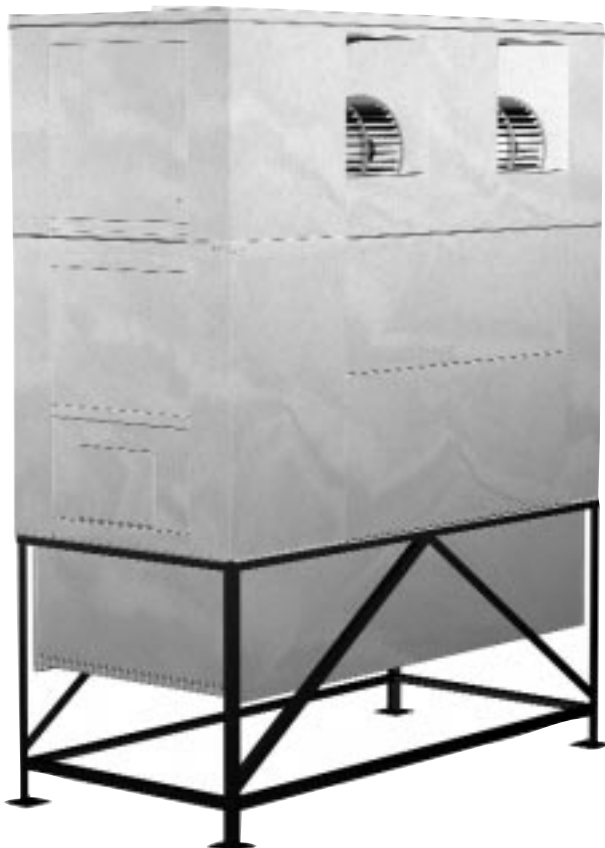


Installation, Operation and Maintenance Instructions **for Model VSU MAKE-UP AIR UNITS** **& OPTIONAL SERVICE PLATFORM**



**Installation with Optional
Service Platform Shown**



WARNING:

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

**This manual is the property of the owner, and is required for future maintenance.
Please leave it with the owner when you complete the job.**

This IOM is for installation, operation, and maintenance of a VSU unit. For information on installation and maintenance of the direct fired gas heating option reference the following manual:

- ***Direct Gas IOM (Part # 456857)***



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Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove to be defective during the warranty period will be repaired or replaced at our option.

The motor is warranted by the motor manufacturer for a period of one year. Should the motor prove defective during this period, it should be returned to an authorized motor service station. Greenheck will not be responsible for any installation or removal costs.

Due to continuing research, Greenheck reserves the right to change specifications without notice.

Installation

Step 1 Filter/Stand Section

The unit should be mounted on a concrete slab 4 inches thick with a proper gravel drainage bed. Allow one foot on each side of the unit as shown in the figure below.

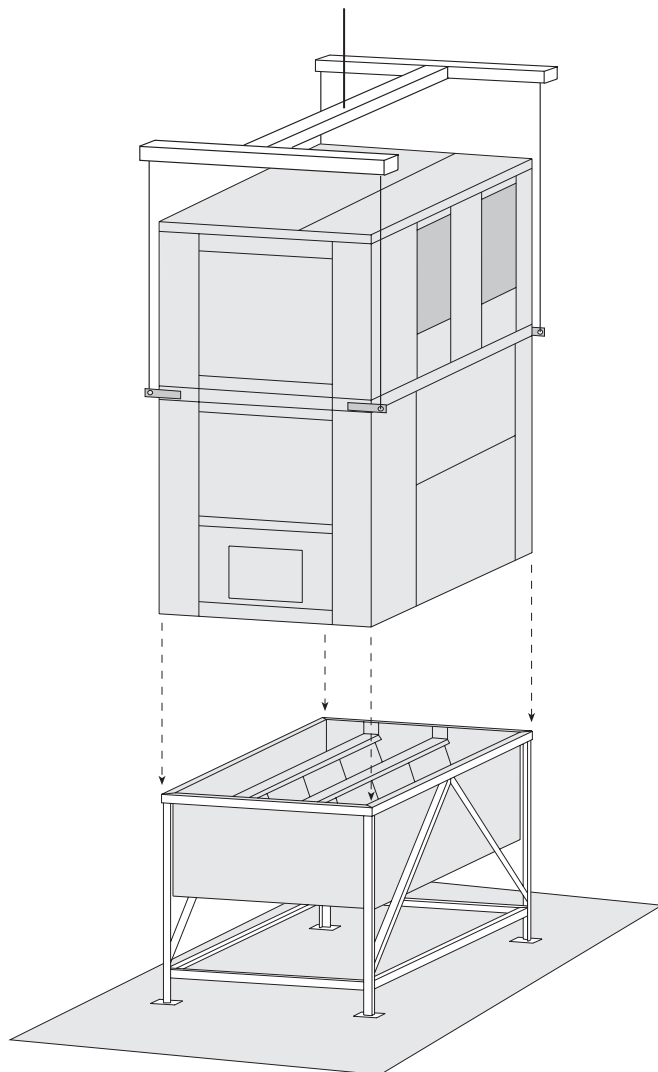
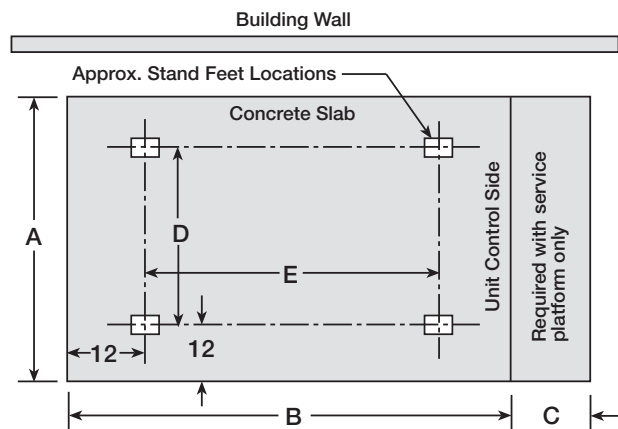
The filter section ships inside the stand as shown on the bottom left. After the unit is set on the slab, it can be anchored through the stand feet. The foot prints of the units are shown below.

Greenheck recommends having a three foot clearance on the controls side and a two foot clearance on the other three sides of the unit for serviceability. The following pertains to direct gas units only: When ordered with insulation, this unit has a 0 in. clearance tolerance to any combustibles, on all sides and top. Without insulation, the clearance tolerance is 6 in.

Concrete Slab Dimensions:

Housing Size	20	30	40	50
A	64	76	78	88
B	64	76	135	180
C	43	43	43	43
D	40	52	54	63
E	40	53	111	156

* All dimensions shown in inches.



Step 2 Burner/Blower Section

Use a crane and a spreader bar hooked to the factory lifting lugs (shown left) to lift and center the unit onto the filter stand section. The sections can be caulked together, but it is not needed with the water kickouts provided with this section.

Step 3 Install Ductwork

The chart (below) shows the duct sizes and straight lengths recommended for optimal performance (AMCA Publication 201-90). Using duct sizes less than recommended will affect fan performance. Good duct installation practices should be followed for the remaining ductwork. See the drawings on the following pages for duct locations.

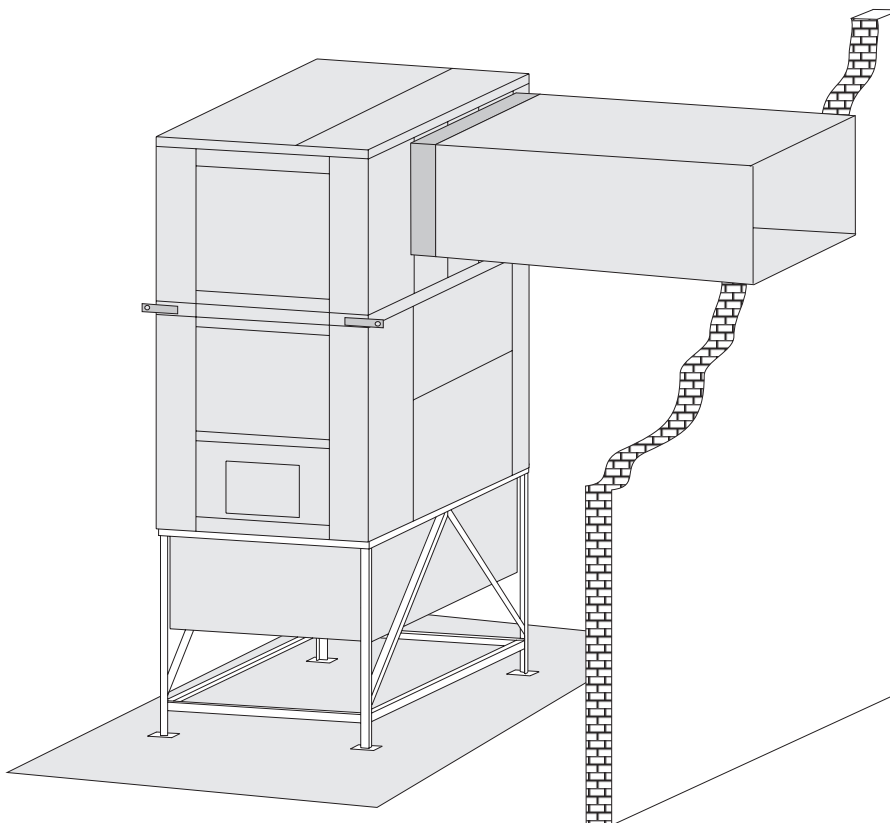
Recommended Supply Ductwork Sizes		
VSU Blower Size	Duct Size	Straight Duct Length
108	13 x 13	37 in.
109	13 x 13	37 in.
110	14 x 14	47 in.
112	16 x 16	54 in.
115	20 x 20	68 in.
118	24 x 24	81 in.
120	26 x 26	96 in.
218	68 x 24	113 in.
220	68 x 26	117 in.
225	100 x 32	160 in.
230	100 x 37	172 in.

Installation Continued

Complete Installation

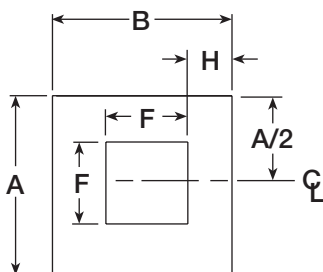
A typical horizontal discharge installation is shown. Gas and/or electrical lines can be connected at this time.

For upblast units a duct elbow may be needed to turn the duct work into the building. Follow proper duct work methods recommended by AMCA to make this elbow to minimize duct losses.



Dimensional Data

Upblast Discharge



Overall Unit Dimensions:

Housing Size	A	B	C	E	Qty Filters	Filter Size(s)
20	40	40	78	128	4 4	16 x 20 20 x 20
30	52	53	92	146	10	20 x 25

* All dimensions shown in inches.

Blower Dimensions:

Blower Size	F	G	H
108/109	13	14 ½	8
110	14	13 ⅝	9 ¼
112	16	11 ⅝	7 ¼
115	20	7	7 ¼
118	24	7 ⅝	12
120	26	5 ½	11 ½

* All dimensions shown in inches.

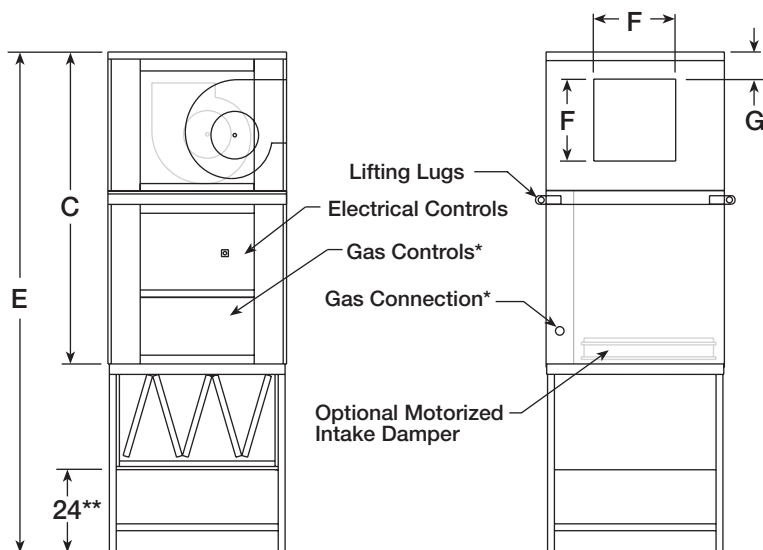
Approximate Unit Weights:

Housing Size	Blower/Heater*	Stand/Filter
20	800	450
30	1100	550

*Weights will vary with blower and hp.

**Standard factory clearance. Additional stand heights are available from the factory.

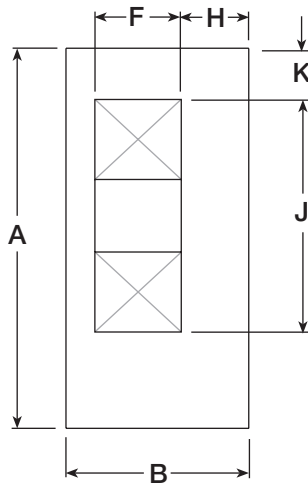
Horizontal Discharge



* Direct Gas Units Only

Dimensional Data Continued

Upblast Discharge



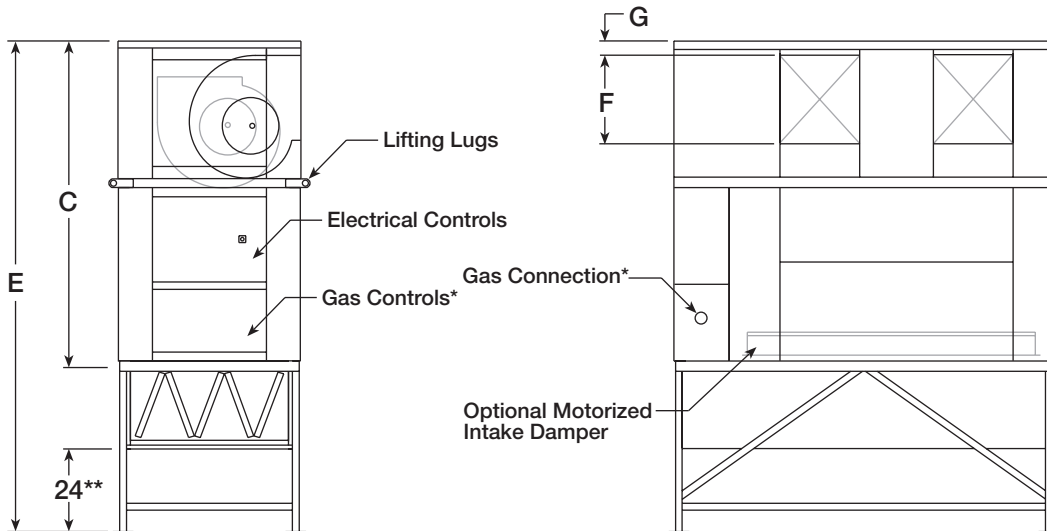
Approximate Unit Weights:

Housing Size	Blower/Heater*	Stand/Filter
40	2000	700
50	2800	1000

*Weights will vary with blower and Hp.

**Standard factory clearance. Additional stand heights are available from the factory.

Horizontal Discharge



* Direct Gas Units Only

Overall Unit Dimensions:

Housing Size	A	B	C	E	Qty Filters	Filter Size(s)
40	111	54	95	144	20	20 x 25
50	156	63	107	162	50	16 x 25

* All dimensions shown in inches.

Blower Dimensions:

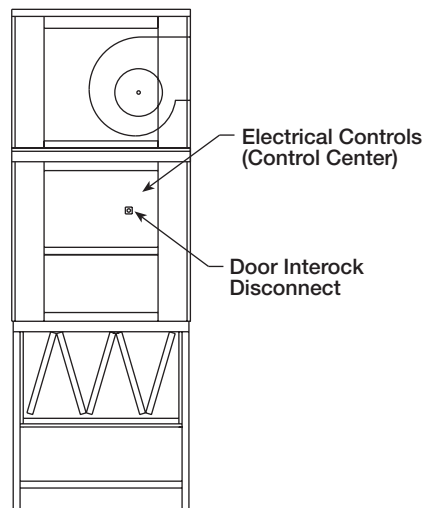
Blower Size	F	G	H	J	K
218	24	7 ¾	22 ½	68	12
220	26	3 ¾	20	68	12
225	31 ¼	8 ¾	20 ½	104	15
230	36 ¾	2 ¾	20 ½	104	15

* All dimensions shown in inches.

Electrical Instructions

Before connecting power to the unit, read and understand the following instructions and wiring diagrams. Complete wiring diagrams are attached inside the door(s) of the unit.

All wiring should be done in accordance with the National Electrical Code ANSI/NFPA 70- latest edition and any local codes that may apply. In Canada, wiring should be done in accordance with the Canadian Electrical Code. The equipment must be properly grounded.



CAUTION !

For direct gas units: If any of the original wire must be replaced, the replacement wire must have a temperature rating of at least 105°C, except for energy cut-off or sensor lead wire which must be 150°C.

DANGER !

High voltage electrical input is needed for this equipment. This work should be performed by a qualified electrician.

NOTE: Any wiring running through the VSU unit in the airstream must be protected by flexible metal conduit, metal clad cable or raceways.

Wiring the VSU unit:

For units *without* control centers:

The motor nameplate is to be used for determining the voltage and amperage required by the unit. If an electric heater is supplied with the unit, a separate power source may be required for the heater.

For units *with* control centers:

1. The units nameplate states the voltage and total amperage required.
The main feeder supplying power to the unit should be sized for the label's voltage and amperage.
2. The main power line should be connected to the disconnect switch.
Make sure that the disconnect lugs are securely tightened.
3. Connect the remote control panel wiring to terminal strip in the control center.
Greenheck's control voltage is 120/60/1. Wiring diagrams are provided with the units and the remote control panels.
4. Wire any remote temperature selectors (optional) at this time. These wires should be shielded cable if they are to be run with other power wires.
5. When an optional convenience outlet is provided, a separate power supply must be provided to the receptacle. This circuit must be on a ground fault breaker.

CAUTION

Any wiring deviations may result in personal injury or property damage. Greenheck is not responsible for any damage to, or failure of the VSU unit caused by incorrect final wiring.

System Startup

For proper unit function and safety, follow everything in this startup procedure in the order presented. This is to be done after the electrical and gas connections are complete.

Special Tools Required

- Voltage meter
- Incline manometer or equivalent
- Tachometer
- Thermometer
- Amperage meter

Special note for direct gas vertical units: Because the burner points up, make sure that debris has not collected in the burner before start up.

1. Check Voltage

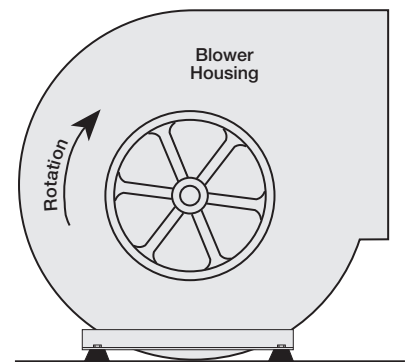
Before starting the unit compare the supplied voltage with the units nameplate voltage and the motor voltage.

2. Check Blower Rotation

First, hand rotate the blower to ensure that the wheel is not rubbing against the scroll. If the blower is rotating in the wrong direction, the unit will move some air but not perform properly. To check the rotation, open the blower access door and run the blower momentarily to determine the rotation.

To reverse the rotation, turn the power off and use the following procedure:

- For single phase units, rewire the motor per the instructions on the motor.
- For three phase units, interchange any two power leads. This can be done at the motor starter.



3. Air Volume Check and Measurement

Along with the building balance, the units air volume (cfm) should be measured and compared with its rated air volume. This unit is flexible (fixed drives for units 15 hp and larger) for varying air volume, but the actual air volume should be known for making final adjustments.

The most accurate way to measure the air volume is by using the pitot traverse method in the ductwork away from the blower. Other methods can be used but should be proven and accurate.

To adjust the air volume, change the fan rpm or the system losses. See Trouble Shooting Section in this guide.

4. Measure Motor Voltage, Amperage and Fan rpm

All access doors must be installed except the control center door. Measure and record the input voltage and motor amperage(s).

To measure the fan rpm, the blower door will need to be removed. Minimize measurement time because the motor may overamp with the door removed.

With blower door in place compare measured amps to the motor nameplate full load amps and correct if overamping. See the trouble shooting section in this guide.

5. Settings for Optional Components

Freeze Protection:

This de-energizes the blower if the output temperature is below the set point. A timer allows the blower to operate during startup. This will reset when turned off.

Typical settings are:

Discharge temperature = 35°F Timer = 5 minutes

2 Hour Time Delay:

This allows the unit to operate for up to 2 hours after the control panel switch has been turned off. The timer is adjustable.

Trouble Shooting

Blower Unit

Symptom	Possible Cause	Corrective Action
Blower fails to operate	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker and check amps
	Broken fan belt	Replace
	Defective motor or capacitor	Replace
	Motor starter overloaded	Reset starter and check amps
Motor overamps	cfm too high	Check cfm and adjust drives if needed
	Static pressures are higher or lower than design	If higher, ductwork should be improved If lower, fan rpm should be lower
	Blower rotation is incorrect	Check rotation and correct
	Motor voltage incorrect	Check motor nameplate and supplied voltage
	Motor horsepower too low	See specifications and catalog for fan curves to determine if horsepower is sufficient.
	Shorted windings in motor	Replace motor.
Insufficient airflow	Unit damper not fully open	Adjust damper linkage or replace damper motor
	System static pressure too high	Improve ductwork to eliminate losses using good duct practices
	Blower speed too low	Check for correct drives and rpm with catalog data
	Dampers or registers closed.	Open and adjust
	Dirty or clogged filters	Clean or replace
	Leaks in ductwork.	Repair
	Elbows, or other obstructions may restrict fan outlet.	Correct or improve ductwork
	Belt slippage	Adjust belt tension
Too much airflow	Blower fan speed too high	Check for correct fan rpm
	Filter(s) not in place.	Install filters
	Insufficient static pressure (SP) (airflow resistance)	Induce SP into system ductwork.
Excessive noise or vibration	Wheel rubbing on housing	Center wheel
	Loose wheel on shaft	Tighten wheel setscrew
	Loose motor or blower sheave	Tighten sheave setscrew
	Belts too loose	Adjust belt tension after 24 hours of operation
	Belts too tight	Loosen to maintain $\frac{3}{8}$ in. deflection per ft. of span between sheaves
	Worn belt	Replace
	Motor base or blower loose	Tighten mountings bolts
	Worn bearings	Replace
	Bearing and drive alignment	Realign
	Motor out of balance	Replace
	Wheel out of balance	Replace or rebalance
	Sheaves eccentric or out of balance	Replace or rebalance
	Accumulation of material on wheel	Clean wheel and housing

Maintenance

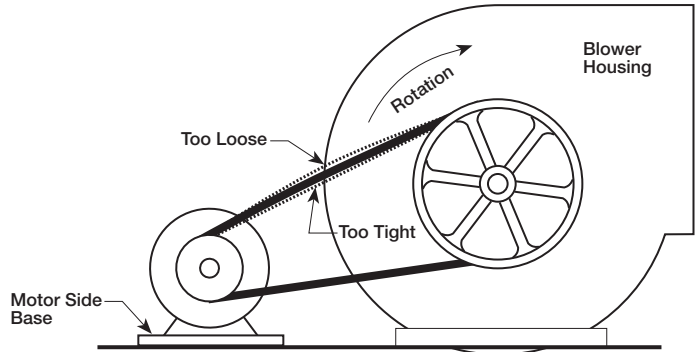
Greenheck recommends these procedures to insure trouble free operation of this unit. It is especially important to maintain heater units for clean and efficient operation. Most unit failures can be attributed to poor setup or poor maintenance.

A record of maintenance performed on this unit should be kept. This information will provide essential information if problems are encountered. A section at the back of this manual is provided for recording the unit's maintenance history.

CAUTION: When performing any maintenance on this unit be sure that the power is disconnected and cannot be accidentally turned on. The control center disconnect can be locked in the off position.

2 weeks after startup

Check belt tension - Belts tend to stretch after a period of time. They should be periodically checked for wear and tightness. **Approximately $\frac{3}{8}$ in. of deflection per ft. of span between sheaves is standard for belt tightness.** When replacing belts, use the same type as supplied with the unit. Matched belts should always be used on units with multigroove pulleys.



Replacement of belts - should be accomplished by loosening the tensioning device to the point where the belts can be removed by hand. Do not force belts on or off as this may cause breakage of cords leading to premature belt failure. Belts should be adjusted as above.

Every 3 Months

The filter in the unit should be inspected at least every 3 months. Depending on the environment filters could require changing or cleaning more or less often. The filters can be slid out of either side of the unit.

If **washable filters** are installed, they can be washed in warm soapy water. An adhesive spray can be applied to increase filter efficiency.

If **disposable filters** are installed, check by holding up to a light source. If light cannot pass through the filter, it should be replaced. Replacement filters should be of the same manufacturer and size.

When reinstalling filters, be sure to install with the airflow in the correct direction indicated on the filter and with any factory spacers that came with the unit.

Yearly

All **bearings** on units 108 to 118 are permanently lubricated and require no further lubrication under normal use. Normal use being considered -20°F to 120°F and in a relatively clean environment. Units from sizes 120 to 220 should be checked monthly for lubrication.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to the exterior surfaces only. Removing dust and grease buildup on motor housing assures proper motor cooling. Greasing of motors is intended only when grease fittings are provided. Many fractional motors are permanently lubricated and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with manufacturer's recommendations. When motor temperature does not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time as a general rule.

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

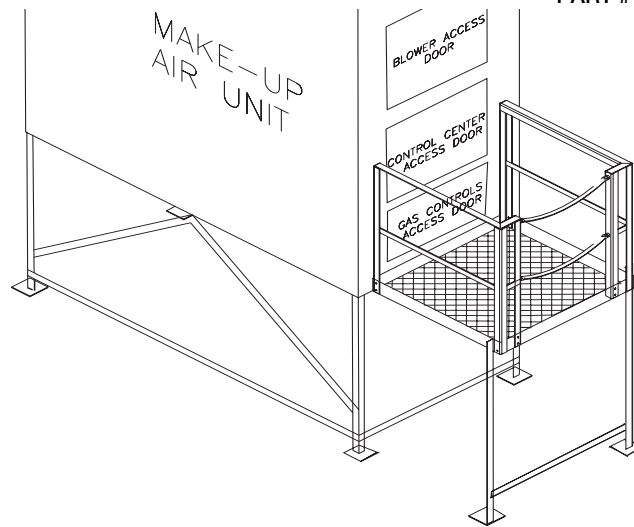
Routinely check all fasteners for tightness.

Assembly Instructions for Model VSU Optional Service Platform

Tools Required For Assembly

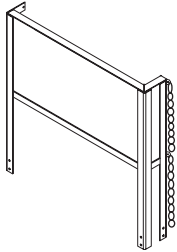
- (2) $\frac{1}{16}$ in. sockets or wrenches
- (1) Drill with (1) $\frac{7}{16}$ in. drill bit
and (1) $\frac{5}{16}$ in. drill bit

A crane or forklift is recommended for assembly and attachment to VSU.

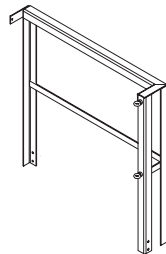


Service Platform Material List

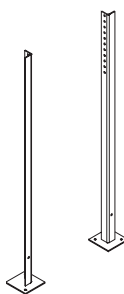
(1) Left Hand Rail with
Safety Chains



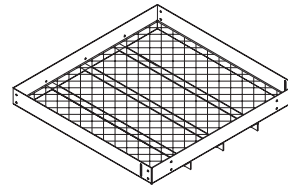
(1) Right Hand Rail



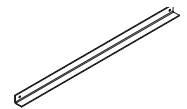
(2) Legs






(1) Platform Base Unit with
predrilled holes for hand rails,
legs, and VSU attachment.



(1) Leg Cross Member



Fasteners:

- (3) Hex Head Bolts (3/8 in. x 1 1/2 in.) 
- (2) Thread Cutting Screws
(3/8 in. x 1 in.) 
- (18) Hex Head Bolts (3/8 in. x 3/4 in.) 
- (27) Hex Head Nuts (3/8 in.) 

Assembly

1. Position Platform Base as shown below in Figure A with the Grate Side up.
2. Attach the left and right handrails to the platform base with (3/8 in. x 3/4 in.) hex head bolts and (5/8 in.) hex nuts as shown in Figure A. Use six bolts and nuts on each rail.
3. Raise the Platform base, grate side up, with a crane or forklift.
4. Attach legs to the slots on sides of platform base with two (5/8 in. x 3/4 in.) hex head bolts and (5/8 in.) hex nuts. Be sure to separate bolts on each leg by one hole spacing.

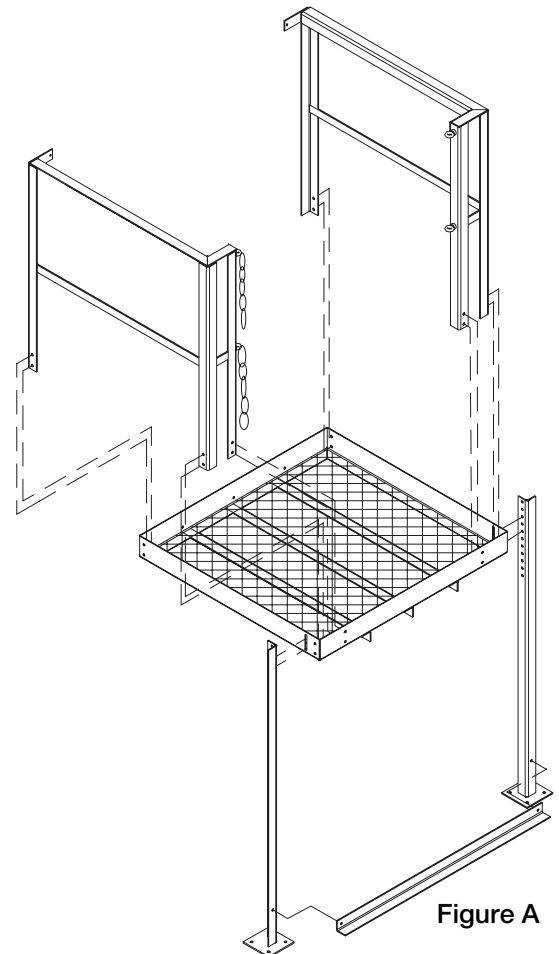


Figure A

- Fasten three ($\frac{3}{8}$ in. x $1\frac{1}{2}$ in.) hex head bolts into the VSU side of the platform base. Secure each bolt with two ($\frac{3}{8}$ in.) hex head nuts placed back to back on each bolt as shown in Figure B. These bolts will be used to attach the platform base to the VSU unit.

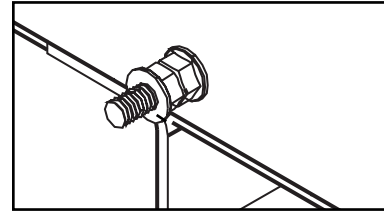


Figure B.

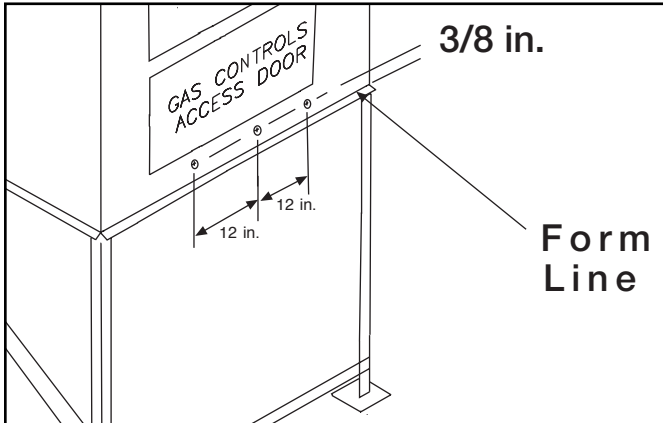


Figure C.

- Facing the control panel side of the VSU, find the center of the housing and drill a ($\frac{7}{16}$ in.) hole through the VSU housing and support stand ($\frac{3}{8}$ in.) above the form line as shown in Figure C. Next, drill two more ($\frac{7}{16}$ in.) holes through the VSU housing and support stand (12 in.) on either side of the center hole, ($\frac{3}{8}$ in.) above the form line. These holes are used to attach the platform base to the VSU.

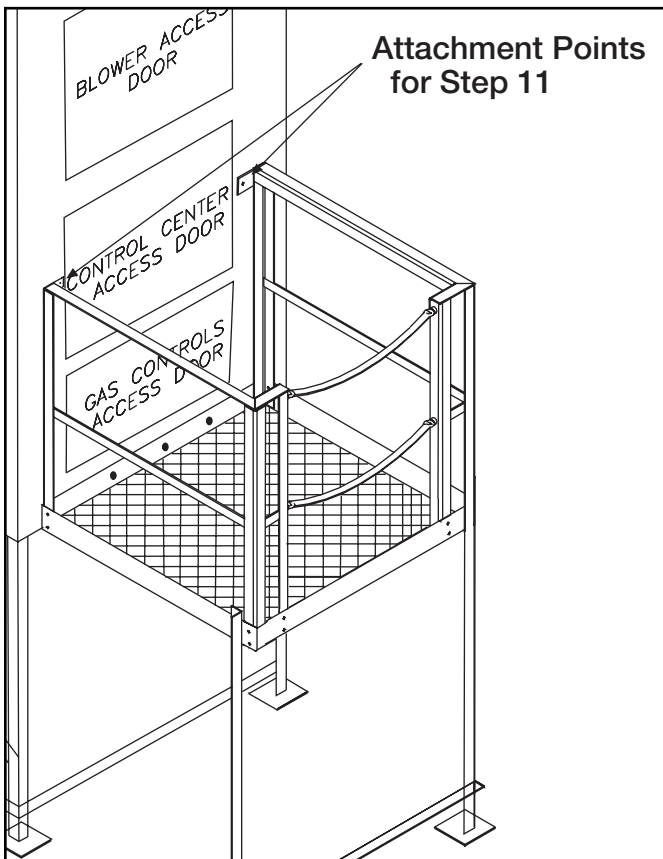


Figure D.

- Attach the service platform to the control panel side of the VSU housing by inserting the three ($\frac{3}{8}$ in. x $1\frac{1}{2}$ in.) bolts of platform base into the three holes of the VSU housing. Securely fasten with three ($\frac{3}{8}$ in.) hex nuts.
- Level service platform if necessary by adjusting legs and then attach leg cross member with two ($\frac{3}{8}$ in. x $\frac{3}{4}$ in.) hex head bolts and $\frac{3}{8}$ in. hex head nuts.
- Securely fasten all nuts and bolts. Make sure all nuts and bolts are tight.
- Attach arm rails of service platform to the VSU housing by first drilling a $\frac{5}{16}$ in. hole through the VSU housing at the attachment point as shown in Figure D. Secure arm rails to the housing with ($\frac{3}{8}$ in. x 1 in.) thread cutting screws. Do not over-tighten screws.
- Attach safety chains to the right hand rail, across the entryway. Assembly is complete.