

**INSTALLATION, OPERATION**

**AND**

**MAINTENANCE**

**FOR**

**CENTRIFUGAL FAN UNITS  
(DIRECT DRIVE)**

**MANUFACTURED BY:**

**B. O. B. STEVENSON LIMITED  
COLEMAN STREET  
DERBY  
DE24 8NL**

**ISSUE NUMBER SEVEN**

**DATED 16<sup>th</sup> February 2005**

**WPDOCS\O&M\CENTDIR**

## 1.0 GENERAL DESCRIPTION

1.1 Centrifugal Fan Unit (incorporating volute case and impeller, directly driven by an Electric Motor).

1.2 The dynamically balanced, radial blade impeller is directly mounted on the shaft of an electric motor. The whole drive assembly is mounted on a support stool.

## 2.0 HEALTH AND SAFETY

2.1 It is essential that all personnel shall adhere at all times to safe working practices.

2.2 It is also essential that all operating and maintenance instructions appertaining to the fan and associated equipment have been read, understood and implemented. **In particular, attention MUST be paid to the safe running speed of the fan unit – this safe running speed is subject to ABUSE with the advent of Inverter Control and modification to the drive arrangement which can then take the Impeller past its safe design speed. If you are unsure then please consult our Technical Design Office for guidance. Impellers run in excess of their safe design speed can EXPLODE !**

2.3 All personnel have been advised of any harmful gasses, liquids, substances requiring the use of protective clothing, glasses, special handling etc. and, in particular, action to be taken if accidents occur. (immediate remedies, antidotes etc.)

## 3.0 OPERATION

### 3.1 INITIAL INSTALLATION

3.1.1 Storage - Protect fans against weather, excess heat, damp and dust. Particularly cover and protect bearings, shaft and motor. Inspect fan periodically and in the case of ball or roller bearings rotate weekly to prevent *brineling* of races. Do not store near vibrating machinery or fan bearings might suffer damage of a similar nature. *Always store the right way up.*

3.1.2 Handling - Use all lifting points provided and distribute load uniformly to avoid distortion. Do not drop or jar. Take care to avoid damage to coated surfaces and anti-corrosion finishes. Always lift a fan by its casing baseframe and not by the shaft, motor or impeller.

3.1.3 The following should be checked before starting the fan for the first time.

3.1.4 Also the procedure should be followed after an overhaul:

3.1.5 A visual check shall be carried out upon receipt of goods and an assessment of any damage during transit.

3.1.6 All guards must be in position and secure.

3.1.7 The supply voltage coincides with the motor windings voltage as shown on the nameplate attached to the body of the motor.

3.1.8 The starter overloads (not of our supply) are correctly set at the full load amperage of the motor.

**3.1.9 No loose material has been left in the fan or system.**

**3.1.10 Establish free rotation of the impeller by hand rotation and ensure that the minimum clearance between rotating and stationary parts is checked.**

**3.1.11. Use *all* the fixing points provided, making sure that when the bolts are fully tightened the fan structure is not strained. Support fully under all base angles and fan structure using shims or packers where necessary.**

**3.1.12. Ensure that all duct work joints are correctly made.**

**3.1.13. Check with a spirit level that the fan shaft is horizontal where this is applicable.**

**3.1.14. A fan casing should not support heavy ducting at inlet or outlet except by prior arrangement with the manufacturer.**

## **3.2. MOUNTING ON SUPPORT STRUCTURE**

**3.2.1. Care has to be taken to ensure alignment of the central fan axis to the supply/discharge ducting where appropriate.**

**3.2.2 Foundations and fixing points must be prepared to suit the dynamic load and frequency of the fan. For high speed or heavy duty industrial fans reinforced concrete foundations are recommended. Steel structures must be well braced and designed to suit the rotational speed. If mounted within a machine or unit, fixing points must be adequate to prevent distortion of the fan or vibration of the sheet metal panels. Check foundation holes for size and position.**

## **3.3. A.V. MOUNTS**

**3.3.1. Anti-Vibration mountings should be selected in consultation with the manufacturer. They should have equal deflection, must not *bottom* and must support a baseframe instead of separate fan components.**

**3.3.2. Effective anti-vibration requires flexible duct connections and flexible electrical conduit.**

**3.3.3. To ensure proper operation these must have adjustment in them i.e. should not be fully compressed. Reference to the G.A. Drawing should be made for the positioning and to ensure that the right type is in the right place in the case of asymmetrical loading.**

**3.3.4. It is important that A.V. Mounts are not fitted with any misaligned casing which causes lateral stress.**

**3.3.5. Fitting of the A.V. Mounts should be carried out in line with the manufacturer's instructions:**

## **3.4. FLEXIBLE CONNECTORS**

**3.4.1. It is prudent, if possible, depending on the type, to fit on the spigot flanges (where applicable) before fitment to the fans/ducting.**

**3.4.2. Lack of fan alignment will 'show up' at this stage if the directions in section 1.2 have not been complied with.**

**3.4.3. In addition, if the design gap is varied between the fan and the ducting, excessive bunching/folding of the connector must be avoided as this could have a detrimental effect on fan performance.**

### **3.5 ACCESSORIES**

**3.5.1 Where anti-condensation heaters, speed sensors and vibration pick-ups are fitted, the necessary connections are to be made to the recipient parts in the control panels.**

**3.5.2 If speed monitor relay is fitted set to 80% of the impeller r.p.m. unless specific instructions to the contrary are supplied with the relay.**

### **3.6 START UP**

**3.6.1 The following should be checked when starting up the fan unit following either INITIAL INSTALLATION OR MAINTENANCE PROGRAMME OVERHAUL.**

**3.6.2 Follow the set checks outlined under INITIAL INSTALLATION.**

**3.6.3 Upon start up, the electric supply to the driving motor should be checked to ensure that the phase rotation of the supply is rotating the impeller in the correct direction. If this is not the case, please refer to the wiring diagram for the driving motor and re-connect to give change of rotation. (Variable speed fans should always be started at the slowest speed)**

**3.6.4 Do not run the fan unit if vibration is excessive.**

**3.6.5 Do ensure that the power consumption is checked by an ammeter to ensure that the power taken on load is within the Full Load Current of the driving motor, as shown on the motor nameplate.**

**3.6.6 Do ensure that the fan is mounted in its correct orientation relative to the airflow direction on the nameplate.**

**3.6.7 Do not run the fan unit if vibration is excessive.**

**3.6.8 Do ensure that the air entry to the motor cooling fan is not obstructed.**

**3.6.9 When starting the fan unit it is beneficial to close dampers in the system so the fan unit is allowed to start up under light load conditions i.e. not passing air.**

**3.6.10 When automatic control is incorporated for the operation of the dampers or vanes, or for speed control on variable speed sets, the control gear suppliers should arrange that dampers and vanes will close and the speed control setting be reduced to the minimum, when the fans are not in use or are on the point of starting up.**

### **3.7 SHUT DOWN**

**3.7.1** When shutting down the fan unit prior to inspection or maintenance the following procedure should be followed:

**3.7.2** It is essential that the driving motor be isolated from the electrical supply and the fuses withdrawn to prevent accidental re-starting.

**3.7.3** The flow of air through the fan unit must be isolated and the impeller is allowed to run down so that it is not rotating - which may take several minutes following isolation of the electrical supply.

**3.7.4** Do not remove guards while the fan is rotating.

**3.7.5** Do not remove ducting while the fan is rotating.

## **4.0 MAINTENANCE**

**4.1.1** The impeller and internal surfaces of the fan casing should be periodically inspected for deposits which can adhere, reducing efficiency and possibly causing imbalance and vibration. Any such deposits should be carefully removed, but on no account should the impeller be subjected to harsh treatment, which will result in damage to the surface finish, airflow surfaces and disturbance of the balance. Cleaning procedures are dependant upon the degree and type of contamination. The minimum amount of cleaning is therefore recommended.

**4.1.2** Due to varying site conditions specific time intervals for impeller and internal surface inspection cannot be forecast and is therefore a liability of site maintenance engineers to determine same.

**4.1.3** At least once per year a complete check on fan alignment is recommended. Tighten all foundation bolts and examine all foundations, especially joints between bed frames and concrete for signs of deterioration.

**4.1.4** All impellers should be checked at least once per year, particularly where abrasion is to be expected. Particular attention should be paid to rivet and welds to see if there is any evidence of the beginning of failure. Impellers in hot gas fans, or those dealing with gases from which there is likely to be a deposit, should be thoroughly cleaned at least once a year, before the inspection as outlined above takes place. If vibration is evident then impellers should be checked for balance.

**4.1.5** Where fans are normally called upon to run continuously, a yearly inspection is usually possible, but in processes where such continuous availability is necessary full advantage should be taken of any short shut downs for a quick examination of the fan impeller for possible structural deterioration due to abrasion, corrosion, etc. if possible the fan alignment should also be checked.

## **4.2 DISMANTLING THE FAN**

**4.2.1** Access to the impeller is gained by removal of the inlet cover plate, secured by a number of nut/stud fixings around its circumference.

**4.2.2** The interface of the cover/casing is normally sealed with a gasket compound, but in certain circumstances neoprene gaskets or similar are substituted, if the compound is used then it should be carefully cleaned off and renewed on re-assembly.

### **4.3 REMOVING THE IMPELLER**

**4.3.1** Having followed the procedure under the heading SHUTDOWN and DISMANTLING THE FAN to thereby expose the impeller apply penetrating oil of good quality with colloidal graphite anti-seize agent in a neutral solvent base, to the joint between shaft and the impeller hub. Allow 10 minutes for oil to penetrate.

**4.3.2** Remove key (if fitted) using appropriate key extraction tool. (NOT supplied by B.O.B. Stevenson Limited). Care should be taken not to damage the shaft or hub.

**4.3.3** NOTE: On no account should the hub assembly be removed from the impeller backplate.

### **4.4 REFITTING IMPELLER**

**4.4.1** Ensure that all parts are clean and free from dirt, rust, etc.

**4.4.2** Check shaft position inside fan case and place impeller on motor shaft for repositioning.

**4.4.3** Locate and position the impeller in the correct position on the motor shaft.

**4.4.4** To fit the shaft key, if fitted, do so after the impeller hub has been fitted on the shaft, and then fit the parallel key that is side fitting with top clearance.

**4.4.5** Fill empty holes with grease to exclude dirt.

**4.4.6** Following re-fitting of an impeller the cover plate/casing gasket should be renewed.

**4.4.7** Carry out checks listed under START UP.

### **4.5 LUBRICATION**

**4.5.1** Driving Motor : Motor should be lubricated in accordance with manufacturer's instructions.

## **5.0 FAULT FINDING SCHEDULE**

<b><u>FAULT</u></b>	<b><u>PROBABLE CAUSE</u></b>	<b><u>REMEDY</u></b>
Motor connected but will not start.	Supply failure either complete or in one phase	Disconnect at once and check supply to motor terminals.
	Overload	Reduce load, by restricting the air into, or out of the fan unit until

		amperage absorbed by the driving motor is within the Full Load Current.
	<b>Overload</b>	<b>Switchgear not set correctly. Reset overload to the Full Load Current as shown on the Motor Rating Plate.</b>
<b>Excessive Vibration</b>	<b>Structure on which the fan unit is mounted not adequate</b>	<b>Review Fan Mounting Structure.</b>
	<b>Fan Impeller Out of Balance</b>	<b>Inspect impeller and motor bearings. Refurbish or renew as required.</b>
	<b>Bearings Worn</b>	<b>Check bearings for wear. Refurbish or renew as required.</b>
	<b>Foreign body entered the fan unit and has damaged the impeller</b>	<b>Refurbish or renew impeller as required.</b>
<b>Excessive Noise</b>	<b>Motor Bearings require attention</b>	<b>Recharge with grease/replace bearings.</b>
	<b>Foreign body entered the fan unit</b>	<b>Investigative Overhaul.</b>