



INSTALLATION & MAINTENANCE INSTRUCTIONS

EC Motor Wiring Diagrams

This publication applies to Acme fan models shipped with the EC Motor (Electronically Commutated Motor)

This section applies only to EC Motor Part Numbers DV3300A01 (923743) 1HP, and DV3302SA01 (924748) 2 HP

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!

The EBSM Motor is an integrated industrial motor and speed control that is simple and easy to install.

General Safety Information

This equipment contains voltages that may be as high as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

WARNING: Do not touch any circuit board, power device or electrical connection before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

WARNING: Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.

WARNING: Surface temperatures of motor may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.

WARNING: Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

WARNING: Motors that are to be used in flammable and/or explosive atmospheres must display the CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.

WARNING: Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying conductors and permanent magnet motors can result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay away from the area surrounding a permanent magnet motor.

WARNING: Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Dangerous voltages are present inside the equipment. Electrical shock can cause serious or fatal injury.

WARNING: Motor circuit may have high voltage present whenever AC power is applied, even when motor is not rotating. Electrical shock can cause serious or fatal injury.

CAUTION: Disconnect motor leads (T1, T2 and T3) from control before you perform a dielectric withstand (insulation) test on the motor. Failure to disconnect motor from the control will result in extensive damage to the control. The control is tested at the factory for high voltage / leakage resistance as part of Underwriter Laboratory requirements.

CAUTION: Suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical short circuit amperes at rated voltage.

CAUTION: Connection of power 115 or 230VAC power to "N" will damage the unit.

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 fan 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 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 or speed control cables to kink or come in contact with oil, grease, hot surfaces or chemicals. If damaged, discontinue use immediately and have cord replaced.
6. Verify that the power source is compatible with the equipment. Branch protection and disconnect means must be provided if required.
7. Never open access doors to a duct while the fan is running.

Features

Soft Start

All EBSM motors use soft start motor technology. They will reliably start at any speed setting.

Overload

If the motor becomes overloaded, the control begins a countdown that creates an "Overload fault" when it ends.

Locked Rotor Protection

If a locked rotor condition occurs, the motor will automatically shut itself down. Restart is attempted (up to 3 times). If the 3rd attempt is unsuccessful, the motor will not attempt restart until power is cycled (turned "Off" then "On").

Thermal Protection

Motor software limits motor current to prevent an overheating condition. If motor temperature increases above the protection limit, a thermal switch provides final protection to prevent a fire. The thermal switch will reset when motor temperature decreases to an acceptable level.

Built-in Protection

Built-in over current, over voltage and under voltage protection.

RPM measurement

Motor RPM can be measured by removing the cooling fan cover on the back of the motor and using an optical tachometer or contact. Replace cooling fan cover when completed to prevent motor from over heating.

Reversible rotation

The motor shaft rotation is set at factory and no adjustments are needed. If a replacement motor is ordered make sure the motor

rotation matches the fans rotations. Rotation can be changed by swapping any of the Red, Black and Blue wires connecting the control board to the motor at terminals T1, T2 and T3.

Installation

1. Wire motor in accordance with local codes. The motor can be mounted by the feet or face. See Figure 1 for mounting hole locations. Verify fasteners holding motor to fan are properly secured.
2. Verify fan wheel is properly secured on motor shaft.
3. Connect the motor to AC power and ground and the external speed control. See Figures 2 or 3. Use appropriate strain relief (not provided).
4. Connect the remote speed control dial. See Figures 4 or 5. Use appropriate strain relief (not provided)

Figure 1 Mount the Motor

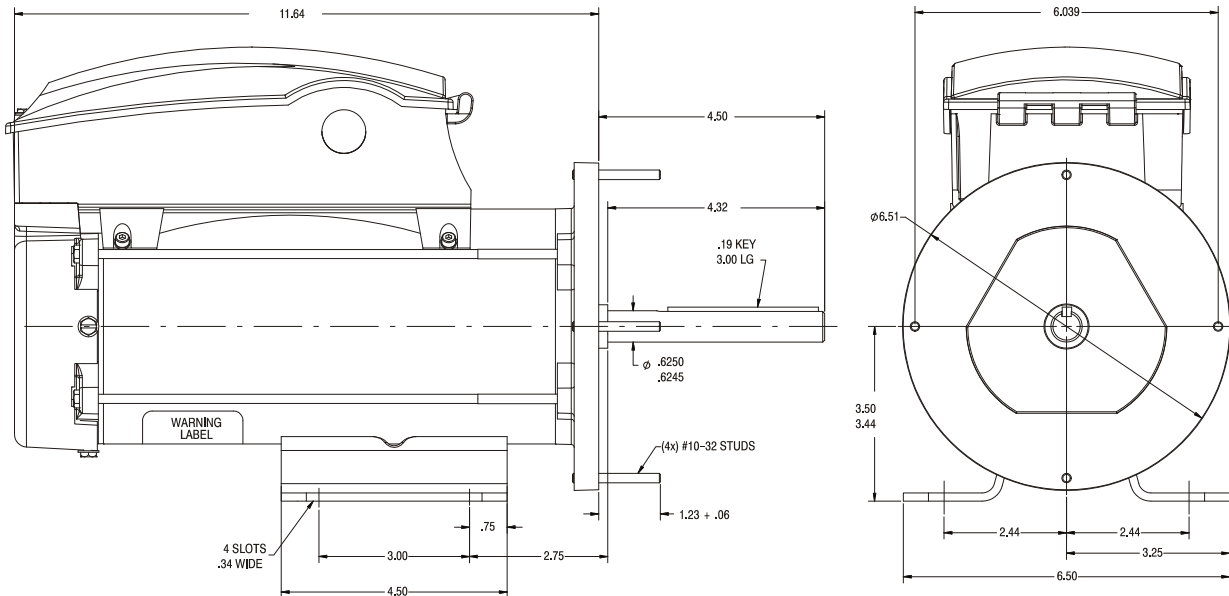


Figure 2 115VAC Power Connection to Motor Speed Controller

AC power

Connect it to the motor control as follows:

- a. Connect 115VAC (Black) to L1.
- b. Connect Neutral (White) to N.
- c. Connect Ground to \perp

Use only Copper Wire for all wiring.

Caution: Connection of 115VAC power to "N" will damage the unit.

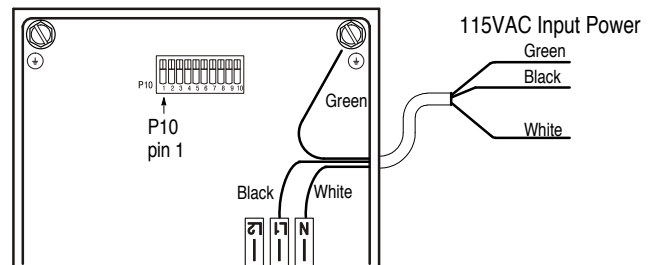


Figure 3 208-240VAC Power Connection to Motor Speed Controller

AC power

Connect it to the motor control as follows:

- a. Connect L1 (Black) to L1.
- b. Connect L2 (Black) to L2.
- c. Connect Neutral (White) to N.
- d. Connect Ground to \perp

Use only Copper Wire for all wiring.

Caution: Connection of either line of 208-240VAC power to "N" will damage the unit.

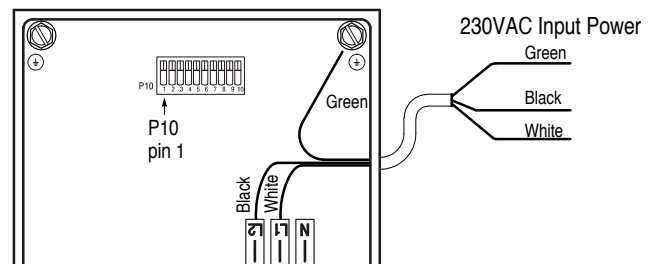


Table 1 Single Phase Power Requirements

Nominal AC Voltage	Minimum AC Volts	Maximum AC Volts	HP	Input A _{RMS}	Output A _{RMS}
115	103	126	1.0	6.18	2.83
230	200	264	2.0	11.05	5.29

Note: Internally, the Speed Controller provides 240VAC 3 phase at 8kHz switching frequency to the motor.

Figure 4 Factory Mounted Motor Speed Controller (Potentiometer)

Connect the Speed Control Potentiometer to the motor control as follows:

- Connect one end of Potentiometer to P10-1 (24VDC).
 - Connect center (wiper) of Potentiometer to P10-2 (AnalogIn).
 - Connect other end of Potentiometer to P10-3 (DGND).
- Use only Copper Wire for all wiring.

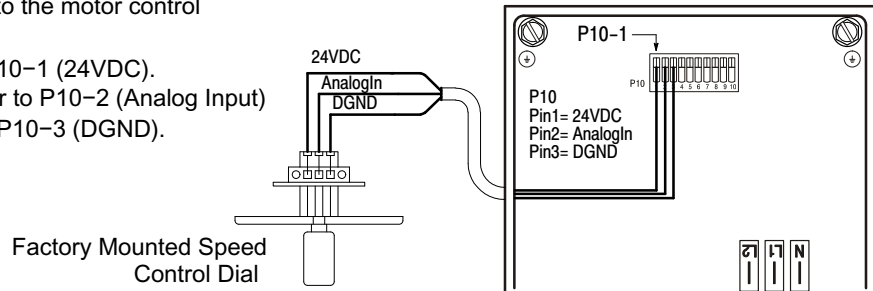
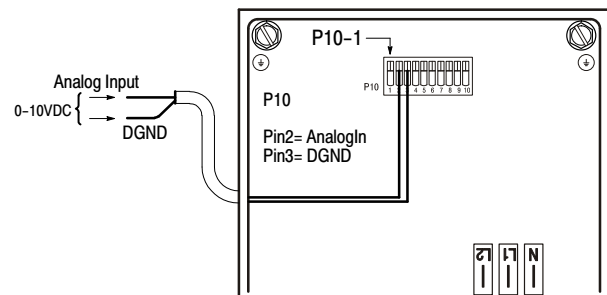


Figure 5 Motor Speed Controlled by 0–10VDC Control Signal

When controlling motor with an external 0-10 VDC disconnect and remove the factory mounted speed controller connect the Speed Control Potentiometer to the motor control as follows:

- Connect a positive voltage source to pin P10-2 (AnalogIn).
- Connect source common to P10-3 (DGND).

Use only Copper Wire for all wiring.



Operation

Operating temperature range is: 14°F to 104°F (–10°C to 40°C)

The EBSM motor offers various control options. Follow the correct wiring diagram based on the control option desired.

- Energize motor and check for proper rotation. Rotation should match wheel rotation as noted in fans instruction manual and rotation arrow located on fan.
- Adjust motor speed to verify the proper motor speed controller functionality.

Troubleshooting

Mounted Speed Control Dial

- Check voltage to ensure the motor is receiving the correct control input.
- Check voltage at the remote dial. 24VAC should be present across the 24V and COM terminals. 0–10VDC should be present across the 0–10V and COM terminals.
- Verify all of the connections inside the fan and make certain that they are secure.

Fault Indication

A red LED on the control board provides fault indication. During a fault, this LED will blink a specific number of times to identify the fault that has occurred.

Table 2 describes these fault indications.

Table 2 Fault Indications	
No. Blinks	Indicated Fault
2	Over current
3	Over voltage
4	Under voltage
5	Communication Error
6	Sync Loss
7	Spin Fault
8	3 Sec/60 sec overload
9	Motor over-temperature

Maintenance

EBSM motors use brushless technology with sealed bearings so no maintenance is required other than keeping any accumulated debris from collecting on the motor.

EC MOTOR WIRING DIAGRAMS

Potentiometer Dial Only*- (See Figure 6) Motor features a potentiometer dial located on the side of the motor allowing the user to make necessary speed adjustments with a small flat tip screw driver. The 3 control wires are not used. The motor can also be controlled by a separate 0-10 VDC and 24 VAC to the control wires, in this set up the potentiometer dial needs to be set to full speed (CW).

Optional Speed Controller (See Figure 7)

Remote Speed Controller Single Speed (Optional)*- (See Figure 7-A) Set the potentiometer dial located on the side of the motor to full clockwise. When selected with this option the fan will come with a 24 VAC transformer mounted for the purpose of powering the logic circuits in both the motor and the remote speed controller. The remote speed control will supply a DC signal that varies from 0 to 10V. This signal will vary the motors speed. The motor will shut off between 0-1.9v.

Mounted Speed Controller Two Speed (Optional)*- (See Figure 7-B) Set the potentiometer dial located on the side of the motor to full clockwise. When selected with this option the fan will come with a 24 VAC transformer mounted for the purpose of powering the logic circuits in both the motor and the dual speed controllers mounted on fan. The supplied toggle switch will select the Low (LO) or High (HI) speed on the speed controllers based on the dial settings. The motor will shut off between 0-1.9v.

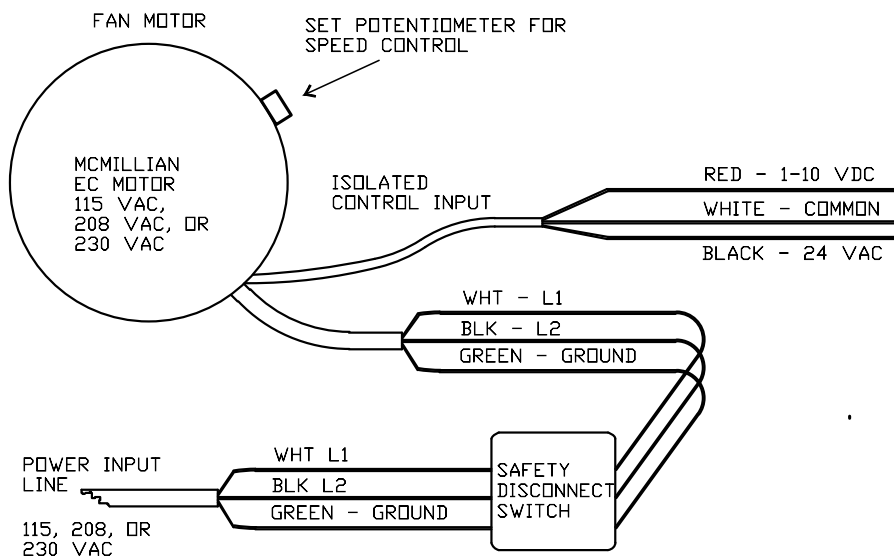
Customer Building Controller - (See figure 7-C) Set potentiometer dial located on motor side to full clockwise. Connect Red (0-10VDC) and White (Common) to building controller. Motor requires factory mounted 24VAC transformer to run motor logic boards. The motor shuts off between 0-1.9V.

* All 115, 208 or 230V connections will be made in the supplied junction box. Wire to the remote speed control is to be supplied by others and must meet all applicable codes.

NOTE: When using a remote variable speed control the potentiometer on the motor (if present) should be set to full clockwise.

The remote speed control location is limited by a maximum wire length of 100 feet. Up to 6 fans can be operated from one remote control. Only one transformer should be used.

POTENTIOMETER DIAL ONLY (FIGURE 6)

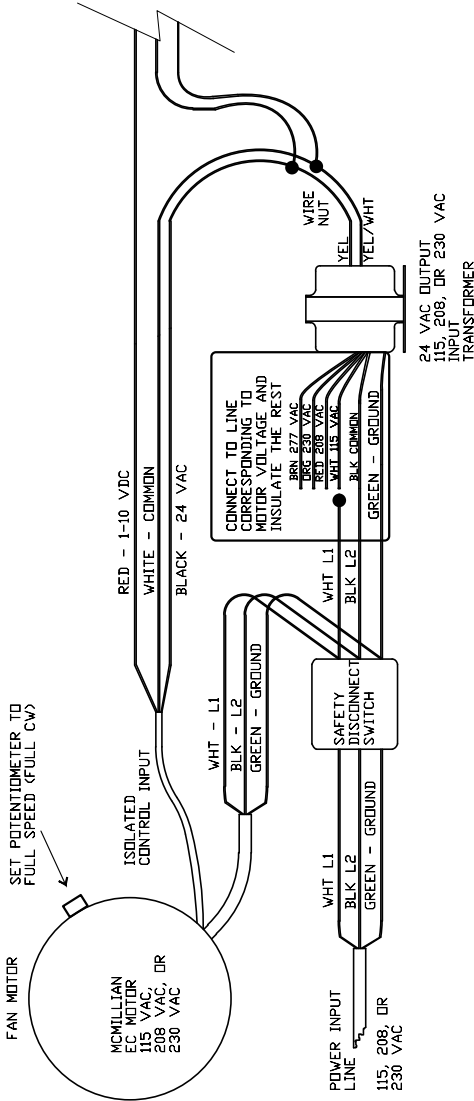
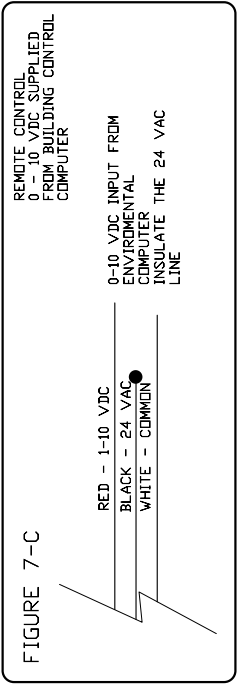
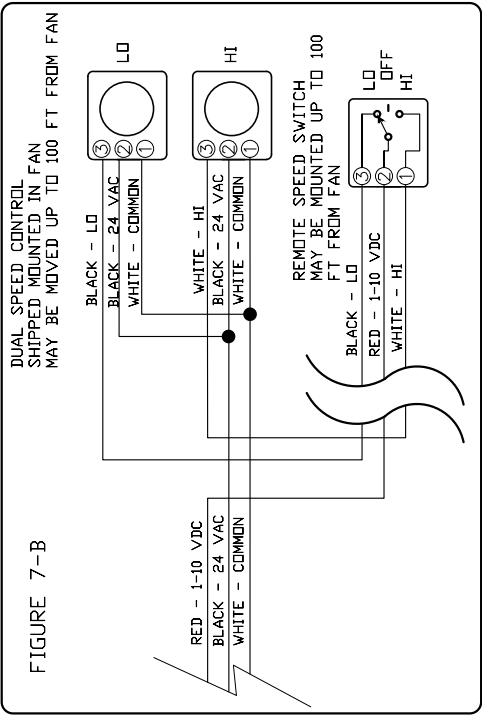
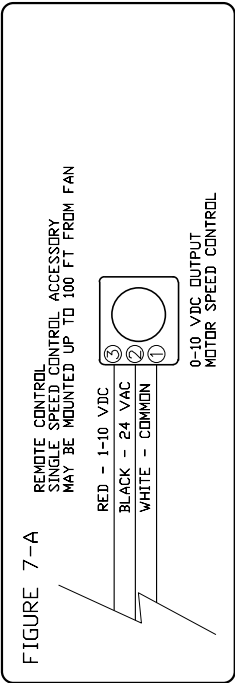


OPTIONAL EC MOTOR CONTROLS (FIGURE 7)

FIGURE 7-A SINGLE SPEED

FIGURE 7-B DUAL SPEED

FIGURE 7-C BUILDING CONTROL (BY OTHERS)



TERMS AND CONDITIONS OF SALE

ACCEPTANCE All orders and sales are subject to written approval and acceptance by an executive officer of Acme Engineering & Manufacturing Corporation at Muskogee, Oklahoma, (the "Company") and are not binding on the Company until so approved.

DELIVERY All shipping and delivery dates are estimated only. No delays in delivery will subject the Company to any costs, damages or fees for late delivery. Delivery of the products herein specified shall be made F.O.B. point of shipment, unless otherwise stated. The Company shall not be liable for delay due to causes beyond its reasonable control, such as Acts of God, acts of the purchaser, acts of civil or military authorities, priorities, fires, strikes, floods, epidemics, war, riots, delays in transportation, car shortages, and inability, due to reasons beyond its reasonable control, to obtain necessary labor, material, or manufacturing facilities. In the event of such a delay, the date of delivery shall be extended for a period equal to the time lost by reason of the delay.

TERMS OF PAYMENT If, in the judgment of the Company, the financial condition of the purchaser at any time does not justify continuation of manufacture or shipment on the terms of payment specified, the Company may require full or partial payment in advance.

Pro rata payments shall become due as shipments are made. Each shipment or delivery shall constitute a separate sale, and the default of any shipment or delivery shall constitute a separate sale, and the default of any shipment or delivery shall not vitiate the contract as to other shipments or deliveries.

SALES AND SIMILAR TAXES The Company's prices do not include sales, use, excise, or similar taxes. Consequently, in addition to the price specified herein, the amount of any present or future sales, use, excise, or other similar tax applicable to the sale of the product herein shall be paid by the Purchaser, or in lieu thereof

the Purchaser shall provide the Company with a tax exemption certificate acceptable to the taxing authorities.

CANCELLATION Any contract resulting from the Purchaser's order may be canceled by the Purchaser only by negotiations and upon payments of reasonable cancellation charges which will take into account expenses already incurred and commitments made by the Company.

DESIGN CHANGES The Company reserves the right to make changes in design, improvements and additions in and to its products any time without imposing any liability or obligations to itself to apply or install the same in any product manufactured by it.

TITLE The title and right of possession of the products sold herein shall remain with the Company and such products shall remain personal property until all payments herein (including deferred payments whether evidenced by notes or otherwise) shall have been made in full in cash and the Purchaser agrees to do all acts necessary to perfect and maintain such right and title in the Company.

PRICE ADJUSTMENTS Prices are subject to change upon notice by the Company. Prices on existing orders are subject to surcharges in the event of cost increases of metals and transportation. All complete component accessory material manufactured by others and furnished with the Company's products such as motors, drives, vibration equipment, controls or other completely assembled component structures, are subject to adjustment to the price at time of shipment regardless of the date of original order entry.

SAFETY ACCESSORIES The Company manufactures products designed to serve multiple applications and offers a wide range of safety equipment, including guards and other devices, as may be required to meet

customer specifications. Without exception, the Company recommends that all orders include applicable safety devices. Products ordered without applicable safety devices is clearly the responsibility of the Purchaser. Further, the Purchaser warrants that it has determined and acquired any and all safety devices required for products sold by the Company. Weather covers and guards for motor and V-belt drives, couplings, shafts and bearings, along with inlet and outlet screens, are optional accessories noted in the price list.

GOVERNING LAW The rights, obligations and remedies of Purchaser and the Company, the interpretation of these terms and conditions and the sale of products by the Company shall be governed by Oklahoma law, without regard to any principles of conflict of laws.

ARBITRATION Any dispute arising under or in connection with these terms and conditions or the sale of products shall be settled by binding arbitration administered by the American Arbitration Association under its Commercial Arbitration Rules, and judgment on the award rendered by the arbitrator may be entered in any court having jurisdiction thereof. The dispute shall be resolved by one neutral arbitrator who shall have no affiliation with either Purchaser or the Company and shall be selected by the American Arbitration Association office in Dallas, Texas. The arbitration proceedings shall be held in Muskogee, Oklahoma.

APPLICABLE DOCUMENTS The agreement between the Company and the Purchaser relating to the products includes these terms and conditions of sale, any applicable installation and maintenance instructions provided by the Company and any terms appearing on the Company's quotation, sales order acknowledgment and invoice.

WARNING Acme products are designed and manufactured to provide reliable performance but they are not guaranteed to be 100% free of defects. Even reliable products will experience occasional failures and this possibility should be recognized by the Purchaser and all End Users. If these products are used in a life support ventilation system where failure could result in loss or injury, the Purchaser and all End Users should provide adequate back-up ventilation, supplementary natural ventilation or failure alarm system, or acknowledge willingness to accept the risk of such loss or injury.

WARNING DO NOT use in HAZARDOUS ENVIRONMENTS where fan's electrical system could provide ignition to combustible or flammable materials unless unit is specifically built for hazardous environments. Comply with all local and national safety codes including the National Electrical Code (NEC) and National Fire Protection Act (NFPA).

CAUTION Guards must be installed when fan is within reach of personnel or within eight (8) feet (2.5 m) of working level or when deemed advisable for safety.

DISCLAIMER The Company has made a diligent effort to illustrate and describe the products accurately in all Company literature; however such illustrations and descriptions are for the sole purpose of identification and do not express or imply any warranty.

LIMITED WARRANTY

WARRANTY AND DISCLAIMER: The Company extends this limited warranty to the original purchaser and warrants that products supplied by the Company, shall be free from original defects in workmanship and materials for two years from date of shipment (except for the warranty periods noted for products listed below), provided same have been properly handled, stored, installed, serviced, maintained and operated. This warranty shall not apply to products which have been altered or repaired without the Company's express authorization, or altered or repaired in any way so as, in the Company's judgment, to affect its performance or reliability, nor which have been improperly installed or subjected to misuse, negligence, or accident, or incorrectly used in combination with other substances. The Purchaser assumes all risks and liability for results of use of all products.

Evaporative cooling pads are warranted to be free of defects in materials and workmanship for a period of two years from date of shipment provided same have been properly handled, stored, installed, serviced, maintained and operated; and further, not subjected to excessive heat, corrosive agents or chemicals, or mechanical abuse that may cause tearing, crushing or undue deterioration, nor used on a system or in a manner other than that for which it was designed as explained in the product literature.

The following products are warranted to be free of defects in materials and workmanship for the periods shown from date of shipment: Acme's exclusive duplex split pillow block bearings and shaft five years, belts one year, Polyethylene tubing 90 days, AIR40 Heater warranty one year, AIR40 Emitter warranty three years and DDP fan lifetime warranty on its propeller, cone, and housing.

LIMITATION OF REMEDY AND DAMAGES: All claims under this warranty must be made in writing and delivered to P. O. Box 978, Muskogee, Oklahoma, 74402, within 15 days after discovery of the defect and prior to the expiration of two years from the date of shipment by the Company of the product claimed defective, and Purchaser shall be barred from any

remedy if Purchaser fails to make such claim within such period.

Within 30 days after receipt of a timely claim, the Company shall have the option either to inspect the product while in Purchaser's possession or to request Purchaser to return the product to the Company at Purchaser's expense for inspection by the Company. The Company shall replace, or at its option repair, free of charge, any product it determines to be defective, and it shall ship the repaired or replacement product to Purchaser F.O.B. point of shipment; provided, however, if circumstances are such as in the Company's judgment to prohibit repair or replacement to remedy the warranted defects, the Purchaser's sole and exclusive remedy shall be a refund to the Purchaser of any part of the invoice price, paid to the Company, for the defective product or part.

The Company is not responsible for the cost of removal of the defective product or part, damages due to removal, or any expenses incurred in shipping the product or part to or from the Company's plant, or the installation of the repaired or replaced product or part.

The warranties set forth above do not apply to any components, accessories, parts or attachments manufactured by other manufacturers; such being subject to the manufacturer's warranty, if any. To the extent not prohibited by the manufacturer's warranty, the Company shall pass through to Purchaser such manufacturer's warranty.

THE COMPANY'S WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, ARISING BY LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND WAIVED. THIS WARRANTY CONSTITUTES THE COMPANY'S SOLE AND EXCLUSIVE WARRANTY FOR DEFECTIVE GOODS AND PURCHASER'S SOLE AND EXCLUSIVE REMEDY FOR DEFECTIVE PRODUCTS.

No employee, agent, dealer, or other person is authorized to give any warranties on behalf of the Company or to assume for the Company any other liability in connection with any of its products except in writing and signed by an officer of the Company.

REPLACEMENT PARTS If replacement parts are ordered, purchaser warrants that the original components in which these replacement parts will be placed are in satisfactory working condition, and

when said replacement parts are installed, the resultant installation will operate in a safe manner, at speeds and temperatures for which the original product was purchased.

TECHNICAL ADVICE AND RECOMMENDATIONS, DISCLAIMER: Notwithstanding any past practice or dealings or any custom of the trade, sales shall not include the furnishing of technical advice or assistance or system design. Any such assistance shall be at the Company's sole option and may be subject to additional charge.

The Company assumes no obligation or liability on account of any recommendations, opinions or advice as to the choice, installation or use of products. Any such recommendations, opinions or advice are given and shall be accepted at Purchaser's and End User's risk and shall not constitute any warranty or guarantee of such products or their performance.

LIMITATION OF LIABILITY The cumulative liability of the Company to the Purchaser and any other persons for all claims in any way relating to or arising out of the products, including, but not limited to, any cause of action sounding in contract, tort, or strict liability, shall not exceed the total amount of the purchase price paid for those products which are the subject of any such claim. This limitation of liability is intended to apply without regard to whether other provisions of this agreement have been breached or have proven ineffective even if the Company has been advised of the possibility of such claims or demands. In no event shall the Company be liable to the Purchaser or any other person for any loss of profits or any incidental, special, exemplary, or consequential damages for any claims or demands brought by the Purchaser or such other persons.

INDEMNITY The Company's maximum liability to Purchaser and to any end user is as set forth above. The Company makes no warranty to anyone for any products not manufactured by the Company and shall have no liability for any use or installation of any products (whether manufactured by the Company or other manufacturers) not specifically authorized by this sale. Purchaser acknowledges various warnings by the Company regarding the products and its installation and use. If the Company incurs any claims, lawsuits, settlements, or expenses (including attorney fees) for any loss, injury, death or property damage including, but not limited to, claims arising out of the Purchaser's or any end user's installation or use of the products, the Purchaser shall indemnify and hold the Company harmless.



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