INSTRUCTIONS NOTICE

CONTINENTAL
INDUSTRIE

Blowers & Exhausters

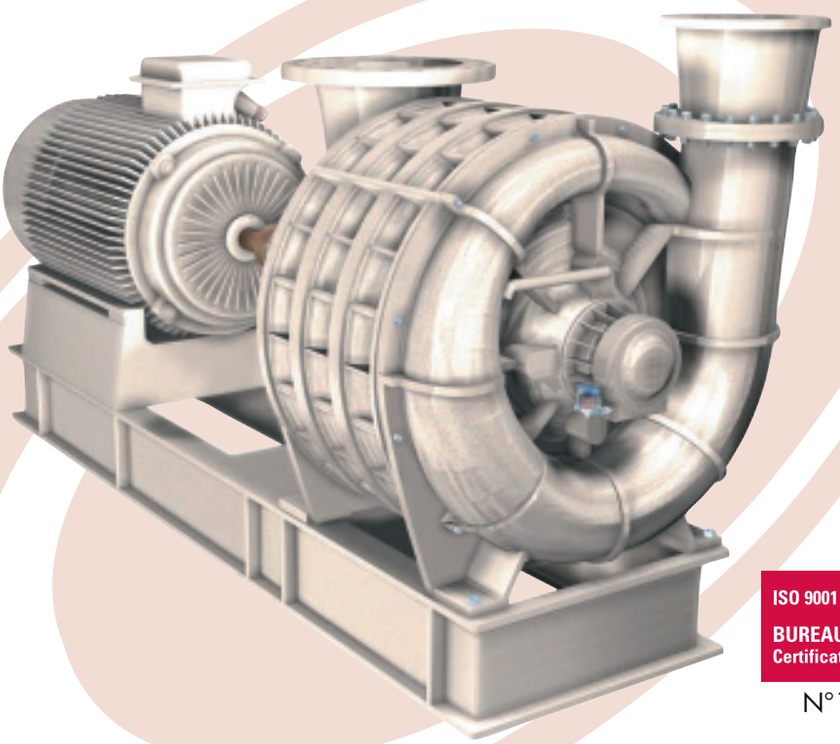
www.continental-industrie.com

INSTALLATION, USE & MAINTENANCE OF

BLOWERS & EXHAUSTERS

OPERATION IN POTENTIALLY EXPLOSIVE GAS AREA

☐ ZONE 1 ☐ ZONE 2



ISO 9001
BUREAU VERITAS Certification
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MAN ATEX REV 102006-3GB

CONTENTS

ATEX DIRECTIVE 94/9/CE

These instructions shall be used for the blowers and exhausters intended for use in potentially explosive atmospheres of surface where gases, vapours or mists are present in an episodic or intermittent way. For other equipments, the standards instructions have to be used (GB MANUAL-rev 042006-GB and following).

IMPORTANT : CONTINENTAL INDUSTRIE does not supply equipment intended for use in potentially explosive atmospheres of surface where gases, vapours or mists are present continuously (zone 0).

The equipment supplied with these instructions, including the accessories, complies with the requirements of the 94/9/CE ATEX directive on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres and its French application decree 96-1010.

These instructions are sent with an EC compliance certificate specifying the zone in which the blower or exhauster can be used. This information is also available on the equipment nameplate.

Equipment group II		ATEX Marking	Potentially explosive atmosphere occurrence
Zone 1	Category 2 G	 **II 2G b,c T3**	Likely to occur in standard operation
Zone 2	Category 3 G	 **II 3G c T3**	Infrequently and for a short period only

It is the user's responsibility to check that the equipment is intended for use in the considered area. If this marking is not affixed on the machine, this should not be installed in a potentially explosive area .

CAUTION : Any noteworthy modification of the material supplied by CONTINENTAL INDUSTRIE and/or the addition of equipment non conforming to ATEX 94/9/CE directive would cancel certification of the aforesaid material.

The use of any material delivered for use in potentially explosive atmosphere will have in particular to respect the provisions of Directive ATEX 99/92/CE concerning the minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres and the standard EN 1127: Explosion prevention and protection.

1 - INFORMATION

This handbook is intended to allow the installation, the start-up, the use and the maintenance of the CONTINENTAL INDUSTRIE blowers and exhausters intended for use in potentially explosive atmospheres due to gas, in the zones 1 and/or 2, as defined by Directive ATEX 94/9/CE.

This handbook will have to accompany the material which it relates to and remain near at hand.

For safety reasons, the blowers and exhausters CONTINENTAL INDUSTRIE will have to be used only by capable and qualified personnel, having first read and understood fully this handbook.

The qualified personnel is trained people who, on the basis of their professional experience, their competence and their formation, have extended knowledge on the regulations of safety, the regulations of prevention of the accidents, the directives and the recognized rules of the technique. He must be able to recognize the possible dangers of the tasks which are entrusted to him and determine the means of avoiding them. He must be authorized by the people responsible for the safety of the installation to carry out the various necessary work.

The non-compliance with the rules and instructions of this handbook can have serious consequences for the material and the personnel and involve the cancellation of the guarantee.

1.1 GENERAL

CONTINENTAL turbo blowers and turbo exhausters are made in accordance with current safety regulations.
The various production phases undergo the checks provided for by the quality control plan to ensure that materials and assembly are free from defects. All machines are mechanically tested before dispatch.

1.2 SAFETY INSTRUCTIONS

Common sense must be used and general safety standards together with any special standards for the specific installation must be strictly observed when moving, installing, using and handling machinery. No operation or maneuver shall be carried out by inadequately qualified personnel.

In particular, the following are not permitted:
- the use of cables or eye-bolts which are damaged or have inadequate characteristics for lifting
- working on high-voltage electrical components if not specifically qualified for such work - working on live electrical circuits or in the presence of charged capacitors
- working on machines connected to an electricity supply without having switched off the isolator or put out appropriate «works in progress» signs
- assuming that the precautions taken are definitely adequate and that checks do not need to be made, for example, where work is resumed after a halt
- operating machines with coupling or bearing housing guards removed
- operating machines with the inlet opening uncovered
- leaving machines in operation unsupervised in the presence

of children or animals
- approaching rotating parts wearing ties or shirts.

The personnel and the people passing near the equipment will have to be informed that potentially hot surfaces of the blowers and the exhausters, the pipes and the accessories can cause burns in the event of contact and of the danger linked to the contact with the parts under tension and the parts in rotation.

1.3. GUARANTEE

CONTINENTAL turbo blowers and turbo exhausters, unless otherwise specified when ordering, are guaranteed for twelve months from their start-up, but for no more than eighteen months from their date of delivery to the original purchaser.

During this period, CONTINENTAL will replace or repair any part free of charge, free own works, provided that the tests made reveal material or manufacturing defects. To make a claim under guarantee, the machines and/or systems must have been used for their intended application and in compliance with CONTINENTAL's instructions.
The purchaser loses all guarantee rights if the machines and/or systems are repaired or modified, in whole or in part, by the purchaser or third parties, unless this has been agreed in writing by CONTINENTAL, who however do not accept any liability for the repair or modification thus authorized.
Transport expenses, including insurance costs, for the defective parts to and from CONTINENTAL's works will be borne by the purchaser.
The guarantee does not cover damage resulting from incorrect use (operation in unstable conditions, at inadmissible speeds of rotation, at inadmissible pressures or temperatures etc.), negligence, alterations and incidents.
Materials and/or components, such as motors, valves, gearboxes, electrical equipment etc. bought by CONTINENTAL from third parties are guaranteed by their respective suppliers and these guarantees are maintained in accordance with the above conditions.
CONTINENTAL reserves the right to invoice all replacements made due to material or manufacturing defects where repairs are carried out on site at the specific request of the customer.

1.4 LIMIT OF LIABILITY

CONTINENTAL's liability in respect of claims of any kind, including negligence, consequential or associated loss or damage, or loss or damage resulting from the performance, design, manufacture, operation, use and likewise from any installation, technical installation instructions, inspection, maintenance or repair of any machine and/or system supplied, will not under any circumstances exceed the purchase price of the machine and/or system giving rise to that claim and ends at expiry of the guarantee period defined in item 1.3.

Under no circumstances, whether due to breach of the guarantee by CONTINENTAL or by manifest negligence, shall CONTINENTAL be responsible for special and consequential damages including, without this list being exhaustive, losses of profits or proceeds, loss of use of the machines and/or systems themselves or connected machinery, capital cost, cost of replacement machines and/or systems, tooling or services, costs for down time or customers' claims to the purchaser for such damages.

Unless expressly stated in writing, the machines produced by CONTINENTAL are not intended for use in nuclear systems or activities.
CONTINENTAL refuses any liability for any damages, injuries and nuclear pollution which may occur as a consequence of such unauthorized use and the customer shall indemnify CONTINENTAL for any claims deriving there-from, including any attributed to negligence.

2 - DESCRIPTION OF THE EQUIPMENT :

2.1 PERFORMANCE

CONTINENTAL INDUSTRIE centrifugal blowers and exhausters are rotating machines intended for the transfer of a gaseous fluid from one environment to another at a higher pressure by taking the energy required from a motor. Their performance is therefore defined in terms of volume, pressure difference and current absorption.
As no wearing parts are in contact which can compromise the volume output, their performance is absolutely constant throughout their whole life.
Performance is only reduced where there is an accumulation of deposits inside the machine which reduce openings (spaces in the impellers and diffusers), but if cleaned whenever necessary the original performance is restored.
Machine performance is naturally affected by changes in pressure and temperature which affect the two environments linked (intake and supply) and by changes in the molecular weight of the fluid processed.
For this reason, it is extremely important that, in the design phase, allowance is made for limit conditions between which the nominal performances are to be guaranteed.

2.1.1 OPERATION AS A TURBO BLOWER

Operation as a turbo blower is characterized by a constant intake pressure and variable supply pressure depending on capacity.

The lower capacity limit is generally defined by the surge limit and more rarely by the temperature limit of the fluid to the supply.
The upper limit, on the other hand, is generally defined by the size of the motor which must not be overloaded.

Changes in pressure and temperature at intake affect the density of the fluid processed and can produce substantial reductions in the mass capacity where the volumetric capacity remains the same.

In processes where it is necessary to ensure the quantity of O2, it is essential to take account of the maximum ranges of temperature and pressure at intake and the humidity which results in a change in the apparent molecular weight of the fluid.

If left to operate with a completely free intake, the turbo blower provides the performance given on its throttle curve, thus drawing in the volume corresponding to the discharge pressure applied on the outlet opening and absorbing the energy shown on the curve for this capacity.

The density of the fluid drawn in is constant at any value of volume and discharge pressure.

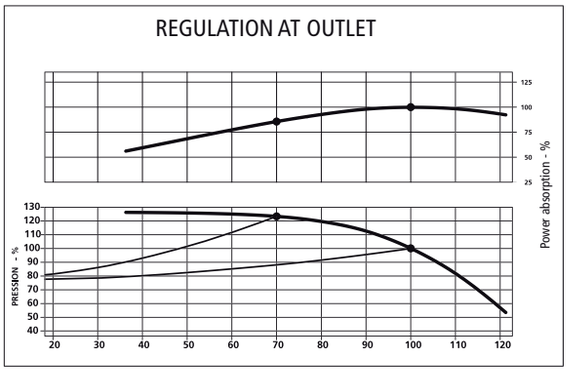
Changes in the discharge pressure applied on its outlet cause the capacity and power absorption to change precisely along the above-mentioned throttle curve.

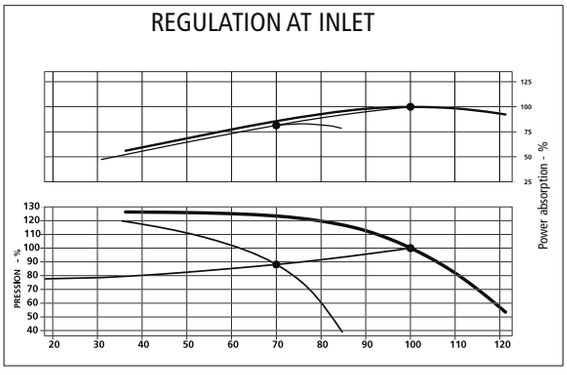
Thus the changing of the discharge pressure, achieved for example by means of a butterfly valve, can constitute a valid method of controlling machine capacity.

If, on the other hand, a pressure drop is introduced at inlet, for example by means of a butterfly valve, the inlet pressure is reduced and is variable depending on the capacity drawn in. In this case, the density of the fluid drawn in varies as the volume varies, if the volumetric capacity remains the same, resulting in a reduction in the mass capacity.

The discharge pressure also falls due to the effect of the increase in the compression ratio following the reduction in the inlet pressure.
A new throttle curve is thus created which starts close to the previous one but moves further away from it as the volume increases.
The greater the scale of the pressure drop introduced at intake, the more rapid is the new curve shift from the previous one.

Similarly to the new throttle curve, a new power absorption curve is also produced, likewise lower than the previous one.
The changing of the inlet pressure too, achieved for example by means of a butterfly valve, can constitute a valid method of controlling machine capacity.
The choice of the type of regulation is generally determined by the characteristics of the application;
however, where possible, regulation at inlet is preferred as this allows for greater energy economy.
This is because with regulation at outlet, the power absorption reduction shown in the basic curve is obtained whereas with inlet regulation, for the abovementioned reduced fluid density, the power absorption curve obtained is lower than that of the standard curve.
This is illustrated by Figs. below.





Graphs 2.1 and 2.2

2.1.2 OPERATION AS A TURBO EXHAUSTER

Operation as a turbo exhauster is characterized by constant pressure at discharge and variable inlet pressure depending on capacity.

Changes in pressure and temperature at inlet affect the density of the fluid processed and can produce substantial reductions in the mass capacity where the volumetric capacity remains the same.

For the turbo exhauster too, the lower capacity limit is generally defined by the surge limit and more rarely by the temperature limit of the fluid at discharge.

The upper limit, on the other hand, is generally defined by the size of the motor installed which must not be overloaded.
If left to operate with the discharge completely free, the turbo exhauster provides the performance shown on the throttle curve and thus draws in the capacity corresponding to the negative pressure applied on the inlet opening and absorbs the energy shown on the curve for this capacity.
The density of the fluid drawn in, however, varies as the capacity varies. Its operation is therefore comparable with that of a turbo blower regulated at inlet.

Increases in the pressure applied at discharge, achieved for example by means of a butterfly valve, reduce the performances of the machine both in terms of attainable relative negative pressure and volume.

Reductions in inlet pressure too, and thus increases in negative pressure, obtained in the same way, reduce machine performances.

When being used as a turbo exhauster too, the choice of regulation type is generally determined by the characteristics of the application; however, where possible, regulation at inlet is preferable as it allows for greater energy economy.

2.1.3 MIXED OPERATION

If pressures are measured in absolute values, there is no reason to use the term «exhauster».

However, in normal practice, barometric pressure is taken as

a reference and machines which inlet is at a pressure lower than barometric pressure are defined by the term «exhauster» and those which inlet is at a pressure equal to or higher than barometric pressure are defined by the term «compressor».

Multistage centrifugal machines can therefore operate simultaneously as turbo-aspirators and turbo-blowers.
The performance of machines thus used is naturally affected by all the factors described in items 2.1.1 and 2.1.2.

2.1.4 SURGE LIMIT

Centrifugal machines are characterized by a limit capacity, below which they are no longer able to develop the pressure or negative pressure required for transferring the fluid from the environment at a lower pressure to that at a higher pressure.

Below this capacity, there is a flow reversal which affects the pressures of the two environments and enables the machine to operate until a similar condition is reached.
The phenomenon repeats itself cyclically, generally with a very low frequency (a few Hz), depending on the installation, until action is taken to increase the capacity.

Operation in these conditions must be absolutely avoided as, when the flow reverses, there is a reversal in the axial thrust on the shaft which subjects the bearing on the inlet side to fatigue.

In large machines with high compression ratios, surging can be very violent and produce irreversible damage to impellers and piping. An appropriate safety circuit must therefore be provided.

2.2 STANDARD FITTING

The typical fittings for CONTINENTAL turbo blowers and turbo exhausters include a base-plate common to the machine and the motor, a series of foundation fixings, the machine/motor transmission unit and the protective guard over the transmission unit.

The preparation of the support of fixing of the equipment falls entirely to the purchaser. The metal supports must be treated against corrosion. The foundations must be on level (lack of flatness < 1 mm) and be designed to avoid the amplification of the vibrations resulting from the phenomenon of resonance.

2.2.1 BASE-PLATE

Small machines are generally given an OMEGA base-plate made of pressed steel plate strengthened with appropriate reinforcements - Fig. 2.3.
Other machines, in contrast, have an electro-welded steel section base-plate - Fig. 2.4.
All the base-plates have screws to align the motor and tighten any transmission belts.
The base-plates must be level if the machine is to work correctly.
This should be checked with particular care in oil lubricated machines.

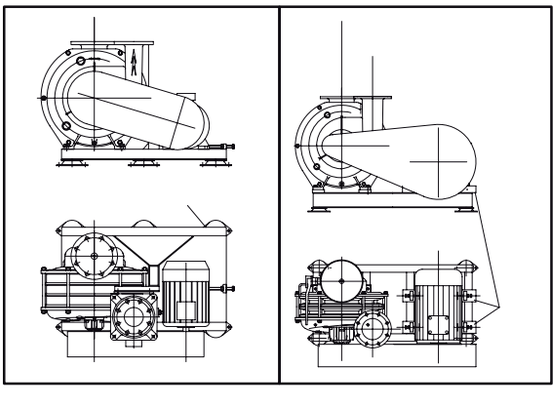
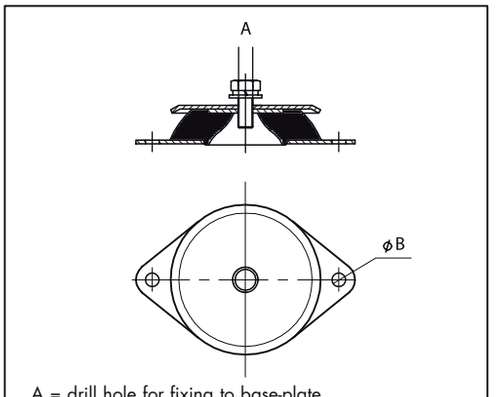


Fig. 2.3 Fig. 2.4

2.2.2.1 Shock-absorbing support blocks

CONTINENTAL machines can be installed by placing the shock-absorbing blocks included in the supply between the base-plate and the bearing surface - Fig. 2.5.



A = drill hole for fixing to base-plate
B = drill holes for fixing to bearing surfaces using expansion bolts

Fig. 2.5

The type and the quantity of blocks required is defined by CONTINENTAL on the basis of machine characteristics.
The shock-absorbing support blocks enable the machine to be installed easily and rapidly without the need to make specific foundations.
This allows the machine to be connected while preventing the transmission to the surrounding environment of vibrations generated by it and likewise the transmission to the machine of any vibrations present in the surrounding environment.
If the machine is to operate correctly, all the shock-absorbing support blocks must be loaded uniformly.
At installation, it is therefore necessary to check that none of the shock absorbers has been left unloaded.
The condition of the supporting surface and the dimensional tolerances of the base-plate and the shock absorbers themselves almost always mean that corrections need to be made by placing shims between the shock absorber base and the supporting surface.

2.2.2.2 Levelling plates and fixing bolts :

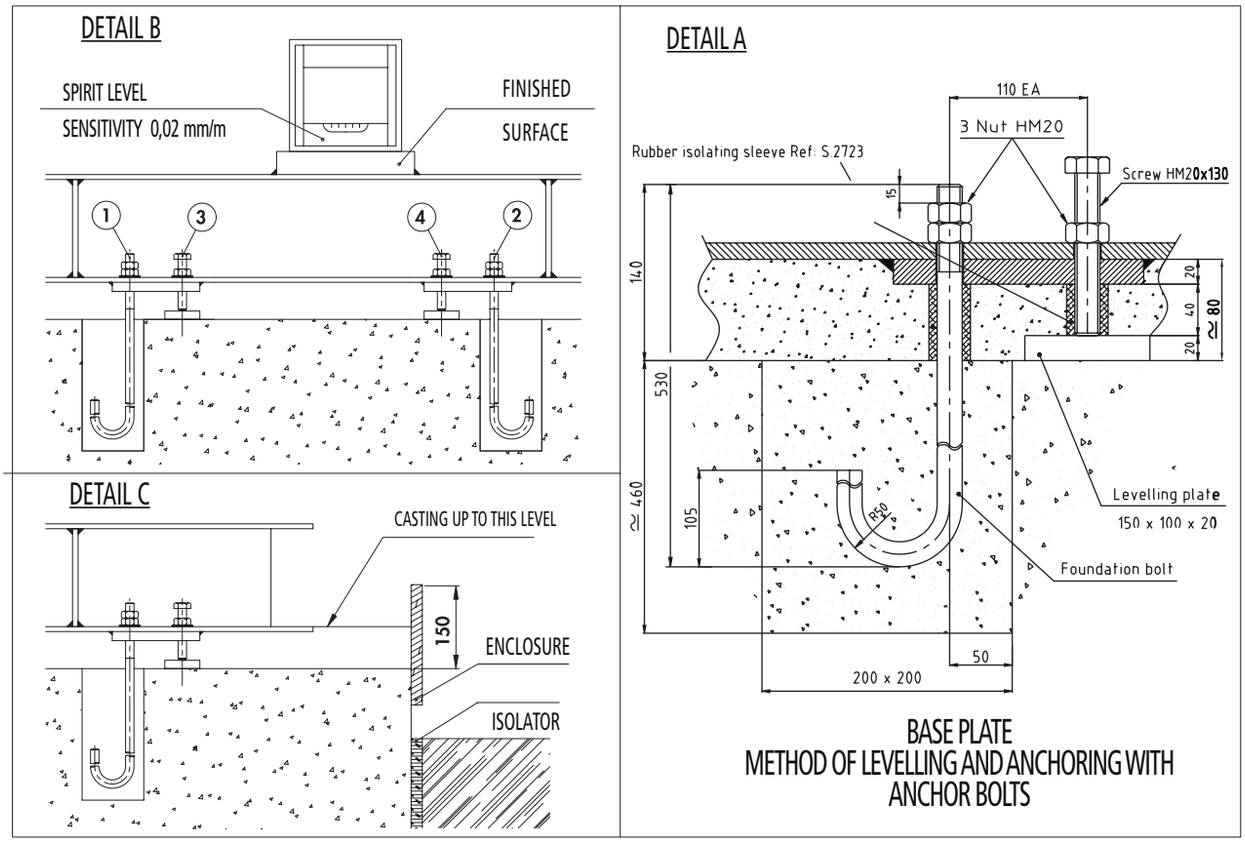


Fig. 2.6

Fixing bolts and levelling plates can be provided instead of shock-absorbing support blocks.

The use of anchor bolts, more usual for machinery with higher installed power, involves the making of a plinth isolated from the rest of the foundations to prevent the transmission of vibrations.

Where anchor bolts are used, the base-plate shall be fitted in accordance with the following instructions:

1 - Make the plinth, as much as possible keeping it isolated from the rest of the foundation.
The upper surface shall be left rough so as to provide a good key with the grouting to be carried out subsequently.

2 - Raise the base-plate to approximately one meter above the plinth. Fit the levelling screws and the anchor bolts as shown in detail A of Fig. 2.6.
Check the 15 mm and 50 mm overhangs indicated.

3 - Lower the base-plate to approximately 200 mm from the plinth, centering the anchor bolts in the pockets.
Position the 100 x 100 x 20 plates under the levelling screws.
Lower until the levelling screws come into contact with the plates.
Position the base-plate in its final location, longitudinally and transversally.
Center the plates under the levelling screws.
Wedge the plates which are not in contact with the adjustment screws.
Do not use the screws to make contact with the plates.

4 - Check that the anchor bolts are positioned correctly in the pockets.
Cement the anchor bolts into their pockets.
Leave to harden as appropriate.

5 - Loosen all the locknuts of the anchor bolts and levelling screws. Slightly tension using the anchor bolt nuts and the levelling screws.

6 - Check that the base-plate is level by using a spirit level sensitive to 0.0,2 mm/m.
This check shall be made longitudinally and transversally on all finished surfaces.
It shall be level to 0.02 mm/m.
It is adjusted by using the spirit level on the finished surface as shown in detail B of Fig. 2.6 and using the levelling screw/ anchor bolt sets.

Each levelling screw/anchor bolt set can be used to raise or lower the base-plate and therefore the edge of the finished surface relative to the adjacent one.

In particular:
- for lowering, the levelling screw must be slackened and the anchor bolt nut tightened
- for raising, the anchor bolt nut must be slackened and the levelling screw tightened.

7 - When all surfaces are levelled transversally and longitudinally as specified, ensure that no screws or nuts are slack. If any are, they must be tightened manually so as not to disturb the level obtained. All lock nuts are also to be tightened manually.

8 - Clean the surfaces of the plinth and prepare it for grouting. Provide an enclosure as shown in detail C of Fig. 2.6. If it is being installed in the open air, provide appropriate drainage for rainwater, taking account of the base-plate shape. Pour grout under the base to the level indicated in detail C of Fig. 2.6. The use of mechanical vibrators is forbidden so as not to disturb the level surface obtained. Instead, promote grout penetration with bars or chains.

9 - Cure the cement adequately for an appropriate number of days.

10 - Tighten all the anchor bolt nuts and the associated lock nuts before fitting the machines.

2.2.3.1 Direct transmission :

Direct drive to the motor with a coupling is used where the speed of rotation of the machine is the same as that of the motor.
This is the case particularly with machines driven by 60 Hz electrical motors and for turbine-driven machines.
The couplings commonly used are of the lamellar type.
A spacer is often fitted to enable the bearing at the coupling end to be replaced without disturbing the alignment.

2.2.3.2 Transmission using pulleys and belts :

Pulley and belt couplings are widely used as they enable a better speed of rotation to be selected and the machine can therefore be used close to the point of top output.
In many cases, it also allows 4-pole motors to be used to reduce the overall noise level of the unit and also enables the throttle curve of the machine to be changed to a certain extent by the simple replacement of the pulleys.
With regard to the alignment and tensioning of the transmission belts, refer to item 5.3.2.

N.B. : - The belts used in potentially explosive atmosphere must imperatively be of anti-static execution
- The machine shall never exceed plated speed without preliminary authorization of Continental Industrie.

2.2.3.3 Transmission using a gearbox :

Where the speed of rotation of the machine is greater than the speed of rotation of the motor and the value of the power to be transmitted does not allow for the use of belts, a gearbox is used.
Gearboxes with parallel shafts and helical or double helical gears are normally used.
Motor/slow shaft and fast shaft/machine connections are made with couplings as described in item 2.2.3.1.
The gearbox is fitted directly on one of the structural supports with the machined surfaces between the motor and the blower.
Its position with regard to the base-plate is fixed and thus no screws are provided for its alignment. There are sometimes two dowels for re-positioning the gearbox if it is removed.
It is aligned only by moving the machine and motor in lateral and longitudinal directions using the appropriate screws.
Any height correction is made by changing the settings of the shims under the feet of the blower and the motor.
The values of the distances to be kept between the shaft ends and the alignment tolerances, hot and cold, for the fast coupling and for the slow coupling are provided separately.
The use of a gearbox requires a forced lubrication circuit and cooling of the lubricating oil, generally achieved using a water/oil heat exchanger.
This also includes a safety system which provides an alarm signal and a shut-off signal if the lubricating oil pressure is too low.
The lubricating oil is generally held in the housing of the gearbox itself and is circulated by a gear pump driven by the slow shaft.
There is sometimes a separate lubricating unit which comprises a tank, any auxiliary and spare electrical pump required, the heat exchanger, the pressure accumulator etc.
Where necessary, specific instructions are provided separately for the use and the maintenance of the gearbox.
With regard to the alignment of the transmission couplings, refer to item 5.3.3.

2.2.3.4 Coupling guard :

The coupling guard, whether for a direct coupling or a belt coupling, is made of aluminum sheet

Given the variety of shapes and dimensions possible, specific instructions cannot be given for removal, although this does not present any difficulty to the maintenance personnel.

2.2.4 PAINTING

The standard painting of CONTINENTAL turbo blowers and turbo exhausters and their common accessories consists of a base coat applied after brushing and degreasing and a finishing coat in standard grey, synthetic enamel RAL 7016.

The corrosive atmospheres will be the subject of a detailed attention; the painting of protection must always be adapted to the environmental conditions.

2.3 APPLICATIONS SPECIFIC TO THE POTENTIALLY EXPLOSIVE ATMOSPHERES DUE TO GAS

Where the fluid processed is a gas other than air, various measures can be adopted depending on the particular characteristics of the application and the gas itself:

- The inside of the machine body can be given a gas-proofing treatment to prevent gas losses to the environment via casting pores.
- Fitting of a safety housing as described in item 2.6.1.
- Use of non-sparking belts and/or transmission couplings.
- Use of non-sparking coupling guards.
- Mechanical shaft sealing to minimize losses of the gas processed into the environment.
- Sealing of the shaft by injection of the same gas processed to prevent contamination of the gas by atmospheric air.
- Sealing of the shaft by the injection of inert gases to prevent losses of the gas processed into the environment.
- Use of special materials for rotors and/or the shaft.
- Use of protective coatings for rotors and/or the internal parts of the machine.

Where necessary, specific instructions are provided separately with regard to the above features.

In order to respect the requirements of Directive 94/9/CE, CONTINENTAL INDUSTRIE blowers and exhausters comprise with minima following specificities:

• MODEL FOR ZONE 1 :
- Protection by constructional safety (c) and by control of ignition source (b).
- Temperature class T3
- Safety housing of the bare blower
- Use of non-sparking and antistatic belts and/or transmission couplings
- Use of non-sparking coupling guards.
- Earthing legs of the base
- Use of intrinsically safe « ia » PT 100 temperature probes on ball bearings

• MODEL FOR ZONE 2 :
- Protection by constructional safety (c)
- Temperature class T3
- Safety housing of the bare blower
- Use of non-sparking and antistatic belts and/or transmission couplings
- Use of non-sparking coupling guards.
- Earthing legs of the base

It is imperative not to exceed maximum speed plated on the machine. If modifications of performance are necessary, those must beforehand be studied and agreed by Continental Industrie. We also recommend the use of probes of detection of the vibrations on the bearings.

The blowers and exhausters CONTINENTAL INDUSTRE designed to operate in potentially explosive atmosphere are equipped with a specific nameplate. Of red color, it announces the conformity to Directive 94/9/CE, the category of the equipment as well as the parameters related to the protection against the explosion.

MODEL FOR ZONE 1 :

MARKING ATEX 2G

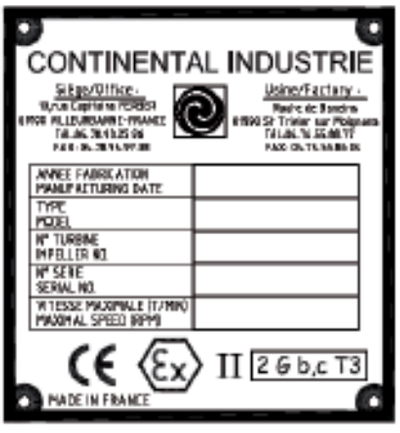


Fig. 2.7

MODEL FOR ZONE 2 :

MARKING ATEX 3G

Fig. 2.8

CE : label of conformity to the applicable European directives.

Ex : label of conformity to directive 94/9/CE and the relative technical standards

II 2 G : equipment for surface installation with presence of gas or vapours, of category 2, adapted for zone 1 and (with redundancy) for zone 2

II 3 G : equipment for surface installation with presence of gas or vapours, category 3, adapted for zone 2

« b » : equipment protected by Control of the ignition source

« c » : equipment protected by constructional safety

T3 : apparatus of class of temperature T3: the maximum temperature of surface is lower than 200°C

The earthing legs which equip the frame must imperatively be connected to the ground by a cable in conformity with the specifications of the standard EN 50014.
Temperature and vibration sensors constitute a protection against an excessive heating if and only if they are connected to a suitable circuit of alarm and /or cut-off.

2.4 MOTORS

The mechanical energy required to run CONTINENTAL turbo blowers and turbo exhausters is taken from an electric motor.

2.4.1 MOTORS FOR POTENTIALLY EXPLOSIVE ATMOSPHERES

The motors for potentially explosive atmospheres are designed with different modes of protection according to the zone for which they are intended.

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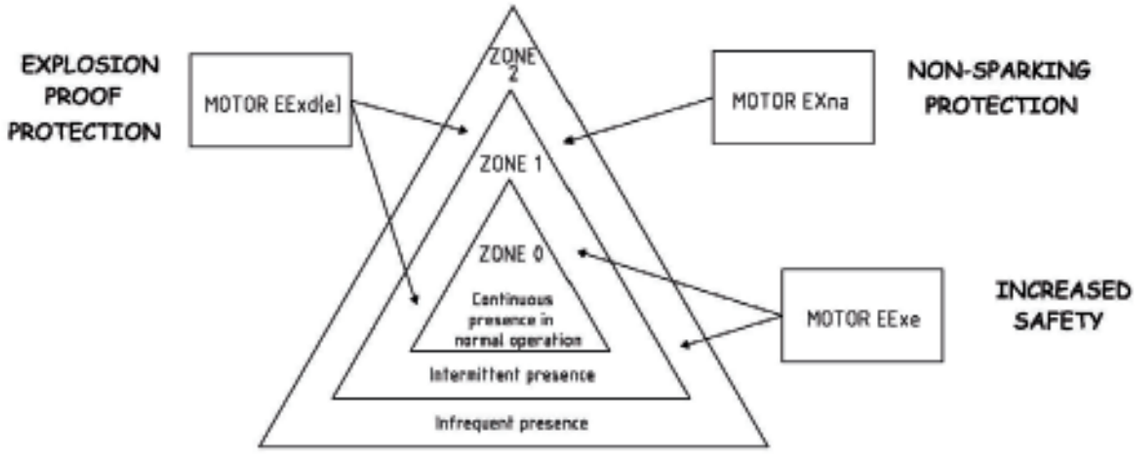


Fig. 2.9

CAUTION : These motors should not be installed in atmospheres with combustible dust.

These motors are delivered with specific instructions and ATEX certificate. It is imperative to conform to the said instructions for the installation, the start-up and the maintenance of the motors.

2.4.2. MOTORS CONNECTION :

IMPORTANT : all interventions on electric motors high voltage must be carried out only by qualified personnel.

All electric motors must be individually earthed using an appropriately sized cable.

The electric motors commonly used run on three-phase alternating current.

The windings of electric motors lead to 6 terminals in a terminal box which has holes for the passage of power cables. The terminal box is located on the top or to one side of the motor. Often terminal boxes located on the top of motors can be orientated at 90 increments.
The terminals are arranged and designated as illustrated in

figures 2.10 and 2.11 (above).

In some cases, there can also be terminals to connect special devices such as anti-condensation resistance (heaters) or platinum probes to measure the temperature of the windings.
The main characteristic data is stamped on a metal plate fitted on every motor.
Motors must always be connected down line from suitable protection against short circuits and overloads.
Not all motors are designed to operate in either direction of rotation. Often the cooling fan blades are orientated to be more efficient and cause less noise.

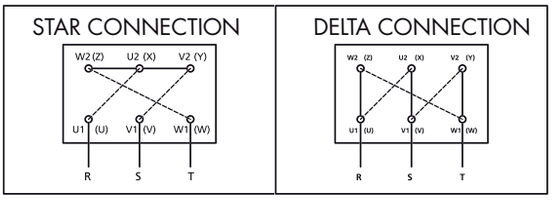


Fig. 2.10

Fig. 2.11

2.4.2.1 Star connection

The star connection is used where the line voltage is the same as the higher of the two voltages given on the plate (the line voltage is the potential difference between two of the three conductors R, S and T).
The three links fitted in the terminal box must be set out as shown in Fig. 2.10

At the first start-up, the direction of rotation must always be checked as, if necessary, it can be reversed quite simply by swapping two of the three supply cables R, S and T.

2.4.2.2 Delta connection

The delta connection is used where the line voltage is the same as the lower of the two voltages given on the plate (the line voltage is the potential difference between two of the three conductors R, S and T).

Apart from factors regarding the electricity supply line, there are no objections to a direct start-up of electric motors coupled to CONTINENTAL turbo blowers and turbo exhausters.

Direct start-up consists of powering the motor directly at normal operating voltage.
This allows the motor to develop the maximum acceleration torque and thus to reduce to a minimum the time required to reach the nominal speed of rotation.
Naturally, maximum current absorption corresponds to the maximum acceleration torque.

2.4.2.3 Star/delta start-up

To reduce the load on the supply line and to contain the absorption «peaks», star/delta start-up is sometimes used, but only for power over 7.5 kW.
The star/delta start-up consists of powering the motor at a voltage lower than that of its normal operation until its speed of rotation is close to nominal (a few seconds) and then moving to a full voltage supply.
This is possible only where the line voltage is the lower of the two voltages given on the plate (the line voltage is the potential difference between two of the three conductors R, S and T).

In the first mode, the motor has a star connection and therefore the line voltage is 1.73 times lower than its nominal supply voltage. The current absorption and the acceleration torque are approximately one third of their maximum value and therefore the time required
to reach values close to the nominal speed of rotation is longer than with direct start-up.

In the second mode, the motor has a delta connection and therefore the line voltage is equal to the nominal supply voltage. Absorption and acceleration torque may now reach their maximum values but the machine is already close to its nominal speed of rotation and requires only a small final acceleration.

The star/delta start-up involves the movement of the terminal box links and the connection of six separate cables, one for each terminal.
To reverse the direction of rotation, two of the three cables connected to one side of the terminal box and the two opposite cables on the other side of the terminal box must be swapped.

In view of the relatively long start-up times typical for multi-stage centrifugal blowers and exhausters, the use of thermal protection is recommended in the control panel.

2.5 FITTINGS

Depending on the application for which CONTINENTAL turbo blowers and turbo exhausters are intended, they can be provided with certain fittings to enhance the installation and enable it to be used correctly.
As the machine ports must not be stressed with forces and/or moments greater than limits depending on their size, it may be necessary to provide for the support of certain fittings.

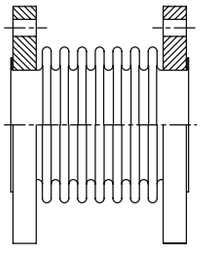
The values of the static stresses admissible on the openings are given in item 3.3.4.

2.5.1 EXPANSION JOINT

The expansion joint is made in stainless steel.

It is used for connecting the ports of the machine to pipes and/or flanged fittings.

The compensator enables thermal expansion to be absorbed and prevents the transmission of vibrations from and to the machine. The fittings and the pipes linked above the compensator must be appropriately fixed so that they do not rest on the joint itself and without significant modification of its free length.



Expansion compensator
made in stainless steel

Fig. 2.12

2.5.2 BUTTERFLY VALVES

The blowers and exhausters Continental Industrie can be provided with hand drive operation, pneumatic or electric butterfly valves.

In explosive atmosphere, these valves must be equipped with a mode of protection studied according to the zone where the material has to be installed.

The valves will have imperatively to be in conformity with directive ATEX 94/9/CE and to be accompanied by a compliance certificate mentioning the zone where they can be installed.

Specific instructions are provided separately if needed.

2.5.3 SILENCERS

IMPORTANT:
An arrow on the silencer body indicates that the flow is one-directional and that the silencer must be placed in the right direction.

The inlet, the outlet and any overflow valves are the major sources of noise in the machine.
The purpose of the silencer is to attenuate the propagation of this noise into the atmosphere.

Absorption, full flow or annular silencers and low pressure drop silencers are generally used on inlet and outlet or discharge lines.
On overflow lines, in certain special cases, combined type silencers may be preferred.
The silencing of the inlet line must be given priority for turbo blowers as it is in direct communication with the atmosphere.
For the same reason, the silencing of the discharge line must be given priority in turbo exhausters.

Inlet and outlet or discharge silencers must be isolated from the machine by expansion joints or flexible sleeves and must be fixed with suitable brackets. These must be fitted as close as possible to the respective openings.
Flanged silencers are often used at one end with a flexible sleeve and a flanged adaptor at the other.
These must be fitted with the flexible sleeve nearer to the machine opening.

Silencers on overflows to the atmosphere used in the anti-surge circuit of turbo blowers must be fitted as close as possible to the overflow valve.
If a piece of pipe needs to be fitted to connect the overflow valve and the silencer, the use of very thick pipe is recommended.
At the end of the discharge, silencers on overflows to the atmosphere must have a fluted curve and a protective wire mesh.

Overflow silencers used in the anti-surge circuit of turbo exhausters must be fitted as close as possible to the overflow valve.
If a piece of pipe needs to be fitted to connect the overflow valve and the silencer, the use of very thick pipe is recommended.
At the end of the inlet, overflow silencers for turbo exhausters must have a filter and, if installed in the open air, they must be protected from rain.

2.5.4 INSTRUMENTS

CONTINENTAL turbo blowers and turbo exhausters can be connected to instruments to display some of the operating parameters and also to provide signals used for regulation and/ or alarms and cut-off in the case of breakdown.

In explosive atmosphere, all the instruments ,and more generally all the electrical equipment, must be in conformity with directive 94/9/CE. These apparatuses will have to be accompanied by a compliance certificate mentioning the zone where they can be installed.

2.5.4.1 Pressure gauge :

The pressure gauge can be used to determine the value of pressure generated by a turboblower.

If fitted immediately down line from the outlet opening, it provides the static value of the load feeding the system served down line from the machine.

It can also be used to find the value of the depression developed by a turbo exhauster.

If fitted immediately up line from the inlet opening, it gives the static value of the load feeding the machine.

2.5.4.2 Thermometer – Thermostat :

In some cases, it can be useful to have a continuous indication of certain temperatures to check that the machine is operating correctly.
The most significant temperatures are:
- temperature of ball bearings of the turbo blower or turbo exhauster.
- temperature of air supplied or discharged
- temperature of plain bearings of the gearbox
- temperature of the lubricating oil of the gearbox at the outlet of the heat exchanger

Thermostats can be used to give signals for alarms and/ or

cut-outs, if pre-set temperatures are exceeded.
With the exception of water-cooled ball bearings, there is generally no practical advantage in keeping a display of their temperature.
Only after a ball bearing has been replaced is it advisable to check the temperature. To this end, the housings have a hole which is normally closed by a threaded plug to allow direct access to the bearing outer ring for temperature measurement.

2.5.4.3 Pressure switch :

Electric pressure switch are most commonly used in alarm and cut-off circuits for low pressure of lubricating oil of gearbox.

2.6 SAFETY ELEMENTS

2.6.1. SAFETY HOUSING OF THE BARE BLOWER :

For zones 1 and 2, the machine is equipped with a safety housing composed of two half - casings screwed out of sheet steel which contains the body of the apparatus. All ordinary maintenance can be assured without disassembling the safety housing.

2.6.2 BEARING TEMPERATURE PROBES :

It is recommended to equip the blowers and exhausters CONTINENTAL with probes for the permanent statement of the temperature of the two bearings. These probes must be connected to a suitable electric circuit of alarm and/or cut-off.

The threshold values of alarm and cut-off for the temperature of the bearings are:

T alarm = 120°C and T cut-off=140°C

The probes are fitted in the threaded holes provided in the bearing housings described in item 2.5.4.2.
With the exception of water-cooled bearings, an increase in the temperature of a bearing above the normal limit is, in almost all cases, due to inadequate lubrication.

The presence of an adequate quantity of lubricant must be ensured by regular preventive maintenance.
(see section 5 – Maintenance and overhaul)

Note: The blowers and exhausters CONTINENTAL INDUSTRIE of category 2G (zone 1) are systematically equipped with temperature sensors on the bearings. Certification ATEX is conditioned to the connection of these probes to a suitable circuit of alarm and/or cut-off. The automatic restarting of the system is not authorized.

The correct operation of the temperature sensors must be checked regularly and in particular during the start-up phases of the machine.

2.6.3 BEARING VIBRATION PROBES

The need to have measurements of the vibration level of ball bearings is illustrated in item 5.2.
It is possible to avoid having to make regular readings with portable instruments by fitting each housing with an individual probe linked to a suitable electric alarm or cut-out circuit.

The alarm level is generally set to a value close to the maximum admissible value so that there is still sufficient time to programme and carry out the necessary replacement operation of the bearings.

The threshold values of alarm and cut-off for the level of vibration of the bearings are:

Ve alarm = 5 mm/s and Ve cut-off = 7 mm/s

The correct operation of the vibration sensors must be checked regularly and in particular during the start-up phases of the machine.

3 - ACCEPTANCE, STORAGE AND INSTALLATION OF THE MACHINE :

3.1 MACHINE ACCEPTANCE

3.1.1 PRELIMINARY CONTROLS

When machinery is taken directly from the works or from a carrier's depot or when it is delivered by a carrier, the delivery and/or dispatch documents must first be checked to ensure that the equipment ordered has been received.
All packs comprising the supply, unless otherwise specified when ordering, are marked with the CONTINENTAL order number.

The packaging or the equipment itself, if it is visible, must be checked for any obvious signs of damage incurred during handling and transport. If such damage is found, this evidence must be put directly to the carrier and it must be ensured that the carrier notes this clearly on the delivery document before signing it. CONTINENTAL must also be informed promptly to avoid any disagreement and to guarantee rapid and satisfactory settlement of any damages.

3.1.2 UNLOADING AND HANDLING

The addressee is responsible and liable for unloading operations and shall therefore entrust supervision thereof to appropriately qualified personnel, selected on the basis of the size of the machinery and the difficulty presented by the operation.

3.1.3 CHECKS

A check shall be made promptly that all the equipment received corresponds to the order and any irregularities shall be advised to CONTINENTAL immediately for the necessary corrective action.
It is particularly recommended
- to check all the fittings ordered and the supply voltage of any electric motors
- to check that the data on the nameplate are in conformity with the order, in particular those related with ATEX certification

3.1.4 RECOMMENDATIONS FOR LIFTING

In view of the number of models produced by CONTINENTAL and the special features possible for each individual order, there is a vast number of feasible cases and nothing therefore can replace the experience of personnel in the handling of machinery in general.

Never use bearing housings for the lifting and the handling.

For the transport using cranes or overhead travelling cranes, the slings should be hung only to the rings envisaged for this purpose. Check that the connection between the blower or the exhauster CONTINENTAL INDUSTRIE and the system of lifting presents all necessary safety. Check the position of the centre of gravity, not turn over nor rock. Not station under the load.

3.2 STORAGE OF THE MACHINE

3.2.1 STORAGE – SHORT TERM

If a period of machine inactivity of not more than 60 days is planned, no particular precautions are required for storage. The protective devices provided directly by CONTINENTAL before its dispatch from the works are thus sufficient to keep it in good condition for this period, provided that it is kept under cover in a clean and dry environment and without the covers on the inlet and outlet openings being removed.

It is necessary at least to place the material in its position of use under even summary shelter (covers or sheet).
All the wear, reserve or spare parts must be stored in a moderated room with 15-25°C, with a maximum relative moisture of 70%.

3.2.2 STORAGE – LONG TERM

For periods of inactivity of over 60 days, in addition to the recommendations of the item 3.2.1, the following precautions must also be taken:

- Check that the inlet and outlet openings are properly sealed
- Slacken any transmission belts
- Fill any oil-lubricated bearing housings in accordance with the instructions given in item 5.2
- Frequently check the condition of machined and unpainted surfaces (shaft ends, bearing services etc.) making good, where necessary, the protective coating provided in the works
- Approximately every 30 days, rotate the machine and motor shafts manually for a few revolutions.

During storage, it is essential to prevent the machine being subject to vibrations produced by the operation of nearby machines and propagated via the bearing surfaces. Such vibrations applied for long periods could damage the machine and motor bearings.

It is also necessary to prevent the machine from being subject to frequent and/or sudden changes in temperature causing the formation of condensation, especially inside machines and motors and inside bearing housings. Where the possibility oF condensation can be foreseen, the following shall be carried out:
- hang, in an accessible way, a bag of silica gel or another hygroscopic substance inside the inlet opening and inside the outlet opening, immediately replacing the respective protective covers
- place a bag of silica gel or another hygroscopic substance for the openings on every bearing housing
- isolate the machinery from the ambient atmosphere, if possible using sealed impermeable bags or using impermeable covers carefully placed to minimize air circulation.

The silicate bags or another hygroscopic substance, installed for long term storage, will have imperatively to be removed before the use of the equipment.

3.3 INSTALLATION

Throughout the installation phases, both the machine flanges must be kept well sealed by means of suitable protective devices provided directly by the works.

Before commencing installation, the following items must be read:

3.1.2 Unloading and handling
3.1.4 Recommendations for lifting
2.2.1 Base plate
2.2.2.1 Shock-absorbing support blocks
2.2.2.2 Levelling plates and fixing bolts.

The blowers and exhausters CONTINENTAL INDUSTRIE must be only assembled in the position of installation for which they were planned and arranged (horizontal/vertical).
Consult the general assembly drawing specific to the project.

3.3.1 CHARACTERISTICS OF THE INSTALLATION SITE

CONTINENTAL turbo blowers and turbo exhausters, provided that they are intended for almost continuous operation, can be installed in the open air at practically any latitude.

If the equipment must be installed at an ambient temperature higher than 40°C or lower than -20°C, it is needed to consult CONTINENTAL INDUSTRIE.

If installed in a closed room, it is necessary to ensure a sufficient ventilation, in particular making it possible to guarantee an ambient temperature lower than 40°C and preventing the stagnation of the possible gas leakages.
The machine must be installed in order to allow an easy access to carry out the preventive and routine maintenance.

The blowers and exhausters CONTINENTAL INDUSTRIE must be installed in plants designed by a qualified personnel. The plant must be in conformity with the local standards, the national regulations and the safety requirements.

Don't expose the equipment to the direct radiation of the sun or other sources of radiation. Don't expose the equipment to exhausts of air or other fluids coming from other units.
The installer is responsible for the choice of the equipment to

use in a given installation, after having analyzed the characteristics of existing danger in the zone of installation, in conformity with the regulation in effect and emitted for purposes of safety.

All the precautions must be taken to avoid any vertical fall of object on the equipment or every intake of object by fall.

3.3.2 INLET CONDITIONS :

The air or the gases admitted in the blower or the exhauster must be filtered in order to eliminate the particles higher than 5 µm. The quality of filtration will have to be controlled regularly.
The air or the gases admitted in the blower or the exhauster must be at a temperature ranging between -20°C and +40°C and a relative humidity allowing a correct operation of the equipment and filter.
Non-observance of these data of process could involve the cancellation of the guarantee CONTINENTAL INDUSTRIE.

3.3.3 FITTINGS

Before installing any fittings, the following items need to be read:
2.5 Fittings
3.3.4 Admissible static stresses on flanges .

3.3.4 ADMISSIBLE STATIC STRESSES ON FLANGES

Although it is always preferable to avoid passing on to machines the weight of fittings and piping, inlet and outlet or discharge openings with a vertical axis and facing upwards can tolerate static stresses with forces and moments, with reference to their center of gravity, not exceeding the values given in tables 3.1 and 3.2 and in Fig. 3.3.

Flanges with a non-vertical axis or with a vertical axis but facing downwards must not be stressed.

It is important to bear in mind that if not correctly fitted, fittings and piping can produce far higher stresses than their weight due to the effect of expansion produced by the increase in temperature during operation.

Values in kg	INLET			OUTLET		
MODEL	FV	FH	FA	FV	FH	FA
8	50	40	15	35	25	15
20	75	60	30	65	50	25
31	75	60	30	75	60	30
51	75	60	30	75	60	30
77	100	80	40	100	80	40
151	150	120	60	150	120	60
251	175	140	70	175	140	70
400	225	80	90	175	140	70
500	225	180	90	200	160	8
600	300	240	120	250	200	100

Tab 3.1 – Admissible forces on vertical flanges - kg

Values in kgm	INLET			OUTLET		
MODEL	Mv	Mh	Ma	Mv	Mh	Ma
8	15	15	30	9	9	18
20	22	22	45	18	18	36
31	22	22	45	22	22	45
51	22	22	45	22	22	45
77	30	30	60	30	30	60
151	45	45	90	45	45	90
251	52	52	105	52	52	105
400	67	67	135	52	52	105
500	67	67	135	60	60	120
600	90	90	180	75	75	150

Tab. 3.2 – Admissible moments on vertical flanges – kgm –

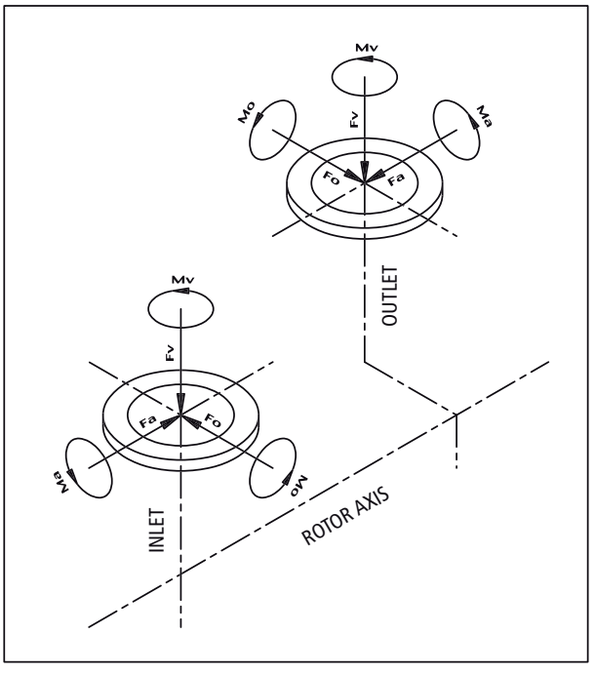


Fig. 3.3

3.3.5 PIPING

Piping must be accurately designed so that its dimensions are appropriate for the nominal performances of the machine served.
An excessive pressure drop produced by the passage of the nominal capacity would reduce the performance available for the consumer.
Normally, piping is fitted after having put the machine in its final position.

Before erecting piping, it is essential to isolate the machine by inserting a sheet metal disc between each flange and the

element immediately adjacent to it (valve, flanged adaptor, expansion joint etc.).
This prevents foreign bodies from getting into the machine during this phase.
These discs will have imperatively to be removed before use of the machine.

Piping must be erected with care and must be appropriately fixed so that it does not generate stresses on the machine flanges or during operation, this being at nominal temperature and pressure conditions.

All the pipes connected to the blower must be tight and in a state which allows them to function in safety

3.4 CONNECTIONS – UTILITIES

Once the machine has been installed and connected to the system served using the inlet and outlet or discharge piping, the other connections required for its operation can be made.

The connection of the motor and other existing electrical components must be carried out on the basis of any electrical diagram, the indications given in the specific instructions notice of the motor and those relating to the particular electric components.

All the operations of electric connection must be carried out only by specialized personnel qualified on a low tension installation (or Medium Average if necessary) equipment stopped, clearly disconnected and blocked against every restarting. Check the absence of tension beforehand.

The connection must take place so as to establish a safe electric connection permanently (cable glands usable in potentially explosive area). Carry out a reliable earthing.

There should not be foreign bodies, dust or moisture in the terminal box. Make the openings of not used cables inlets and the case himself waterproof and dustproof.

4 - STARTING UP :

The instructions given below are generic and must be completed by the technician responsible for start-up on the basis of the specific characteristics of the machine, installations and system served.

4.1 PREPARATION

To prepare the machine for start-up, the following must be carried out:
- Clean the inlet and outlet or discharge piping internally to prevent any foreign bodies reaching the inside of the machine;

- Remove the fitting closest to the inlet opening and the outlet or discharge opening, taking care to leave the sheet metal discs protecting the openings in position, fitted in accordance with the instructions given in item 3.3.5.

- Carefully remove all the material trapped by the discs;

- Remove the discs and any bags of hygroscopic material fixed in the machine openings for storage;

- Refit the two above-mentioned fittings;

- Where there may be water inside the machine, remove the drainage plugs on the base of each intermediate part and the outlet or discharge head and re-insert them when drainage is completed;

- Align and tighten the transmission belts as instructed in item 5.3.2., if necessary,

- Fill the bearing housings and oilers as instructed in item 5.2.

4.2 CHECKS

Immediately prior to starting up the machine, make the following checks:

- Check that the base-plate of the machine has been installed as instructed in items 2.2.1, 2.2.2.1, 2.2.2.2.

- Check the supply voltage of the electric motor and of any electrically powered fittings and/or instruments;

- Check the connection of the electric motor and of any electrically powered fittings and/or instruments while referring to the indications provided in the specific notes

- Check the installation of fittings, referring to the instructions given in section 2.5.

- Check that the inlet line has been fitted correctly and that all flanges are tight;

- Check that the outlet or discharge line has been fitted correctly and that all the flanges are tight;

- Check that the screws anchoring the machine to the base-plate are tight;

- Check that the screws anchoring the motor to the base-plate are tight;

- Check that the screws on all transmission couplings have been correctly tightened;

- Check that any brackets and gauges used for alignment have been removed;

- Check that there is lubricating oil in the oilers of the bearing housings and in any other oil-lubricated components;

- Check that the shaft of the machine can be rotated freely by hand; uncoupled motor.

- Check that all protective guards have been correctly fitted.

4.3 VALVES MOUNTING

Refer to herewith drawing for the mounting of the valves.
In particular, the following points shall be checked :
- Shaft of the butterfly mounted perpendicularly to the blower shaft
- Opening of the valve towards the outside of the blower.

These instructions shall be carefully observed in order to ensure the correct operation of the unit. Non observation of these instructions may void factory warranty.

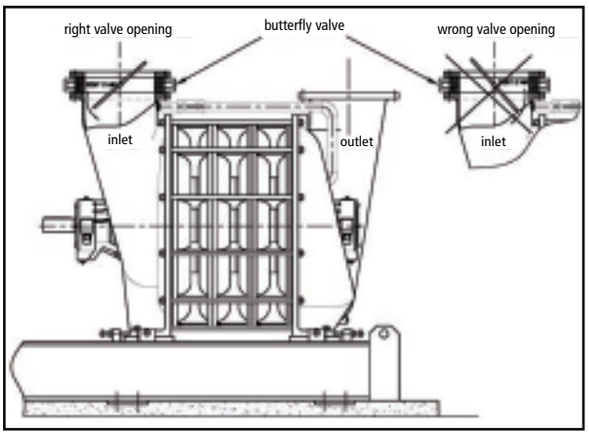


Fig. 4.1

All the valves in the system must be checked and appropriately set:

- Manual isolation and regulation valves for utilities must be opened and adjusted;
- Isolation valves for any instruments used must be open;
- Valves which affect the flow of the fluid processed must be appropriately set for purposes of:

* controlling the flow of fluid processed depending on the specific requirements of the system served;

* allowing the machine to be started up in the shortest time possible;

* preventing the machine from surge operation (see section 10.2.1).

BUTTERFLY VALVE AT INLET
The degree to which this valve is opened determines the capacity value whereas the overflow valve to the atmosphere and/or the outlet or discharge valve are left open;
Keep the start-up time close to the minimum value possible, the valve must be set to its minimum aperture;
Excessive closing of the valve causes the machine to go into surge operation.
Small machines can be started up with the valve closed if they are characterized by non-violent surging.
Medium and large machines, on the other hand, must be started up with the inlet valve set for a capacity slightly greater than that provided for surging.
As this setting can only be determined experimentally, the first start-up should be with an opening of 15° and subsequently modified.

OVERFLOW VALVE
It is present in systems with protection against surge operation and is actuated automatically by an appropriate electrical circuit.

BUTTERFLY VALVE AT OUTLET
In the first start-up phase, it is advisable to use a butterfly valve at inlet to control capacity; however, this valve must be kept open if the system served can take the fluid processed; otherwise an overflow to the atmosphere or an appropriate bypass must be provided.

4.4 DIRECTION OF ROTATION

The machine shaft must rotate as indicated by the arrow on the outlet or discharge head.
It is also necessary to ensure the correct direction of rotation when connecting the motor and electrical equipment to the supply cable. The direction of rotation can also be checked when the motor is uncoupled.

4.5 COMMISSIONING

- Start up any pumps and compressors which ensure the circulation of any service fluids (lubricating oil, cooling water, compressed air etc.);

- Check that the control valves of the flow are not completely closed and ensure a sufficient air flow to avoid working in the surge zone.

- Start up the machine, paying particular attention during the start-up and during the first seconds of operation, to irregular noise and/or high levels of vibration, in which case stop the machine immediately and carry out the necessary checks;

- Check the start-up time to optimize timer regulation for changeover to delta in the case of star/delta start-up;

- Check power absorption and correct as follows:

  → if power absorption is unstable, the machine is in surge operation and volume must be increased using the valves;

  → if power absorption is excessive, the volume needs to be reduced by means of valve regulation;

- Let the machine run for approximately 30 minutes, then check the vibration level and temperatures (see section 6).

- If everything is normal, let the machine run for a further 30 minutes, then stop it and carry out the following operations:
• check the tensioning of the belts as instructed in item 5.3.2.
• check the alignment of transmission couplings when hot as instructed in item 5.3.3.

5 - MAINTENANCE AND SERVICING OF BLOWERS AND EXHAUSTERS :

The blowers and exhausters CONTINENTAL INDUSTRIE are delivered in perfect operating condition. It is important to set up a plan of maintenance and servicing, to maintain the characteristics of the equipment and to ensure its high availability. With regard to the maintenance of the accessories delivered with the blowers/exhausters, and in particular the electric motor, please refer to the specific instructions which accompany them.

CAUTION :

The ATEX certification of the blowers / exhausters is conditioned by a good maintenance of the equipment. The maintenance notebooks of the equipment must be consultable.

We point out that the operations of maintenance and servicing on the blowers and exhausters CONTINENTAL INDUSTRIE can be carried out only by competent and qualified personnel. (see §1

5.1 MAINTENANCE AND SERVICING SCHEDULE

PART	DAILY	WEEKLY	MONTHLY	EACH 4 MONTHS	YEARLY
BEARING HOUSINGS			Changing of the grease of grease-lubricated housings (see § 5.2)	Changing of the oil of oil-lubricated housings (see § 5.2)	
DRIVE ELEMENTS				Checking alignment and fixing (1)	Checking alignment and fixing
EARTHING CONNECTION		Visual check (2)			Checking operation. Tighten bolts.
CONNECTION OF MONITORING AND ASSISTANCE	Collect measurements. Check alarms				Checking operation
WHOLE UNIT BLOWER / EXHAUSTER	Check the operating noises, the temperature and the vibrations while running	Cleaning Check the coating. (3) (4)			Tighten bolts

(1) Check that the elements of the transmission are in perfect condition and that screws and nuts are perfectly tight.
(2) Check that the electric cables do not present signs of deterioration and that connections are firmly tight; check that the earthing conductors are in good condition.
(3) Coating: Carry out a specific analysis of the damage of the coating and corrosion. Cure the damage before those do worsen. When the equipment is installed in places where corrosive agents are present and each time some need arises, it is wise to repaint the equipment to protect external surfaces from corrosion.
(4) Control that no electric or mechanical modification of the blower/exhauster and/or his accessories was made. This control must also be carried out at the time of a stop/restarting of the equipment.

MAXIMAL PERIOD OF REPLACEMENT	
BEARING HOUSINGS :	20 000 h of operation
BEARINGS :	2 years
BELTS :	2 years
SEALING LINING :	2 years

5.2 ROUTINE MAINTENANCE

If, during the normal routine maintenance programme to keep the machine efficient, the condition of the few components subject to wear is assessed, it is possible to obtain information to allow servicing operations to be programmed (see section 5.3) and unexpected stoppages, with their attendant inconvenience, to be avoided.

Therefore, in addition to the normal lubrication operations to be carried out at pre-set intervals, it is asked to keep a log for each machine, on which a record is kept of the progress over time of parameters which reflect the condition of the parts more commonly subject to wear.

In particular, it is recommended that the vibration level on the bearing housings is measured regularly; a study of the large number of readings thus obtained gives valuable information for assessing the need for replacement and thus for programming this operation.

The level of wear of transmission belts, assessed visually, must also be recorded so that the replacement operation can be carried out at programmed intervals.

5.2.1 GREASE LUBRICATION

The main purposes of the lubrication of the ball bearings fitted on the machine are: :
- to avoid metal-to-metal contact between the rolling bodies, tracks and cage;
- to protect the bearings from corrosion and wear.

Lubricating greases are composed of mineral oils or synthetic fluids dispersed in a thickening agent which determines its consistency, normally assessed in accordance with the NLGI classification (National Lubricating Grease Institute).

The consistency, the range of temperatures of use and the rust-proofing properties are the main determining factors when choosing a grease.

The operating characteristics of CONTINENTAL machines require a consistency 3 grease which can be used in the temperature range of -20 - +140.C.

Characteristics of grease used with CONTINENTAL INDUSTRIE blowers and exhausters of standard construction.
HP-ST Grease 3

Density at 15°C	.....	0,900
Melting point	.....	200°C
Ash content	.....	0,8%
Soap	.....	Lithium
Temperature range	.....	-20°C/+140°C

EQUIVALENT GREASES :

ESSO	.....	BEACON 3
ELF	.....	ROLEXA 3
TOTAL	.....	MULTIS TIR
SHELL	.....	ALVANIA.EP3
MOBIL	.....	MOBILUX EP3

Generally, lithium soap greases, with the addition of rust-proofing additives or EP, are able to meet the above requirements.

When choosing a grease, it is, however, important to check that the consistency does not change excessively under the effect of mechanical stresses or temperature changes; this is because an excessive increase in consistency at low temperatures can impede the rotation of the bearing, whereas its excessive reduction at high temperatures can result in the escape of all the grease held in the housing, leaving the bearing without any lubrication.

To keep the operating temperature of a bearing at its lowest possible value, and thus to obtain the maximum service life possible, the quantity of grease has to be kept to that strictly essential for purposes of effective lubrication.

In practice, however, it is sufficient that the grease present does not take up more than 30 - 50% of the free space in the housing.

If there is excess grease, the temperature of the bearing increases suddenly, which substantially reduces its service life and can cause irreversible damage. In such conditions therefore, the bearing has to operate at temperatures far higher than those considered when it was designed and therefore is subject to premature wear .

Re-lubrication with greases of a different type is not recommended as this creates the risk of mixing incompatible greases with each other; this generally results in a fall in consistency and maximum admissible temperature values to below the typical values of the individual greases mixed.
The bearings in CONTINENTAL machines are lubricated in the works for mechanical testing and therefore no re-lubrication is needed before the machine is first brought into operation. However, if this one is carried out within a time higher than three months after delivery, it is necessary to proceed to re-lubrication.

The lubrication periods shown in table 5.1 below are defined on the basis of bearing size, characteristics of use and the type of service for which the machine is intended.
The quantity of grease required for re-lubrication of each bearing is shown in the same table.

TYPE	Re-lubrication PERIOD (HOURS)	GREASEQUANTITY / BEARING (G)
08	750	5
20	750	5
31	750	10
51	750	10
77-151	750	20

Tab 5.1 – Re-lubrication periods - grease

The bearing housings for all CONTINENTAL machines are fitted with lubricators with ball valves and re-lubrication is therefore carried out at pressure.

All bearings in CONTINENTAL machines are fitted with a grease valve to allow for re-lubrication while the machine is in operation and to prevent the accumulation of grease in the housing and the consequent overheating of the bearing.

However, it is advisable to re-lubricate with the grease quantities shown in the table 5.1.

As the lubricating power of grease reduces over time under the effect of mechanical stresses, ageing and pollution (dust, humidity, metal particles), it is recommended that all the grease in the housing be changed regularly. (see .1 maintenance and servicing schedule)

The presence of the above-mentioned grease valve means that this operation can be carried out without the need to halt the machine. (CAUTION ! Don't exceed the quantity mentioned in the table 5.1)

5.2.2 OIL LUBRICATION

Oil lubrication is used where the speed of rotation of the rolling bodies and/or their operating temperature reach values which make the use of grease no longer advisable.

It is clear, therefore, that with equal speeds of rotation of the rotors, smaller machines can be grease-lubricated whereas larger machines need to be oil-lubricated.

All oil-lubricated CONTINENTAL machines are fitted with a sump, placed directly in the bearing housing, in which the oil level is maintained by means of a constant level oil feeder and an oil nozzle disc.

During operation, this system produces actual oil circulation inside the housing which, in addition to providing the obvious lubricating functions, has an effective cooling action on the bearing and immediately removes any pollutants which may affect it.
Particle pollutants of a magnetic nature are dealt with by appropriate magnetic plugs placed in the housing drains while other pollutants settle at the bottom of the sump. For the lubrication of ball bearings, mineral oils are generally used with the addition of additives to improve resistance to oxidation and the resistance of the lubricating film.

Viscosity is one of the main characteristics of a lubricating oil and is that which, in our case, is a decisive factor when choosing an oil. Viscosity, like consistency with greases, falls as the temperature rises.

Therefore when choosing an oil, it is essential to check that at the maximum foreseeable operating temperature, the viscosity remains at values which enable a lubricating film of an adequate thickness to be formed.

Technical characteristics of the oil used by CONTINENTAL INDUSTRIE on the standard blowers and exhausters

JAROGEAR Z .150		
Extreme-pressure oil	.....	Service API – GL5
Properties :		
- Extreme pressure, anti oxidizing, anti corrosive, antifoam, anti-rust.		
- Resistant to alteration at high temperature.		
Medium characteristics :		
- Density at 15°C	.....	0,892/0,917
- Cinematic viscosity in Cst :		
at 40°C	.....	143/148
at 100°C	.....	14,3/15,5
- Viscosity index	.....	103
- Flash point VO	.....	≥215°C
- Flow point	.....	≤ -24°C
List of other equivalent oils :		
ESSO	.....	SPARTAN EP 150
ELF	.....	REDUCTELF SP 150
TOTAL	.....	CARTER EP 150
SHELL	.....	OMALA 150

→ periodicity of oil renewal every 3000 hours

Regardless of operating hours and level of use, the lubricating oil needs to be changed at least once per year.

With oil lubrication too, excess lubricant is damaging as it causes a rise in the operating temperature of the bearing and thus reduces its useful life.

In this regard, it is important that when the housing is refilled the necessary precautions are always taken to ensure that the level inside it does not exceed that maintained by the action of the constant-level oil feeder.

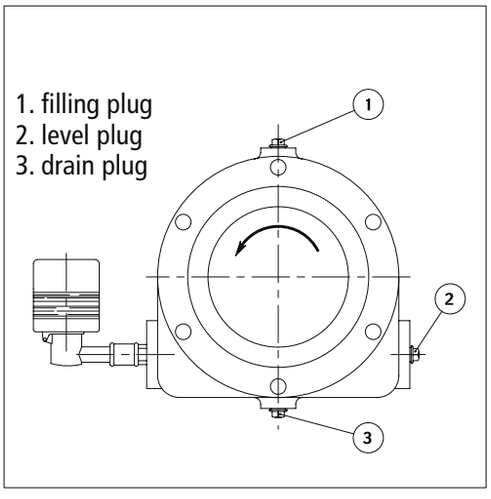
Once this level has been reached, plugs 1 and 2 can be replaced and oil can continue to be added via the transparent bulb in the oil feeder - as shown in Fig. 5.3 - until the level in the bulb itself stabilizes.

Oil must be filled into the bulb in accordance with the method shown in Fig. 5.3.

It is recommended that when filling, the same oil should be used as that used to fill the housing, to avoid the danger of mixing oils which are incompatible with each other.

Bearing housings in CONTINENTAL machines are drained after mechanical testing to prevent oil leaks during transport.

The housings must therefore be refilled as described above before the machine is brought into operation for the first time



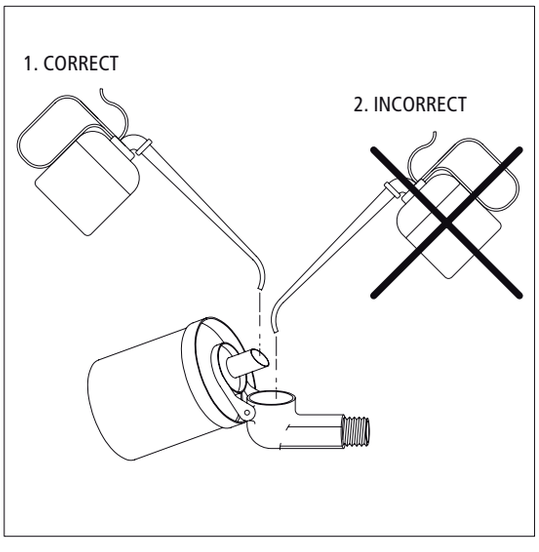


Fig. 5.2 - Fig. 5.3

The quantities of oil required for filling, depending on the machine model, are shown in table 5.4 hereafter.

CAPACITY OF OIL-LUBRICATED MACHINES (liters)

MODEL	PER HOUSING	PER OILER	TOTAL PER MACHINE
77	0.67	0.11	1.56
151	0.67 or 1.67	0.11	1.56 or 3.56
251 / 400 / 500	1.91	0.11	4.04
600 / 700	5.11	0.11	10.44

Tab.5.4 - Oil required for filling

5.3 PREVENTIVE SERVICING :

5.3.1 REPLACEMENT OF TRANSMISSION BELTS

This operation must be considered in the case of the visible deterioration of one or more belts and at the latest every two years.

The replacement of transmission belts is a non-routine maintenance operation which is necessary only a few times in the life of the machine if the following conditions are maintained during its operation:

- tension at minimum possible value so as not to allow any slipping in any conditions of operation;
- perfect alignment of pulleys. (see § 5.3.2)

The operation of the blower or the exhauster apart from the limits of maximum capacity authorized by the manufacturer of belts is prohibited and it is appropriate to avoid very frequent starting, especially on line and loaded, which appreciably decrease the duration of a set of belts.

It is also important to avoid any form of overheating of the belts and to keep them well ventilated.

It is recommended that belt tension be checked regularly and corrected where necessary, ensuring that pulley alignment is observed.

To replace the belts, the protective guard has to be removed and the motor/machine center distances reduced using the motor fixing screws and those provided or its positioning.

The position of the machine in relation to the base-plate, on the other hand, must not be changed in any way.

It is very important that, during operation, every belt transmits its part of the power so that all the belts contribute to power transmission.
Otherwise, all the power is transmitted by only some of the belts which then wear prematurely as they are overloaded.
Only when these belts start to slip are the others involved in power transmission, but these too are overloaded and likewise wear prematurely.
To avoid this, the pulleys must be well aligned and it is essential above all that all the belts are equal. For this reason, the belts are grouped in sets directly by the manufacturer, on the basis of strict measurements.

→ For this reason, the belts should not be replaced separately, it is appropriate to replace all the set of belts which constitutes the transmission

When the belts are bought, it is preferable to order a set comprising a given number of belts rather than a given number of belts.

When the belts are replaced, it is worthwhile assessing whether the operation is necessary due to normal wear or whether the operation has become necessary prematurely for other reasons.