable (BV2) must be ON for the unit to start.
	2	OnOffUnitMng.BmsOnOff (Binary_ Value:2)	Read/Write	Unit On/Off by BMS
Analog Value	102	Setpoint_SP1 (Analog_Value:102)	Read/Write	Static Pressure Setpoint 1 [in w.c.]
Binary Value	4	FanRotation_ForceRotate (Binary_ Value:4)	Read/Write	Force fan rotation - used by BMS for rotating primary fan
AnalogValue	5	System_Reaction_Adjust_REAL (Analog_Value:5)	Read/Write	System reaction - changes fan and damper response time
	13	FanSpeed_Fireman (Analog_Value:13)	Read/Write	User Defined Speed of Fan When Fireman's Override is Enabled [0-100%]
	14	FanSpeed_Pressure_AllAlarm (Analog_Value:14)	Read/Write	User Defined Speed of Fan When All Pressure Transducers are in Alarm [0-100%]
Binary Value	101	Pressure_Source_IO_BMS[1] (Binary_Value:101)	Read/Write	Set true if transducer value is from BMS
Analog Value	101	Pressure1_BMS (Analog_Value:101)	Read/Write	Pressure 1 measurement from BMS [0-15 IN H2O] – BV101 must be set to 1 for this pressure to be used for pressure 1 rather than the analog input. [in w.c.]
AnalogInput	1	Pressure1_AIN.Val (Analog_Input:1)	Read Only	Static Pressure 1 [IN H2O]
	7	BypassDamperCmd1_AOUT.Val (Analog_Input:7)	Read Only	Bypass Damper 1 Position [0-100%]
	9	FanModCmd1_AOUT.Val (Analog_Input:9)	Read Only	Fan 1 Speed [0-100%]
	10	FanModCmd2_AOUT.Val (Analog_Input:10)	Read Only	Fan 2 Speed [0-100%]
	101	Fan_Msk[1].Power_KW (Analog_Input:101)	Read Only	Fan 1 Power [KW]
	102	Fan_Msk[1].Power_Hp (Analog_Input:102)	Read Only	Fan 1 Power [Hp]
	103	Fan_Msk[1].MotorVolt (Analog_Input:103)	Read Only	Fan 1 Motor Voltage [V]
	104	Fan_Msk[1].MotorCurrent (Analog_Input:104)	Read Only	Fan 1 Motor Current [A]
	105	Fan_Msk[1].Freq (Analog_Input:105)	Read Only	Fan 1 Frequency [HZ]
	107	Fan_Msk[1].Speed_RPM (Analog_Input:107)	Read Only	Fan 1 Motor Speed [RPM]
	108	Fan_Msk[1].Torque_Nm (Analog_Input:108)	Read Only	Fan 1 Torque [Nm]
	110	Fan_Msk[1].DCLink_Volt (Analog_Input:110)	Read Only	VFD 1 DC Link Voltage [V]
	114	Fan_Msk[1].ControllerCardTemp (Analog_Input:114)	Read Only	VFD 1 Controller Card Temp [C]
	115	Fan_Msk[1].Power_kWh_Counter (Analog_Input:115)	Read Only	VFD 1 Power kWh Counter
	116	Fan_Msk[1].Speed_Pct (Analog_Input:116)	Read Only	VFD 1 Speed Percentage
	201	Fan_Msk[2].Power_KW (Analog_Input:201)	Read Only	Fan 2 Power [KW]

AnalogInput	202	Fan_Msk[2].Power_Hp (Analog_Input:202)	Read Only	Fan 2 Power [Hp]
	203	Fan_Msk[2].MotorVolt (Analog_Input:203)	Read Only	Fan 2 Motor Voltage [V]
	204	Fan_Msk[2].MotorCurrent (Analog_Input:204)	Read Only	VFD 1 DC Link Voltage [V]
	205	Fan_Msk[2].Freq (Analog_Input:205)	Read Only	VFD 1 Heatsink Temp [C]
	207	Fan_Msk[2].Speed_RPM (Analog_Input:207)	Read Only	VFD 1 Inv Nom Max [A]
	208	Fan_Msk[2].Torque_Nm (Analog_Input:208)	Read Only	VFD 1 Inv Max Current [A]
	210	Fan_Msk[2].DCLink_Volt (Analog_Input:210)	Read Only	VFD 1 Controller Card Temp [C]
	214	Fan_Msk[2].ControllerCardTemp (Analog_Input:214)	Read Only	Fan 2 Power [KW]
	215	Fan_Msk[2].Power_kWh_Counter (Analog_Input:215)	Read Only	Fan 2 Power [Hp]
	216	Fan_Msk[2].Speed_Pct (Analog_Input:216)	Read Only	VFD 2 Speed Percentage
BinaryInput	502	AI_Prb_Pressure1.Active (Binary_Input:502)	Read Only	1 = pressure transducer alarm, operating at failsafe speed, 0 = pressure transducer is ok
	508	AI_Safety_DIN.Active (Binary_Input:508)	Read Only	1 = safety switch is active (system is off), 0 = ok.
	510	AI_VFD1_Offline.Active (Binary_Input:510)	Read Only	1 = VFD1 is offline, 0 = VFD1 is online
	511	AI_VFD2_Offline.Active (Binary_Input:511)	Read Only	1 = VFD2 is offline, 0 = VFD2 is online
AnalogValue	0	FanRotation_Method_REAL (Analog_Value:0)	Read Only	1=FIFO, 2=LIFO, 3=Lowest hrs
	1	Num_Fans_REAL (Analog_Value:1)	Read Only	Number of fans in system
	2	Num_StandbyFan_REAL (Analog_Value:2)	Read Only	1 = standby fan present, 0 = no standby fan
	3	Num_BypassDamper_REAL (Analog_Value:3)	Read Only	1 = bypass damper present, 0 = no bypass damper
	100	SwVer_REAL	Read Only	Software version
	103	RunHours_Act_REAL[1] (Analog_Value:103)	Read Only	Fan1 run hours
	203	RunHours_Act_REAL[2] (Analog_Value:203)	Read Only	Fan2 run hours

MultiStateInput	1	UnitStatus (Multi_State_Input:1)	Read Only	1 = On
				2 = Off by Alarm
				3 = Off by BMS
				4 = Off by Schedule
				5 = Off by Keypad
				6 = Fan Rotation
				7 = Off by Dig Input
				8 = Off by Safety Input
				9 = Fireman Override
				10 = In Failsafe Mode
				11 = On by Test Balance
				12 = Off by VFD Alarm
MultiStateInput	101	FanStateProg[1] (Multi_State_Input:101)	Read Only	1 = Off
				2 = Start
				3 = Rotating In – At minimum speed
				4 = Rotating In – Ramp up
				5 = Running
	201	FanStateProg[2] (Multi_State_Input:201)	Read Only	6 = Rotating Out – Ramp down
				7 = Rotating Out – At minimum speed
				8 = Shutdown
				9 = Alarm
				10 = Offline

Troubleshooting

WARNING
Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT
Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

Symptom	Cause	Corrective Action
Display on CAREL controller is not on	No power	Check that control box is wired and upstream disconnect or breaker is on.
		Verify that control box transformer breaker is not tripped; this is located on the transformer under the transformer cover. Prior to resetting, verify the transformer is wired correctly
		Verify that orange J1 plug is seated firmly into CAREL controller.
		Verify that orange J1 plug has 24V AC voltage present.
	Display ribbon cable loose	If the CAREL has power at the J1 plug and the digital display on the bottom of the CAREL is illuminated, the ribbon cables behind the display may be loose. Use a small, flat screwdriver to pry the display from the PLC body. Inspect that both ribbon cables behind the display are correctly seated.
VFD Offline	No Power to VFD	Check that VFD is wired and upstream disconnect or breaker is on.
		Verify VFD disconnect is on.
	5 pin cable not connected	If the VFD is OFF or in Hand mode, it will not communicate with the control box. Verify the VFD is in Auto mode.
	VFD is not in Auto mode	If the VFD is Off or in Hand mode, it will not communicate with the control box. Verify the VFD is in Auto mode.
	Incorrect VFD addressing	Verify that the correct VFD Modbus® address is entered into each VFD. Addresses should be 1 for the VFD connected to fan 1 and 2 for the VFD connected to fan 2. Fan 1 is the fan closest to the 8 pin quick connect box on the plenum. If the addresses are the same neither VFD will communicate with the control box.
	5 pin cable is too close to high power cables	Confirm that the 5 pin cable from the VFD to the control box is at least 12 inches from any incoming power or motor power. High voltage will interfere with Modbus® communication and cause intermittent VFD Offline alarms.
Pressure reading remains at 0.0 on the CAREL display with fan running	Fan Pressure transducer is not wired	Wire transducer.
	Pressure transducer is wired incorrectly.	Correct wiring terminations. If pressure transducer is wired correctly 24VAC voltage should be present between terminals VAC and COM. The pressure transducer will output a 0-10VDC signal to the control box with a linear relationship to the pressure range of the pressure transducer setting.
	Pressure transducer tubing is not connected to duct	Connect transducer tubing to static pressure tap.
Pressure	Pressure transducer tubing is not connected to the correct pressure port on the bottom of the pressure transducer	Connect transducer tubing to correct port.
Pressure reading showing with fans off or incorrect pressure being displayed	Controller out of calibration	Calibrate transducers with offset in Test & Balance menu to calibrate the input.

Symptom	Cause	Corrective Action
Isolation damper does not open	8 pin cable not connected	Connect 8 pin cable from plenum to control box.
Bypass damper does not open	8 pin cable not connected	Connect 8 pin cable from plenum to control box.
Fan is hunting	System response too fast or slow Need to follow System Fine Tuning process outlined in this IOM	On system setup screen of controller, adjust the System Reaction. Increase value for faster response or decrease the value to reduce the system response. See **System Fine Tuning** section of this IOM.
BMS will not communicate with controller	Incorrect addressing	Check MSTP addressing or IP settings.
	Missing wiring	Verify MSTP wiring to J25 plug or IP Ethernet cable to either Ethernet ports on the controller.
Isolation damper is not opening Fans not creating correct pressure or low airflow	Isolation damper is not opening	Confirm the isolation damper for the fan that is operating is open. If the isolation damper is not open, confirm the correct VFD is wired and addressed to that fan; if a nonoperating fan has the isolation damper open, then the VFD Modbus® address might need to be adjusted in the VFDs to synchronize the fan with the correct isolation damper position. Fan 1 is the fan closest to the 8 pin quick connect box on the plenum. The VFD with the Modbus® address of 1 controls fan 1 and the VFD with Modbus® address 2 controls fan 2.
	Isolation damper is not opening	After confirming that the VFD wiring and Modbus® address corresponds to the correct isolation damper measure the AC voltage between terminals ISOL1 and COM for fan 1 or ISOL2 and COM for fan 2 on the terminal strip located in the control box. If no voltage is present, contact factory. If 24VAC is present, there may be an issue with the 8 pin cable connecting the control box to the plenum or wiring in the quick connect box. Please see the quick connect box wiring diagram located in the Component Hardwiring section in this IOM. Confirm the wire connections in the quick connect box are correct. Measure voltage between terminals ISOL1 and COM for fan 1 or ISOL2 and COM for fan 2. If 24 VAC is present, check voltage at actuator. If no voltage, then replace the 8 pin cable with a known good cable.
	Bypass damper is open	Confirm bypass damper is closed. Confirm 8 pin cable between control box and plenum is connected. If bypass damper is open and the 8 pin cable is connected, look at the display to see if the bypass position is 0%. If the CAREL displays 0%, then measure the DC voltage between 1BYPAS and COM or 2BYPAS and COM on the terminal strip located in the control box. 1.8 - 2.3VDC will be present if the CAREL displays 0% Bypass. If it is outside that range, contact factory.
	Fan is rotating backwards	Verify the fan rotation and correct if necessary.
	Excessive duct leakage.	Seal duct work.
	Max fan speed percentage is too low.	Increase max fan speed percentage.

Control Settings Reference

Unit Model Number _____

Unit Serial Number _____

Sales Order Number _____

System Setup Settings

Pressure Setpoint _____ in w.c.

Fan Start % _____ %

Min Fan % _____ %

Max Fan % _____ %

System Reaction _____

System Set

Remote On/Off Enabled: ☐ Off ☐ On

Action: ☐ On ☐ Off if Closed

Fireman Input Enabled: ☐ Off ☐ On

Action: ☐ On ☐ Off if Closed

Fireman Input % _____ %

Safety Input Enabled: ☐ Off ☐ On

Action: ☐ On ☐ Off if Closed

Alarm Output:

Action: ☐ On ☐ Off if Alarm

Alarm FailSafe % _____ %

Fan Rotation

Rotation Source _____

When to Rotate _____

Rotate Every _____

Next On Fan _____

Rotation Day _____

Rotation Time _____

Rotation Phase

New Fan ON _____ seconds

New Fan Ramp _____ seconds

Old Fan Ramp _____ seconds

Old Iso Close _____ seconds

Rotation Min _____ %

BMS Settings

BMS Protocol

☐ BACnet™ MS/TP

☐ BACnet™ IP

☐ None

BACnet™ MS/TP Settings

Device Instance _____

Address _____

Baud Rate _____

Max Master _____

Max Info Frames _____

Timeout _____ ms

Cmd Timeout _____ ms

BACnet™ IP Settings

DHCP: ☐ Off ☐ On

IP _____–_____–_____–_____

Mask _____–_____–_____–_____

GW _____–_____–_____–_____

DNS _____–_____–_____–_____

Devise Instance _____

Port _____

Timeout _____ ms

Cmd Timeout _____ ms

Foreign Device: ☐ No ☐ Yes

Our Commitment

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

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

GREENHECK
Building Value in Air.

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GREENHECK
Building Value in Air.

Document 469003
Model Vektor®-H
Laboratory Exhaust System

Installation, Operation and Maintenance Manual

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

Vektor®-H
Belt Drive

Vektor®-H
Direct Drive

General Safety Information

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

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than maximum cataloged fan RPM. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

Receiving

Greenheck model Vektor-H fans are thoroughly inspected, test run at the factory, and shipped on a skid or packaged to minimize damage during shipment. The transportation carrier has the responsibility of delivering all items in their original condition as received from the manufacturer. The individual receiving the equipment is responsible for inspecting the unit for obvious or hidden damage and recording any damage on the bill of lading before acceptance of the equipment. All claims (if necessary) shall be filed with the final carrier.

Unpacking

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

Handling

The Vektor-H laboratory exhaust system is shipped in subassembly sections for easy rigging and installation. Depending on the fan size, the sections can include: Blower Assembly, Stack Extension, and Discharge Nozzle.

The Vektor-H is designed to be self-supporting and standing (without the use of guy wires) when assembled per the instructions provided within this manual. All subassembly sections have lifting lugs as shown.

Storage

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

INDOOR

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

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

The unit should be stored at least 3-1/2 in. (*89 mm*) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

OUTDOOR

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

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

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

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

Inspection and Maintenance during Storage

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

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

Machined parts coated with rust preventive coating should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths.

Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean thoroughly with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or WD-40® or the equivalent.

REMOVING FROM STORAGE

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

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

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

General Information

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

Unit and System Identification Tags

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

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

Vektor fan systems may arrive in component pieces due to shipping restrictions. Individual components of a system have matching identification tags which should be used to identify and assemble the complete system. Assembling systems with different identification tags can cause reductions in the fan(s) performance.

Prior to fully assembling and installing the Vektor-H fans, inspect bypass air plenums and the fan assembly to make sure they are in working order.

Pre-Installation Information

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

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

Electrical Disconnects

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

Moving Parts

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

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

Guards (Motor Cover, Weatherhoods)

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

Air Pressure and Suction

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

Rigging and Lifting

The steel cone is to be lifted by the points at the top, separately and individually from the fan assembly. **Polyethylene nozzles do not have lifting points.** If needed, attach polyethylene nozzle to fan or stack prior to lifting and use component lifting points.

Fans and bypass air plenums (BAP) should be disassembled prior to lifting and lifted individually. Fans and BAP are to be rigged and moved by the lifting points provided or by the skid when a forklift is used. Location of the brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce the ability of the fan to resist corrosion. Spreader bars are recommended to prevent damage to the unit. Failure to use spreader bars may result in damage which becomes the installer's responsibility.

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

Vektor-H

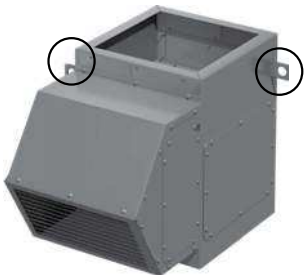
Unit Assembly Lifting Lugs

Belt Drive
Sizes 9-12

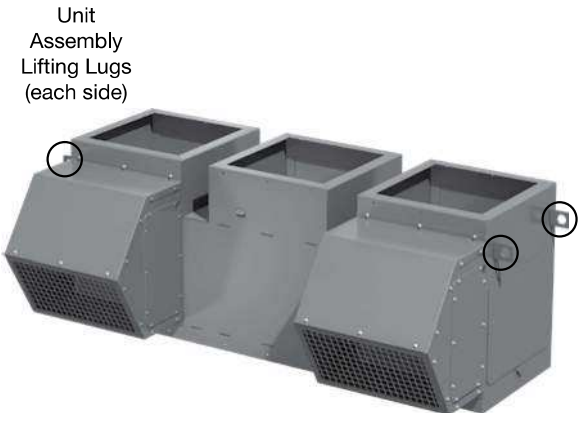
Belt Drive
Sizes 13-36

Direct Drive
Lift as an assembly with all four (4) lifting lugs.
Image shows if motor and wheel assembly needs to be removed.

Nozzle sizes 13-36



Bypass Air Plenum
Sizes 9-22



3x1 Fan System with Bypass Air Plenum
Sizes 9-13, 18-36

Rigging and Lifting (continued)

Unit Lifting Points		
Fan		
Size	Quantity	Placement
Belt – 9-12	2	Inside fan body, on top of belt tube
Belt – 13-36	2	Exterior of fan body
Direct – All	4	Outside of core and outside of fan body, All (4) to be used to "balance" the lift.
Bypass Air Plenum (BAP)		
Size	Quantity	Placement
1x1 – 9-22	2	Opposite sides of plenum
1x1 – 24-36	4	Two on each end of plenum
2x1 – 9-16	2	Opposite sides of plenum
2x1 – 18-36	4	Two on each end of plenum
3x1 – 16	2	Opposite sides of plenum
3x1 – 9-13, 18-36	4	Two on each end of plenum

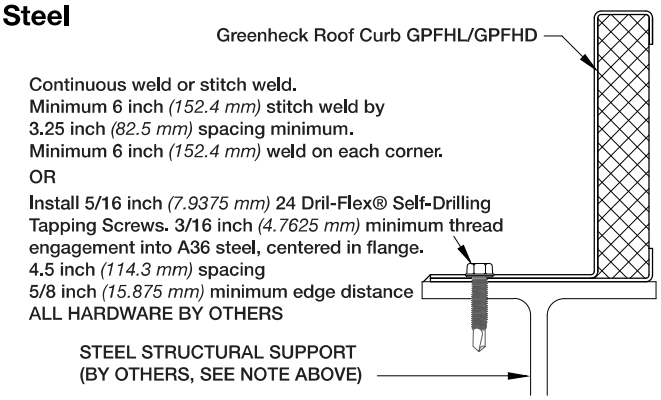
Roof Curb and Mounting Details

NOTE

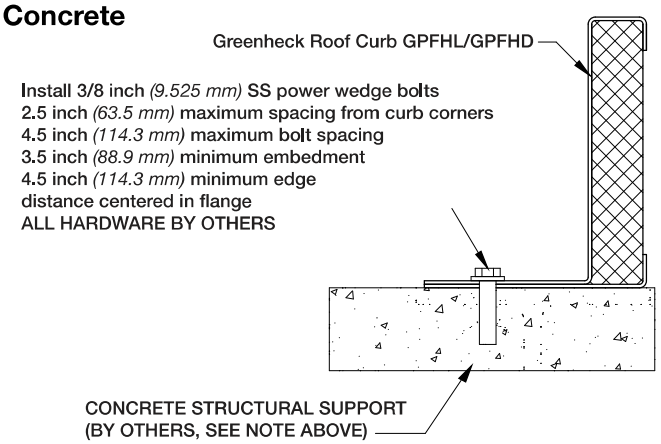
Steel, concrete or wood roof support is per structural engineer and in accordance with load requirements and applicable building codes.

The figures below illustrates three common methods used to install Vektor systems. Methods used to attach a Vektor unit are dependent on local codes, roof construction design and roof construction materials. Consult an architect or structural engineer for proper means of attachment.

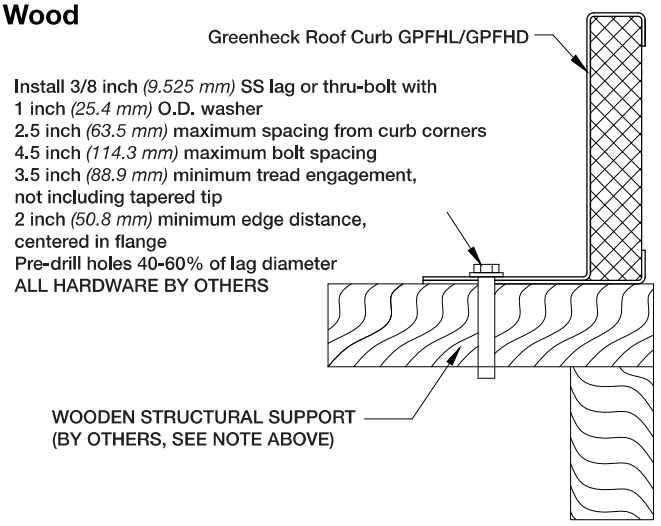
Steel



Concrete



Wood

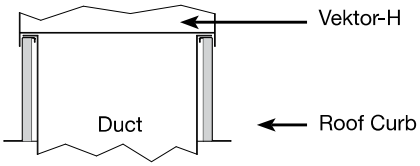


Duct Installation

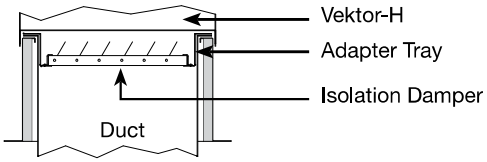
Bottom Inlet Duct Connection

The end of the duct (customer-supplied) is secured between the roof curb's top edge and the curb cap of either the Vektor-H or bypass air plenum. If an isolation damper is present in the roof curb, the duct is located between the roof curb and the damper adapter tray.

Option 1:
- No isolation damper in roof curb
- Bottom inlet on bypass air plenum



Option 2:
- With isolation damper in roof curb



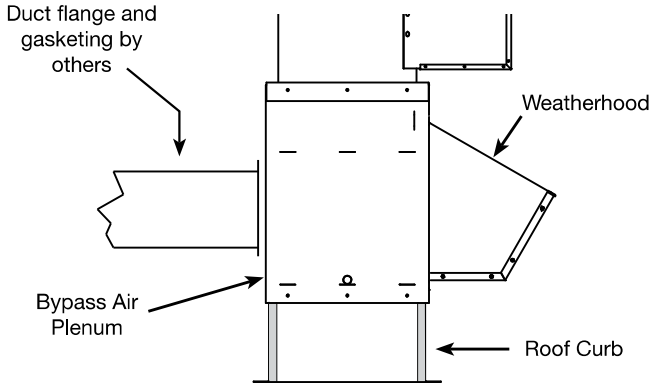
Duct Connection to Curb

Side or End Duct Connection

- Vektor-H
- With bypass air plenum

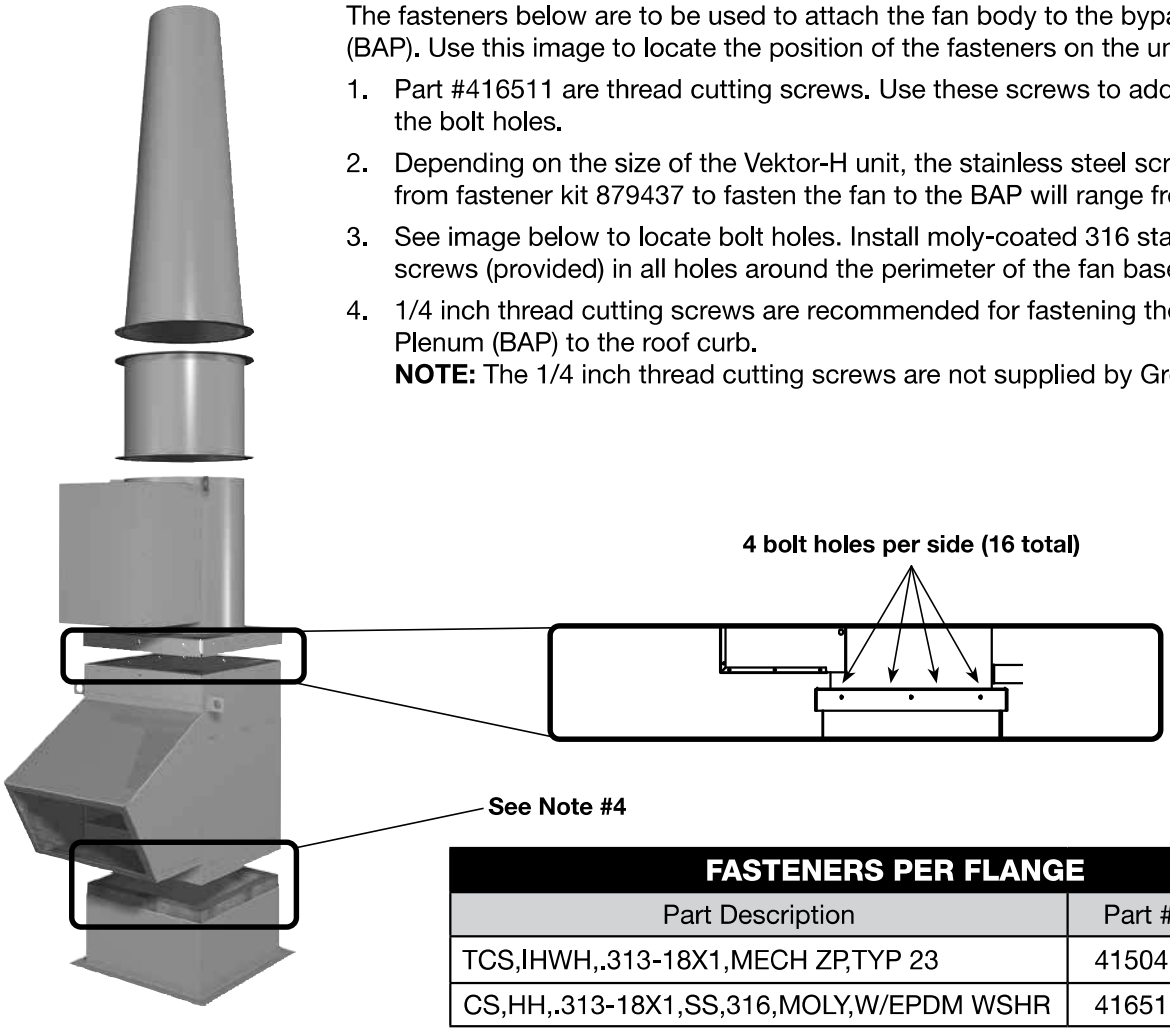
NOTE

Plenum is provided with removable side or end panels, allowing the proper duct connection.



Duct to Bypass Air Plenum

Fan to Bypass Air Plenum (BAP) Assembly



The fasteners below are to be used to attach the fan body to the bypass air plenum (BAP). Use this image to locate the position of the fasteners on the unit.

1. Part #416511 are thread cutting screws. Use these screws to add threads to the bolt holes.
2. Depending on the size of the Vektor-H unit, the stainless steel screws used from fastener kit 879437 to fasten the fan to the BAP will range from 12 to 16.
3. See image below to locate bolt holes. Install moly-coated 316 stainless steel screws (provided) in all holes around the perimeter of the fan base.
4. 1/4 inch thread cutting screws are recommended for fastening the Bypass Air Plenum (BAP) to the roof curb.
   NOTE: The 1/4 inch thread cutting screws are not supplied by Greenheck.

FASTENERS PER FLANGE		
Part Description	Part #	Quantity
TCS,IHWH,.313-18X1,MECH ZP,TYP 23	415041	2
CS,HH,.313-18X1,SS,316,MOLY,W/EPDM WSHR	416511	16

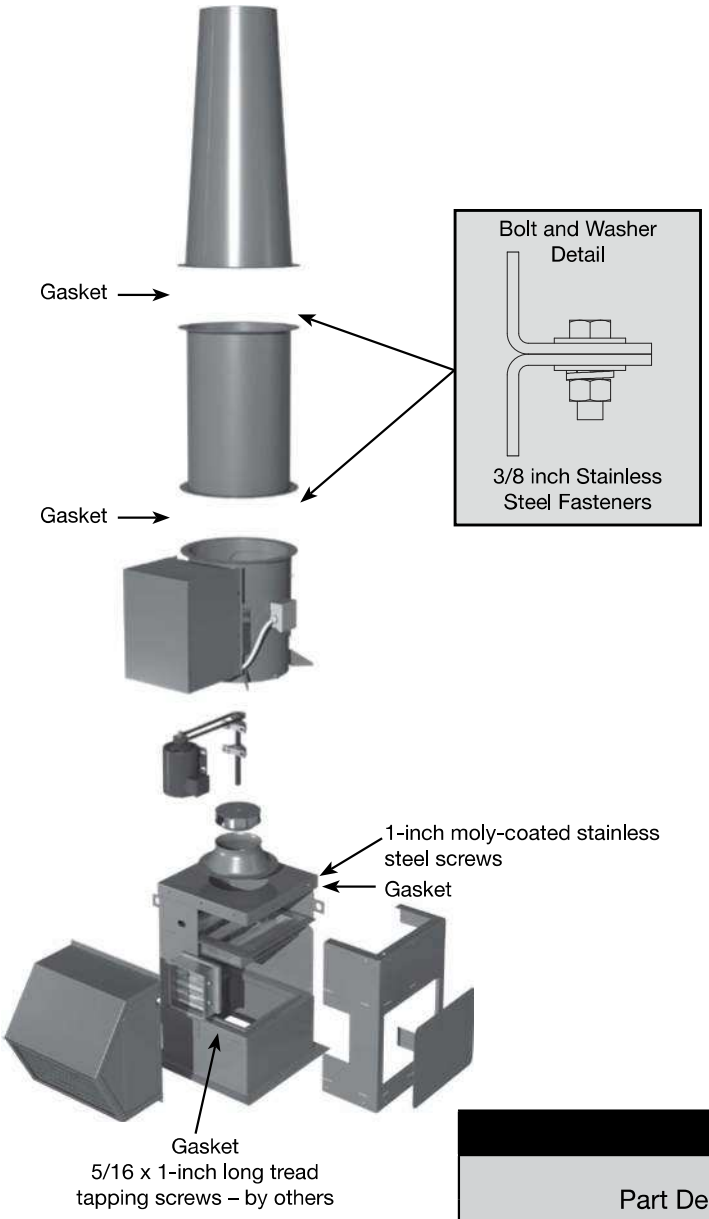
NOTE

For curb mounted exhaust systems using “Bottom Inlet” duct connections, installation of drain locations within the ductwork is recommended to allow for safe removal of any water that enters the duct system. This requires the installing contractor to determine whether insulation, watertight construction, or sloped and drained ductwork are required. For curb mounted exhaust systems with “Free Inlet Bottom Intake” connections (free air inlet conditions), it is recommended to install a moisture collecting drip pan at least one housing diameter below the inlet of the fan.

System Assembly

NOTE

When installing each section, be certain to rig each section separately using the lifting lugs provided.



1. Mount roof curb to roof deck in accordance with local codes.
2. Place the bypass air plenum (BAP) onto the secured roof curb. Pre-drill pilot holes into the roof curb using pre-existing holes in plenum as a guide. Use thread cutters to add threads to holes in roof curb. After installing gasketing on top edge of roof curb, attach the BAP to the roof curb with mounting hardware (recommend 5/16 x 1-inch long tread tapping screw – by others).

   If a BAP is not provided for the unit, skip to Step 4.
3. Install 3/16-inch thick x 1/2-inch wide, closed-cell gasket on the top edge of BAP, adhesive side down (gasket provided). Leave no gaps between gasket sections to ensure a tight seal.
4. Place the panel of the fan housing onto the gasket and BAP or onto roof curb if BAP is not provided. Use thread cutters to add threads to holes, securing with 1-inch moly-coated stainless steel screws. Must use every hole for proper coverage.
5. Install the final nozzle subassemblies as shown in the submittal drawing. Align flange bolt holes and fasten sections using the 3/8-inch 316 stainless steel bolts, washers, and lock washers provided.
6. Follow electrical connection and pre-start-up checks as listed on pages 10 and 11.

FASTENER PER FLANGE

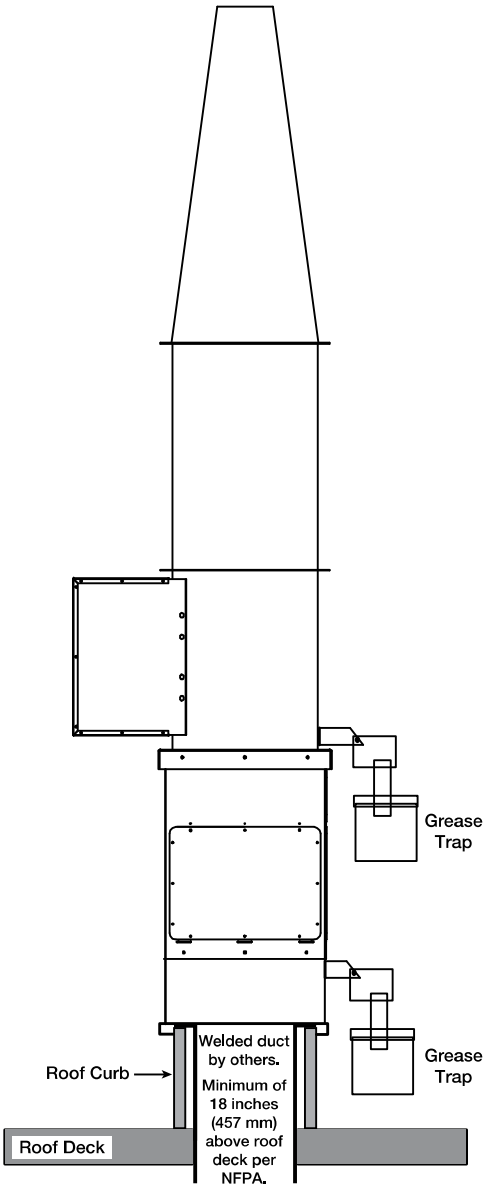
Part Description	Part #	Quantity	
		Size 9-24	Size 30-36
CS,HH,.375-16X1.5,SS,316,MOLY	415781	8	16
NUT,HEX,.375-16,SS,316	415799	8	16
WSHR,FLAT,.313X.05X.406X.875,SS,316	415800	16	32
WSHR,LOCK,SPLIT,.375,SS,316	415810	8	16

Stack Extensions

Systems with multiple stack extensions require all sections assembled and installed on site between the main fan body and the discharge cone. Each section has guy wire attachment brackets located on the upper end of each section. The order sections are installed in are universal. Gasketing (3/16 x 1/2 inch with sticky back) is provided and is to be installed between each joining section.

Guy wires are required on system with multiple stack extensions. Location of connections, wiring and anchorage is determined by a structural engineer.

Kitchen Roof Mounting Installation



Typical Commercial Kitchen Installation

WARNING

In a kitchen exhaust application, do not use a speed control or isolation damper.

NOTE

In a kitchen fan and high temperature applications exhaust upblast fans must have external wiring.

UL/cUL 762 installation for restaurant applications

1. The size of the duct must be equal to the inlet opening.
2. Secure the fan to curb at all four corners using a minimum eight anchor bolts, lag screws or other suitable fasteners.
3. Use optional grease trap and external junction box.
4. Area codes may require a continuous weld between duct and inlet.
5. To comply with NFPA 96, the discharge is required to be a minimum of 40 inches *(1016 mm)* above the roof deck and a minimum of 10 ft. from any building air intake. The minimum velocity in the duct should be 500 ft/min. or greater.
6. Ductwork to an upblast discharge exhaust fan is constructed of carbon steel not less than 16 MSG *(1.6 mm)* and extends a minimum of 18 inches *(457 mm)* above the roof surface.
7. Ensure that a minimum of 500 ft/min. of air velocity through the fan is maintained per NFPA 96, clause 8.2.1.1, 2008 edition and UL 762, Issue #5, December 19, 2003, clause 6.2.

Grease Trap

A grease trap is an aluminum trap designed to collect grease residue to avoid drainage onto roof surface. It contains a built-in water separating baffle.

Instructions

1. Apply cover to grease trap. Install clip nuts to trap over holes provided. Attach cover with two #10 - 24 x 1/2 fasteners.
2. Position the container under the grease drain so the drain spout enters the cover approximately 1-1/2 to 2 in. *(38-51 mm)*.
3. Locate and mark the container mounting holes on the extended base or roof curb.
4. Drill 3/16 in. (*5 mm*) diameter holes in marked locations.
5. Apply container with #10 - 24 x 3/4 fasteners.
6. For most climates, fill container with water (at installation and after each cleaning) until it flows out the drain hole. The unit is now ready for use.

Maintenance

Regular inspection of grease trap is recommended. Depending on the amount of grease discharged through the fan, the grease trap should be changed accordingly to ensure proper operation.

Fan and Plenum Drainage Piping / Trap Detail (By Others)

Fan Drain Connection

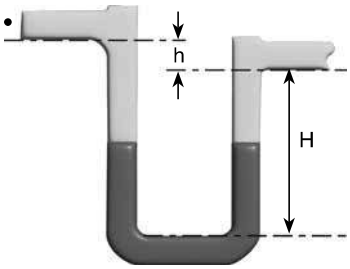
Plenum Drain Connection

There is a location for a pipe connection on each tubular fan housing and bypass air plenum. Each drain may need to be connected to a drainage system to ensure proper disposal of any water or condensate that may occur.

- Drain connections are 1/2-inch NPT
- Installed piping to have a downward angle to allow for drainage
- Fill traps to recommended level before start-up

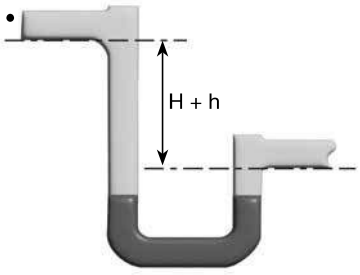
Note: A conservative method of trap design is to set H = total static pressure.

• Connect this end to the fan drain.



* A trap is needed for each fan

• Connect this end to the optional BAP drain.



h = 1 inch (*25.4 mm*)

H = 1 inch for each inch of static pressure (*25.4 mm for each 250 Pa of static pressure*)

Electrical Connections

NOTE

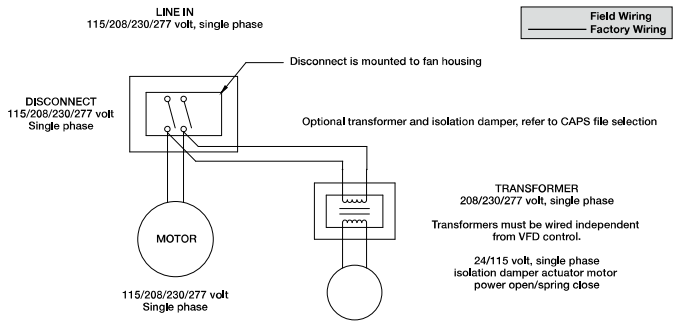
Refer to the Vektor Laboratory Exhaust with Variable Geometry Nozzle (VGN) Technology Electrical Controls Installation, Operation and Maintenance Manual for electrical wiring and connection information.

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

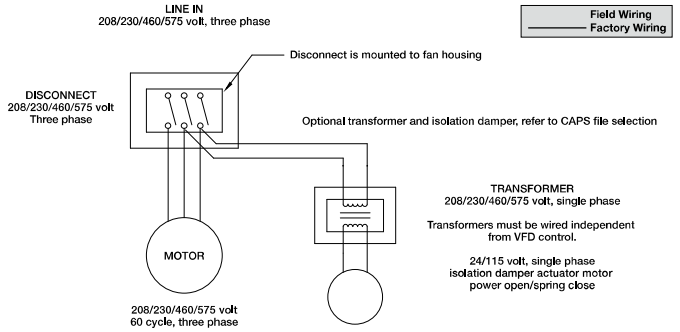
Vektor-H Motor Disconnect and Isolation Damper Wiring Diagram

Disconnect is mounted to fan housing. Transformers are mounted to bypass air plenum with damper actuator motors. For systems that ship unassembled because of physical size, this connection at disconnect from transformers must be field-installed. Wires with conduit and fittings are provided pre-connected to transformers.

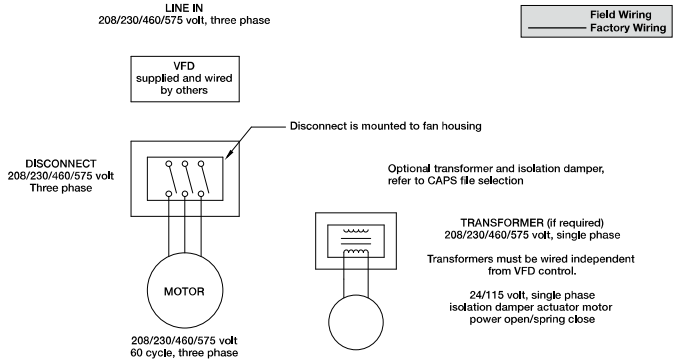
Single Phase Layout



Three Phase Layout



Three Phase with Variable Frequency Drives Layout



NOTE

For units supplied or used with a Variable Frequency Drive (VFD), reference the VFD documentation for installation requirements, start-up settings, parameter adjustments and trouble shooting. VFDs provided by Greenheck are factory programmed for basic motor parameters, incoming voltage parameters and maximum operating speed (Hz).

Follow NEC and local codes for VFD wiring and installation. If the wire length between the VFD and the controlled motor exceeds 100 ft (*30.5 m*), DV/DT filters or VFD cabling may be required. Calculations and proper application of DV/DT filters and VFD cabling is by others; failing to do so may result in premature motor failure.

Vektor-H Applications with Variable Frequency Drive (VFD)

For Vektor systems with single-point, three-phase wiring per blower, the isolation damper actuator will be powered via a step-down transformer, which is wired to the fan disconnect, as shown in the wiring diagrams on page 10.

If fan flow (motor speed) is to be controlled using a variable frequency drive with this wiring, the reduced voltage and frequency supplied to the fan will cause control problems with the isolation damper actuator.

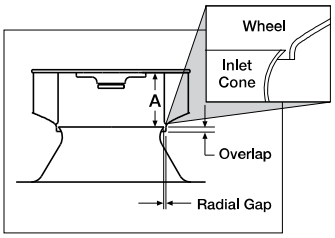
When a project's Vektor control sequence requires the use of a VFD, it is suggested that the control contractor supply the isolation damper actuator voltage, independent of the power supplied to the Vektor fan motor.

Pre-Start-Up Checks

Check all fasteners for tightness.

Check radial gap, overlap and wheel alignment. The wheel should be aligned as shown. Although the wheel position is preset and the unit is test run at the factory, movement may occur during shipment.

The radial gap should be consistent at all locations between the centrifugal wheel and the inlet cone. Centering may be accomplished by loosening the inlet cone bolts and repositioning the inlet cone.



To obtain the optimum performance, the centrifugal wheel must overlap the inlet cone. Adjustments can be made by loosening the set screws in the wheel and moving the wheel to the desired position.

Wheel rotation should be in the same direction as the rotation decal affixed to the unit. (Counterclockwise rotation is correct as viewed from fan inlet). For 3-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single phase installations, follow the wiring diagram located on the motor.

NOTE

Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to nameplate rating when changing fan speed.

Unit Size	Belt Drive – Inlet Cone to Backplate			
	A Dimension ± Tolerance		A Dimension ± Tolerance	
	Inches		millimeter	
9	3-3/16	± 1/8	81	± 3
10	3-7/16	± 1/8	87	± 3
12	4	± 1/8	102	± 3
13	4-7/16	± 1/8	113	± 3
16	5-7/16	± 1/8	138	± 3
18	6-3/8	± 1/8	162	± 3
22	7-13/16	± 3/16	198	± 5
24	8-5/8	± 1/4	219	± 6
30	10-9/16	± 3/8	268	± 10
36	12-3/4	± 3/8	324	± 10

Unit Size	Direct Drive – Inlet Cone to Backplate			
	A Dimension ± Tolerance		A Dimension ± Tolerance	
	Inches		millimeter	
10	3-1/2	± 1/8	89	± 3
12	4-5/16	± 1/8	125	± 3
13	4-7/8	± 1/8	124	± 3
14	5-7/16	± 1/8	138	± 3
16	6-1/16	± 1/8	154	± 3
18	6-7/8	± 1/8	175	± 3
20	7-11/16	± 1/8	195	± 3

Radial Gap is adjusted by loosening the inlet cone bolts and centering the cone on the wheel. If additional adjustment is required to maintain a constant radial gap, loosening the bearing bolts and centering the wheel is acceptable as a secondary option.

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

Maintenance

WARNING

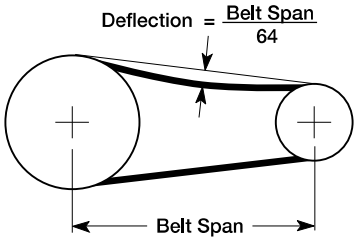
Disconnect all electrical power to the fan and secure to the 'OFF' position prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

Once the fan has been put into operation, a periodic maintenance program should be set up to preserve the reliability and performance of the fan. Items to be included in this program are:

- Belts
- Fasteners
- Set Screws
- Motors
- Removal of dust and dirt
- Fan shaft bearings
- Vektor-HS nozzle bearings
- Relubrication schedule

Belts

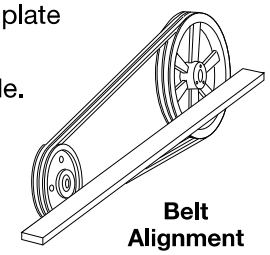
Premature belt failures are frequently caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection half-way between pulley centers is 1/64-inch for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be one inch using moderate thumb pressure at midpoint of the drive.



Belt Tension

Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys will result in premature belt wear, noise, vibration and power loss.



Belt Alignment

Fasteners and Set Screws

A periodic inspection should include checking all fasteners and set screws for tightness. Particular attention should be paid to set screws attaching the wheel to the shaft.

Motors

Belt Drive:
Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Motors supplied with grease fittings should be greased according to directions printed on the motor.

Direct Drive:
Motor bearings are lubed for life, with no maintenance required.

If motor or wheel needs to be serviced or replaced, use the lifting lugs to pull assembly cartridge out.

Removal of Dust and Dirt

Dirt clogs cooling openings on the motor housing, contaminates bearing lubricant, and collects on the impeller causing severe imbalance if left unchecked. The exterior surface of the motor and impeller should be thoroughly cleaned periodically. Use caution and do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam or water.

Fan Shaft Bearings

The bearings for Greenheck fans are carefully selected to match the maximum load and operating conditions of the specific class, arrangement, and fan size. The instructions provided in this manual and those provided by the bearing manufacturer will minimize any bearing problems. Bearings are the most critical moving part of the fan; therefore, special care is required when mounting them on the unit and maintaining them. Locking collars and set screws, in addition to fasteners attaching the bearing to the bearing plate must be checked for tightness. Greenheck Fan Corporation recommends bearings to be relubricated quarterly at a minimum. All Vektor-H fans use Mobil Mobilith SHC-100 synthetic grease conforming to NLGI Grade 2. Never mix greases made with different bases as this will cause a breakdown of the grease and possible failure of the bearing. For specific information, contact the factory representative or the fan system submittals.

Synthetic Grease				
Recommended Bearing Lubrication Schedule Relubrication Schedule in Months*				
Fan Size	9 - 13	16 - 22	24	30 - 36
Fan RPM	Bearing Bore (inches)			
	½ - 1	1⅛ - 1½	1⅝ - 1⅞	1 15/16 - 2 3/16
to 250	12	12	12	12
500	12	12	12	12
750	12	12	12	12
1000	12	12	12	12
1250	12	12	12	12
1500	12	12	12	10
2000	12	10	8	6
2500	12	7	5	4
3000	12	5	3	2
3500	12	3	2	0.75
4000	12	2	0.5	
5000	12	1		
Number of shots of grease**	4	8	8	10

* Lubrication interval is based on 12 hour per day operation and maximum 160°F. housing temperature. For 24 hour per day operation, the interval should be cut in half.

** Lubricant should be added with the shaft rotating and until clean grease is seen purging from the bearing. The lubrication interval may be modified based on the condition of the purged grease. If bearing is not visible to observe purged grease, lubricate with number of shots indicated for bore size.

- For conditions including high temperatures, moisture, dirt or excessive vibration, consult the factory for a specific lubrication interval for your application.
- Lubricant should be a high quality lithium complex synthetic grease conforming to NLGI Grade 2. Factory recommends Mobilith SCH-100.
- The use of non-synthetic grease will decrease lubrication intervals by approximately 3 times.
- Storage periods of 3 months or longer require monthly rotation of the shaft and purging grease prior to storage and start-up.

Damper and Damper Actuators

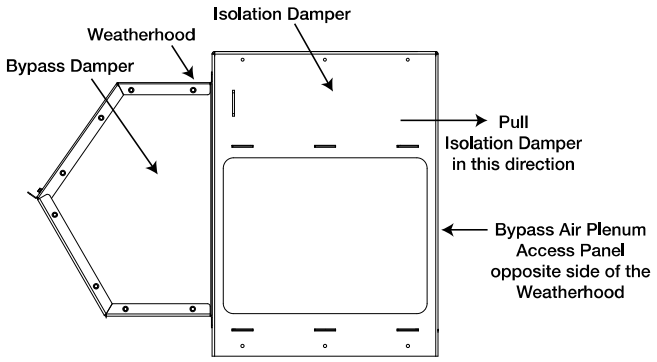
CAUTION

If performing maintenance on the dampers or replacing actuators, disconnect power to damper actuators.

If access is required to a gravity isolation damper, remove the panel opposite the weatherhood on the bypass air plenum section and slide the damper straight out toward you.

When performing maintenance on an isolation damper **with** an actuator, remove the bolted weatherhood, and disconnect the actuator from damper. Then remove the panel opposite the weatherhood on the bypass air plenum section and slide the isolation damper out.

Damper actuators, when supplied by Greenheck, are designed to be maintenance free. No lubrication is required.



Field Coating Touch-Up for Scratched Areas

Standard coating and color is LabCoat™ RAL 7023 Concrete Grey.

Failure to perform touch-ups may result in rust or corrosion which can accelerate color fade. This not covered under warranty.

TOUCH-UP PAINT REPAIR KIT CONTENTS
• One Zinc Clad Aerosol Can • One pint (recoat epoxy primer grey) with one pint (recoat epoxy primer catalyst) • One quart H.S. Polyurethane • One Scotch-Brite scratch pad • Two 1-1/2 inch wide paint brushes • Four pint-sized empty cans for mixing • One quart-sized empty can for mixing • Zinc repair instructions • MSDS sheets

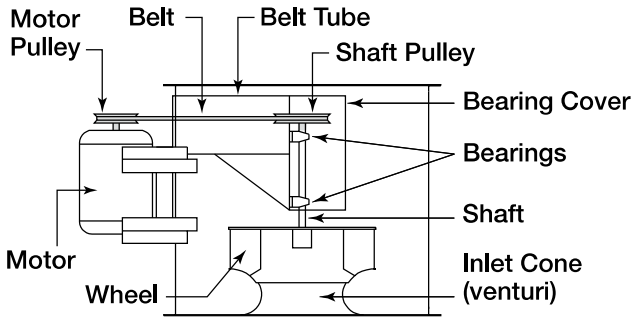
NOTE
While the manufacturer provides heavy-duty, quality products for marine environments, routine paint touch-ups may be required in coastal regions where salt or marine air could damage the coating. The severe environment will accelerate the damage from any scratches or chips and it is recommended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

To order a coating repair kit, please reference part number **HAZ2597 PNT FIELD REPAIR KIT, RAL7023 CONCRETE GREY.** Please contact factory with your fan's serial number for colors other than our standard.

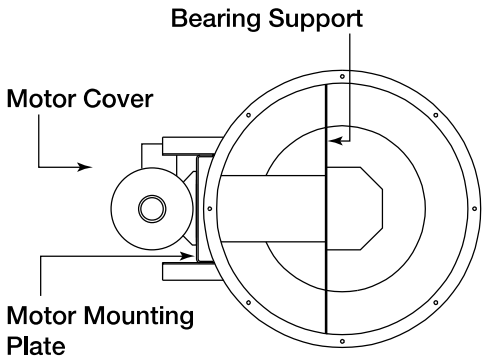
Vektor-H Exhaust Fan Parts List and Assembly

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information in addition to the parts list shown, will assist the local sales representative and the factory in providing service and replacement parts.

Side View



Top View



Maintenance Log

Date _____Time _____ AM/PM
Notes:_____

Date _____Time _____ AM/PM
Notes:_____

Date _____Time _____ AM/PM
Notes:_____

Date _____Time _____ AM/PM
Notes:_____

Date _____Time _____ AM/PM
Notes:_____

Date _____Time _____ AM/PM
Notes:_____

Date _____Time _____ AM/PM
Notes:_____

Date _____Time _____ AM/PM
Notes:_____

Our Commitment

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

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Vektor-H catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

Installation, Operation and Maintenance Manual

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

Sure-Aire™ Electronics Features:

- NEMA-4/IP56 enclosure rating
- Factory calibrated
- 24 VDC/24 VAC or 100-240 VAC 50/60 Hz input voltage
- Part numbers and pressure ranges:
  - 386719 – 0-4.15 in. wg
  - 386720 – 0-8.30 in. wg
  - 386721 – 0-22.14 in. wg
  - 386722 – 0-41.52 in. wg
  - 386723 – 0-83.14 in. wg
  - 386724 – 0-138.40 in. wg

Pressure ranges reflect differential pressures between the fan inlet and inlet cone, not system static pressure.

- Isolated output transmitter linear to differential pressure or volume
  - 4-20 mA
  - 2-10 VDC
- Communication protocols
  - BACnet MSTP
  - Modbus
- LCD display with user-friendly touch panel interface
- Temperature compensation for air density
- Remote duct temperature sensor
- Programmable elevation
- English or metric readings

Hardware Required:

- Four (4) #8-32 screws
- 1/4-inch nylon tubing (length dependent on distance between fan and Sure-Aire electronics, maximum 75 feet *(23 m)* each line)
- Sensor wiring for temperature sensor (if temperature sensor is being used)

Flow Accuracy +/- 3.0% of actual flow

Transducer in Electronics:

- Accuracy +/- 0.5% of full scale at 77°F (*25°C*)
- Pressure limit: 70 psi (1938 in. wg)
- Thermal effects: 0.015%/°F (*0.027%/°C*) from -13° thru 185°F (*25° thru 85°C*)

WARNING

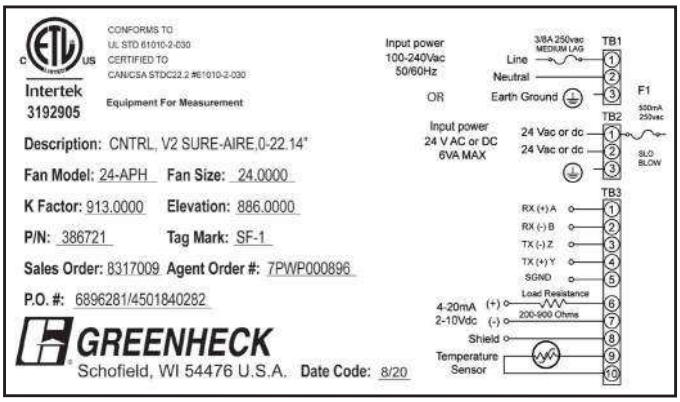
Improper installation, adjustment, alterations, service or maintenance may cause injury and/or property damage, as well as possibly void the factory warranty. No person may install, operate, or maintain a Sure-Aire™ electronics without first being fully trained and qualified in the installation, operation and maintenance, and carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your local representative.

CAUTION

Risk of electrical shock! More than one disconnect switch may be required to de-energize the equipment before servicing.

Table of Contents

Label Information



Match the Tag Mark on the Sure-Aire electronics tag to the Tag Mark on the fan nameplate. Sure-Aire electronics are supplied set-up individually for a specific model and performance. Contact factory if Sure-Aire electronics are being used on a different Tag Mark then specified.

General Information

This instruction manual provides installation, operating, maintenance, and other information for the Sure-Aire™ series differential pressure electronics.

Receiving

Upon receiving the electronics, check to ensure all items are accounted for by referencing the packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the packing list and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your local sales representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts.

Storage

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

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

Removing from Storage

As electronics are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the control goes into operation. Environmental Operation Range: -4° to 140°F (*-20° to 60°C*).

Installation and Setup

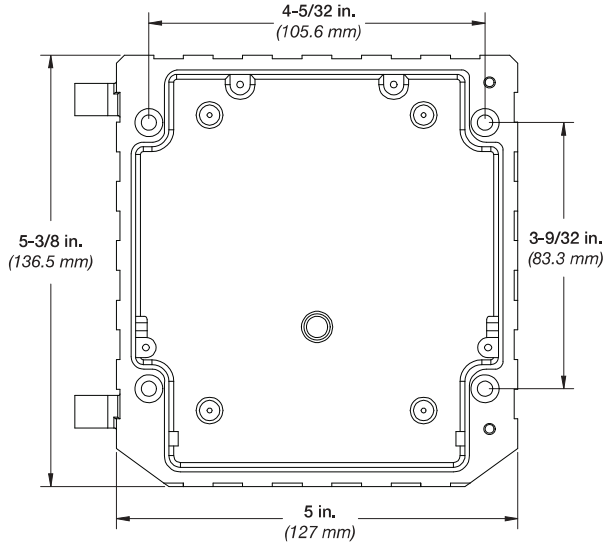
WARNING

When wiring the electronics, you must follow industry standard practices for controls and protect against electrostatic discharge (ESD). Failure to exercise good ESD practices may cause damage to the electronics.

1. Mount the electronics in the vertical plane using four (4) #8-32 screws, field supplied. Open the front cover by unscrewing the two captive thumb screws to gain access to the four mounting locations.

   Note: Mount the Sure-Aire™ electronics within 75 feet of the termination plate on the fan.

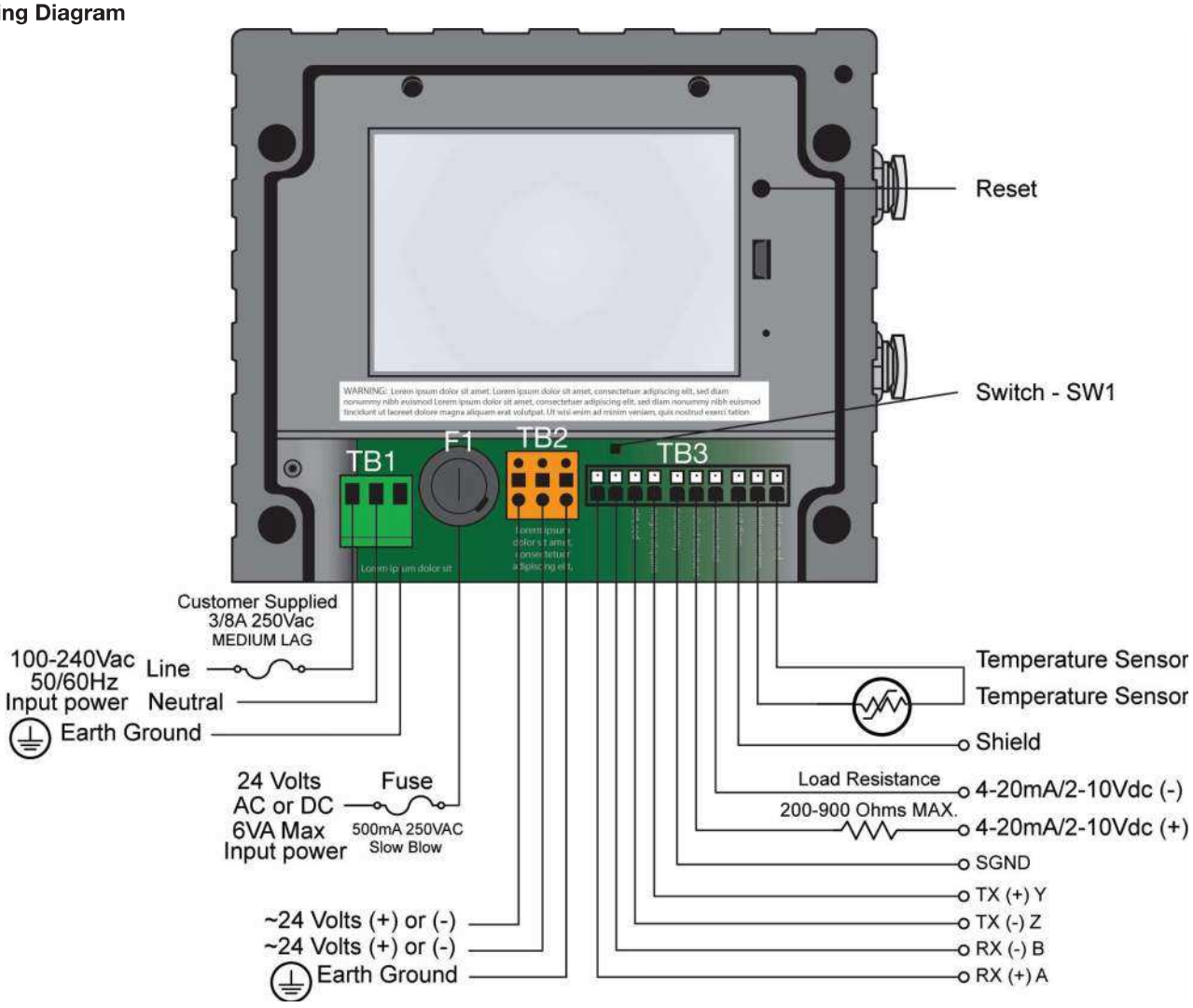
Dimensions and Hole Mounting Pattern



2. Use 1/4-inch nylon tubing to connect the corresponding High (H) and Low (L), 1/4-inch quick connect, pressure ports of the Sure-Aire electronics to the high and low pressure ports on the fan.

Installation and Setup (continued)

Wiring Diagram



3. Remove terminal block TB1 and perform wiring for the pins if you are using AC. If using low voltage AC/DC, plug the wires into TB2. For liquid tight applications, use only 1/2-inch liquid tight conduit.

   Terminal Block TB1: AC Input Power:
   Pin 1 = 100-240VAC Line
   Pin 2 = 100-240VAC Neutral
   Pin 3 = Earth Ground

   Terminal Block TB2: Low Voltage AC/DC Input Power:
   Pin 1 = 24V, AC or DC (+ or -)
   Pin 2 = 24V, AC or DC (+ or -)
   Pin 3 = Earth Ground

4. Provide power to the electronics to turn it on.
5. Select the desired Output Signal of the electronics for the Building Automation System. Use the touch screen to select the 4-20 mA or 2-10 VDC output signal via the monitor's setup menu. (Refer to Setup Menu, Output Signal, page 9).
6. Wire TB3 appropriately for the selected Output Signal in Step 5.

   Terminal Block TB3: Transmitter/Temperature Sensor:
   Pin 6 = 4-20 mA or 2-10 VDC (+) (output)

   Note: 4 to 20 mA requires a load resistor 200-900 ohms
   Pin 7 = 4-20 mA or 2-10 VDC (+) (output)
   Pin 8 = Shield
   Pin 9 = Remote Temperature Sensor (input)
   Pin 10 = Remote Temperature Sensor (input)

   Note: Signal isolator may be required when two or more output signals share a common connections at the PLC/electronics.

7. Select the desire network protocol of the electronics for the Building Automation System. Use the touch screen to select Modbus/BACnet, baud rate, and the network address of the electronics. This is done via the setup menu. (Refer to Setup Menu, Output Signal, page 9)

8. Wire TB3 appropriately if the networking features of the electronics are being used. There are two wiring options for the network protocol: 2-Wire and 4-Wire. The currently selected option is based on the position of SW1.

Switch SW1: 2-Wire/4-Wire Select:

Left Position = 2-Wire
Right Position = 4-Wire

Terminal Block TB3: 4-Wire Communication:

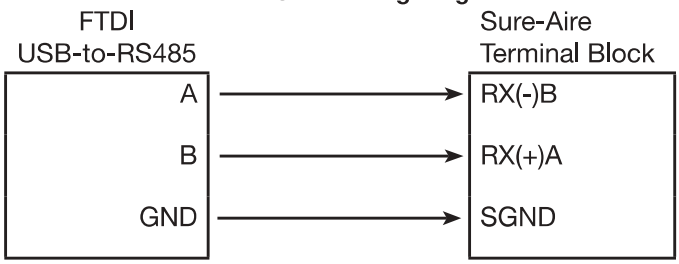
Pin 1: RX+ (A)
Pin 2: RX- (B)
Pin 3: TX- (Z)
Pin 4: TX+ (Y)
Pin 5: Signal Ground (SGND)

Terminal Block TB3: 2-Wire Communication:

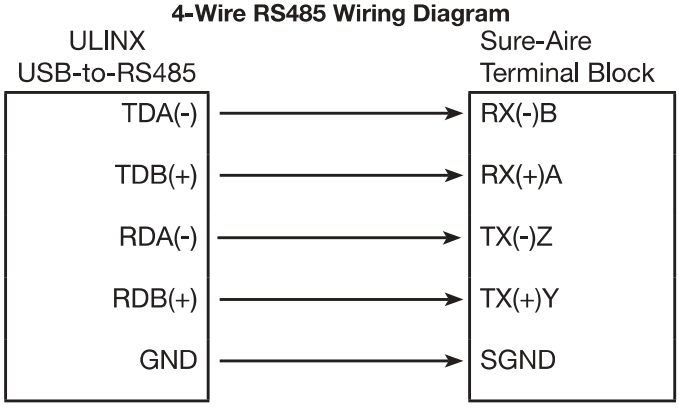
Pin 1 or Pin 4: RX+ (A)/TX+ (Z)
Pin 2 or Pin 3: RX- (B)/TX- (Y)
Pin 5: Signal Ground (SGND)

9. If not using temperature compensation, change Temperature Compensation to "No" via the setup menu. If temperature compensation is desired, mount the provided temperature sensor in contact with the airstream. Wire the temperature sensor into TB3 and confirm Temperature Comp is "Yes" via the setup menu. (Refer to Setup Menu, Temperature Compensation, page 9).
10. When the above steps are completed, make sure the front cover is properly aligned to the housing and the two captive thumbscrews are securely tightened.

2-Wire RS485 Wiring Diagram



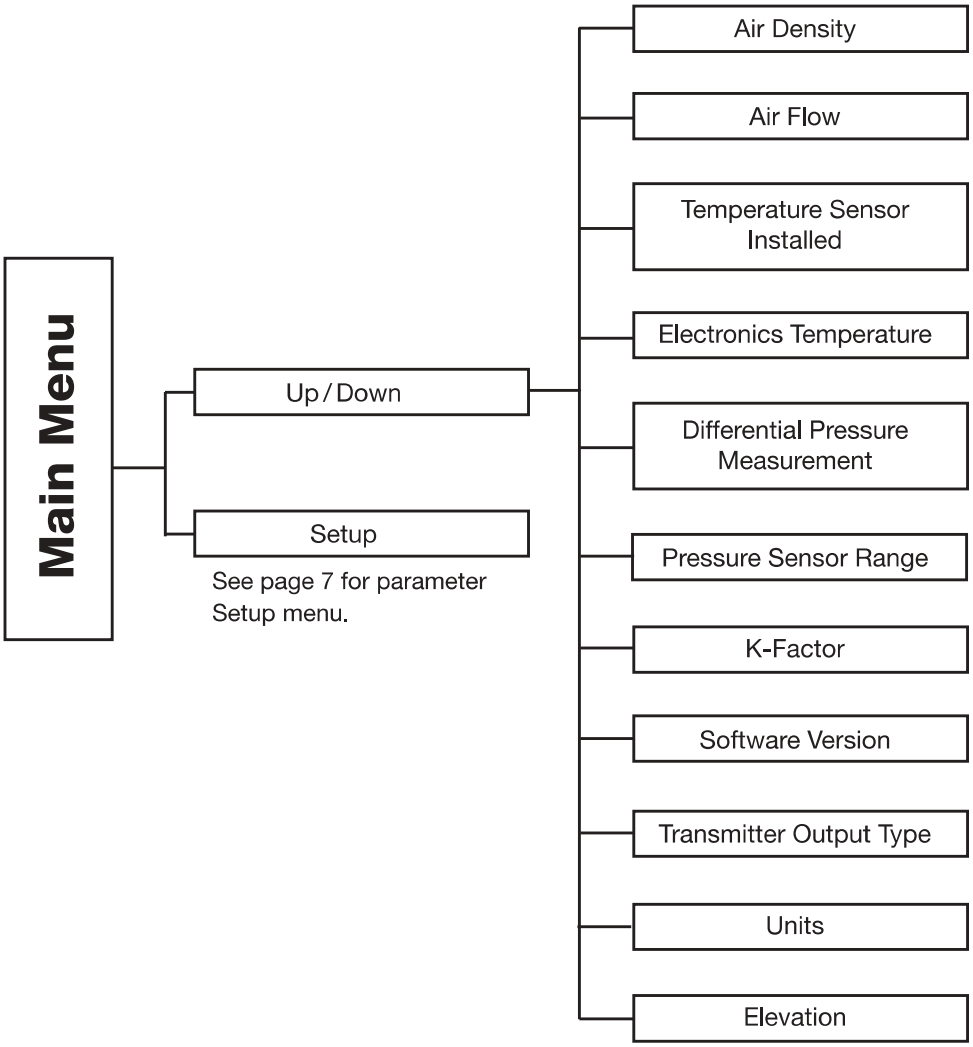
4-Wire RS485 Wiring Diagram

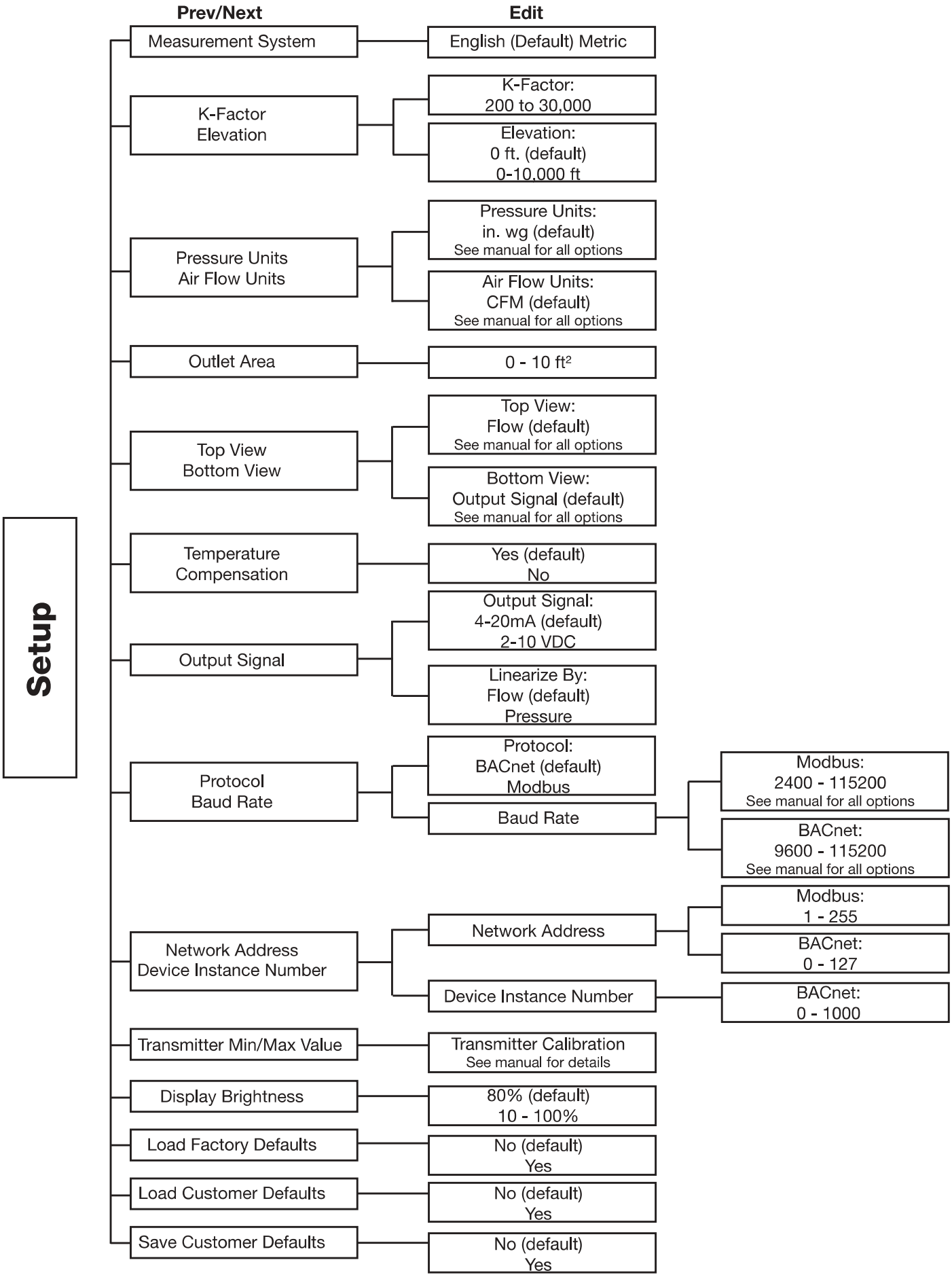


Network Input Register Address

Object Name	Modbus	BACnet
	16-bit address	16-bit address
K Factor	0	0
Elevation	1	1
Outlet Area	3	2
Flow Temperature	2	3
Pressure	4	4
Volume	5	5
Velocity	6	6

Menu Structure




Prev/Next
Edit
Setup
Measurement System
English (Default) Metric
K-Factor
Elevation
K-Factor:
200 to 30,000
Elevation:
0 ft. (default)
0-10,000 ft
Pressure Units
Air Flow Units
Pressure Units:
in. wg (default)
See manual for all options
Air Flow Units:
CFM (default)
See manual for all options
Outlet Area
0 - 10 ft²
Top View
Bottom View
Top View:
Flow (default)
See manual for all options
Bottom View:
Output Signal (default)
See manual for all options
Temperature
Compensation
Yes (default)
No
Output Signal
Output Signal:
4-20mA (default)
2-10 VDC
Linearize By:
Flow (default)
Pressure
Protocol
Baud Rate
Protocol:
BACnet (default)
Modbus
Baud Rate
Modbus:
2400 - 115200
See manual for all options
BACnet:
9600 - 115200
See manual for all options
Network Address
Device Instance Number
Network Address
Modbus:
1 - 255
BACnet:
0 - 127
Device Instance Number
BACnet:
0 - 1000
Transmitter Min/Max Value
Transmitter Calibration
See manual for details
Display Brightness
80% (default)
10 - 100%
Load Factory Defaults
No (default)
Yes
Load Customer Defaults
No (default)
Yes
Save Customer Defaults
No (default)
Yes

K-Factor and Elevation

K-Factor: Press “Edit“ to change K-Factor. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 200 to 30,000
  (Factory set to fan model and size)

Elevation: Press “Edit“ to change elevation. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store