



# BIOCLIMATIC

DEEP BED AIR SCRUBBER

MODEL DBAS, TAS

INSTALLATION, OPERATION

&

MAINTENANCE

MANUAL

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## 1 INTRODUCTION

### 1.1 Disclaimer

These instructions are provided under the following conditions:

- 1.1.1 This manual is to guide the user of Bioclimatic equipment in the proper installation, operation and maintenance procedures to insure maximum equipment life with efficient operation.
- 1.1.2 The customer has assigned competent maintenance and operating personnel to the system described herein and will assume operational and maintenance responsibility upon start-up of the system.
- 1.1.3 The customer will read and thoroughly examine the foregoing instructions and will notify the seller of any points not fully understood, points of conflict or error.
- 1.1.4 The customer, in lieu of any notification to the contrary, has read and fully understands the operation of the System and is aware of the hazards of corrosion, abrasion and fire or explosion and shall take the necessary steps in the operation of equipment to control such hazards to the maximum extent possible.
- 1.1.5 Start-up assistance or field engineering service provided by Bioclimatic, or its authorized representative, shall in no way relieve the customer of responsibility for the proper operation of the System.

**IMPORTANT: Any modifications to the unit by unauthorized personnel will void factory warranty. The unit must be installed in accordance with the manufacturer's instructions to preserve warranty.**

### 1.2 Receiving

Products leaving the Bioclimatic factory are inspected and in satisfactory operating condition. All equipment should be thoroughly inspected when received. Although all units are firmly secured and palletized, rough handling in transit can cause breakage. Any shortage or damage should be reported at once to the transportation company. Note the damage on the bill of lading before signing for the shipment. **No equipment may be returned to Bioclimatic without written authorization.**

All products are shipped F.O.B. (EX Works) Bioclimatic warehouse. Responsibility for all equipment passes to the Buyer at the time equipment is loaded onto the carrier's truck.

### 1.3 Handling

All equipment must be handled with extreme care. The unit is shipped on wooden skids to facilitate equipment movement by lift truck without damage. Wooden skids must be

removed once the equipment is in its final location. When indicated on submittal drawings, lifting lugs are provided to permit lifting by crane.

Handle equipment with care when removing the skid or moving equipment to prevent damage to special paints and surface coating. A small chip in the paint or coating will break the continuity of the surface treatment and destroy its protective value. Always touch-up scratched surfaces prior to installation and start-up.

#### 1.4 Storage

When storing equipment, care must be taken to protect bearings, shafts, electrical connections, leads and finished surfaces from moisture, and contamination. Do not store unit outdoors. Do not store any other material on top of equipment. Periodic inspections of the equipment should be made until it is ready to be put into service. Remove all filters from equipment when storing.

**NOTE: If equipment is not installed upon delivery, it must be stored in a weather protected area.**

#### 1.5 Warranty

THE SELLER WARRANTS THE EQUIPMENT AGAINST DEFECTIVE WORKMANSHIP AND MATERIAL FOR ONE (1) YEAR FROM DATE OF FACTORY SHIPMENT OR 15 MONTHS FROM COMMISSIONING, WHICHEVER OCCURS FIRST. IN THE FULFILLMENT OF ITS WARRANTY, THE SOLE OBLIGATION OF SELLER SHALL BE TO REPAIR OR REPLACE, AT ITS OPTION, F.O.B. ITS FACTORY, ANY PART OR PARTS WHICH ARE RETURNED F.O.B. ITS FACTORY, SHIPPING CHARGES PREPAID, AND WHICH AFTER INSPECTION BY SELLER ARE FOUND TO BE DEFECTIVE. BUYER SHALL NOTIFY SELLER OF DEFECT IN WRITING, PROMPTLY UPON DISCOVERY AND WITHIN THE WARRANTY PERIOD. THIS WARRANTY DOES NOT COVER DEFECTS CAUSED BY CORROSION OR NORMAL DETERIORATION; IT DOES NOT EXTEND TO CONSEQUENTIAL DAMAGE, LOSS OR DELAY ASSOCIATED WITH A WARRANTY DEFECT; AND IT DOES NOT COVER ANY COST OF LABOR, TRAVEL, OR OTHER EXPENSE ASSOCIATED WITH THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS. SELLER ASSUMES NO LIABILITY FOR PRODUCT LOSS OR OTHER CLAIMS WHATSOEVER ARISING OUT OF THE USE OR APPLICATION OF THE EQUIPMENT IN ANY OPERATIONS, WHETHER THE MACHINE IS USED ALONE OR IN CONJOINT USE WITH OTHER EQUIPMENT OR PROCESSES. NOTWITHSTANDING THE FOREGOING, SELLER'S WARRANTY OBLIGATIONS WITH RESPECT TO ANY ITEMS NOT MANUFACTURED BY SELLER SHALL NOT EXCEED THE OBLIGATIONS UNDERTAKEN BY THE MANUFACTURER THEREOF UNDER EXPRESS WARRANTY TO THE SELLER. THIS EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OF FITNESS OF THE MACHINE FOR ANY PARTICULAR PURPOSE.

THERE ARE NO OTHER REPRESENTATIONS, WARRANTY OF CONDITION IN ANY RESPECTS EITHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONTRACT OR TORT, OTHER THAN WHAT IS STATED ABOVE.

THE SELLER SHALL NOT BE HELD LIABLE IN ANY WAY FOR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED.

THIS WARRANTY WILL NOT APPLY IF THE SELLER'S EQUIPMENT HAS BEEN DAMAGED DUE TO IMPROPER INSTALLATION, ALTERATION, ABUSE OR MISUSE, ACCIDENT, FIRE, FLOOD OR ACT OF GOD. FURTHER, THIS WARRANTY WILL NOT APPLY IF REPAIRS, REPLACEMENTS, OR ALTERATIONS ARE MADE BY OTHERS WITHOUT THE SELLER'S PRIOR WRITTEN AUTHORIZATION.

IN THE EVENT THE STATE IN WHICH THE EQUIPMENT IS INSTALLED DOES NOT PERMIT THE LIMITATION OR EXCLUSION OF IMPLIED WARRANTIES OR CONDITIONS UNDER GIVEN CIRCUMSTANCES, THE PROVISIONS OF THIS WRITTEN WARRANTY ARE IN ADDITION TO AND NOT A MODIFICATION OF THE STATUTORY WARRANTIES AND OTHER RIGHTS AND REMEDIES PROVIDED BY SUCH LAWS.

**NOTE:**

“ANY MODIFICATION TO ORIGINAL EQUIPMENT BY ANY COMPANY OR PERSON OTHER THAN THE MANUFACTURER WILL SERVE TO CANCEL AND VOID ALL OF THE SELLER'S LIABILITY UNDER THE MANUFACTURER'S WARRANTY. ENCLOSURES CONTAINING ELECTRONIC COMPONENTS ARE NORMALLY SEALED BY THE MANUFACTURER TO PREVENT UNAUTHORIZED TAMPERING OR ADJUSTMENTS. ONLY AUTHORIZED SERVICE PROVIDES MAY BREAK SEALS TO COMPLETE CALIBRATION OR TO TROUBLE SHOOT THE UNIT. UNAUTHORIZED TAMPERING OR BREAKING SEALS WILL RELEASE THE SELLER FROM ANY FUTURE LIABILITY UNDER THE WARRANTY”.

## 2 INSTALLATION

### 2.1 Initial Setup

After receiving the DBAS, remove the packaging materials. Open the hinged access doors and remove the filters. If provided, remove the wooden skid bolted to the base of the unit and inspect all parts for damage including the interior portions of the media holding cells. If any parts are damaged contact shipping company to file claim for damaged equipment.

Select a location for the unit where adequate service clearance is provided for removing the filters from the unit. The access door must be able to swing open 90 degrees for service. Ample clearance should also be provided to access the motor starter/disconnect. (This may be provided by others).

### 2.2 Electrical Connections

An electrical wiring diagram is included with these instructions. 230/460 volt, 3 phase systems require a motor starter and disconnect. Refer to the wiring diagram for proper wiring connections. Check for proper motor rotation before operating the unit. All external wiring must be in accordance with National and Local Electrical Codes. Pay particular attention to proper grounding of the unit.

### 2.3 Filter Installation

When installing filters, refer to the filter label located on the inside of the access door. This label itemizes all filters in the unit and their arrangement. Check the filter gaskets and seals to make sure that there is no air bypass.

**NOTE: Make sure that airflow arrow on the filter points in the direction of airflow through the unit.**

### 2.4 Media Holding Cells

Fill the media holding cells as follows:

**NOTE: Gloves and a dust mask should be worn when handling media. See MSDS sheet for proper handling requirements.**

- 2.4.1 Remove the access panel(s) from fill ports on top of the unit.
- 2.4.2 Inspect the interior of the cell to be certain it is empty.
- 2.4.3 Close and secure vacuum discharge ports or slide gates.
- 2.4.4 Select the correct media type and load the cell to within 1 to 2 in. of the top.
- 2.4.5 Fill the remaining cells as above.
- 2.4.6 Replace the access panel(s).

After 48 to 72 hours of operation, open media access panels and check media level for settlement. Media level must be 6 in. above screens to prevent bypass. Add media as required.

**NOTE: Unit should not be operated without filters and media in place because the lack of adequate resistance will cause the motor to draw excessive current and consequently burn out.**

3 PHYSICAL DESCRIPTION

3.1 Principle of Operation

The DBAS System is designed for filtration of environmental air so as to control particulate and gaseous contaminants for new or retrofit applications. Please refer to the filter arrangement drawings for proper filter location. The filter stage designation refers to the installation sequence in the direction of airflow.

3.2 Prefilter/Media Postfilter

Prefilters are 2 in. or 4 in. deep, disposable type, using preformed pleated design with reinforced fabric media. Filters have a rated average efficiency of not less than 30% by ASHRAE Standard 52.2 test method, using atmospheric dust. Filters are listed Class 2 by Underwriters' Laboratories.

3.3 Primary Filter

There are different types of primary particulate filters available in different efficiency ratings. The available space in the filter section will determine the filter type.

<u>Filter Type</u>	<u>Efficiency</u>
Bag Filter to 21" Deep	60%, 80%, 90%
Lofted Media Filters	60%, 80%, 90%
Ultrafine Glass with Aluminum Separators	60%, 80%, 90%
Ultrafine Glass in Minipleat Configuration	60%, 80%, 90%
HEPA, HEPA Type	99.97%, 95% DOP

3.4 Gas Phase Filtration

One or more media cells from 6 in. to 24 in. in depth are provided to hold the preferred gas filter media for the application. The media cell is designed with a vacuum port(s) or slide gate to permit easy removal of the filter media.

A blank space above the media screens is provided to accommodate extra gas filter media in the event of media settlement to prevent air bypass. Refer to the included Material Safety Data Sheets for more information on the media that was supplied with your unit.

4 SYSTEM START-UP

4.1 General

Before starting the System, a complete inspection should be made to ensure that all the equipment is installed for safe and proper operation. It is particularly important that the system is free of all foreign objects. Be sure that all access doors are securely closed.

4.2 Inspection Check List

FILTERS		PANELS	
Complete filter installation	_____	Insulation intact	_____
Surface continuity between adjacent filters and seal surfaces.	_____	Fasteners secure	_____
Wipe interior section clean	_____	Gaskets intact	_____
		Doors properly aligned & adjusted	_____

4.3 Outside Air Ductwork

This unit is designed to pressurize the space being controlled with outside air. Thus, it is necessary to duct this unit to an external air source. The unit will not properly pressurize the room if external ductwork is not connected to the outside air intake on the unit. **Make sure to make this ductwork connection before powering up the unit.**

4.4 Electrical Connection and Power Up

Provide electrical connection to the system. All external wiring must be in accordance with National and Local Electrical Codes. Pay particular attention to proper grounding of the system. Remove the retaining bolts from the vibration isolators on the blower assembly. After checking that all filters are in place, input electrical power is correct, and all electrical connections are as per the National and Local codes, energize the unit. Check motor for proper rotation. The current being supplied to the unit should be checked after powering up the unit. It should not exceed the full load amperage.

5 OPERATION & MAINTENANCE OF UNIT

5.1 General

The initial set of particulate filters is included and shipped with the unit. The gas phase filtration media is shipped in 1 cu.ft. (28.3 liter) sealed containers. Once all the duct work is installed, and just before starting up the system, the unit should be filled with the gas phase filtration media using the procedure in section 2.3. The gas phase filtration media is supplied by Bioclimatic and installed by others.

## 5.2 Damper Adjustment

The outside air damper included with this unit can be manually adjusted to regulate the flow of pressurization air. The damper assembly should be inspected periodically to ensure that the proper pressurization flow is being provided. In some cases, electrically or pneumatically operated dampers are provided. Units with redundant blowers include gravity backdraft dampers. Quarterly inspect all dampers for proper operation.

## 5.3 Filter Maintenance

### 5.3.1 Fibrous Filters

Changing dirty filters must be performed periodically. Filter change out intervals will depend on local conditions and can be determined only by inspection of the filter gauges and the filters. Check filters and gauges weekly until the maintenance interval is established. When the interval is determined, establish a filter replacement program. The medium efficiency filter immediately following the media cells may require replacement following gas filter media changeout. Check the differential pressure gauge. On a scheduled basis, it is recommended that the media post filter be changed 24 to 72 hours following media changeout.

It is important to use high quality filters with the same specifications as those provided with the unit. The filter label affixed on the inside of the access door lists the part number of the filters supplied with the unit. Refer to the unit specifications to determine the proper replacement filters.

### 5.3.2 Gas Filtration Media

5.3.2.1 The life of the media will vary depending on the contaminants present and their concentration. A predetermined schedule for media change-out is NOT recommended since it may result in establishing an incorrect maintenance schedule. In order to obtain the maximum operating time from the gas filtration media, Bioclimatic offers a Laboratory Service to inform the customer of the remaining media life and the correct time to change the media.

#### 5.3.2.2 Special Precautions for Handling Gas Filtration Media

##### 5.3.2.2.1 Inhalation

A well ventilated work area is suggested for changing the media, since dusting from fresh pellets and granules results due to handling abrasion. In closed unventilated spaces, dust masks, such as the 3M No. 8500 are strongly recommended. Avoid direct inhalation of media dust. Refer to Material Safety Data Sheets.

##### 5.3.2.2.2 Water

DO NOT expose the Gas Filtration Media pellets to water or moisture since this will cause leaching of permanganate or other impregnate. Exposure of permanganate solution to the skin will stain but will not burn or blister. The staining condition is temporary. This staining may be neutralized by washing in a solution of sodium bisulfide.

#### 5.3.2.2.3 Eye Contact

If the event that eyes or other sensitive areas are exposed to media dust, flush thoroughly with water and seek treatment from a physician, for exposure to abrasive dusts. Refer to Material Safety Data Sheets.

#### 5.3.2.3 Laboratory Service (Media Life Analysis)

Laboratory Service is a support system offered to our customers, free of charge. This service will ensure timely media change out for cost effective and efficient system operation.

##### Media Sampling Procedure

- 5.3.2.3.1 Open test port and insert sample tube into media bed to a depth of at least 36 in. Take two samples from each bed.
- 5.3.2.3.2 In the event test ports are not provided, take samples by removing the access panel on top of the media cell. Push aside excess media so that the media level is within 3 in. of screen. Draw an imaginary line parallel to the airflow in the central portion of the media bed. Take media samples as described in 5.3.2.2.1 above at 6 in. intervals. Replace media.
- 5.3.2.3.3 Place samples of media into a clean container.
- 5.3.2.3.4 Mix contents thoroughly.
- 5.3.2.3.5 Fill a plastic lined sample bag from the prepared media sample at least 2/3 full. Label bag. Close sample ports or access panel. Obtain sample bags from Bioclimatic.
- 5.3.2.3.6 Enter the date on the media sampling label located on the inside of the housing door.
- 5.3.2.3.7 Label the sample bag and ship to:  
Bioclimatic Air Systems  
600 Delran Parkway, Suite D  
Delran, NJ 08075 USA  
Attn: Laboratory Supervisor

#### 5.3.2.4 Filling the media cells

**NOTE: Please read the included MSDS sheets before filling the media modules. Gloves and a dust mask should be worn when**

**handling media. See MSDS sheet for proper handling requirements.**

Refer to paragraph 2.4 above

After 48 to 72 hours of operation, it may be necessary to "top off" the media cell because of possible media settlement. Media settlement results in air bypass and loss of efficiency.

#### 5.4 Blower Section

##### 5.4.1 Fan Balancing

Fan wheels are balanced by factory and, if undamaged should require no further balancing. Fans have had a running test to check balance.

A fan handling clean air should not need re-balancing once it is balanced. Dust build-up on fan blades or wear can unbalance fan. Periodic inspections of fan should be made to determine amount of dust build-up or wear. Before any attempt is made at balancing, check other causes of vibration or unbalance.

Portable instruments are available indicating vibration displacement in mils (1 mil - 0.001 inches). The following table can be used as a guide to determine when fan is operating with too much vibration.

<u>Fan Speed (RPM)</u>	<u>Smooth</u>	<u>Fair</u>	<u>Rough</u>	<u>Very Rough</u>
600	2 mils	4 mils	8 mils	15 - 20 mils
900	1.5	2.75	6.1	8 - 10
1200	1.0	2.0	4.5	6 - 8
1800	0.75	1.5	3.5	5 - 7

##### 5.4.2 Fan Maintenance

**A definite time schedule** for inspecting all rotating parts and accessories should be established. Frequency of inspection depends on severity of operation and locality. Initially, inspections might be weekly in order to set up a schedule.

5.4.2.1 Make sure there are no obstructions to air flow in outlet or inlet ductwork.

5.4.2.2 Shaft must not be cocked in bearings. Misalignment can cause overheating, wear to dust seals bearing failure and unbalance.

5.4.2.3 Check belt wear, alignment of sheaves and belt tension. Replace all belts when necessary with new belts. New belts will not work

properly in conjunction with used belts due to difference in length. Belts must be free of grease.

- 5.4.2.4 Check fan and motor bearings and add lubricant if necessary. If oil lubrication is used and oil becomes dirty or cloudy, it should be drained and bearing flushed with mineral oil. Drain mineral oil and add new lubricant. If grease is used and it is breaking down into a sludge, flush bearing out and re-grease.
- 5.4.2.5 Check tightness of all bolts and setscrews.
- 5.4.2.6 Inspect wheel blades for accumulations of dust and dirt. Clean thoroughly with steam or water jet compressed air or wire brush. This will help prevent an unbalanced condition. If blades are aluminum, be careful not to damage them. Cover bearings so water will not enter. Wheel should be centered to prevent blades from striking housing. Make sure wheel is rotating in proper direction. Never run fan at a higher speed than it was designed for unless you check with **Bioclimatic** first. Higher speed may be over the critical speed of rotating parts, causing wheel collapse. Also, power required by fan may increase enough to overload and burn out the motor.
- 5.4.2.7 Bearings on high speed fans tend to run hot. Therefore, do not replace a bearing because it feels hot to the touch. Place a Pyrometer or contact thermometer against bearing and check temperature. A ball or roller bearing may attain temperatures of 165° F (74° C) before cause for alarm is necessary.
- 5.4.2.8 Repainting of exterior and interior parts of fans and ductwork will extend service life of the installation. Select paint which will withstand operating temperature. For normal temperature, good machinery paint may be used. If moisture is excessive or if fans are exposed to weather, bitumastic paint is suitable. Corrosive fumes require all internal parts to be wire brushed, scraped clean and repainted with acid resisting paint. Competent advice should be secured when corrosive fumes are present.
- 5.4.2.9 Lubricate Motor Bearings according to manufacturer's recommendations. **DO NOT OVER LUBRICATE.**
- 5.4.2.10 Repair Parts  
If fan wheel is allowed to wear out completely, it may collapse due to weakness of blades or flange. This may severely damage housing, shaft, bearings or even the motor. For these reasons, a close inspection should be made after cleaning and before wear has become a serious problem. Due to details of construction, most

wheels should be returned to the factory for reblading or repairing of any kind.

#### 5.4.2.11 Motors

Maintenance and repair of electric motors is best explained by the manufacturer. Most important features are lubrication, cleaning of commutator and replacement of worn out brushes or bearings. Poor performance is often due to low voltage and an auxiliary transformer may be required. On a noisy fan unit, motor should be disconnected from fan and run separately to ascertain actual source of noise.

### 5.4.3 Belt Drive Maintenance

It is important that alignment of V-belt drive be checked **before installation** of fan.

5.4.3.1 Be sure sheaves are locked in position.

5.4.3.2 Key should be seated firmly in keyway.

5.4.3.3 Place straight edge or taut cord across faces of driving and driven sheaves to check alignment. Motor and fan shafts must be parallel with V-belts at right angles to shafts.

5.4.3.4 Start fan. Check for proper rotation. Run fan at full speed. A slight bow should appear on slack side. Adjust belt tension by adjusting motor on its adjustable base. Depending upon motor frame size, fan motor base may have slotted holes for adjustment.

5.4.3.5 If belts squeak at start-up, they are too loose and should be tightened.

5.4.3.6 When belts have had time to sit in sheave grooves, re-adjust belt tension.

#### 5.4.3.7 Drive Belt Assembly

5.4.3.7.1 Clean motor and fan shafts. Be sure they are free from corrosive material. Clean bore of sheaves and coat with white lead or heavy oil for ease of shaft entry. Remove oil, grease, rust or burrs from sheave grooves.

5.4.3.7.2 Place fan sheave on fan shaft and motor sheave on its shaft. **DO NOT POUND SHEAVES ON FAN SHAFT** as this may damage bearings. Tighten sheaves in place.

5.4.3.7.3 Loosen motor base, adjusting screws so belts can be placed in grooves without forcing. Do not roll belts or use a tool to force belts over grooves.

- 5.4.3.7.4 Align fan and motor shafts so they are parallel. Belts should be right angle to shafts. Straight edge or taut cord placed across faces of sheaves can aid in alignment.
- 5.4.3.7.5 Tighten belts by adjusting motor position. The correct tension will yield the highest drive efficiency. Excessive tension causes undue bearing pressure.
- 5.4.3.7.6 Start fan and run at full speed. Adjust belt tension until only slight bow appears on slack side of belts. If slippage occurs, a squeak will be heard at start-up and can be resolved by tightening the belts.
- 5.4.3.7.7 Give belts a few days running time to become seated in sheave grooves. Adjust belt tension.

If shafts become scratched or marked, carefully remove sharp edges and high spots such as burrs with fine emery cloth or honing stone. Avoid getting emery dust in bearings. Do not apply belt dressing unless it is recommended by drive manufacturer. V-belts are designed for frictional contact between grooves and sides of belts. Dressing will reduce friction. Belt tension on an adjustable pitch drive is obtained by moving the motor - **not by changing the pitch diameter of the adjustable sheave.**

#### 5.4.4 Motor Maintenance & Replacement

After motor has been mounted, aligned and bolted down, connect to a power supply through a disconnect switch, short-circuit protection and suitable motor starter with overload protection. **All motors** should be connected as shown on nameplate. Install all wiring and fusing in accordance with National Electric Code and local requirements. Be sure power supply (voltage, frequency and current carrying capacity of wires) is in accordance with motor nameplate. If grease plugs are inaccessible, motor end frames may be rotated 90° or 180° to afford better access. Main frame may be turned end-for-end to shift conduit box to opposite side. Conduit box may be rotated to one of four 90° positions. Most motors are received with bearings lubricated and require no re-lubrication for some time depending on operating conditions.

**ALWAYS CHECK TO BE SURE MOTOR BEARINGS ARE LUBRICATED BEFORE START-UP.**

##### 5.4.4.1 To Reverse Direction of Rotation

**Three phase motors** - interchange any two line leads. Normal operation of motors results in temperature rises according to motor insulation. The total motor operating temperature includes ambient temperature plus motor temperature rise. The motor rise includes nameplate temperature rise, service factor allowance and hot-spot allowance.

The motor nameplate indicates type of insulation. As the hot-spot allowance is not measurable, the maximum total operating temperature must be reduced.

Class A insulation is then suitable for total measurable temperature of 194° F (90° C) on open motors, 203° F (95° C) on enclosed motors. Class B insulation is suitable for total temperature of 230° F (110° C) on open motors, 239° F (115° C) on enclosed motors. If the motor feels hot, measure its temperature - thermometer against stator windings or by resistance measurement.

<u>Insulation Class</u>	<u>Maximum Total ° Centigrade</u>	<u>Operating Temperature ° Fahrenheit</u>
A	105	221
B	130	266
F	155	311
H	180	356

#### 5.4.4.2 Potential Motor Problem

5.4.4.2.1 Low or high voltage.

5.4.4.2.2 Overload - high temperature - drawing too much current.

5.4.4.2.3 Armature unbalance - vibration and noise.

5.4.4.2.4 Worn bearings - armature rubs against stator.

5.4.4.2.5 Excessive or insufficient lubricant in bearings.

5.4.4.2.6 Commutator brushes on DC motor worn or not seated under proper tension.

5.4.4.2.7 Loose hold down bolts - vibration and noise.

5.4.4.2.8 Dirt in windings - high temperature.

5.4.4.2.9 Low insulation resistance due to moisture - check resistance with a meg ohm meter (“Megger”) or similar instrument employing a 500 Volt DC potential. Resistance should read at least 1 meg ohm. If it is less, remove motor from service, clean and dry windings. A high grade insulation varnish should be applied to the windings before putting back in service.

#### 5.4.5 Lubrication

The most important function of a lubricant is to prevent metal-to-metal contact, or to minimize friction between metal surfaces in motion. Operating conditions do affect the performance of lubricants.

All the bearing units are shipped pre-lubricated with grease chosen for chemical and mechanical stability. The bearings are designed for lubrication by grease - not oil. Periodic re-lubrication of these units should be made with length of intervals between re-lubrication depending on operating **bearing speed** and atmospheric conditions.

Operating and environmental conditions such as temperature and contaminants can and will reduce the life of the lubricant, hence, grease

fittings can be used to re-lubricate at appropriate intervals. Re-lubrication intervals can best be established through experience with the conditions to which the units are exposed. The following table will serve as an initial guide.

**CONDITION** (Bearing loads are less than values at RPM in rating charts.)

<u>Speed</u>	<u>Temperature</u>	<u>Cleanliness</u>	<u>Greasing Intervals</u>
100 RPM	Up to 120° F	Clean	6 to 12 months
500 RPM	Up to 150° F	Clean	2 to 6 months
1000 RPM	Up to 210° F	Clean	2 weeks to 2 months
1500 RPM	Over 210° F	Clean	Weekly
All Speeds	Up to 150 ° F	Dirty	1 weeks to 1 month
All Speeds	over 150° F	Dirty	Daily to 2 weeks
All Speeds	All Temps.	Very dirty, wet or Extreme conditions.	Daily to 1 week

With the shaft rotating, grease should be added slowly until some shows past the metal flinger. Greasing should be done with a low pressure hand gun.

After re-lubrication, additional grease may appear at a flinger due to a light rise in bearing temperature. After surplus grease has moved out of the bearing, the temperature should return to normal.

Quantity of grease for re-lubrication is shown in the chart below.

<u>Shaft Diameter</u>	<u>Grease quantity in Grams</u>
Up to 1 inch	6
1-1/6 to 1-7/16 inch	10
1-1/2 to 1-15/16 inch	14
2 to 2-7/16 inch	20

Greases compatible with the factory fill grease are as follows.

Alvania EP2	Gulf Crown EP2
Alvania R2	Esso Unirex N2

While lubricating the electrical motors, remove both plugs on each end of motor and add grease until fresh grease appears at opposite plug. Run motor for a few minutes to allow excess grease to drain before replacing plugs.

#### 5.4.6 Safety Precautions

Any piece of machinery should be treated with respect and not overconfidence. Overconfidence usually leads to carelessness, which leads to injury.

##### 5.4.6.1 Suggestions

- 5.4.6.1.1 Make sure fan is static and electrical power locked out before putting hands into the fan or near belt drive. We suggest a warning sign on **START SWITCH** cautioning not to start when fan is being serviced and a padlock on disconnect.
- 5.4.6.1.2 Follow low maintenance section instructions.
- 5.4.6.1.3 Do not put hands near or allow loose and hanging clothing to be near belts, sheaves, or cooling wheels while fan is running.
- 5.4.6.1.4 Do not put hands into inlet or outlet while fan is running. It is sometimes difficult to tell whether or not a fan is running. Be sure it is not running and cannot be operated before any inspection.

#### 5.4.7 Troubleshooting

In the event that trouble is experienced in the field, listed below are some common fan difficulties. These points should be checked in order to prevent needless delay and expense of factory service.

##### 5.4.7.1 Air Delivery or External Static Pressure below Rating

- 5.4.7.1.1 Total resistance of system higher than anticipated.
- 5.4.7.1.2 Speed too low.
- 5.4.7.1.3 Dampers not properly adjusted.
- 5.4.7.1.4 Poor fan inlet or outlet conditions.
- 5.4.7.1.5 Air leaks in system.
- 5.4.7.1.6 Damaged wheel.
- 5.4.7.1.7 Incorrect direction of rotation.
- 5.4.7.1.8 Wheel mounted backwards on shaft.

##### 5.4.7.2 Vibration and Noise

- 5.4.7.2.1 Misalignment of bearings, wheel of V-belt drive.
- 5.4.7.2.2 Unstable foundation.
- 5.4.7.2.3 Foreign material in fan causing unbalance.
- 5.4.7.2.4 Worn bearings.
- 5.4.7.2.5 Damaged wheel or motor.
- 5.4.7.2.6 Broken or loose bolts and setscrews.
- 5.4.7.2.7 Bent shaft.
- 5.4.7.2.8 Fan wheel or drive unbalanced.
- 5.4.7.2.9 120 cycle magnetic hum due to electrical input. Check for high or unbalanced voltage.
- 5.4.7.2.10 Fan delivering more than rated capacity.
- 5.4.7.2.11 Loose dampers or variable inlet vanes.
- 5.4.7.2.12 Speed too high or fan rotating in wrong direction.
- 5.4.7.2.13 Vibration transmitted to fan from some other source.

5.4.7.3 Overheated Bearings

- 5.4.7.3.1 Too much grease.
- 5.4.7.3.2 Poor alignment.
- 5.4.7.3.3 Damaged wheel or driver.
- 5.4.7.3.4 Bent shaft.
- 5.4.7.3.5 Abnormal end thrust.
- 5.4.7.3.6 Dirt in bearings.
- 5.4.7.3.7 Excessive belt tension.

5.4.7.4 Overload on Drive

- 5.4.7.4.1 Speed too high.
- 5.4.7.4.2 Discharging considerable under capacity due to existing system resistance being higher than originally anticipated.
- 5.4.7.4.3 Specific gravity or density of gas above design value.
- 5.4.7.4.4 Wrong direction of rotation.
- 5.4.7.4.5 Bent shaft.
- 5.4.7.4.6 Poor alignment.
- 5.4.7.4.7 Wheel wedging or binding.
- 5.4.7.4.8 Bearings improperly lubricated.
- 5.4.7.4.9 Motor improperly wired.

5.4.8 Field Correction of Fan Vibration

Vibration in fans can be induced by any of the following.

5.4.8.1 Hopping or bent pulleys.

Hold a rigidly supported pencil or piece of chalk close enough to slowly rotated member to just touch. If line is continuous, pulley or shaft, it is OK.

5.4.8.2 Sprung shaft.

5.4.8.3 Misalignment of pulleys.

Check with a straight edge.

5.4.8.4 Dirt in pulley grooves.

Pulley grooves must be smooth and concentric as in (1) above.

5.4.8.5 Dirt or lumps on V-belts.

Defective belts will have rough joints.

5.4.8.6 Dirty fan wheels.

If fan is handling dirty air, wheel should be cleaned periodically.