



**INSTRUCTIONS, OPERATION
AND MAINTENANCE MANUAL**

AIR EXHAUST UNITS

SERIES CV-CVM-CVMI-EV



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0. INTRODUCTION

This manual has been compiled by TCF Srl to provide the installer, customer and user with instructions intended to ensure the proper management and use of the air-exhaust units series CV, CVM, CVMI, EV from the delivery up to the commissioning.

The recommendations which follow are intended to ensure a continuous and durative operating life of the air exhaust unit. The procedures described below should be performed by skilled personnel with a good knowledge of air-conditioning systems design and operation, even though, thanks to the unit's simplicity of design, these could be carried out also by those unfamiliar with air handling.

1. DESCRIPTION OF THE AIR-EXHAUST UNIT

1.1 COMPOSITION

The air exhaust unit is made up from:

- Return section possibly including one control damper or grille
- Fan section

1.2 PERMITTED USE

TCF air exhaust units are designed exclusively for CIVIL AND INDUSTRIAL AIR TREATMENT.

In case of CORROSIVE and/or EXPLOSIVE air flows, a number of special technical modifications must be made at the design stage which, altogether, adapt the machine for the treatment of special air flows.

The air exhaust units must at all times be used strictly in accordance with the design conditions established at the time of contract in agreement with the customer. ANY OTHER USE SHALL CONSTITUTE IMPROPER USE AND IS THEREFORE DANGEROUS. THE MANUFACTURER MAY NOT BE HELD LIABLE FOR DAMAGE CAUSED BY NON-STANDARD USE OR ANY USE NOT ENVISAGED IN THE CONTRACT.

2. CONTROL, PACKING, TRANSPORTATION

2.1 FACTORY INSPECTION OF THE SUPPLY

Prior to shipping, each TCF air exhaust unit is subject to all the functional tests listed on the attached UNIT INSPECTION SHEET. The controls concern:

- General machine dimensions
- Correct assembly of the various parts and sections
- Compliance with the various safety rules in force
- Integrity of all the system's component parts
- Application of the identification, operation and safety notices

On completion of the inspection, the Chief Inspector applies the EC mark demonstrating product compliance with prevailing European Union machine directives.

2.2 PACKING

Transportation of the machines may be:

- normal
- special

In the former case, TCF Srl does not normally pack the units.

In case of special transportation, the packing requested is agreed at the time of contract and is entirely on the customer's charge.

Fragile components supplied separate from the unit, such as control boards etc., are always delivered packed.

2.3 LOADING,TRANSPORT,UNLOADING

TCF Srl disclaims any liability for damage occurred to the air exhaust unit during loading, unloading and transportation. We therefore recommend that precautions be taken, including:

- The load must be firmly secured to ensure its integrity during transportation
- Handling must be performed without exerting force on protruding accessories (hydraulic attachments, handles, hinges, air locks, protection roof)
- Do not overturn the sections as you may otherwise break internal supports, components and dampers
- Do not subject the unit to violent impacts as you may damage its integrity
- If a forklift truck is used during the loading, unloading and handling operations, the forks of the truck must be at least the same length as the unit to ensure stability (fig. 1)
- If the air exhaust unit is fitted with a continuous steel base frame, handling may be carried out with a crane, using cables firmly secured to rods (sufficient for the stress involved) passing through the holes provided in the base.

If a crane is used, proceed as shown in the illustration, using spacers to protect the structure (fig. 2).

- During transportation, protect the unit from atmospheric agents. Special care must be taken if the unit is supplied disassembled or designed for internal use.

Fig. 1

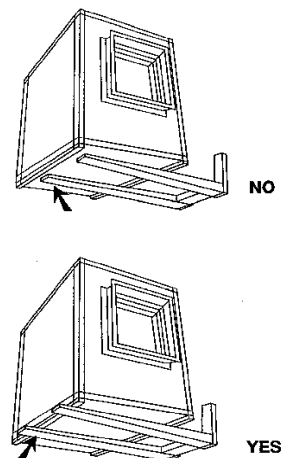
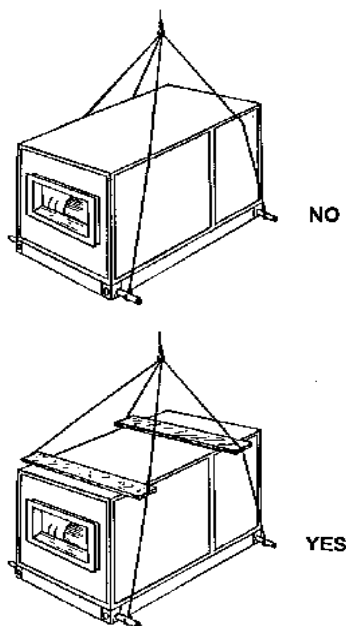


Fig. 2

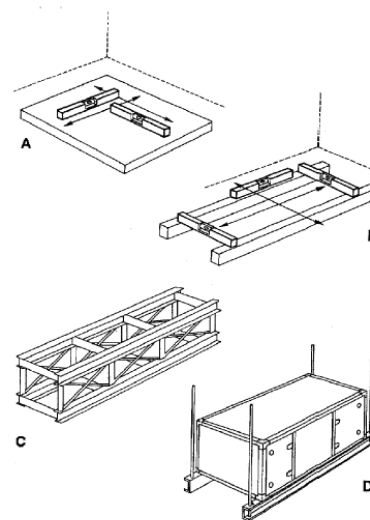


The air exhaust unit must be positioned on a horizontal surface so as to prevent:

- damage to the fan motor units caused by uneven weights on the vibration dampers
- difficulty in opening and closing the inspection doors

The horizontal alignment of the support surface must be checked with a SPIRIT LEVEL; adjustments may be made using STEEL SHIMS.

FIG. 3



3. ASSEMBLY ON SITE

3.1 POST-TRANSPORTATION CHECK

Upon arrival of the air exhaust unit on site, TCF suggests the customers to perform an accurate check of the structure and of the components.

Should any transportation damage be detected, this must be notified on the delivery bill. The carrier must immediately file a report of the accident to obtain compensation from the insurance company.

3.2 PRESERVATION ON SITE

In order to keep the air exhaust unit in good and efficient condition on site, the following steps must be taken first:

- prior to installation, position the unit and the accessories in a place offering the best possible protection against accidental knocks, dust and atmospheric agents
- carefully cover the inlets and outlets to prevent foreign matter from entering the unit and damaging the internal components

3.3 POSITIONING

3.3.2 Base frame

The permanent installation of the air exhaust unit may be made:

- directly on the floor (fig. 3a)
- on a concrete bed (fig. 3b)
- on a steel section bed (fig. 3c)
- on a suspended base (fig. 3d)

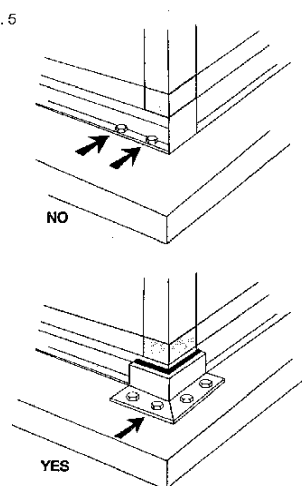
Both the floor and the beds must be capable of withstanding the machine weight to within the required safety margins.

3.3.2 VIBRATION DAMPING

In order to ensure effective protection against vibrations, the air exhaust unit must be installed as follows:

- suitable DAMPERS must be placed between the machine and the support surface, in material designed to withstand the weight involved
- the unit must not be fastened directly with screws but by means of brackets (fig. 5)

Fig. 5



Even in case of suspended installation of the unit, the supports must not be screwed directly into the ceiling; vibration damping material must always be placed between the support and the ceiling (fig. 5).

FIG. 5

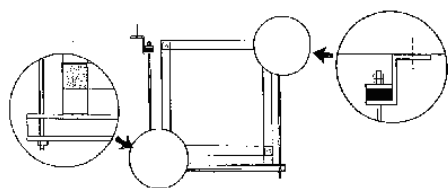
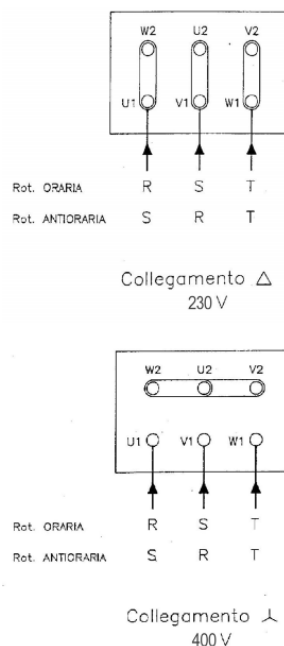


FIG. 6



4. CONNECTION TO SYSTEMS AND START UPS

4.1 CONNECTION TO DUCTS

At the point of connection to the air ducts, the air exhaust units have a smooth or a flanged surface.

In order to optimise the connection with the ducts, you must:

- clean the connection edges between duct and unit
- fit a seal to the flanges in order to prevent air infiltration
- tighten the connecting screws firmly
- treat the joint with silicone to enhance the seal

If the connection is made with rubber canvas joints, make sure they are not tightened on assembly completion, so as to prevent damage or the transmission of vibrations.

In order to ensure the tightness of the connections and the integrity of the unit, the weight of the ducts must under no circumstances bear down on the unit. The ducts must be supported by BRACKETS.

4.2 3-PHASE FAN-MOTOR ASSEMBLY CV MODELS

4.2.1 Electric motors

Before starting up the unit:

- inspect the motor CONTROL BOARD and check that the motor protection devices are sized for the maximum amperage, corresponding to the rated value on the plate.
- The TERMISTORS, if present, must not be connected to the power supply line of the electric motors since otherwise they would be damaged irreparably (operating voltage 1V)
- Check that the MAINS SUPPLY VOLTAGE is suited to that of the motors as indicated on the relevant plates

4.2.1.1 Connection for direct starting

The simplest electric motor start-up system is obtained by connecting the motor directly to the supply line. However, this method has limitations due to the high start-up current (pick-up); this type of start-up is recommended for power ratings up to 5,5kW for which TCF installs, as standard, 4-poles 220/380 V three-phase motors.

The wiring diagrams are shown in fig. 6.

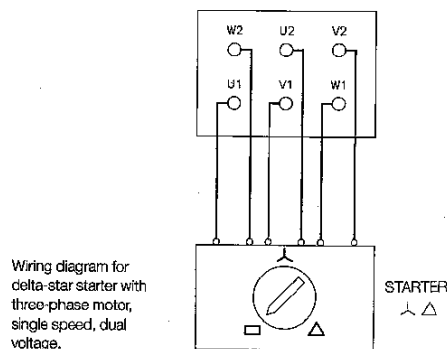
4.2.1.2 Connection with star-delta starting

If the motor start-up current exceeds the value permitted by the power supply, you may decide to choose for delta-star starting.

For this purpose TCF installs dual voltage 400/690V motors on its air exhaust units starting from an output of 7,5kW, thus allowing the motor to operate normally at 400V (delta connection) and to start-up at 690V (star connection).

This arrangement reduces the starting current by approximately 30% of the current involved in case of direct starting.

FIG. 7



4.2.1.3 Dual speed three-phase motors

The diagram in fig. 8 shows the connection of a TWO-SPEED MOTOR with two separate windings to the power supply.

TCF installs motors of this kind on the following units:

- 230/400V for power ratings up to 5,5kW
- 400/690V for power ratings from 7,5kW

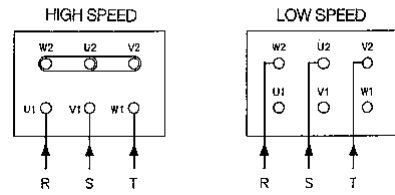
This type of electric motor permits the delta-star connection by means of a starter.



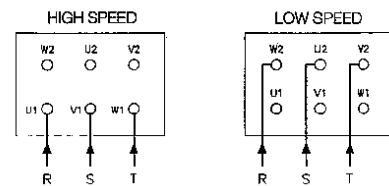
The two-speed motors with a single DAHLANDER commutable winding (fig. 9) offer the advantage of generating greater power than motors of the same size but with separate windings.

FIG. 9

SINGLE COMMUTABLE WINDING (DAHLANDER)
SINGLE VOLTAGE - DIRECT CONNECTION 2/4 POLES 4/8 POLES



DOUBLE WINDING - 8 TERMINALS
SINGLE VOLTAGE - DIRECT CONNECTION 2/4 4/8 6/8 POLES



4.2.1.4 Permitted start-up time

Because of the temperature increase, the start-up time of a motor may not exceed the value shown in table 1. The data refer to start-ups at exercise temperature, whereas for cold start-ups such timings may be doubled.

TABLE 1

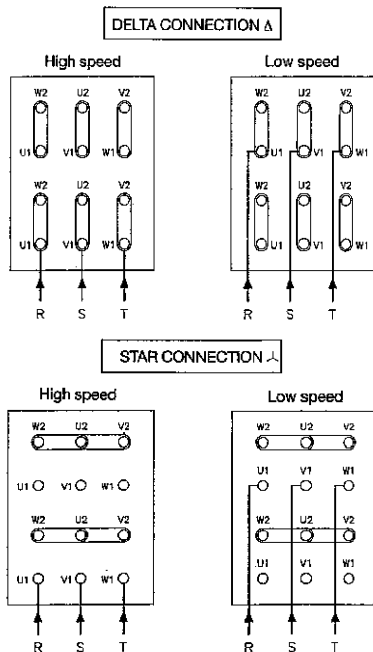
Grandezza motore	Metodi di avviamento	Tempo max di avviamento [sec], per avviamenti occasionali			
		Numero di poli			
		2	4	6	8
63	Avv. Diretto	25	40	-	40
71	Avv. Diretto	20	20	40	40
80	Avv. Diretto	15	20	40	40
90	Avv. Diretto	10	20	35	40
100	Avv. Diretto	10	15	30	40
112	Avv. Diretto	20	15	25	50
	Avv. Y/Δ	60	45	75	150
132	Avv. Diretto	15	10	10	20
	Avv. Y/Δ	45	30	30	60
160-250	Avv. Diretto	15	15	20	20
	Avv. Y/Δ	45	45	60	60

4.2.1.5 Recommended connection and protection accessories

For the sizing of cables and connections, please refer to the motor nameplate data and to the laws in force in the country where the unit is installed.

FIG. 8

DOUBLE WINDING - 12 TERMINALS
DUAL VOLTAGE - DELTA-STAR - CONNECTION 2/4 4/8 4/8 6/8 POLES

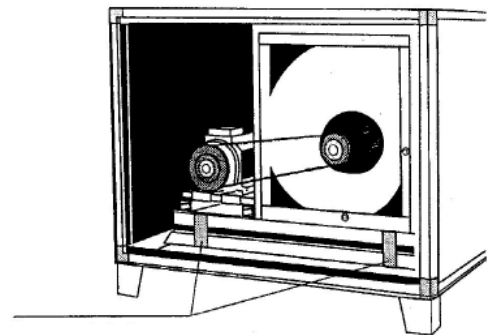


4.2.2 Fan

Before start-up, carry out the following checks:

- make sure that the fan wheel is functioning correctly by rotating it manually
- check that any safety clamp, fitted to prevent damage during transportation, has been removed from the dampers (fig. 10).

FIG. 10



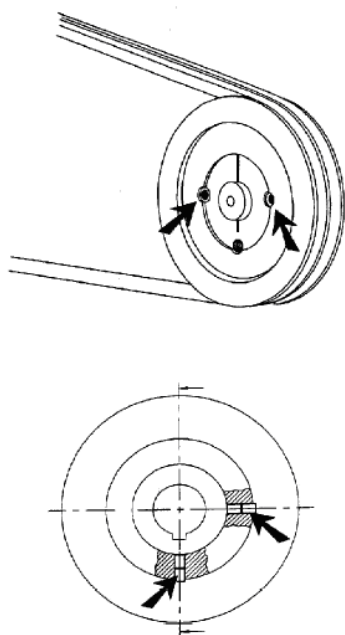
safety clamps

4.2.3 Transmission

Before starting the air exhaust unit please check:

- the tension of the V-belts (section 5.2.3.1)
- that the pulleys are aligned (section 5.2.3.1)
- that the dowels, shown in fig. 20, in their possible installation positions, are doing their function of securing the pulleys to the hubs

FIG. 11



4.3 1-PHASE FAN MOTOR ASSEMBLY CVM, CVMI, EV MODELS

4.3.1 Electric motors

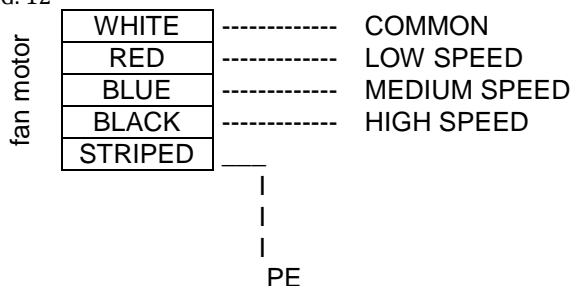
Before starting up the unit:

- inspect the motor CONTROL BOARD and check that the motor protection devices are sized for the maximum amperage, corresponding to the rated value on the plate.
- The thermal protections, if present, must not be connected to the power supply line of the electric motors since otherwise they would be damaged irreparably
- Check that the MAINS SUPPLY VOLTAGE is suited to that of the motors as indicated on the relevant plates

4.3.1.1 3-speed fans

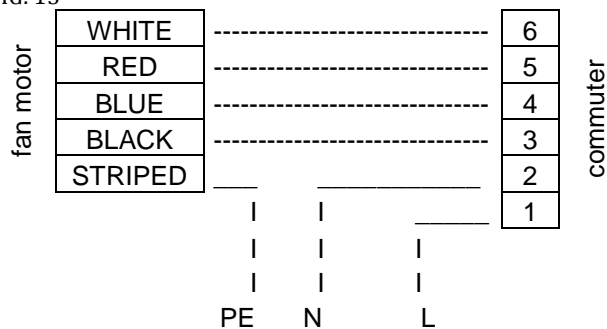
The scheme on fig. 12 shows the 'code colour' of the terminal plate installed on the fans used for the EV and CVM series.

FIG. 12



The scheme on fig. 13 shows the connection of a fan motor actuated by the 3-speed selector type '6990'.

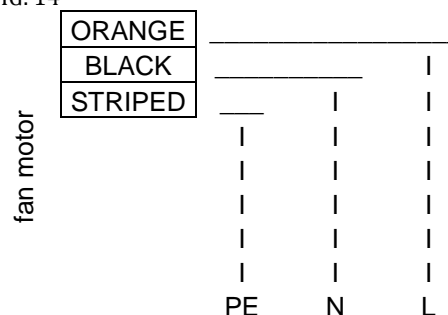
FIG. 13



4.3.1.2 Single speed fans

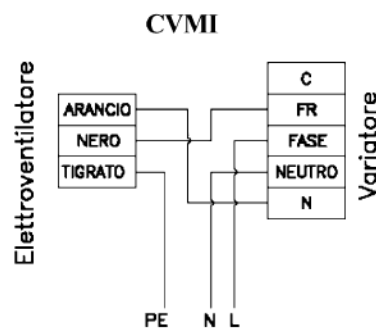
The scheme on fig. 12 shows the 'code colour' of the terminal plate installed on the fans used for the CVMI series.

FIG. 14



The scheme on fig. 15 shows the connection of a fan motor actuated by a "VVM" type speed controller.

FIG. 15



5. MAINTENANCE

5.1 FOREWORD

TCF recommends that its customers carry out PREVENTIVE MAINTENANCE on the air exhaust units in order to ensure a long-term efficiency. Such air exhaust units require little maintenance and have been designed to make each operation as easy and safe as possible.



5.2 FAN SECTION

5.2.1 Fan

In order to keep the fan in perfect working order, WE RECOMMEND YOU TO CHECK THE FOLLOWING AT LEAST ONCE A MONTH:

- The cleanliness of the shell and wheel; remove any deposits
- Damage and corrosion to the fan components; in case remedy with zinc-powder paint
- The tightness of the parts comprising the fan section
- Seal of the vibration-damping joint fitted to the fan supply mouth
- Cleaning and lubrication of any DAPO control air locks. Lubrication of this part must be performed every six months
- Absence of abnormal noises due to deterioration of the bearings. If necessary, replace them. The fans mounted on the TCF units are fitted with oilless bearings (design life 20.000 hours) or pedestal bearings, depending on the operating conditions. The pedestal bearings require periodic lubrication. THE LUBRICATION INTERVALS show in table 2 are subject to the environmental conditions and the maximum temperature range during operation.

TABLE 2
Lubrication of fan support bearings

ENVIRONMENTAL COND.	TEMP. RANGE °C	LUBRICATION INTERVALS
CLEAN	UP TO 50	6 ÷ 12 MONTHS
	50 ÷ 70	2 ÷ 4 MONTHS
	70 ÷ 100	2 ÷ 6 WEEK
	100 AND OVER	1 WEEK
DIRTY	UP TO 70	1 ÷ 4 WEEKS
	70 ÷ 100	1 ÷ 2 WEEKS
	100 AND OVER	1 ÷ 7 DAYS
MAXIMUM HUMIDITY		1 WEEK

RECOMMENDED GREASE:
MOBILUX3 (MOBIL), ALVANIA GREASE3 (SHELL), BEACON3 (ESSO)

5.2.2 Motor

In order to maintain the motor in perfect working order, TCF recommends the FOLLOWING MONTHLY CHECKS:

- Cleanliness: remove any deposits
- Absence of abnormal noise due to deterioration of the bearings

Powerful motors fitted with grease nipples require periodic lubrication. The greasing intervals, under normal operating conditions, are shown in Table 3.

TABLE 3

Greasing of motor bearings

MOTORE RPM	—	3000	1500	1000	750
GREASE EVERY (HOURS)	—	5000	10000	20000	25000

NOTE: The bearings must be greased more frequently in harsh operating conditions.

5.2.3 Transmission (CV models)

In order to ensure optimum drive efficiency and to avoid damaging the fan motor unit, the transmission must be kept in perfect working conditions.

The following must be CHECKED EVERY MONTH:

- The operating condition and dirtiness of the transmission; remove any deposits
- Damage to the drive (cracks on belt and pulleys, frayed belt edges, worn belts and pulleys). If necessary, replace the damaged part(s)
- The perfect alignment of the transmission
- The tension of the belt (see section 5.2.3.1)

5.2.3.1 Determining belt tension

To alter the tension of the driving belts you must remove the motor.

To facilitate this operation the motors are positioned on:

- guides
- belt-tensioning slides

in both cases it is easy to tighten or slacken the driving belt by means of the lock nuts and adjusting screws.

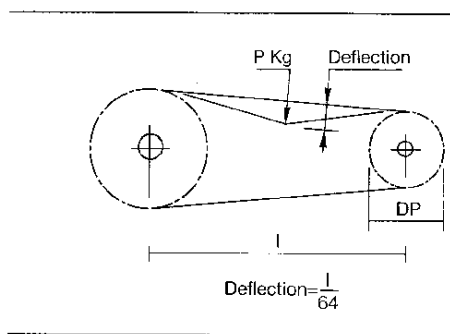
In order to determine DRIVING BELT TENSION (fig. 16), you must:

- establish a centre distance (I) and block the drive
- using a spring-operated torque wrench, apply a force (P) on the midway point of the belt (perpendicular to it) to obtain a deflection equal to 1/64 of the centre distance (approx. 16mm/m)
- check that the applied force is within the values indicated in table 5, if not, set a new centre distance and repeat the test

TABLE 4

BELT SECTION	MINOR PULLEY DIAMETER (mm)	FORCE P (daN)
A	70 ÷ 120	9 ÷ 15
	125 ÷ 180	13 ÷ 18
B	112 ÷ 140	18 ÷ 26
	150 ÷ 225	23 ÷ 30
C	180 ÷ 225	36 ÷ 53
	250 ÷ 400	48 ÷ 70
SPZ	67 ÷ 90	11 ÷ 20
	95 ÷ 150	17 ÷ 25
SPA	90 ÷ 132	20 ÷ 35
	140 ÷ 224	30 ÷ 45
SPB	140 ÷ 224	35 ÷ 50
	236 ÷ 355	43 ÷ 65

FIG. 16

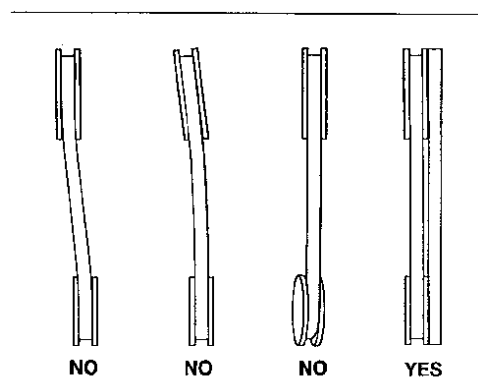


If the tension is not correct, the following will occur:

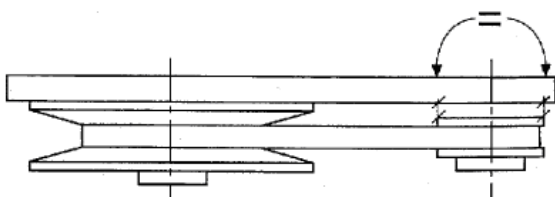
- if the belt is slack, it will wear out rapidly and the drive system will be inefficient
- if the belt is too tight, the motor and fan bearings will be damaged

whenever the belts are tightened, you must check that the drive belts are aligned using an ordinary RULER (fig. 17)

FIG.17



If the pulleys are of different thickness, you must check their equivalence as shown in fig. 18 to ensure correct installation.



5.2.3.2 Replacement of driving belt

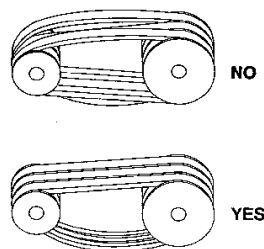
To REPLACE THE DRIVING "V" BELT:

- loosen the drive and remove the worn-out belt
- check the condition and wear of the pulleys and replace them if necessary
- introduce the new belt without forcing; any forcing could impair the transmission and shorten its service life
- align the drive and tension the belt
- check the belt tension after about 10 working hours

5.2.3.3 Drive with multiple-race pulleys

- in case of drives with several belts, the belts must be replaced at the same time. This means that there must not be belts presenting different states of wear in the same transmission system
- the number of belts must always match the number of races
- in this type of drive system, the belt slack must be on the same side, as shown in fig. 19, before they are tightened

FIG. 19



5.3 ACCESSORIES

5.3.1 Control dampers

The TCF control dampers of the SAL range do not require particular maintenance. It is however recommended to verify the alignment of the gears and the smooth operation of the fins. This could be damaged by the weight of ducts in case they bear down of the dampers themselves, by deflecting them (condition to be avoided).

5.3.2 Fresh air inlet grilles

They must frequently be cleaned by deposits which obstruct the air passage, jeopardizing the correct operation of the whole installation.

5.4 TROUBLESHOOTING

The most common MALFUNCTIONS in air exhaust units are:

- reduced flow rate
- increased flow rate
- abnormal noise

5.4.1 Reduction in flow rate

This is the result of an uncontrolled increase in resistance in the aeraulic circuit which alters the fan operating point.

The most frequent causes are:

- blockage of the intake grille(s)
- fully or partially closed control air locks
- inefficient fan motor unit drive

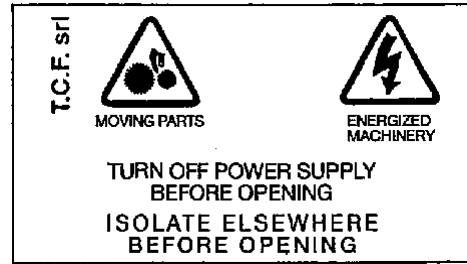
5.4.2 Increased flow rate

If the sum of the resistances in the aeraulic circuits is less than the value considered at the design stage, the most common causes are:

- incorrect setting of any mechanical flow controls or zone air locks
- open or partially closed inspection doors

disconnect the system power before opening the inspection doors (fig. 20).

FIG. 20



5.4.3 Abnormal noise level

With regard to the fan, the causes may be:

- worn-out or defective bearings
- fan off-balance
- foreign matter in the fan wheel

With regard to the electric motor, the causes may be:

- worn-out or defective bearings
- loose cooling fan and/or fan guard
- magnetic noise during frequency reductions with inverter (applications below 22Hz are not recommended as a rule)

With regard to the drive system, the causes may be:

- slipping of belt
- worn belt
- misaligned pulleys
- pulley with play on key

in order to remedy the malfunctions listed above (and not the entire air-conditioning system), CONSULT THE CHAPTER RELATED TO THE MAINTENANCE (ch. 5) OR, IF THE PROBLEM PERSISTS, CONTACT OUR TECHNICAL DEPARTMENT.

6. SAFETY

6.1 SAFETY-RELATED FEATURES OF AIR EXHAUST UNITS

TCF Srl has fitted its air exhaust units with every possible safety feature to prevent accidents, especially during start-up and maintenance.

Some of the SAFETY FEATURES are listed below:

- INSPECTION DOORS THAT CAN ONLY BE OPENED WITH A KEY are installed in the sections housing rotating parts and drives
- the GRATES and HOUSINGS protecting rotating parts and drives can only be removed with a key
- the outside of the structure has ROUNDED EDGES
- elimination of sharp-edged steel sheet parts inside and outside of the unit
- use of SELF-TAPPING SCREWS WITH NON-PROTUDING TIPS inside sections and panels

we always recommend to install, inside the fan section, an ELECTRIC ISOLATOR, which has the function of preventing the fan-motor assembly from getting started during maintenance operations, thus jeopardising the safety of the technician.

6.2 SAFETY NOTICES APPLIED TO THE EXHAUST UNITS

The inspection doors of the air exhaust unit carry SAFETY NOTICES drawing the operator's attention to the danger connected with moving parts and warning him to

6.3 PRACTICAL ACCIDENT-PREVENTION TIPS

- Open the inspection doors only when the fan is at a standstill
- Before carrying out maintenance work on the fan motor unit, make sure that the motor cannot be restarted by accident
- Before operating on the motor, make sure that it has cooled down completely
- In order to protect your hands, use a lever to remove the belts
- Block the fan wheel before maintaining it, since (especially when the belt is removed) the 'updraft effect' caused by the ducts could make it rotate and cause injury

7. WARRANTY

TCF Srl guarantees its products for 12 months from shipment date.

The warranty covers the normal operation of the individual components installed on our units, such as motors, fans, heat exchangers, humidifiers and other parts.

It should be stressed that the warranty covers manufacturing defects in these parts, while their efficiency is categorically excluded since this is determined by the characteristics of the aeraulic and hydraulic systems and by the design, and does not therefore fall within our sphere of responsibility.

TCF therefore undertakes to replace any individual component which malfunctions as rapidly as possible and subject to stocks. The part should be sent (freight costs pre-paid) to our headquarters and the replacement part will be sent ex-works.

Please note, too, that the warranty does not include the service of our personnel for the replacement of the part on site; this cost is entirely on the installer's account.

On receipt of the returned material deemed to be defective, an inspection will be carried out to establish whether the part reveals abnormalities justifying application of the warranty. If it is established that the defect is due to external factors, the replacement part will be charged to the customer.

It should furthermore be noted that the warranty shall not apply in the case of tampering or in case the failure is a consequence of incorrect installation or connection.

On this behalf, reference will be made to the instructions contained in this Installation, Operation and Maintenance Manual which accompanies each of our machines.

TCF Srl



**TERMOVENTILATORI
CONDIZIONATORI
FELSINEA**

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