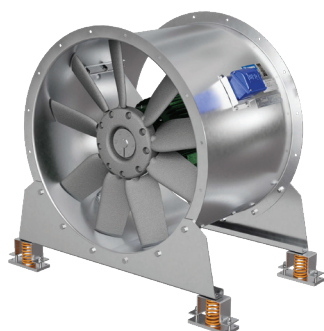


Installation, Operation and Maintenance Manual

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 instructions could result in personal injury and/or property damage!

High Performance Axial Fan

These fans are direct-drive axial fans designed for inline air ventilation in commercial, institutional or industrial buildings. Performance capabilities range up to 126,544 CFM (215,000 CMH) and up to 8 in. wg. (1,700 Pa) of static pressure with wheel diameters ranging from 315 to 1600 mm. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

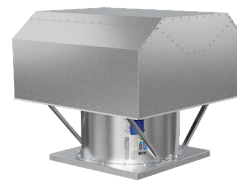


RA-3

Roof Mount Options



Butterfly Damper



Fan Hood

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.
2. The rotation of the propeller 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 propeller faster than the maximum cataloged fan rpm. Adjustments to fan speed with Variable Frequency Drives (VFD) may affect 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.

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.

Table of Contents

General Safety Information	1
Receiving, Unpacking Handling and Storage	2
Removing from Storage	2
Lifting.	3
Effects of Installation on Performance.	3
Typical Installation	4
Isolator Channel Mounting.	6
Terminal Block Position	7
Operation and Unit Start-Up.	8
Performance Adjustments	8
Maintenance	9
Parts List	10
Field Coating Touch-Up Procedure	11
Maintenance Log.	12

Receiving

Upon receiving the product, check the bill of lading to ensure all items were received. Inspect each crate for shipping damage before accepting delivery. Notify the carrier if any damage is noticed. The carrier will make notification on the delivery receipt acknowledging any damage to the product. All damage should be noted on all the copies of the bill of lading which is countersigned by the delivering carrier. A Carrier Inspection Report should be filled out by the carrier upon arrival. If damaged upon arrival, file claim with carrier. Any physical damage to the unit after acceptance is not the responsibility of Greenheck India Pvt. Ltd.

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 and Lifting

Handle in such a manner as to keep from scratching or chipping the finish. Damaged finish may reduce ability of unit to resist corrosion. Fans should not be lifted by the motor shaft, motor housing, fan impeller or fan accessories, to ensure proper operation, reliability and performance. Fan model RA-3 is to be lifted using a minimum of four (4) points on the fan housing or attach two suitable chains/straps around the entire fan housing, one near each duct flange. For flange mounted fans, attach suitably sized chains or lifting straps to two locations on the inlet and outlet flanges. The two chains/straps must be lifted at the same rate of speed.

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. 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 — Units 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 unit. The unit 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 unit parts on blocking supports so that rain water will run off.

Do not wrap parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles. A covered shelter is preferred.

INSPECTION AND MAINTENANCE DURING STORAGE

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

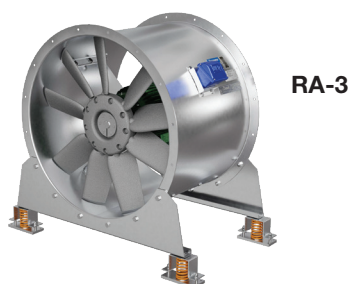
If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the fan propeller by hand ten to fifteen revolutions to distribute lubricant in motor bearings. Every three months, the fan motor should be energized. If paint deterioration begins,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

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. Wipe thoroughly 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 or WD-40® or the equivalent.

REMOVING 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.

1. Check all fasteners on the fan, propeller, motor base, and accessories for tightness.
2. Rotate the fan propeller by hand and assure no parts are rubbing.
3. Fans should not be lifted by the motor shaft, motor housing or fan accessories.

Lifting

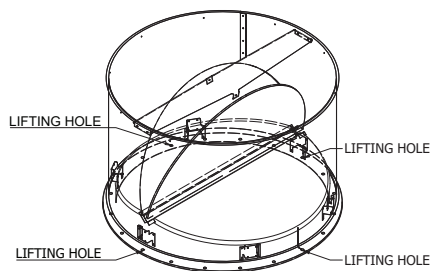


Fan model RA-3 is to be lifted using a minimum of four (4) points on the fan housing or attach two suitable chains/straps around the entire fan housing, one near each flange on the motor tube. While lifting fans, make sure motor shall always be in resting position.

For flange mounted fans, attach suitably sized chains or lifting straps to clevis fasteners located on the inlet and outlet flanges (Fan housing tube) as shown.



Optional Butterfly Damper



Butterfly Damper (Shipped Loose) are to be lifted using the four (4) location from the Main tube flange holes unless lifting lugs are provided. A spreader bar is recommended to prevent damage to the damper section when lifting.

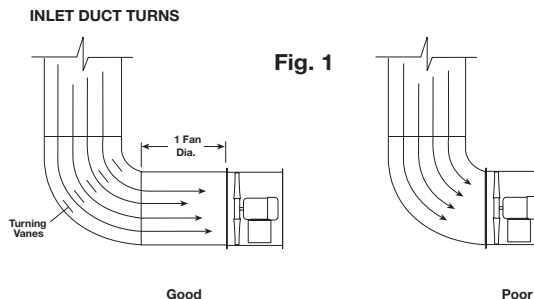
Effects of Installation on Performance

Fans with inlet or discharge configurations that deviate from these recommendations may result in reduced performance. Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan propeller yielding large system losses and increased sound levels. Free discharge or turbulent flow in the discharge ductwork will also result in increased system effect.

Prior to fan installation, ensure proper duct system configuration to minimize system effect. The most common inlet and discharge conditions which affect fan performance are:

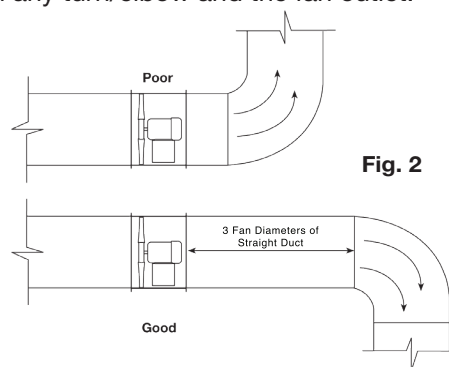
Inlet Duct Turns

Installation of a duct turn or elbow too close to the fan inlet reduces fan performance because air is loaded unevenly into the fan prop. For proper fan performance, there should be at least one to two equivalent fan diameters of straight ductwork between any turn/elbow and the fan inlet.



Discharge Duct Turns

Fan performance is reduced when duct turns are made immediately off the fan discharge. To achieve cataloged fan performance, there should be at least three equivalent fan diameters of straight ductwork between any turn/elbow and the fan outlet.



NOTE

For curb mounted exhaust or supply 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 or supply 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.

Typical Installation

The examples shown below are common installations of different housing options. Before beginning installation, reference the airflow direction as indicated by the direction decal attached to the fan.

Note that airflow direction for RA-3 units with straightening vanes is opposite to the standard RA-3 long casing design.



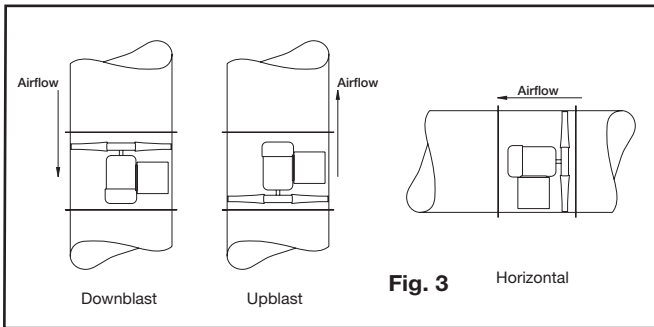
The component parts of the fan assembly, including silencers, must be fully aligned before being bolted together so that no stress is placed on the equipment. After components are fully aligned, all bolts can be tightened in an alternating pattern.

Mounting

Prior to installation and mounting, ensure the fan is mounted level with the floor, wall, or ceiling. If the fan includes isolators, refer to the RA Isolator IOM (418327) for instructions.

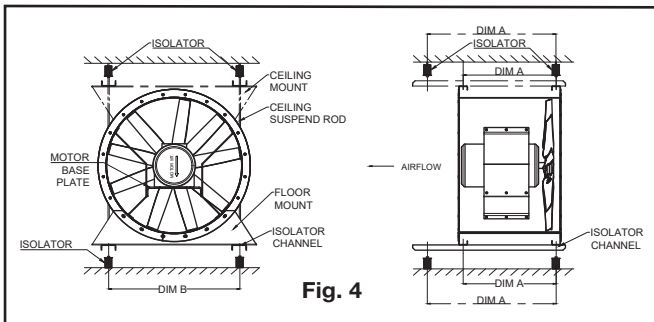
Units with Flange Mounting

• Upblast, Downblast or Horizontal



Units with Universal Mounting Brackets (Optional)

• Horizontal, Floor or Ceiling Mount with Isolators



NOTE

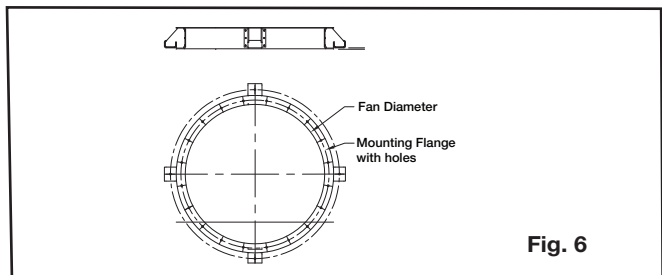
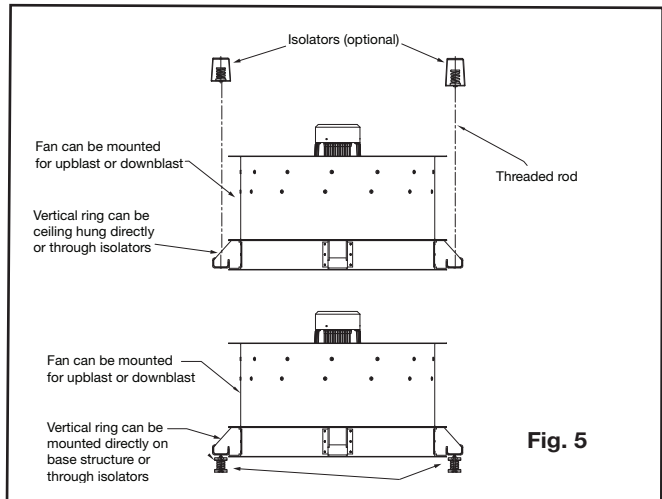
Always orientate the unit as shown, with the motor above the motor plate. Motor weight should be resting on the motor plate when the fan is mounted horizontally.

*DIM A & B for installation and overall dimensions of fan for each selection is available in submittal file.

Vertical Mount

With a vertical mount, either a mounting ring or curb cap is added to mount the fan. Refer to the submittal for dimensions. Vertical wall mount stand assembly is shipped disassembled with parts shown in Figure 7. Follow the steps below to assemble and install.

1. Assemble weldment structure to wall side channels with fasteners provided. Keep fasteners loose.
2. Assemble all four diagonal support channels shown in Figure 7. Make sure fasteners are added both inside and outside of diagonal support.
3. Torque all fasteners (see Table 1) after assembly is complete. Final assembly will look as shown in Figure 8.
4. Install isolators on weldment structure and torque fasteners as shown in Table 1.
5. Install vertical wall mount structure to required position.
6. Install and fasten fan over isolators. For safety, follow correct installation by lifting and installing fan using overhead or Hydra cranes.



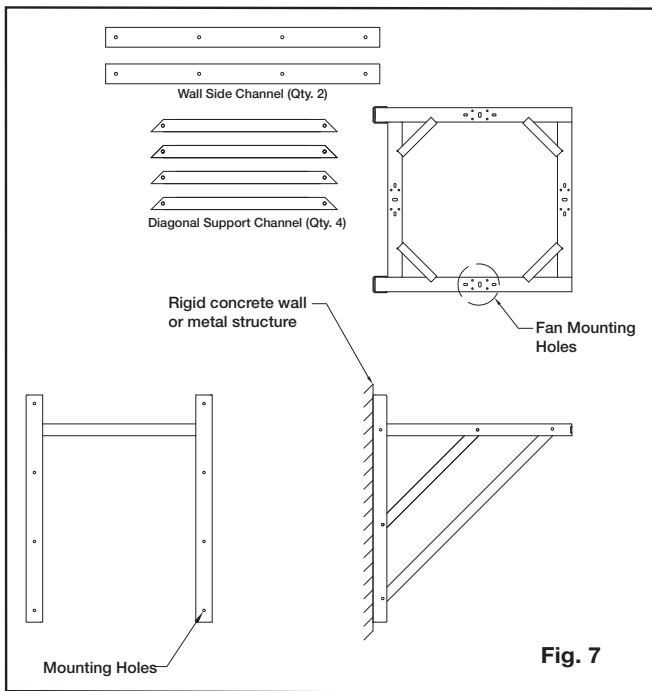


Fig. 7

Wall Mount Bolt Torque		
No.	Fastener Size	Torque
1	M8 X 1.25	16.0 ft.-lbs / 21.7 N m
2	M10 X 1.5	31.6 ft.-lbs / 42.8 N m
3	M12 X 1.75	55.1 ft.-lbs / 74.7 N m
4	M14 X 2.0	88.1 ft.-lbs / 119.4 N m

Table 1

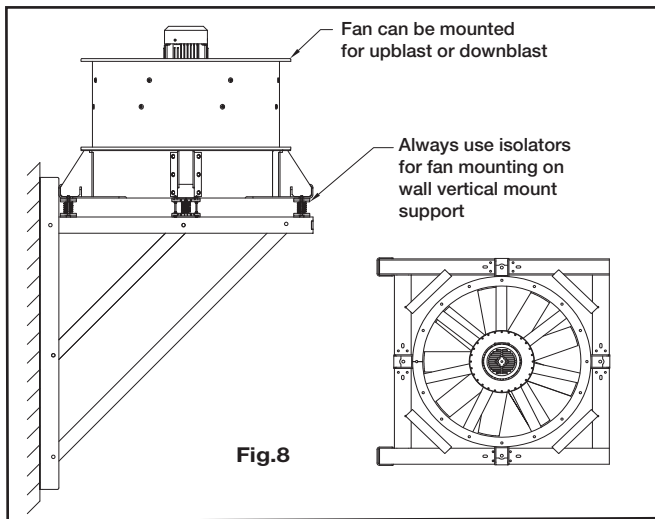
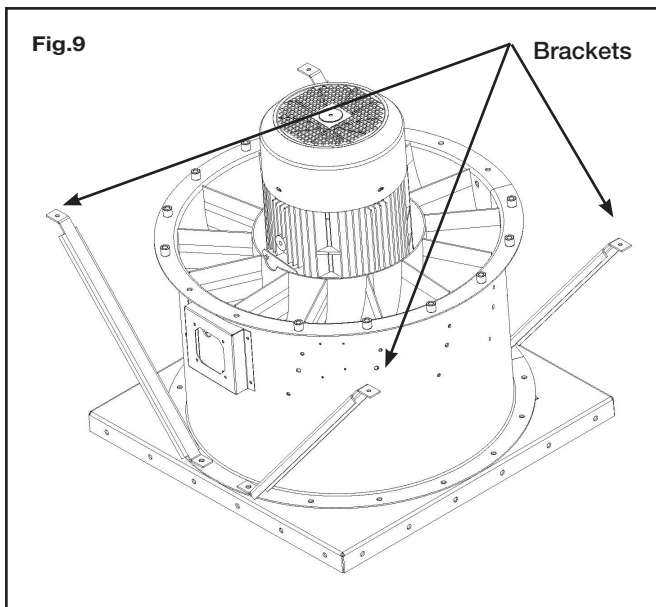


Fig.8

Typical Roof Mounting Installation

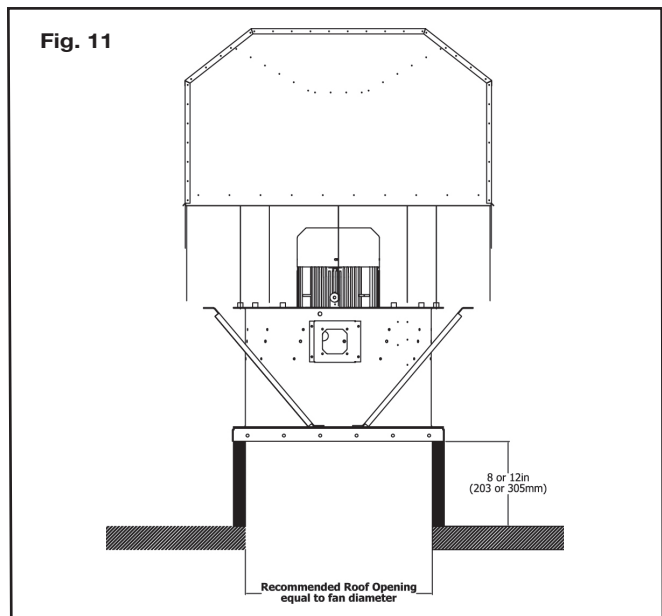
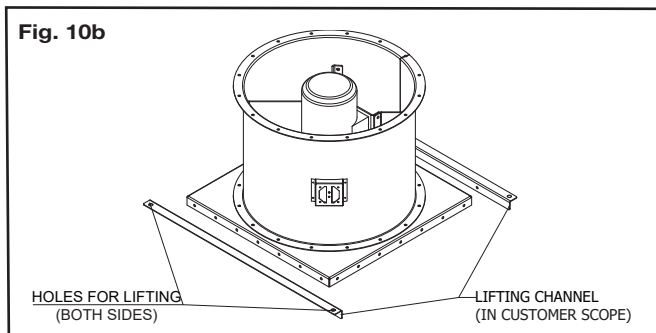
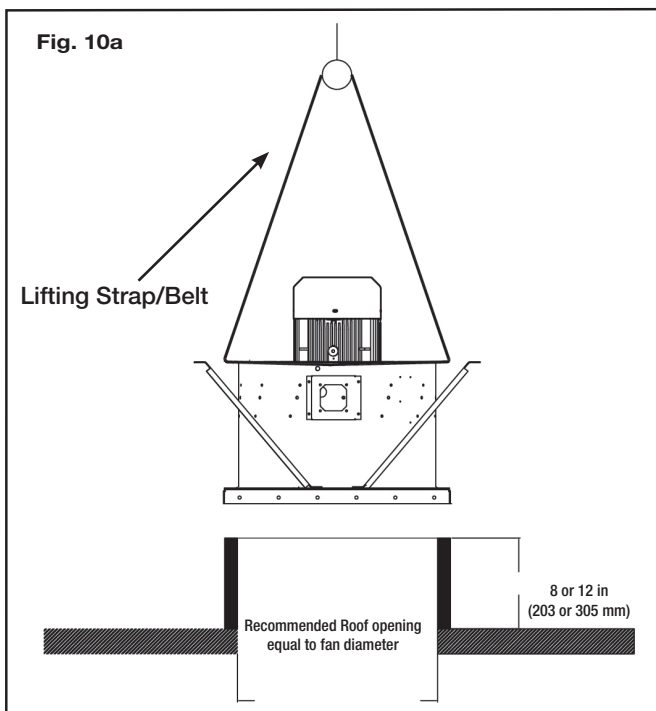
For roof mount installation, fan hood is shipped loose with support brackets and fasteners. Refer to the submittal for dimensions. To assemble and install the fan hood, follow the below steps.

1. On the roof surface, cut an appropriate sized opening and follow manufacturer's instruction on curb installation.
2. To assemble the support brackets on the curb, unfasten bolts on the flange/curb connection. Then align the bracket holes to flange holes and keep orientation as shown in Figure 9. Finally install the removed fasteners and torque it (See Table 2). Top side of the brackets shall be fastened to the fan hood weldment.
3. To lift the fan/curb assembly for installation, make a loop below the flange and around the tube using two equal length straps. Refer Figure 10 for more details.
4. Secure the curb to surface opening deck using all mounting holes (Figure 11) on the curb flange. Before securing the curb, make sure to apply caulk for water tight seal. Then connect the assembled support brackets (point #2) to fan hood weldment. While assembling fasteners, make sure to use spacer (provided loose) between fan flange and fan hood weldment. Make sure to keep orientation of hood in such a way that terminal box comes at diagonal position of fan hood for protection from direct sun and water.
5. 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.
6. Check fan wheel for free rotation as per label. Change connection if necessary for rotation in right direction.
7. Check all fasteners for tightness.

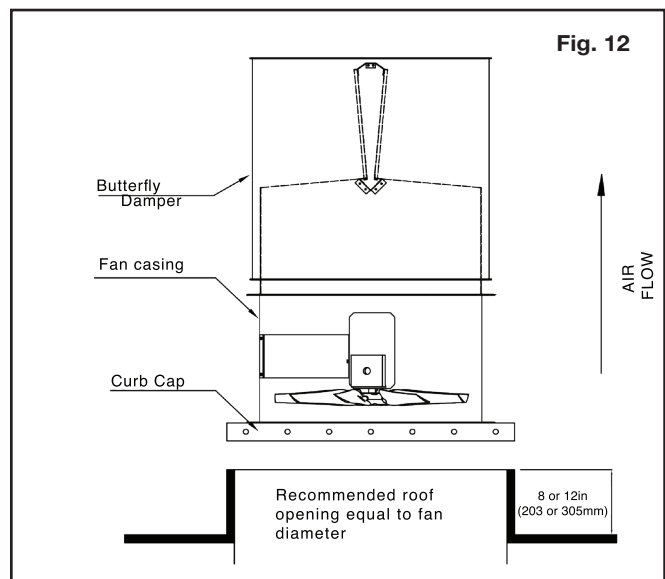


Torque detail for bolts		
S.No.	Fastener Size	Torque
1	M8 X 1.25	16.0 ft-lbs / 21.7 N m
2	M10 X 1.5	31.6 ft-lbs / 42.8 N m

Table 2



Roof Upblast on a Curb Cap

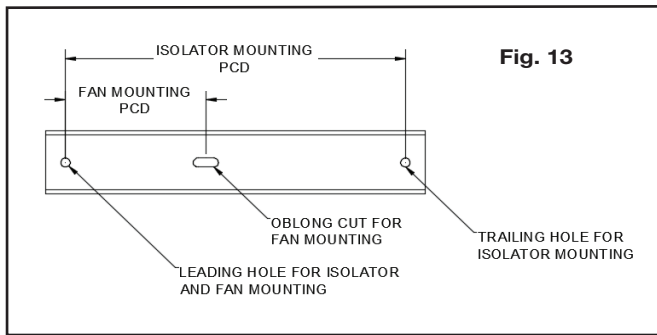


Isolator Channel Mounting

Isolator channels are used when a fan is either ceiling suspended or base mounted while using a combination of isolators and fan casing. These channels are used to equally distribute fan weight on four mounting locations.

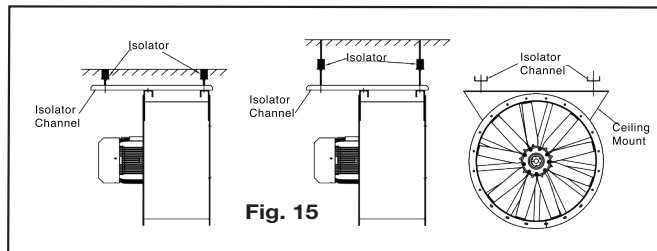
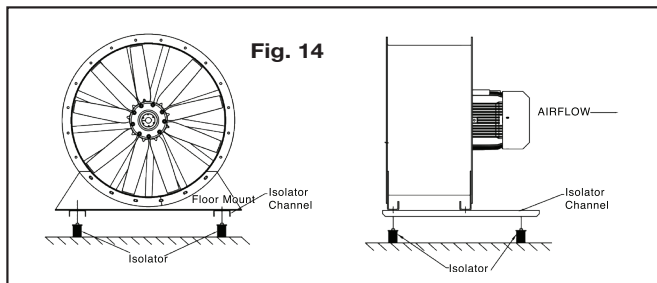
Isolators and isolator channels are shipped loose with the fan. Each channel has two side holes and an oblong cut in the center. The side holes are used for mounting isolators. The oblong cut and leading hole should be used for connecting to the universal mount. Isolators should be mounted on leading and trailing holes.

Due to the motor extension outside of the fan casing, the fan's center of gravity shifts causing varying channel length. Isolator channels provided with each fan are specific to the fan selected to keep corner weight equal.



Installation

1. Mark position of isolators for either ceiling or base mounted applications as per dimensions provided in submittal. Refer to PN 418327 for installation of isolators.
2. For base mount application, either lift the fan using a suitable chain or strap. If ceiling mount, use scaffolding. Precaution should be taken while lifting the fan, as the motor side may tilt due to mass concentration.
3. Arrange the isolator channel in position as close to the universal mount as possible. The isolator channel PCD should match the universal mounting feet (See Figure 14 and Figure 15).

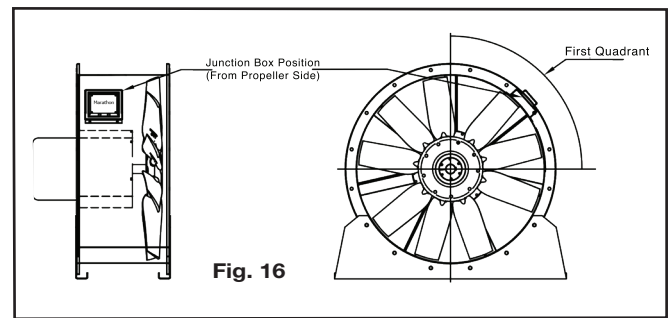


IMPORTANT

Check that case height of all four isolators are the same.

4. Assemble isolator channel to universal mount using the oblong cut on the channel.
5. If base mount application, lower the fan so that side holes can align with loosely grouted isolators. Once fan is settled in position, follow the steps in PN 418327 for final assembly and check.

Terminal Block Position



Operation and Unit Start-Up

Electrical Connections

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.

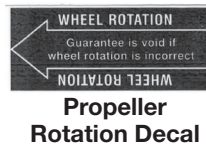
The supply wires are then connected to a terminal box on the outside of the fan.

If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

MCB, 1.5 times of motor rated Amps shall be incorporated in the fixed wiring to ensure all pole disconnection.

Pre-Start-Up Checks

1. Check all fasteners for tightness. Fasteners may come loose during transit or handling at the job site. This includes motor bolts, mounting brackets, and bushing bolts attaching the propeller to the motor shaft.
2. Ensure no debris, tools, or rubbish is near the fan inlet which might get pulled into the fan.
3. Propeller rotation should be in the same direction as the rotation decal affixed to the unit. For 3-phase installations, if the impeller is rotating backwards, fan rotation can be reversed by simply interchanging any two of the three electrical leads.
4. Lead the power supply wires into the terminal box on the outside of the fan.
5. Ensure the wiring configuration is connected as per the wiring diagram on the motor.
6. Securely connect the motor ground wire and building ground wire to the ground connection post in the fan terminal box.



Performance Adjustments

Field Performance Adjustments

The performance of an RA-3 fan can be adjusted through the use of a variable speed drive (VFD) or adjusting the blade pitch. Both can be effectively used for final air balancing. Note that any change, increase or decrease in fan speed (RPM) or blade pitch, can represent a substantial increase in power required from the motor. Check motor load amperage and compare to nameplate rating when changing the fan speed or blade pitch and ensure the motor load amperage is less than the nameplate amperage.

Adjusting Performance with a Variable Frequency Drive (VFD)

Before wiring a VFD, determine that the motor is compatible with this type of equipment. Connecting a VFD to a non-compatible motor may reduce the life of the motor. Additionally, it is important to properly ground fans being wired with a VFD. For more information on these subjects, refer to Greenheck document "Are Bearing Currents Causing Your Motor Failures?" Located at www.greenheck.com. Click on Library under Application Articles, and use the keyword "VFD". Greenheck is not responsible for potential motor damage as a result of improper wiring of a VFD, operating a fan outside its operating frequency, or fan range.

Adjusting Performance through Blade Pitch (Cast Aluminum Propellers Only)

The blade pitch can be adjusted without removing the propeller from the fan casing. Steps to adjust the blade pitch are as follows:

1. Determine the new blade pitch required with assistance from your local Greenheck representative. Verify that the motor has sufficient capacity to handle the new power requirements.
2. Disconnect and lock out all power to the fan to prevent accidental start-up.
3. Gain access to the propeller side of the fan. This may require removing the fan from the existing duct system or dismantling ductwork to gain access.
4. Loosen the blades to the point where they can be rotated in the hub. Hub and blade fastening vary by fan size. Hub styles and bolt torque requirements are provided. Blades should be snug, but movable by hand or rubber mallet.
5. Use the blade pitch protractor found on Greenheck India's website (www.greenheck.co.in) to adjust the pitch. Follow the directions stated on the guide for determining blade pitch.
6. Adjust one blade to the desired pitch angle and remove the protractor sheet.
7. Use a marker to trace the profile of the blade on the fan housing.
8. Adjust the remaining blades to the traced profile.

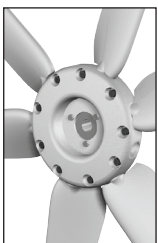
9. Retighten the hub to the torque specs detailed below per hub size.
10. If using the 533 mm hub, reinstall the inlet cone and tighten the bolts to the recommended torque of 45.6 in.-lbs.
11. Reinstall the fan or any duct pieces that were removed.
12. Review the Operation and Start-Up procedures listed in this manual.
13. After start-up, make a final check of the fan amps to ensure the motor is not overloaded.

Torque Specifications for Bushings and Propeller Bolts



HUB SIZE: 190 mm

Bushing bolts	16 ft-lb / 21.7 N-m
Propeller bolts	7 ft-lb / 9.5 N-m

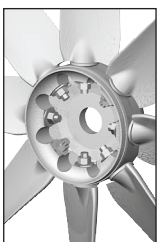


HUB SIZE: 275 mm

Bushing bolts	16 ft-lb / 21.7 N m
Propeller bolts	21 ft-lb / 28.5 N m

HUB SIZE: 400 mm

Bushing bolts	27 ft-lb / 36.6 N m
Propeller bolts	40 ft-lb / 54.2 N m



HUB SIZE: 533 mm

Bushing bolts	40 ft-lb / 54.2 N m
Blade Nuts	125 ft-lb / 169.5 N m

NOTE

Fans configured for reversible operation have blades installed both in a forwards and backwards facing direction. The blade pitches are the same, but in opposite directions. When making blade pitch adjustments, first do one set of blades all in the same orientation and then repeat the adjustment on the other backward facing blades.

Maintenance

Once the unit has been put into operation, a routine maintenance schedule should be set up to accomplish the following:

1. Lubrication of motor (if required).
2. Propeller, housing, and bolts on the entire fan should be checked for tightness.
3. Any dirt accumulation on the propeller or in the housing should be removed to prevent unbalance and possible damage.
4. Inspection of fan propeller and housing looking for fatigue, corrosion, or wear.

When performing any service to the fan, disconnect and lock out the electrical supply, and secure fan propeller.

Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling. Never wash-down motor with high pressure spray.

Greasing of motors is only intended when fittings are provided. Many motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the motor manufacturer's recommendations.

Consult fan manufacturer for instructions on the removal or replacement motors.

Fasteners and Set Screws

A periodic inspection should include checking all fasteners and bolts for tightness. Particular attention should be paid to the bushing attaching the propeller to the motor shaft and the motor to its mounting fixture.

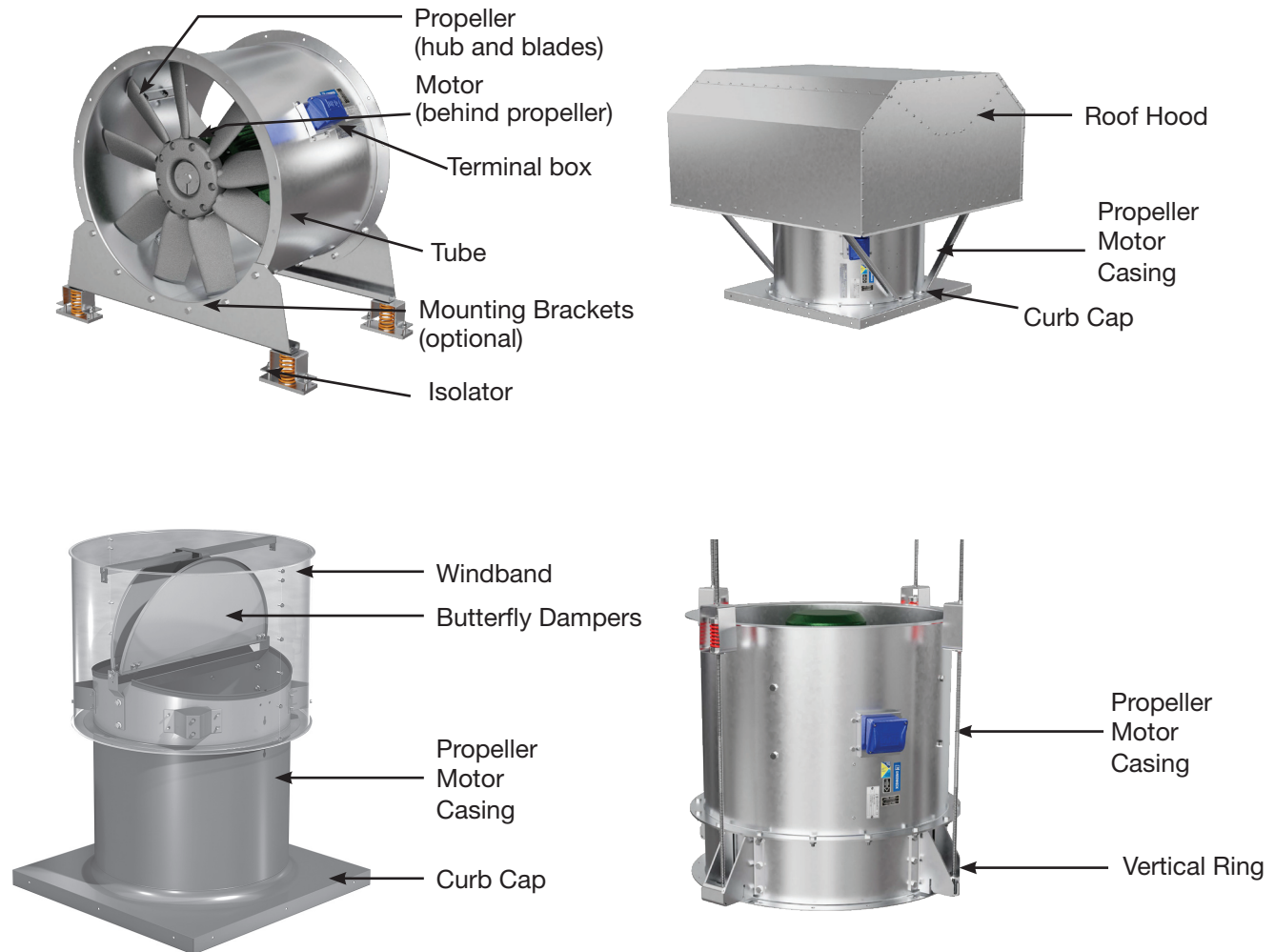
Removal of Dust and Dirt

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

Parts List

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

Nameplates are mounted in an area which is clearly visible, usually near the terminal box. The exact tag location may differ with fan model and size.



Field Coating Touch-Up Procedure for Scratched Areas

Standard coating and color is RAL 7023 Concrete Grey. The procedure outlines the correct method for repairing minor scratches in the coating.

TOUCH-UP PAINT REPAIR KIT CONTENTS

- Pint of Kem Kromik® primer
 - Pint of industrial enamel
 - Disposable foam brushes
 - Sheet sand paper
1. Scuff affected area to be repaired using medium sandpaper or medium Scotch Brite™ pad. Feather the edges.
 2. Clean affected area to be touched up using an alkaline-based cleaner and rinse.
 3. Apply Kem Kromik® primer or equivalent using 1-inch foam brush. Follow technical data sheet instructions.
 4. Allow primer to dry a minimum of 2-1/2 hours before top coating.
 5. Apply topcoat with industrial enamel using a 1-inch foam brush. Follow technical data sheet instructions. Allow painted units to air-dry and cure before putting into service.

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.

Tips to Prolong Coatings Integrity

The coating on our products provide the end user years of protection and beauty. Some additional preventative maintenance will extend the integrity of the coating.

- Wipe down flat surfaces that may collect chips or shavings resulting from installation.
- Check for areas of corrosion annually and repair with recommended process. Nicks and scratches from the installation, maintenance or wind abrasion may allow corrosion to start. Touching up these spots will stop further damage.
- Wipe down the fan's exterior with a mild detergent and rinse annually.

End of Life Disposal

Use authorised agencies for metal scrap, e-waste, motor winding, plastic parts etc. during disposal, at the end of product life.

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
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Date _____ Time _____ AM/PM
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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’s High Performance Axial Fan catalogs, Model RA & RA 3, provide 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.

