

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. Three signal words "DANGER", "WARNING", and "CAUTION" are used to indicate the severity of a hazard and are preceded by the safety alert symbol.



DANGER

Indicates the most serious hazard and is used when serious injury or death WILL result from misuse or failure to follow specific instructions.



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.

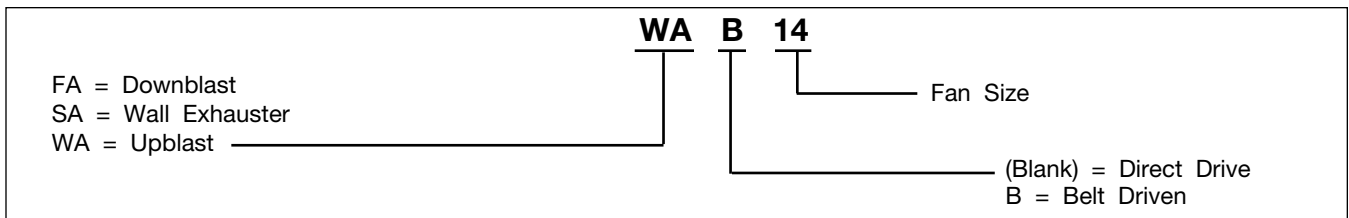
It is the responsibility of all personnel involved in installation, operation and maintenance to fully understand the  Danger,  Warning, and  Caution procedures by which hazards are to be avoided.

Models

FA, FAB, SA, WA, WAB

Twin City Fan & Blower Catalog 3000 provides additional information on this equipment. This catalog can be found at www.tcf.com or by contacting your local Twin City Fan & Blower sales representative.

Nomenclature



Introduction

DO NOT INSTALL, USE OR OPERATE THIS EQUIPMENT UNTIL THIS MANUAL HAS BEEN READ AND UNDERSTOOD. READ AND SAVE THESE INSTRUCTIONS FOR FUTURE USE.

The purpose of this manual is to aid in the proper installation and operation of fans supplied by Twin City Fan Companies, Ltd. These instructions are intended to supplement good general practices and are not intended to cover detailed instruction procedures because of the wide variety and types of fans manufactured by Twin City Fan Companies, Ltd.

It is the responsibility of the purchaser to assure that the installation and maintenance of this equipment is handled by qualified personnel experienced in such work and equipment.

Contact your local representative should you need further information.

Shipment and Receiving

Prior to shipment, all fans have been thoroughly inspected and tested.

All equipment shipped from Twin City Fan Companies, Ltd. is boxed or crated to fully comply with trucking requirements. Inspect all shipments carefully for damage. THE RECEIVER MUST NOTE ANY DAMAGE ON THE CARRIER'S BILL OF LADING AND FILE A CLAIM IMMEDIATELY WITH THE FREIGHT COMPANY IN THE CASE OF ANY DAMAGE. Keep a record of all equipment received including inspection details and date of receipt due to the possibility of partial shipments.

If you receive damaged goods, contact your sales or factory representative for repair or replacement service.

Handling

Handle your equipment with caution. Some fans are provided with lifting lugs or holes for easy handling. Others must be handled using nylon straps which protect the fan's coating and housing. Spreader bars should be used when lifting large parts.

Fans should be lifted by using straps around the fan housing only. DO NOT LIFT FANS BY THE MOTOR, MOTOR BASE, PROP OR FAN WHEEL.

Roof ventilators should be lifted by using straps around the fan housing or base only.

Storage

If fans are stored for any length of time, they should be stored in a clean, dry location to prevent rust and corrosion. Outdoor storage is not recommended. When outdoor storage is necessary, fans should be protected from the elements as completely as possible. Cover fan inlets and outlets and keep motors dry and clean.

For extended storage (more than 3 months) motor shafts and bearings should be rotated monthly. If stored longer than 6 months, bearing grease in the motor and fan should be purged and replaced with compatible grease. Re-check belts for proper tension. Storage records should be kept to assure proper maintenance. The factory can advise warranty centers to provide motor and bearing service if needed.


Installation


Roof ventilators should always be mounted to a flat, level, solid and rigid structure. Particular caution should be exercised when installing fans on metal buildings. Be sure wall or roof is capable of supporting the fan(s). Fans mounted on walls or roofs and not supported correctly will cause vibration that could cause damage or injury.

Fans mounted off ground level should be rigidly mounted to a structural platform and be placed over or as near as possible to a solid wall or column.

Support for suspended fans must be cross-braced for live load support to prevent side sway.

Use guy wires to help secure roof units if excessively windy conditions prevail.

1. 
CAUTION
 This fan contains rotating parts and requires electrical service. Appropriate safety precautions should be taken during installation, operation and maintenance.


2. 
WARNING
 Do not install or operate this fan in an environment or atmosphere where combustible or flammable materials, gases or fumes are present unless it was specifically designed and manufactured for use in that environment. Explosion or fire can result. Explosive, corrosive, high temperature, or other extreme conditions may require special construction, inspection and maintenance. It is necessary to observe the fan manufacturer's recommendations and limitations concerning the type of material to be handled by the fan and its application to special conditions.

3. When the roof ventilator is designed to be mounted on a curb, the curb should be securely installed prior to fan installation.

Table 1. Utilization Voltages


SYSTEM VOLTAGE/ UNIT NAMEPLATE	UTILIZATION VOLTAGE	
	MIN.	MAX.
115/60/1	104	127
208-230/60/1 or 208- 230/60/3	187	253
230/60/1 or 230/60/3	207	253
277/60/1	249	305
200/60/3	180	220
380/60/3	342	418
460/60/3	414	506
575/60/3	517	633
110/50/1	99	121
220/50/1	198	242
380-415/50/3	342	456
440/50/3	396	484

4. A damper, if used, should be securely mounted within the curb or wall in a manner which allows free and unobstructed operation.

5. 
WARNING
 All electrical work must be done in accordance with local and/or national electrical codes as applicable. If you are unfamiliar with methods of installing electrical wiring, secure the services of a qualified electrician.

6. 
WARNING
 This product must be grounded.

7. 
DANGER
 Make sure power is turned off and locked in the OFF position at the service entrance before installing, wiring or servicing the fan.

8.  **CAUTION**

Before wiring the motor, check the supply voltage against the motor nameplate voltage.

High or low voltage can damage the motor and void the motor warranty. See Table 1 on page 2.

9. On three-phase units check and calculate phase unbalance as follows:

$$\% \text{ Voltage Unbalance} = 100 \times \frac{\text{max. voltage deviation from avg. voltage}}{\text{avg. voltage}}$$

How To Use The Formula:

With voltages of 220, 216 and 213


a. Avg. Voltage = $220 + 216 + 213 = 649 \div 3 = 216$

b. Max. Voltage Deviation From Avg. Voltage = $220 - 216 = 4$

c. % Voltage Unbalance = $100 \times (4 \div 216) = 1.8\%$
Voltage unbalance should not exceed 2%.

10.  **WARNING**


Be sure to keep all wiring clear of rotating or moving parts.

11.  **WARNING**

Before starting the fan, turn the wheel to assure it rotates freely. If needed, adjust the wheel/shaft/bearing/motor position as required to achieve necessary clearances.

12. On belt driven units, assure belts are tensioned and aligned properly. See Maintenance section.
13. Check all setscrews and keys. Tighten as necessary prior to fan startup.
14. On roof units, anchor the fan securely to the curb. Anchoring through the vertical portion of the curb cap flange is recommended. Use a minimum of four lag bolts or other suitable fasteners.
15. As with most installations of rotating machinery, due to the nature of their applications, most fans are available with protective guards and/or other devices for required operating safety. Before operating the unit in any of its applications, determine requirements for any guards and/or devices needed for protection against accidental contact with moving parts or against injury to nearby personnel or equipment due to accidental rupture of fast moving parts.

Check, Test and Start Procedure

1.  **WARNING**


Electric shock hazard. Could cause severe injury or death. Failure to bond the frame of this equipment to the building electrical ground by use of the grounding terminal provided or other acceptable means may result in electrical shock. Disconnect electric power before servicing equipment. Make sure power is turned off and locked in the OFF position.

2. Tighten all bolts and setscrews securely and, on belt driven fans, check sheave alignment and belt tension. Tighten belts if necessary. **NOTE THAT ALL BOLTS, SETSCREWS AND BELTS SHOULD BE CHECKED AND TIGHTENED AFTER TWO DAYS OF INITIAL OPERATION.**

3. Clearance should be checked all around between wheel or propeller tips and the housing before starting up. The wheel or propeller should not strike the housing.


No initial lubrication is required. Motors and fan bearings have been prelubricated by the motor manufacturer.

4. Apply power to the unit and check the rotation of the wheel with the directional arrow on the unit.

 **WARNING**

Especially check three-phase units for rotation. For three-phase, rotation can be changed by interchanging any two of the three line leads. If the unit is checked on temporary wiring, it should be rechecked when permanently installed. Motor burn-out or tripped overload protection devices are usually the result of wrong rotation.

5. **Electrical Input Check:** Perform check of fan ampere draw and verify that motor nameplate amps are not exceeded. Take account of the service factor range if motor is nameplated above a 1.0 service factor.
6. **Fan RPM Check:** Fan RPM should be checked and verified with a tachometer. Refer to Table 2 on page 4 for maximum fan RPM values.

 **NOTICE**

The fan should not need balancing, as it was balanced at the factory to be within stringent vibration levels before shipment. However, there are several things that may cause vibration such as rough handling in shipment and erection, weak foundations and alignments.

Table 2. Maximum Fan RPM (Belt Driven Units)

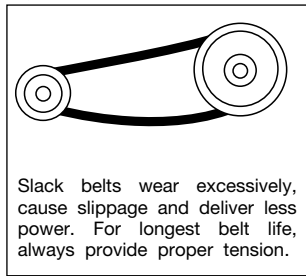
MODEL FAB		MOTOR HP	MAXIMUM FAN RPM	MODEL WAB		MOTOR HP	MAXIMUM FAN RPM
12FA	1B, 2B, 3B	1/4	1676	14WA	1B, 2B, 3B	1/4	1420
	4B	1/3	1844		4B	1/3	1560
	5B	1/2	2112		5B	1/2	1786
14FA	1B, 2B, 3B	1/4	1468	18WA	1B, 2B	1/4	898
	4B	1/3	1616		3B	1/3	988
	5B	1/2	1850		4B	1/2	1131
18FA	1B, 2B	1/4	905	24WA	1B, 2B	1/4	559
	3B	1/3	993		3B	1/3	615
	4B	1/2	1140		4B	1/2	704
24FA	1B, 2B	1/4	568		5B	3/4	806
	3B	1/3	625	6B	1	887	
	4B	1/2	716	30WA	1B	1/3	434
	5B	3/4	819		2B	1/2	497
	6B	1	902		3B	3/4	569
30FA	1B	1/3	436		4B	1	627
	2B	1/2	500	5B	1 1/2	717	
	3B	3/4	572	6B	2	790	
	4B	1	630	36WA	1B	1/2	363
	5B	1 1/2	721		2B	3/4	416
6B	2	793	3B		1	458	
36FA	1B	1/2	369		4B	1 1/2	524
	2B	3/4	422		5B	2	577
	3B	1	464	6B	3	660	
	4B	1 1/2	532	7B	5	782	
	5B	2	585	40WA	1B	1/2	312
6B	3	670	2B		3/4	357	
40FA	1B	1/2	320		3B	1	393
	2B	3/4	366		4B	1 1/2	450
	3B	1	403		5B	2	495
	4B	1 1/2	461	6B	3	567	
	5B	2	508	7B	5	672	
	6B	3	581	8B	7 1/2	763	
	7B	5	689				

V-Belts

V-belts on these belt driven fans are oil, heat, and static resistant type and oversized for continuous duty. With proper installation and maintenance, years of operating efficiency can be added to the lifespan of the V-belt drive.

The condition of the V-belts and the amount of belt tension should be checked prior to startup (see Figure 1). When it becomes necessary to adjust belt tension, do not over-tension as bearing damage will occur. Recommended belt tension should permit 1/64" deflection per inch of the span of the belt at the center of the belt span. To find this point, measure halfway between the pulley centerlines as shown in Figure 2. Extreme care must be exercised

Figure 1. Eliminate Slack



when adjusting V-belts as not to misalign the pulleys. Any misalignment will cause a sharp reduction in belt life and will also produce squeaky, annoying noises (see Figure 3). On units equipped with 2 or 3 groove pulleys, adjustments must be made so that there is equal tension on all belts (see Figure 4).

Figure 2. Belt Deflection

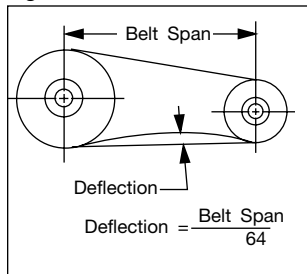


Figure 3. Alignment

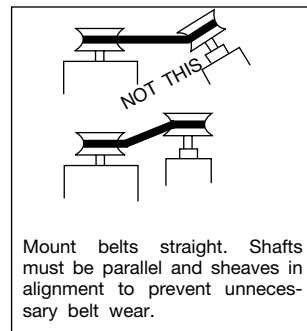


Figure 4. Two-Groove Sheaves

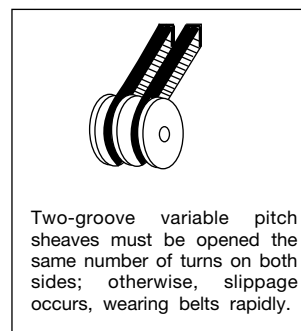
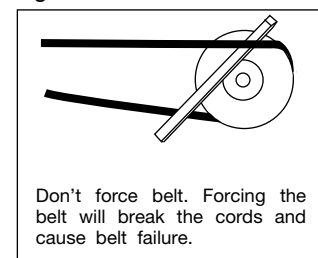


Figure 5. Belts



1. Where tensioning rods are not provided, adjustment is more easily obtained by loosening and adjusting one side of the motor bracket at a time.
2. Always loosen tension adjustment enough to place belts on sheaves without running belts over the edge of either sheave. A new belt may be seriously damaged internally by careless handling (see Figure 5).

WARNING

When removing or installing belts, never force belts over pulleys without loosening the motor first to relieve belt tension.

The fan has been checked for mechanical noises at the factory prior to shipment. If mechanical noise should develop, some suggestions are offered here as a guide toward remedying the cause.

1. Check rotating members for adequate clearance.
2. Check proper belt tension and pulley alignment.
3. Check installation and anchoring.
4. Check fan bearings.

Maintenance

1.

WARNING

Before performing any maintenance on the fan, be sure power is turned off and locked in the OFF position at the service entrance.

 2. Ventilators should be carefully checked at least once a year. For critical or rugged applications, a routine check every two or three months is suggested.
 3. All motors supplied with Twin City Fan & Blower ventilators carry a one-year warranty from date of shipment. For repairs within the warranty period, the motor must be taken to the motor manufacturer's authorized service dealer. Contact your representative for additional warranty details.
 4. A periodic motor check should consist of spinning the motor shaft with the power off to be sure the motor turns freely and the bearings run smoothly. The belt on belt driven units should be removed from the motor sheave.
 5. When removing or installing a belt, do not force the belt over the sheave. Loosen the motor mount so that the belt can be easily slipped over the sheave.
 6. The belt on belt driven units should be removed and carefully checked for glazing, cracks, ply separation or irregular wear. A small irregularity in the contact surface of the belt will result in noisy operation. If any of these defects are apparent, the belt should be replaced. Check the sheaves also for chipping, dents or rough surfaces which could damage the belt.
 7. The correct belt tension is important. Too tight a belt will result in excess bearing pressure on the motor bearings and shaft pillow blocks and may also overload the motor. Too loose a belt will result in slippage which will quickly "burn" out belts. A belt should feel "live" when thumped, approximately 1/4" belt deflection (3 to 5 lb.) when subject to finger pressure at midpoint between sheaves.
 8. The belt alignment should also be checked to be sure the belt is running perpendicularly to the rotating shafts. Motor and drive shafts must be parallel. Improper alignment will result in excessive belt wear.

9. Check sheave setscrews to ensure tightness. Proper keys must be in keyways.
10. Do not readjust fan RPM. If sheaves are replaced, use only sheaves of identical size and type.
11. If the unit is to be left idle for an extended period, it is recommended that the belts be removed and stored in a cool, dry place to avoid premature belt failure.
12. The standard pillow block bearings on belt driven ventilators are factory lubricated and are provided with external grease fittings. Relubrication annually or more frequently is recommended. See Table 3.

Do not over-grease. Use only 1 or 2 shots of recommended lubricant with a hand gun in most cases. See Table 4. The maximum hand gun rating is 40 P.S.I. Rotate bearings during lubrication where good safety practice permits.

CAUTION

Greases of different soap bases (lithium, sodium, etc.) may not be compatible when mixed. Prevent such intermixing by completely purging the bearing of old greases.

The most frequent causes of bearing failure are not greasing often enough, using an excessive quantity of grease, or using incompatible greases. Excessive vibration, especially if the bearing is not rotating, will also cause bearings to fail. Bearings must also be protected from water and moisture to avoid internal corrosion.

13. During the first few months of operation it is recommended that the setscrews be checked periodically to assure they are tight.
14. The rotating wheel requires particular attention since materials in the air being handled can build up on the blades to cause destructive vibration or weaken the structure of the wheel by corroding and/or eroding the blade metal. Regular inspection and corrective action at intervals determined by the severity of each application are essential to good service life and safety.

Table 3. Suggested Fan Bearing Greasing Intervals

INTERVAL (MONTHS)	TYPE OF SERVICE
12 to 18	Infrequent operation or light duty in clean atmosphere.
6 to 12	8 to 16 hrs./day in clean, relatively dry atmosphere.
3 to 6	12 to 24 hrs./day, heavy duty, or if moisture is present.
1 to 3	Heavy duty in dirty, dusty locations; high ambient temps; moisture laden atmosphere; vibration.

Table 4. Grease Manufacturers

MANUFACTURER	GREASE (NLGI #2)
Shell	Gadus S2 V100 2
Exxon/Mobil	Ronex MP

Bearing Replacement

Fan bearings on belt driven fans should not need to be replaced for many years if the previous recommendations are strictly adhered to. However, use the following procedure when bearing replacement is necessary.

1. Gain access to the fan bearings. Remove the bearing cover, if any.
2. Loosen the belts by shifting the motor.
3. Remove the propeller or wheel and disconnect the remote lube lines (if applicable).
4. Measure the location of the bearing to the propeller or wheel end of the shaft and the bearing spacing.
5. Remove the shaft and bearing assembly. Note the position of the bearings' shims (if applicable).
6. Loosen all bearing/shaft setscrews or other locking devices.
7. Remove bearings (may have to be pressed off the shaft).
8. Polish the shaft with fine emery paper (240 grit or finer) and file the setscrew dimples left on the shaft flat.
9. Install new bearings on the shaft, making sure that the collars are together (i.e. facing each other on the shaft). Lightly seat one setscrew or eccentric locking collar on each bearing to hold in the approximate marked position.
10. Mount the shaft/bearing assembly in the fan with bolts. Do not tighten yet. Just snug up. Loosen the setscrew.
11. Center the shaft in the housing (both ends) as closely as possible. (The fan propeller or wheel may need to be temporarily installed to get its clearances equal.)
12. Tighten the bearing mounting bolts.
13. Reinstall the lube lines (if applicable).
14. Install bearing cover, propeller and belts and adjust the motor to get proper belt tension. Also, make sure that the sheaves are properly aligned.
15. If a new shaft is supplied, ignore items #6 through #8.

Motors

Twin City Fan & Blower recommends periodic checks of voltage, frequency and current of a motor while in operation. Such checks assure the correctness of frequency and voltage applied to the motor, and yield an indication of the fan load. Comparison of this data with previous data will give an indication of the fan performance. Any serious deviations could indicate a potential motor failure.

All motors have prelubricated sealed bearings and are lubricated for the life of the motor.

1. All motors carry a one-year warranty from date of shipment. For repairs within the warranty period, the motor must be taken to the motor manufacturer's authorized service dealer. Contact your representative for additional warranty details.

2. A periodic motor check should consist of spinning the motor shaft with the power off to be sure the motor turns freely and the bearings run smoothly. The belt on belt driven units should be removed from the motor pulley.

Repair or replacement of motors is normally performed by a repair station authorized by the manufacturer. Contact your representative or the factory for locations nearest you. DO NOT ship motor to the factory without specific authorization forms.

Fan Troubleshooting Chart

PROBLEM	POSSIBLE CAUSES
EXCESSIVE VIBRATION	<ol style="list-style-type: none"> 1. Wheel or sheaves loose on shaft. 2. Belts too loose or too tight. 3. Out of balance wheel. 4. Excessive buildup of dirt/dust on wheel. 5. Bent shaft. 6. Weak mounting base for fan. 7. Fan mounting bolts loose. 8. Loose or worn bearings. 9. Bearing or drive misalignment. 10. Mismatched belts. 11. Structures not cross-braced (wall fans). 12. Curb not flat and level.
EXCESSIVE HORSEPOWER	<ol style="list-style-type: none"> 1. Wheel rotating in wrong direction. 2. Fan speed higher than design. 3. Wheel rubbing on inlet venturi. 4. Worn fan bearings.
TOO LITTLE AIR	<ol style="list-style-type: none"> 1. Restricted fan inlet or outlet. 2. Wheel rotating in wrong direction. 3. System is more restrictive (more static pressure) than expected. 4. Fan speed lower than design. 5. Inlet or outlet screens clogged. 6. Dampers or shutters not opening.
TOO MUCH AIR	<ol style="list-style-type: none"> 1. Fan speed higher than design. 2. System is less restrictive (less static pressure) than expected.
FAN DOES NOT OPERATE	<ol style="list-style-type: none"> 1. Wrong voltage. 2. Electricity turned off or not wired properly. 3. Loose pulleys. 4. Blown fuses. 5. Tripped overload protector. 6. Broken belts.
EXCESSIVE NOISE	<ol style="list-style-type: none"> 1. Wheel or sheaves loose. 2. Bearing or drive misalignment. 3. Accumulation of material on wheel. 4. Worn or corroded wheel. 5. Wheel out of balance. 6. Wheel hitting housing. 7. Bent shaft. 8. Bearings need lubrication. 9. Loose bearing bolts. 10. Loose or worn bearings. 11. Mismatched belts. 12. Belts too loose or too tight. 13. Belts oily or dirty. 14. Belts worn. 15. Loose fan mounting bolts. 16. Rattle of components in high velocity airstream. 17. Electrical noise. 18. Noise from high velocity air system. 19. Vibrating parts not isolated from building. 20. Vibrating ductwork.

It is recommended that the users and installers of this shipment familiarize themselves with AMCA Publication #201, "Fans and Systems" and publication #202, "Troubleshooting" which are published by Air Movement and Control Association, 30 West University Drive, Arlington Heights, Illinois 60004.

Limitation of Warranties and Claims

Seller warrants to the original purchaser that the goods sold hereunder shall be free from defects in workmanship and material under normal use and service (except in those cases where the materials are supplied by the buyer) for a period of one year from the date of original installation or eighteen (18) months from the date of shipment, whichever occurs first. The liability of seller under this warranty is limited to replacing, repairing, or issuing credit (at cost, F.O.B. factory and at seller's discretion) for any part or parts which are returned by buyer during such period provided that:

- a. seller is notified in writing within ten (10) days following discovery of such defects by buyer, or within ten (10) days after such defects should reasonably have been discovered, whichever is less;
- b. the defective unit is returned to seller, transportation charges prepaid by buyer.
- c. payment in full has been received by seller or said products; and
- d. seller's examination of such unit shall disclose to its satisfaction that such defects have not been caused by misuse, neglect, improper installation, repair, alteration, act of God, or accident.

No warranty made hereunder shall extend to any seller product whose serial number is altered, effaced or removed. Seller makes no warranty, express or implied, with respect to motors, switches, controls, or other components of seller's product, where such components are warranted separately by their respective manufacturers. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHETHER STATUTORY OR OTHERWISE, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. In no event shall seller be liable to buyer for indirect, incidental collateral, or consequential damages of any kind. (BUYER'S FAILURE TO PAY THE FULL AMOUNT DUE WITHIN SIXTY (60) DAYS OF DATE OF INVOICE SHALL OPERATE TO RELEASE SELLER FROM ANY AND ALL LIABILITY OR OBLIGATION ARISING PURSUANT TO ANY WARRANTY, EXPRESS OR IMPLIED, WHETHER STATUTORY OR OTHERWISE, INCLUDING ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, MADE IN CONNECTION WITH ANY CONTRACT FORMED HEREUNDER. BUYER AGREES THAT SUCH FAILURE TO PAY SHALL CONSTITUTE A VOLUNTARY WAIVER OF ANY AND ALL SUCH WARRANTIES ARISING PURSUANT TO SUCH CONTACT.)



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