INSTALLATION, OPERATION

AND

MAINTENANCE

FOR

BIFURCATED FAN UNITS
(DIRECT DRIVE)

MANUFACTURED BY:

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1.0 GENERAL DESCRIPTION

1.1 Bifurcated Fan Unit (incorporating case and impeller directly driven by an Electric Motor).
1.2 The dynamically balanced, axial blade impeller is directly mounted on the shaft of an electric motor. The whole drive assembly is foot (B3) mounted on to a support stool inside the Pod of the fan casing.

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 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 to right way up.*

3.1.2 Handling - Use all lifting points provided and distribute load uniformly to avoid distortion. Do nor 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 are 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

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 following instructions:
a. Position mount beneath base of equipment to be mounted. Line up holes in base with the tapped hole in the top of the mounting and insert the levelling screw.
b. By screwing the levelling screw into the mount the outer cup will rise thus raising the height.
c. Adjust each mount until equipment is level, then tighten locknuts on top of base.
d. Levelling adjustment is normally 19 mm, but this does depend on the type of mount supplied and on how much the mount deflects when the load is placed upon it.

e. Never try to level the mount to a greater height than its free height, i.e. the height before the load is placed upon it. Use shims below the mounts as required.

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 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.

3.6 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. (Correct impeller rotation and airflow direction are shown by arrows on the fan casing) If this is not the case, please refer to the wiring diagram for the driving motor (normally placed in the Motor Terminal Box during transit) and re-connect to give change of rotation.

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.

3.7 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.

3.7.5 Do not remove ducting while the fan is rotating.

3.8 EHT BIFURCATED FAN UNITS (Extra High Temperature)

3.8.1. These units are suitable for handling gases up to 315.0^{o}C maximum for extended periods. The fan *MUST* be allowed to 'run on' for a period of 30 minutes after the source of heat has been switch off to normalise.

3.8.2. The fan unit must *NOT* be allowed to 'soak' in hot gases whilst stationary.

4.0 MAINTENANCE

4.1 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.

4.2 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 REMOVING THE IMPELLER

4.1.1 Having followed the procedure under the heading SHUTDOWN and DISMANTLING THE FAN, access to the impeller is gained from the impeller end of the casing.

4.1.2 Once the nosecone is removed thereby exposing the impeller hub the Loctite bond between the Motor Shaft and the threaded retaining bar (if this type of fitting is utilised) should be broken and the bar removed, then 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.

4.1.3 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.

4.1.4. Take this opportunity to mark the relation between the impeller hub and the motor shaft to enable exact positioning of the impeller when re-fitting.

4.2 REFITTING IMPELLER

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

4.2.2 Check shaft position in relation to the impeller position on motor shaft for repositioning.

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

4.2.4 To fit the shaft key do so after the impeller hub has been fitted on the shaft, and then fit the key.

4.2.5 Fill empty holes with grease to exclude dirt.

4.2.6 Following re-fitting of an impeller the threaded retaining bar should be Loctite'd back in position and the nosecone then refitted. (Appendix 2 - Drawing No. CSK0504/A)

4.2.7 Carry out checks listed under START UP.

4.3 REMOVING THE DRIVING MOTOR

4.3.1 The driving motor is held in the central Pod of the casing by 4 Bolts, but these can only be removed once the impeller has been removed and the electrical connections have been removed. Work on Zone 1 Flameproof Exd and Zone 2 Non-Sparking ExN Motors can only be undertaken by trained and approved personnel.

4.4 LUBRICATION

4.4.1. Motor should be lubricated in accordance with (assuming a Brook Hansen driving motor is fitted) Brook Hansen "Installation and Maintenance A.C. Electric Induction Motors" Publication 103-4EFD Issue 4 (Appendix 3)

5.0 FAULT FINDING SCHEDULE

FAULT	PROBABLE CAUSE	REMEDY
Motor connected but will not start	Supply failure either complete or in one phase	Disconnect at once and check supply to motor terminals
	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 for damage and /or build up of foreign matter
	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
	An axial fan operating far back on its curve in a condition of *stall*	Check pressure drop calculations against characteristic curve
	An obstruction or bad connection at the fan inlet creating unstable air entry conditions	Consider system design
Excessive noise	Motor bearings require lubrication / replacement	Recharge with grease/replace bearings
	Foreign body entered the fan unit	Investigative overhaul