

INSTALLATION, OPERATION
AND
MAINTENANCE

FOR
CENTRIFUGAL FAN UNITS
(INDIRECTLY DRIVEN)

MANUFACTURED BY:

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1.0 GENERAL DESCRIPTION

1.1 Centrifugal Fan Unit (incorporating volute case and impeller, indirectly driven by an Electric Motor through belts and pulleys).

1.2 The dynamically balanced impeller is mounted on the fan shaft which sits in two support bearings and is driven through belts and pulleys by an electric motor.

2.0 HEALTH AND SAFETY

2.1 Health & Safety at Work etc. Act 1974. It is essential that all personnel shall adhere at all times to safe working practices and that equipment is installed, earthed and guarded in accordance with current legislation.

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

3.1.2 Also the procedure should be followed after an overhaul.

3.1.3 A visual check shall be carried out upon receipt of goods and an assessment of any damage during transit. Any light gauge inlet and outlet covers provided for transport must be removed as they are not designed for anything else except a protection from ingress during transportation.

3.1.4 All guards must be in position and secure.

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

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

3.1.7 No loose material has been left in the fan.

3.1.8 Establish free rotation of the impeller by hand rotation.

3.1.9 Check holding down bolts and ductwork joints are correctly made.

3.1.10 The fan unit will have been supplied for fitting into a ducted system, either inlet or outlet or both. Under no circumstances should the fan be operated independently of the system envisaged. Where possible the fan should be started against closed dampers in order to reduce the load on the driving motor and prevent the starter overload tripping out until full running speed is achieved and only then should the airflow be allowed to pass through the fan.

3.1.11 After the fan unit has been running within the set parameters with no problems/faults arising the belts may require re-tensioning in accordance with the belt manufacturer's instructions.

3.1.12 Do not allow the fan unit to continue running if the bearing temperatures are excessive. This is indicative of the factory set tolerances having been changed possibly due to transportation.

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.

3.3. 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 3.2.1 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 be 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. Access covers or guards must NOT be removed unless the fan unit is stationary and isolated from the electrical supply.

3.7.5 Do not remove ducting while the fan is rotating.

3.7.6 When automatic control is incorporated for the operation of the dampers or vanes it is recommended that all vanes and dampers should be closed before the fan driving unit is stopped.

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. 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 once a year at least, before the inspection outlined above takes place. If vibration is evident impellers should be checked for 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 Once a year a complete check on the fan alignment is recommended. Tighten all foundation bolts and examine all foundations, especially joints between bedframes and concrete, for signs of deterioration.

4.1.4 All fan housings, casings and inlet boxes should be examined at least once a year, particularly in those instances where abrasion or excessive scaling may be expected, to ensure that no holes are appearing or that none of the metal is wearing thin.

4.1.5 Where fans are normally called upon to run continuously, a yearly inspection is usually possible, but in processes where such 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 COUPLINGS

4.2.1 Couplings should be checked for worn buffers at least once a year and replacements made when necessary. For proprietary makes of couplings, reference should be made to the manufacturer's instructions.

4.3 DRIVE BELTS

4.3.1 Belt tension should be checked at regular intervals and adjustments made where necessary. If excessive wear is taking place, then the alignment should be checked. One belt in a "v" rope drive should never be replaced, a complete set should be fitted to replace all belts, even if only a few are showing signs of wear. If in doubt, consult the drive manufacturer or B.O.B. Stevenson Ltd. for advice.

4.3.2 Having followed the procedure under the heading SHUTDOWN Inspection should be carried out by removing the external belt guard. If the belts show signs of wear, they should be replaced

This can be carried out as follows:

- a. Slacken the lock nuts on the motor platform
- b. Slacken the main adjusting nuts/bolts to allow tension to be taken from the belts, sufficient to allow removal of the belts.
- c. Remove belts and replace.
- d. Tighten adjusting nuts/bolts equally to take up slack in the belts.

- e. Check pulley alignment using template straight edge or a string line.
- f. Tensioning of the belts should be carried out in line with manufacturers instructions.

4.4 DISMANTLING THE FAN

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

4.4.2 The interface of the cover/casing is sealed with a gasket compound which should be carefully cleaned off and renewed on re-assembly.

4.5 REMOVING THE IMPELLER

4.5.1 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.

4.5.2 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.

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

4.6 REFITTING IMPELLER

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

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

4.6.3 Locate and position the impeller in the correct position on the motor shaft.

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

4.6.5 Fill empty holes with grease to exclude dirt.

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

4.6.7 Carry out checks listed under START UP.

4.7 LUBRICATION

4.7.1 Driving Motor : Motor should be lubricated in accordance with the manufacturer's instructions.

4.7.2 Fan Shaft Bearings : The fan bearings are lubricated from grease nipples. Only high quality bearings such as F.A.G. and S.K.F. are used and all bearings are correctly charged before leaving the Factory, but must then be lubricated in accordance with the manufacturer's instructions relative to the conditions under which the equipment is operated.

5.0 FAULT FINDING SCHEDULE

<u>FAULT</u>	<u>PROBABLE CAUSE</u>	<u>REMEDY</u>
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.
	Overload	Switchgear not set correctly. Reset overload to the Full Load Current as shown on the Motor Rating Plate
Excessive vibration	Structure on which the fan unit is mounted not adequate	Review fan mounting structure
	Fan Impeller out of balance	Inspect impeller and motor bearings. Refurbish or renew as required.
	Bearings worn	Check bearings for wear. Refurbish or renew as required
	Foreign body entered the fan unit and has damaged the impeller	Refurbish or renew impeller as required
Excessive noise	Motor bearings require attention	Recharge with grease/replace bearings
	Foreign body entered the fan unit	Investigative overhaul