

MODELS:  
**ECLFN / ECLQN**



**REVIEW AMCA BULLETIN 410 PRIOR TO INSTALLATION**

This bulletin has been prepared to guide the users of compact plenum fans in the proper installation, operation and maintenance procedures to ensure maximum equipment life with trouble-free operation. For safe installation, startup and operational life of this equipment, it is important that all involved with the equipment be well versed in proper fan safety practices and read this bulletin. It is the user’s responsibility to make sure that all requirements of good safety practices and any applicable safety codes are strictly adhered to. Because of the wide variety of equipment covered in this bulletin, the instructions given here are general in nature. Additional product and engineering information is available at [www.tcf.com](http://www.tcf.com).

**SAFETY NOTICE**

Refer to the safety section(s) in this manual prior to installing or servicing the fan. The most current version of this installation and maintenance manual can be found on our website at [www.tcf.com/resources/installation-maintenance-manuals](http://www.tcf.com/resources/installation-maintenance-manuals).

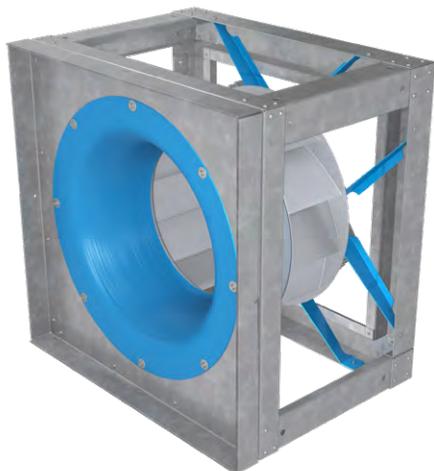
**TABLE OF CONTENTS**

Compact Plenum Fan Arrangements .....	2	Wheel Placement / Wheel Overlap .....	7
Exploded View – Compact Plenum Fans .....	2	Electrical Connections .....	8
Wheel (Impeller) Nomenclature .....	3	Speed Control Methods .....	8
Wheel Rotation – Plenum Fans .....	3	Motor Safety – Electrical .....	9
Safety & Hazard Warnings .....	4	Motor Safety – Mechanical .....	9
Shipping & Receiving .....	4	Troubleshooting Guidelines .....	10
Handling .....	5	Motor Troubleshooting .....	11-12
Unit Storage .....	5	Installation / Startup Checklist .....	13
Foundations and Supporting Structures .....	6	Fan Maintenance Log .....	14-15
Fan Installation – Factory Assembled Units .....	6		
Fan Installation – Disassembled Units .....	6		
General Motor Maintenance .....	7		
Wheel Maintenance .....	7		
Structural Maintenance .....	7		





COMPACT PLENUM FAN CONFIGURATIONS/ARRANGEMENTS

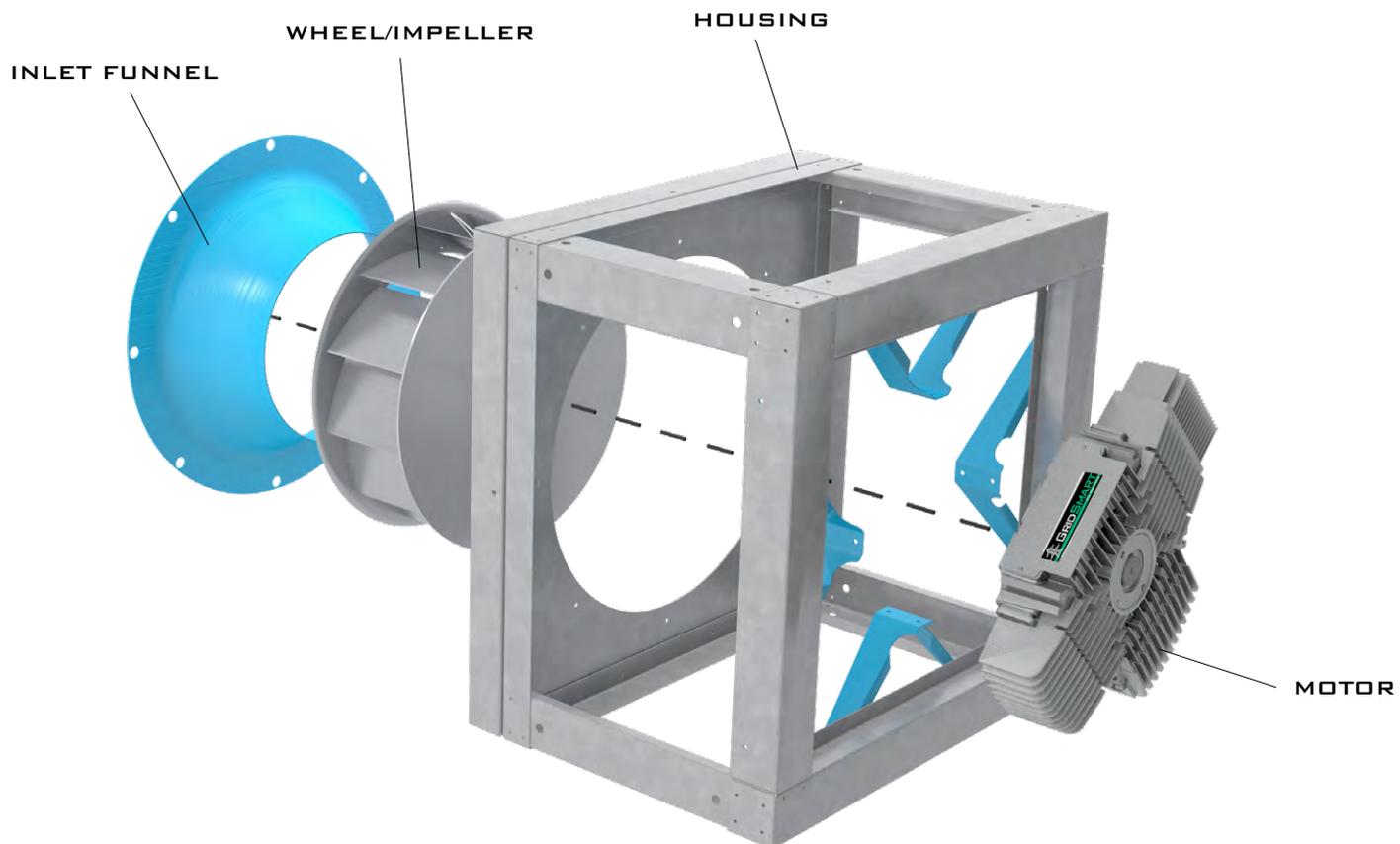


HORIZONTAL CONFIGURATION  
Arrangement 4

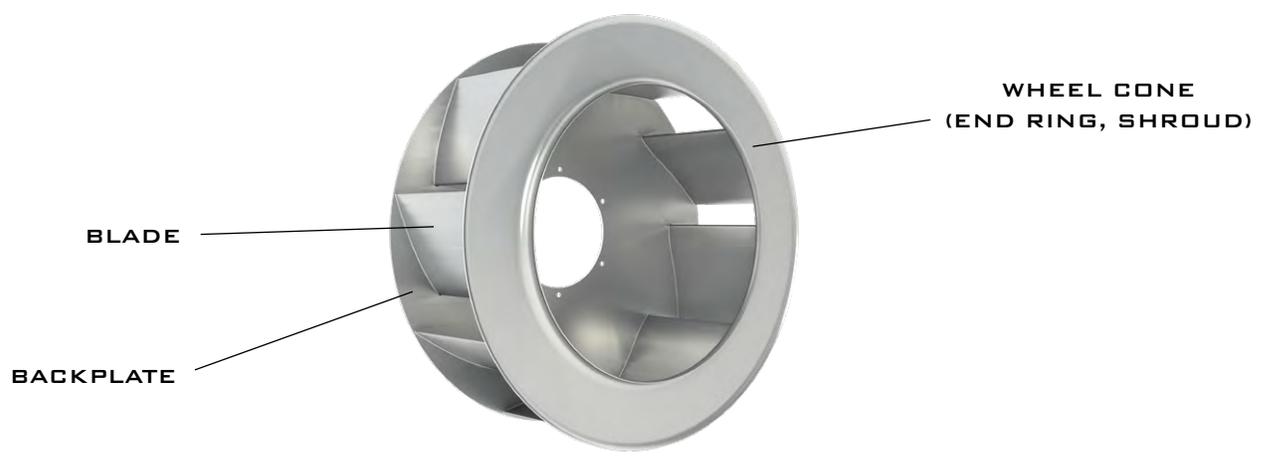


VERTICAL DOWN CONFIGURATION  
Arrangement 4

EXPLODED VIEW



## WHEEL (IMPELLER) NOMENCLATURE



## WHEEL ROTATION

### ROTATION VIEW FROM DRIVE SIDE

CLOCKWISE (CW)  
EXAMPLE SHOWN



## SAFETY & HAZARD WARNINGS

For general safety practices for air moving equipment, see AMCA Bulletin 410. Twin City Fan & Blower offers many safety accessories. These safety devices include (but are not limited to) belt guards, shaft guards, inlet and discharge screens. The use and suitability of safety devices is the responsibility of the purchaser.

Facility related safety conditions include fans' accessibility and location. How easily can non-service personnel access the unit? Is the fan in a hazardous duty environment? Was the unit ordered for this duty? Other concerns must also be addressed. All fans should be powered through switches which are easily accessible to service personnel from the fan. Fan power must have the ability to be "locked out" by service personnel trained in lockout/tagout procedures per OSHA requirements (29CFR1910.147). When performing lockout, be aware of factors, such as building pressure and additional fans in the system that can influence unwanted fan rotation (wind milling). If you have any doubt about your ability to perform a task, seek a person qualified to do that task. Before any work is done on a fan, ensure that the fan is isolated from the electrical supply using a 'lockout/tagout system.'

Note: A stationary, non-rotating fan does not mean that the fan is isolated from the electrical supply. A non-rotating fan could be subject to controls or other circuit protection devices that may start the fan without notice.

The following safety precautions should be followed, where applicable:

- Do not attempt to slow a rotating impeller even when it is isolated from the electrical supply. Fan impellers have a high inertia and injury could result from an attempt to stop it. It is recommended that the impeller is isolated by closing off the inlet or outlet to prevent wind-driven rotation. If an impeller is chocked to prevent rotation, ensure that the chocks are removed prior to start up.
- Wear appropriate personal protective equipment. This may include protective clothing, eye protection, ear protection, respiratory equipment, hand and foot protection when installing or servicing the fan.
- Always use caution when entering a fan's air path. High velocity airflow can cause you to lose your balance.
- Motor, bearings and drives can be hot and similarly if the fan is subject to processes that are hot, the fan housing could be hot.
- Fans are often used to move hazardous materials that could be dangerous. Always wear protective clothing and take precautions not to inhale dust/gases. If hazardous chemical vapors are present, respiratory equipment may be required.
- Sharp edges – wear protective gloves when handling, installing, or servicing a fan.
- Fans can operate at high decibel sound levels. Wear proper ear protection to protect from excessive noise levels.
- Access Doors – Do not open access doors when fan is in operation. The effects of suction and air pressure could result in injury.
- When working around pulleys and belts, keep hands away from pinch points. This pertains to when the fan is under or off power.

Throughout this manual, there are a number of HAZARD WARNINGS that must be read and adhered to in order to prevent possible personal injury and/or damage to equipment. Two signal words "WARNING" and "CAUTION" are used to indicate the severity of a hazard and are preceded by the safety alert symbol. It is the responsibility of all personnel involved in installation, operation and maintenance to fully understand the warning and caution procedures by which hazards are to be avoided.



**WARNING:** Used when serious injury or death MAY result from misuse or failure to follow specific instructions.



**CAUTION:** Used when minor or moderate injury or product / equipment damage MAY result from misuse or failure to follow specific instructions.

**NOTICE:** Indicates information considered important, but not hazard-related.

## SHIPPING & RECEIVING

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

## HANDLING

Handling of all air moving equipment should be conducted by trained personnel and be consistent with safe handling practices. Verify the lift capacity and operating condition of handling equipment.

Units shipped completely assembled may be lifted with slings and spreader bars. Use well-padded chains, cables or nylon straps. On most units, lifting lugs are provided for attaching chains. Lift the fan in a fashion that protects the fan and fan coating from damage. Never lift a fan by the inlet or discharge flange, wheel or impeller, motor or motor base or in any other manner that may bend or distort parts.

Partial or disassembled units require special handling. All parts should be handled in a fashion which protects the coatings and parts from damage. Components should be handled such that forces are not concentrated and bending or distortion cannot occur.

Housing should be lifted using straps and spreaders. Do not distort housing or side plates when lifting.

**CAUTION**

1. Maintain handling equipment to avoid serious personal injury and do not stand under the load.
2. If supplied, only use the provided lifting lugs to lift the equipment.
3. Ensure that the lifting equipment is rated for the capacity to be lifted.



Lifting lugs are provided on most units.

### BARE FAN WEIGHTS

SIZE	WHEEL DIA. (IN.)	WEIGHT (LB.)				MOTOR
		HORIZONTAL STD. MOUNT		VERTICAL STD. MOUNT		
		ECLFN	ECLQN	ECLFN	ECLQN	
165	16.50	70	72	70	72	60
182	18.25	86	88	86	88	60
200	20.00	108	110	108	110	60
222	22.25	141	145	141	145	60
245	24.50	159	163	159	163	60
270	27.00	183	189	183	189	60



## UNIT STORAGE

**Short Term Storage:** If fan installation is to be delayed, store the unit in a protected area. Protect the fan and motor from moisture and vibration (or shock loading).

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

**Periodic Check** – On a monthly interval, the equipment should be checked to ensure that it has remained in an acceptable stored condition. The fan impeller should be left at approximately 180 degrees from that of the previous month to prevent the impeller from taking a set in one position. Storage records should be maintained which indicate the above requirements have been followed. Consult the motor manufacturer for proper storage, space heater connection and lubrication if the unit was supplied with one.



## FOUNDATIONS AND SUPPORTING STRUCTURES

Floor mounted fans should be installed on a flat, level surface with sufficient structure support. Support shall be suitable for static and dynamic loads and foundation frequencies be separated at least 20% from the rotational speed/speed ranges.

If the fans are mounted in a structure, the support should be placed under the enclosure inlet and outlet edges as a minimum. The fan mounting surfaces or beams must be flat and level. Structural resonance should be at least 20% from the fan operating speed, when considering the weight of all fans and accessories.

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## FAN INSTALLATION – FACTORY ASSEMBLED UNITS

Follow proper handling instructions given earlier.

1. Move the fan to the final mounting position.
2. Remove skid, crates and packing materials carefully.
3. Place fan on mounting structure. Carefully level unit using shims as required at all mounting hole locations. Bolt down the unit. Be careful not to force the fan to conform to the mounting structure/foundation.
4. Continue with Operations Checklist.

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## FAN INSTALLATION – DISASSEMBLED UNITS

A unit is considered “disassembled” if any component required for proper operation is shipped or supplied separately or in pieces. Reference earlier instructions concerning proper handling of fan components.

Instructions for Mounting and Assembly of Unit:

1. Move lower housing/framework to mounting location.
2. If vibration pads or bases are used, place on bolts first. Place lower housing assembly onto bolts.
3. Level and shim if required. Bolt into place.
4. Install any safety devices or accessories supplied. (Accessories commonly used are inlet or discharge screens. Refer to appropriate documents in appendix.)
5. When connecting the fan to the system, it is recommended that the inlet and discharge be isolated from the system with flex connections (where practical) to block transmitted vibration. All duct connections to the fan should be independently supported. Do not use fan to support duct.



### GENERAL MOTOR MAINTENANCE

Two basic rules of motor maintenance are keep the motor clean and dry.

Keeping motors and windings clean is important because dirt and dust serve as thermal insulators. Heat normally dissipated by the motor is trapped causing overheating and/or premature failure. Blow dust and dirt out of windings and off the motor periodically. Use low pressure (50 psig) airstream so that winding damage does not occur. Keep the area surrounding the motor open so the air can circulate through the motor cooling fan. Follow normal maintenance schedule given to the right.

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

Motor bearings on ECLFN and ECLQN are permanently lubricated. The motor must be grounded to earth and proper shielded cabling must be used.

### WHEEL MAINTENANCE

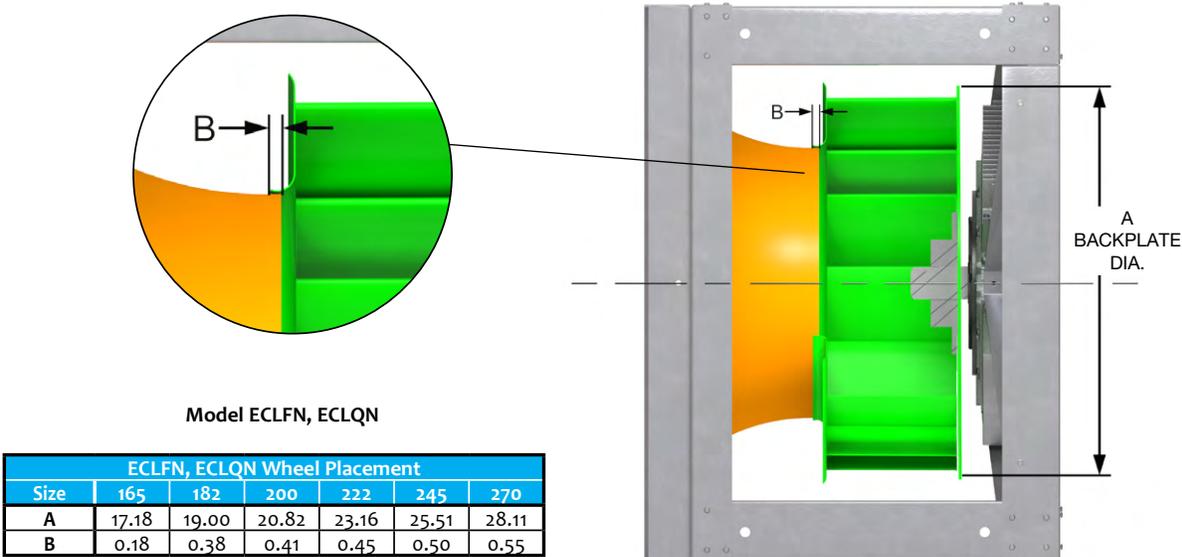
Periodically inspect the wheel for dirt buildup, corrosion, and signs of excess stress or fatigue. Clean the components and, when appropriate, apply new coatings. (Any addition of coatings or weld can create an imbalance.) Check the balance of the assembly.

### STRUCTURAL MAINTENANCE

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

Check metallic components for corrosion, cracks or other signs of stress. Concrete should be checked to ensure the structural integrity of the foundation.

### WHEEL PLACEMENT / WHEEL OVERLAP



## ELECTRICAL CONNECTIONS



### WARNING

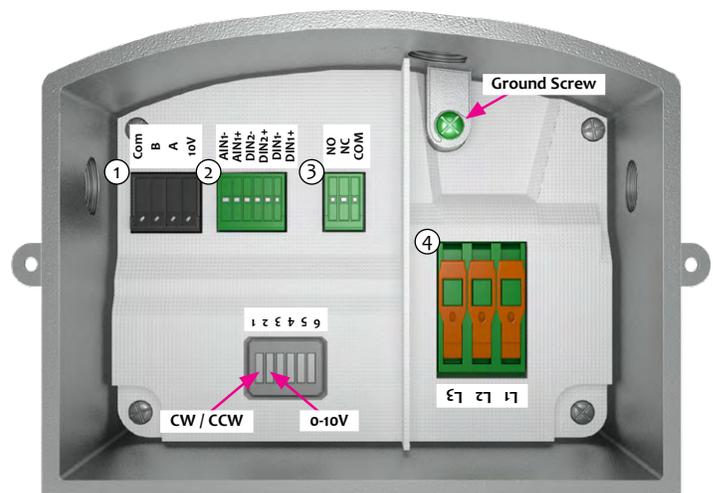
- Before proceeding read Motor Safety - Electrical section. Failure to follow the instructions in that section could result in serious personal injury, death and/or property damage.
- Voltage may be present at the motor terminals even after the motor has stopped rotating. To assure there is no voltage at motor, disconnect drive input power and allow 5 minutes for capacitors to discharge before servicing. Failure to follow this instruction could result in serious personal injury or death.

## CONNECTIONS

This motor is designed to be connected to the three-phase supply mains. Motor operation is controlled by an analog DC voltage signal. The UlteMAX™ axial motor is shipped with all necessary internal connections made for signal, power and ground connections. Input for the three-phase AC lines are labeled “L1”, “L2” and “L3” and the earth ground is a green grounding screw. Three-phase AC lines and earth ground should be supplied. Figure 2 displays the connections required to be made for the motor operation.

### Minimum Required Connections

- 3-phase line and ground
- Speed control signal (0-10VDC) at AINo- and AINo+
- Cover must be reinstalled before power is applied.



Connector	Wire Gauge Range	Wire Strip Length	Wire Ferrule
1	22 – 14 AWG	5-6 mm	Optional
2, 3	24 – 16 AWG	8 mm	Optional
4	14 – 10 AWG (per NEC and local codes)	12 mm	Optional

## SPEED CONTROL METHODS

**0-10VDC** - The default motor control method is 0-10V DC where 0V is off or zero input and 10V or full input is full speed. DC signal should be applied per the image above. +V DC line attached where shown (AIN+). DC common line should be attached per the image above where shown (AIN-). Since the minimum speed is 300 RPM, the motor will not start until the voltage reaches the threshold assigned to 300 RPM. The voltage is scaled linearly between 0 RPM (0 volts) and max rated RPM (10 volts). The 0-10VDC control signal must provide a minimum of 0.3mA to power the internal controller.

**4-20mA** - To put the motor in 4-20mA speed command mode, place dip switch 2 in 0-10V setting positioning. Using 16-18AWG stranded copper wire, connect a jumper from J4-1 (COM) to J1-1 (AIN1-). Connect a second jumper from J4-4 (10V) to J1-2 (AIN1+).

**Dip switches** - The 3-6 dip switches are only used when user interface is in MODBUS serial communication.

**Serial Communication Port** - This motor is equipped with a RS-485 serial communication port. MODBUS is enabled on all motors. Software contains no load trip safety which is disabled due to motor being directly mounted. Contact factory for availability of other communication options. Connection is made at header J4. The mating plug for this header is On-Shore Technology part number OSTTX040100. An isolated 10V (250 mA) power supply is available at J4 for purposes of powering outboard communication equipment.

## MOTOR SAFETY – ELECTRICAL



### WARNING

- Electrical connections shall be made by a qualified electrician in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel should install or repair electrical motors and their accessories.
- Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.
- Rotor rotation produces voltage in PM motors even when motor is disconnected from power source. Do not open any of the pods or touch unprotected terminals while the motor rotor is rotating. Failure to do so may cause serious injury or death to personnel. Disconnect drive input power and allow 5 minutes for capacitors to discharge before servicing.
- Rotor rotation produces voltage in PM motors even when motor is disconnected from power source. Do not operate the motor or allow equipment to back drive the motor above the maximum RPM listed on the motor nameplate. Failure to do so may cause serious injury or death to personnel or damage the motor or system equipment.
- Permanent magnet motor rotors, when removed from the motor body, expose surrounding personnel and equipment to powerful magnetic fields which may cause serious health hazards to persons with pacemakers, hearing aids, or other implanted electronic medical devices and may impact other electronic devices such as mobile phones, credit cards, etc.

## MOTOR SAFETY – MECHANICAL



### WARNING

- Before starting the motor, ensure no loose rotating parts to prevent them from flying off. Failure to follow these instructions could result in serious personal injury, death and/or property damage.
- Keep extremities, hair, jewelry and clothing away from moving parts. Failure to follow these instructions could result in serious personal injury, death and/or property damage.
- Due to powerful magnetic fields, disassembly and assembly of permanent magnet motors should only be performed by the manufacturer or specialized personnel authorized by the manufacturer. Only qualified personnel who are familiar with the applicable national codes, local codes and sound practices should install or repair electric motors and their accessories.

## TROUBLESHOOTING GUIDELINES

Use current safety practices when investigating fan or system performance problems. General safe practices and performance troubleshooting guidelines can be found in AMCA Publications 410 and 202, respectively. Fan application and field measurement procedures can be found in AMCA Publications 201 and 203.

### Troubleshooting Performance Problems

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

#### Air Capacity Problems:

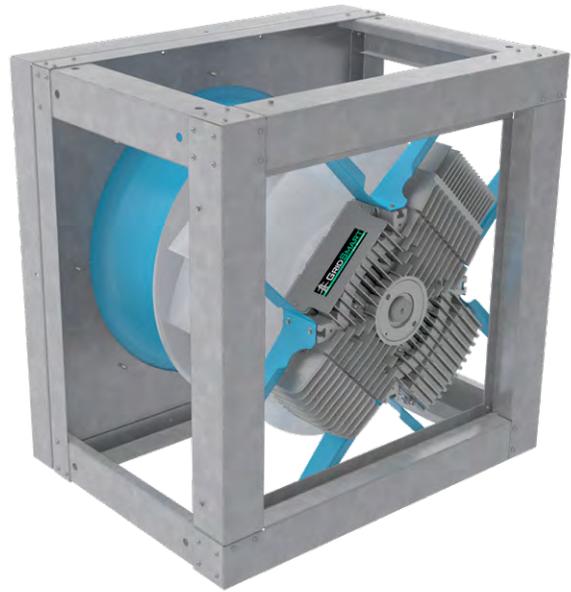
1. Resistance of system not at design rating. If resistance is lower than expected, both airflow and horsepower may be up. If resistance is higher than anticipated, air volume will be down.
2. Fan speed is not at design speed.
3. Air density not at design values. Also check air performance measurement techniques/procedures.
4. Devices for air modulation are closed or plugged. Also check filters.
5. Wheel mounted improperly or is rotating in reverse.
6. Parts of system or fan have been damaged or need cleaning.

#### Noise Problems:

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

#### Vibration Problems:

1. Poor foundations or mounting structure (resonances).
2. Foreign material attached to rotating components.
3. Damaged rotating components.
4. Broken, loose or missing setscrews.
5. Loose bolts.
6. Vibration transmitted by another source.
7. Water accumulating in airfoil blades.
8. Fan is operating in stall or unstable flow region.



### NOTICE

All fans manufactured by Twin City Fan & Blower are factory balanced prior to shipment. Installation variables, handling, and movement of the fan during shipment may cause the rotating assembly to shift. Balance should be checked once the fan is installed. If a final trim balance is required, it is the end user's responsibility to bring the fan back to factory specifications. Final trim balancing is not the responsibility of Twin City Fan & Blower. Refer to the Vibration Guidelines table below.

#### VIBRATION GUIDELINES

Condition	Fan Application Category	Rigidly Mounted mm/s (in./s)	Flexibly Mounted mm/s (in./s)
Start-up	BV-3	6.4 (0.25)	8.8 (0.35)
	BV-4	4.1 (0.16)	6.4 (0.25)
Alarm	BV-3	10.2 (0.40)	16.5 (0.65)
	BV-4	6.4 (0.25)	10.2 (0.40)
Shutdown	BV-3	12.7 (0.50)	17.8 (0.70)
	BV-4	10.2 (0.40)	15.2 (0.60)

Values shown are peak velocity, mm/s (inches/s), Filter out. Table taken from ANSI/AMCA Standard 204-05, Table 6.3. AMCA defines BV-3 for applications up to 400 HP; BV-4 for applications over 400 HP.



## MOTOR TROUBLESHOOTING



### WARNING

Before conducting any trouble-shooting, be sure to read and follow all safety warnings and instructions. Failure to do so could cause severe injury, death and/or equipment damage.

ISSUE	LIKELY CAUSE	CORRECTIVE ACTION
Motor fails to start upon initial installation		
A	Low or no input voltage.	(1) Ensure that rated input voltage is present. (2) Check line fuses.
B	Driven load exceeds motor capacity. Motor may trip on overload fault.	(1) Verify that motor is adequate for application. (Fault codes only available with MODBUS functionality)
C	Load is jammed or motor is binding.	(1) Verify that motor & load turn freely. (2) Disconnect motor from load & ensure motor turns freely. (3) Verify that motor starts when disconnected from load. The no load trip safety disabled. Remove excessive / binding load if present.
D	Motor programmed incorrectly. Motor trips on overload fault.	Repeat checks listed above. (Fault codes only available with MODBUS functionality)
Motor has been running, then slows down, stalls, or fails to restart		
A	Drive has faulted.	(1) Check fault codes. (Fault codes only available with MODBUS functionality) (2) Verify that motor & load turn freely. (3) Replace inverter pod.
B	Supply voltage has dropped or has become severely unbalanced.	(1) Check fuse or reset circuit breaker. (2) Verify that rated and balanced supply voltage has been restored at input before restarting motor. Measure input voltage after motor has reached set speed during restart.
C	Motor is overloaded. Motor trips on overload.	(1) Verify that motor & load turn freely. (2) Disconnect motor from load & ensure motor turns freely. (3) Verify that motor starts when disconnected from load. (4) Remove excessive / binding load if present. (5) Motor may have overheated, allow motor to cool before attempting to restart.
D	Motor bearings are seized.	
E	Load is jammed. Motor trips on overload.	
F	Motor will not start after tripping.	(1) Check fault codes and follow troubleshooting procedures. (Fault codes only available with MODBUS functionality) (2) Verify that input voltage is balanced and within limits. (3) Remove excessive mechanical load if present.
Motor takes too long to accelerate		
A	Supply voltage has dropped or become severely unbalanced.	Ensure that steady state supply voltage at input terminals is within limits. Correct as needed.
B	Load exceeds motor capability.	(1) Verify the motor rating and current capability is sized correctly for the load. (2) Disconnect motor from load & ensure motor turns freely.
Motor rotates in the wrong direction		
A	Motor direction is reversed or commanded direction is reversed.	Program direction change by toggling dip switch in the user interface pod, to proper setting. Disconnect drive input power and allow 5 minutes for capacitors to discharge before servicing.

## MOTOR TROUBLESHOOTING (CONT.)

ISSUE	LIKELY CAUSE	CORRECTIVE ACTION
Unit trips repeatedly on overload or motor over-temperature fault		
A	Load exceeds motor capability.	(1) Verify the motor rating and current capability is sized correctly for the load. (2) Disconnect motor from load & ensure motor turns freely.
B	Ambient temperature too high.	Confirm that ambient temperature at motor does not exceed value stamped on motor nameplate. Reduce ambient temperature as needed.
C	Start/stop time (duty cycle) is too short or too frequent.	Reduce the number of start/stop cycles.
Motor vibrates		
A	Motor misaligned to load.	Realign load.
B	Load out of balance.	Ensure that load is dynamically balanced.
C	Driven load operating at resonant point / natural frequency.	(1) De-energize motor and record vibration as load coasts from 100% speed to 0 RPM. If vibration drops immediately, vibration source is electrical. If levels do not drop immediately, source is mechanical. (2) If mechanical, redesign system to operate below the resonant point.
D	Uneven, weak or loose mounting support.	Shim, strengthen or tighten where required.
E	Motor out of balance.	Motor is balanced at the factory and will remain balanced in operation. If motor balance is in question, remove motor from application and send to motor manufacturer or authorized service shop for inspection.
Failure due to worn bearing system		
A	Load to motor may be excessive or unbalanced.	(1) Check loading on motor rotor. An unbalanced load will also cause the bearings to fail. (2) Check run-out of mating components and if bearings are worn replace motor.
Motor makes a rubbing, grinding, or squealing noise		
A	Contact between rotating and stationary components.	Isolate motor from load. To locate point of contact turn motor rotor by hand. If point of contact is not located, contact motor manufacturer or authorized service shop.
Unit trips on Ground Fault		
A	Condensation forms on motor winding.	Remove source of moisture. Dry out motor.
B	Motor winding is shorted to ground.	Disconnect leads at motor user interface pod and Megger motor leads to ground. If resistance is less than 1.5 mega-ohms, remove motor from service and send to authorized service shop for inspection.
Motor rotor cogs		
A	Rotor cogs when turned by hand. Note that because of the presence of the magnets, some motor cogging is normal.	Motor leads are shorted together inside user interface pod producing braking torque. Isolate all leads and repeat rotor turning by hand.



# INSTALLATION/START-UP CHECKLIST

Become familiar with the equipment by looking at the fan assembly drawing for special instructions and accessories.

**WARNING**

Verify that proper safety precautions have been followed. Electrical power must be locked off.

**NOTICE**

Always observe site specific and regulatory safety precautions.

## INITIAL FAN CHECK

- Inspect fan for damage
- Check foundation
- Is the fan shimmed
- Are the bolts tight
- Check to see if the fan is distorted  
*Note: Applies to direct or isolation mount.*
- Check fan interior for debris & standing water

### Fan Wheel

- Wheel clearance checked
- Wheel overlap checked
- Fasteners tight
- Wheel rotates freely

### Springs (if equipped)

- Springs adjusted properly
- Flex joints allow movement
- Electrical conduit allows movement

### Accessories

- Guards installed correctly, do not rub
- Other accessories per drawing

## ELECTRICAL COMPONENTS

- Motor wired for proper voltage and starter
- Motor grounded
- Appropriate starter and heaters
- Leads are properly insulated
- Accessories wired per instructions supplied.

## ENERGIZE

- Energize motor long enough to start assembly rotating, shut down
- Verify direction of wheel rotation, flip dip switch 1 CW/CCW if necessary *Note: Refer to wheel rotation section*
- Run the fan up to speed
- Check for excess vibration and listen for unusual noise. Refer to the Vibration Guidelines table on page 10 for vibration limits

## AFTER ONE WEEK

- Verify bolt tightness.

SERIAL NUMBER: \_\_\_\_\_

COMPLETED BY: \_\_\_\_\_

DATE COMPLETED: \_\_\_\_\_



## SERIAL NUMBER & FAN TYPE

The serial number and fan type can be found on our permanent nameplate of the fan.







TWIN CITY FAN & BLOWER | [WWW.TCF.COM](http://WWW.TCF.COM)

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