



CONTINENTAL INDUSTRIE
CENTRIFUGAL BLOWERS AND EXHAUSTERS



BLOWERS & EXHAUSTERS

INSTALLATION, OPERATION
& MAINTENANCE MANUAL



GAS POTENTIALLY EXPLOSIVE ATMOSPHERES



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INTRODUCTION

The equipment supplied with these instructions complies with the requirements of the 2014/34/UE ATEX directive relative to the connection established between the laws of the EU Members concerning equipment and protective systems intended for use in potentially explosive atmospheres.

These instructions are sent with an EC conformity certificate specifying the zone in which the blower or exhauster can be used. This information is also available on the equipment nameplate (§ 2.7).

1. INFORMATIONS

This handbook is intended to allow the installation, start-up, use and maintenance of the CONTINENTAL INDUSTRIE blowers and exhausters in potentially explosive atmospheres due to gas as defined by the ATEX directives 2014/34/UE and 1999/92/CE.

This handbook must be kept close to the corresponding equipment.

For safety reasons CONTINENTAL INDUSTRIE blowers and exhausters are only to be used by trained and qualified staff having read and fully understood this manual.

The qualified staff is composed of experienced members trained to safety regulations, rules for accident prevention, the directives and acknowledged rules of technologies. The staff must be able to identify all possible hazards related to the tasks which are entrusted to him and to determine the means of avoiding them. The staff must be authorized by the safety representative of the installation to carry out the necessary work.

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

1.1 GENERAL INFORMATION

CONTINENTAL INDUSTRIE blowers and exhausters are made in accordance with current safety regulations.

The various production steps are checked according to the quality controls to ensure that the equipment is free from defects. All machines are mechanically tested before dispatching.

1.2 SAFETY INSTRUCTIONS

General safety standards and any special standard for the specific installation must be applied when handling, installing, using and servicing the equipment.

In particularly:

- Cables and slings must have sufficient resistance and have to be regularly controlled for lifting.
- Only qualified staff is allowed to work on live electrical components.
- Wait the time the capacitors need to be discharged before working on these lines.
- Switch off the isolator and put out appropriate "work in progress" signs while working on machines connected to an electrical supply.
- Check that adequate precautions are taken after every work interruption.
- Mount safety guards before operating machines.
- Prevent access around inlet opening.
- If loose clothing keep away from rotating parts.

The personnel and people passing near the equipment must be advised against danger to be in contact with:

- potentially hot surfaces of the blowers and exhausters, the pipes and accessories
- parts under tension
- rotating parts

1.3 GUARANTEE

CONTINENTAL equipments are guaranteed twelve (12) months after startup, limited to (18) eighteen months after shipment, for material and manufacturing defects. When it specified in the quotation, some special material is guaranteed six months. The guarantee is limited to replacement and repair of the defective elements at our factory.

To make a claim under guarantee the machines and or systems must have been used for their intended application and in compliance with CONTINENTAL instructions. The purchaser loses all guarantee rights if the machines or systems are repaired or modified without CONTINENTAL agreement. Repairing, modification or replacements of parts under guarantee don't affect the initial guarantee dates. We don't accept any return of machines without our prior agreement.

Transport cost to our factory will be paid by the purchaser. Nevertheless, and concerning open and hidden defects of the sold object, our contractor guarantee doesn't replace the legal guarantee terms to which all professional sellers are bound. However, the contractual guarantee doesn't imply the right to ask for damages or compensation. We





are not responsible for any special destination or dependency not specified in the purchase order.

1.4 LIMIT OF LIABILITY

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

Under no circumstances, either due to breach of the guarantee by CONTINENTAL, or by manifest negligence, CONTINENTAL shall be responsible for special and consequential damages including, without this list being exhaustive:

- Losses of profits or proceeds,
- Losses of the use of the machines, systems themselves or connected machinery
- Capital cost for material or replacement of machines or systems
- Tooling or services involved
- Cost, for down time or purchaser's customers claims for such damages

2. EQUIPMENT DESCRIPTION

2.1 CHARACTERISTICS

2.1.1 GENERALITY

CONTINENTAL INDUSTRIE blowers and exhausters are multi-stage centrifugal compressors intended for the transfer of gaseous fluid.

Their impellers are driven in rotation, by taking the energy required from an external source (e.g. motor, steam turbine, ...), allowing to increase enthalpy level of the moved fluid by increasing its pressure and consequently its temperature.

The basic and efficient design of the CONTINENTAL blowers and exhausters allows keeping stable working features in reducing at the maximum the level of mechanical lost. The only mechanical contacts are onto the ball bearings.

These features depend on the fluid density at the inlet, its composition (Molecular weight) and its characteristics state (pressure and temperature).

To ensure operation in any conditions, the equipment is designed with limit conditions corresponding to the lowest density at the inlet.

The flow rate limits are defined as follows:

- Minimum flow rate: is generally given by the surge point (§ 2.2.1), sometimes by the temperature limit at the outlet (mechanical limit).

- Maximum flow rate: is given by the maximal motor power which must not be overloaded.

Note that load of the machine (blower or exhauster) increases with the density of the fluid at the inlet.

For example, lower temperatures in winter time increase significantly density; that results a significant increase of machine load, outlet pressure and consumed power.

To avoid this phenomenon, pressure regulation can be used as follows:

- Variable Frequency Drive (VFD) to adjust motor speed: As no loss is added, It is the best choice to optimize power consumption

- Butterfly valve at the outlet to meet the nominal working point

- Butterfly valve at the inlet also to meet the nominal working point. In that case, as the density at the inlet is reduced to its initial lowest value, the machine load is also at its minimum value and the consumed power decreases too.

Therefore, to realize an important saving energy, to choose regulation by butterfly valve at the inlet, is better than at the outlet.

2.2 OPERATION PRINCIPLE

For the transfer of a gaseous fluid from one environment to another, we can consider only the evolution of absolute pressure inside the machine. In that case, the atmospheric pressure does not modify the performance of the machine.

As the compressor has always:

- Absolute static pressure at the inlet lower than upstream,
- Absolute static pressure at the outlet higher than downstream,

The CONTINENTAL centrifugal compressor is always both:

- a blower, when one looks at the outlet pressure vs flow rate evolution,
- an exhauster, when one looks at the inlet pressure vs flow rate evolution. We prefer to look at the vacuum





created: the pressure difference between the upstream network and the inlet of the machine.

In practice, most of the applications are based on the following additional conditions:

- **BLOWER:** inlet is open to the atmosphere. If considering inlet pressures losses are insignificant, the blower is characterized by constant pressure at the inlet (equal to atmospheric pressure) and variable pressure at the outlet as a function of the flow rate.

- **EXHAUSTER:** outlet is open to the atmosphere. If considering outlet pressures losses are insignificant, the exhauster is characterized by a constant outlet pressure (equal to atmospheric pressure) and the inlet pressure varies in function of the flow rate.

2.2.1 SURGE LIMIT

Centrifugal machines are characterized by a limit capacity, below which they are no longer able to develop the pressure (or the negative pressure for an exhauster) required for transferring the fluid from the inlet environment to the outlet environment.

Below this capacity, there is a pressure reversal which makes a flow reversal between those two environments. The phenomenon repeats itself cyclically, generally with a very low frequency (a few Hz), depending on the installation; it can be stopped by increasing the flow (until an upper flow of the surge one).

Operation in these conditions must be absolutely avoided as, when the flow reverses, it generates alternative stress on the impellers vanes, and there is a reversal of the axial thrust on the shaft, which subjects the bearing to fatigue.

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

2.3 TYPICAL ASSEMBLY

The typical assembly for CONTINENTAL blowers and exhausters include a common base plate for motor, machine, machine/motor transmission unit and the protective guard of the transmission unit. The preparation of the holder for equipment fixing is the purchaser responsibility. The metal elements must be treated against corrosion. The foundations must be leveled (lack of flatness < 1 mm) and be designed to avoid the amplification of the vibrations.

2.3.1 BASE PLATE

Small machines are equipped with a base-plate made of folded sheet steel strengthened with appropriate reinforcements Fig. 2.1.

In contrast the other machines have a tack welded base plate Fig. 2.2.

All the base plates have screws to align the motor and to eventually tighten transmission belts. The base-plates must be installed on a horizontal surface, particularly for oil lubricated machines.

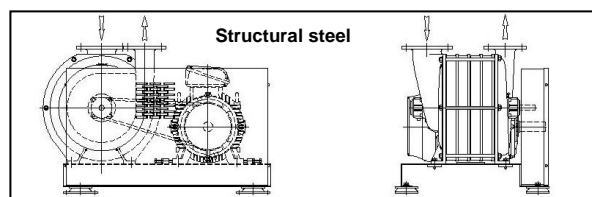


Fig. 2.1

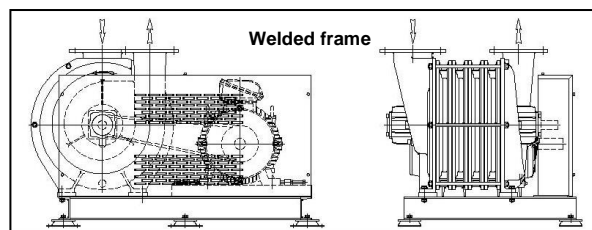
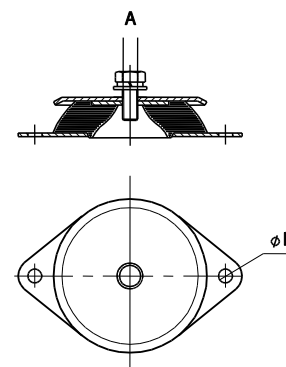


Fig. 2.2

2.3.2 BASE PLATE FIXING

2.3.2.1 Resilient pads

CONTINENTAL machines can be installed on resilient pads. The type and the quantity of pads required are defined by CONTINENTAL according to the machine characteristics.



A= Mounting hole to the frame
B= Mounting hole to the ground

Fig. 2.3





The resilient pads allow the machine to be installed easily and quickly without making special foundations.

In addition of fixing the machine, the pads prevent the transmission of machine vibrations to the environment and reciprocally (transmission of any vibrations present from the surrounding environment).

All the shock absorbing resilient pads must be loaded uniformly to assure the correct operation of the machine.

Corrections often need to be made by placing shims between the resilient pad and the supporting surface.

2.3.2.2 Levelling plates and fixing bolts

Fixing bolts can be provided instead of resilient pads. Anchor bolts are mainly used for machinery with higher power.

To prevent the transmission of vibrations, that installation involves the making of a solid concrete isolated from the rest of the foundations. The installation of the base plate on the foundations must be made according to the following instructions:

1. Make the solid concrete and keep it as much as possible isolated from the rest of the foundation. The

upper surface shall be left rough to provide a good link with the concrete screed which will be carried out after.

2. Raise the base plate about one meter above the solid concrete. Fit the levelling screws and the anchor bolts as shown in detail A of Fig. 2.4. Check the 15 mm and 50 mm positions.

3. Lower the base-plate to approximately 200 mm from the solid concrete, and centre 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 shims. Position the base-plate in its final location, longitudinally and transversally. Centre the shims 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 up to the level. Let harden as required.

5. Loosen all the locknuts of the anchor bolts and levelling screws and slightly tighten.

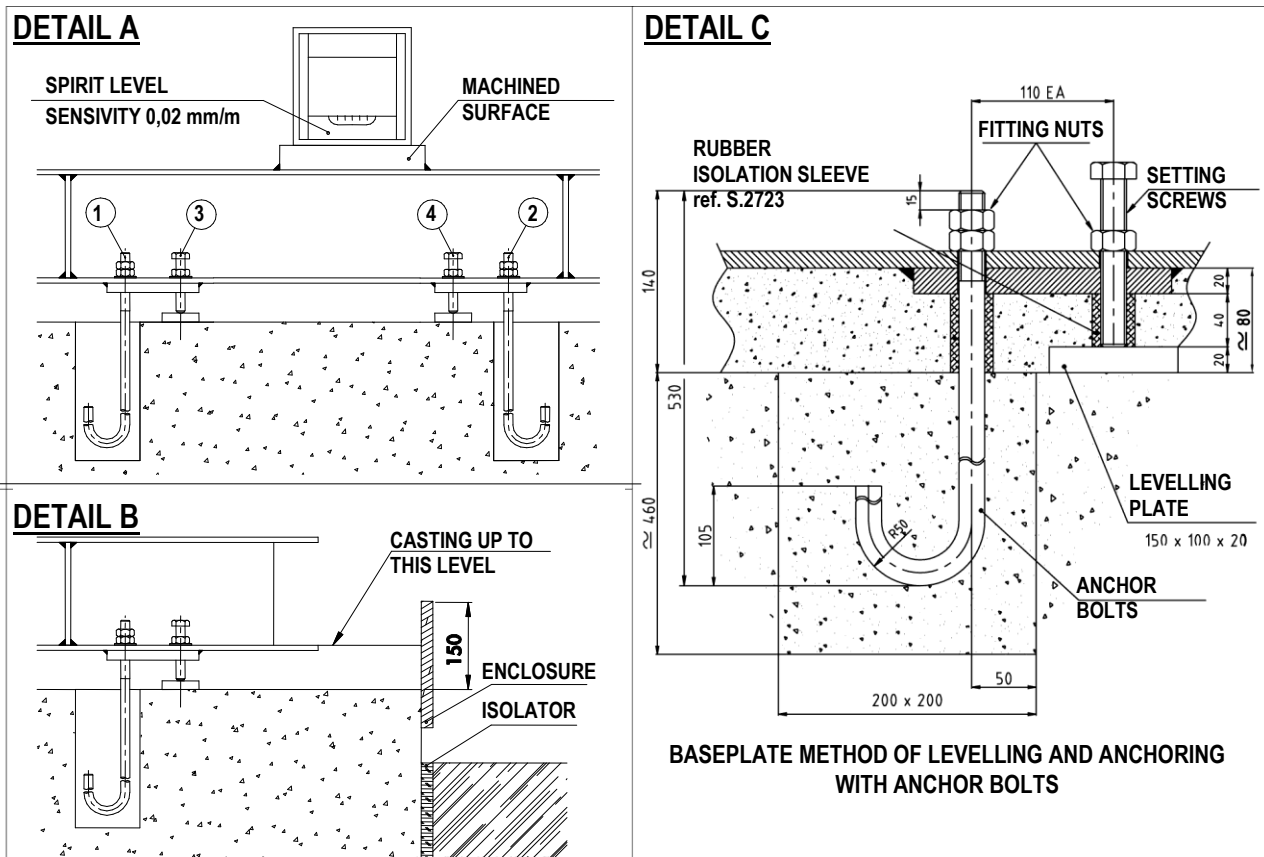


Fig. 2.4





6. Check that the base-plate is leveled by using a spirit level sensitive to 0.02 mm/m or if possible with a laser alignment tool. This check shall be made longitudinally and transversally on all finished surfaces. The flatness shall be to 0.02 mm/m. The levelness is adjusted by using the spirit level on the finished surface as shown in detail C of Fig. 2.4 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 loosened and the anchor bolt nut tightened
- rising, the anchor bolt nut must be loosened and the levelling screw tightened.

7. When all surfaces are leveled transversally and longitudinally as specified, ensure that no screws or nuts are loosened. If they 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 solid concrete and prepare it for flow the cement. Provide an enclosure as shown in detail B of Fig. 2.4. If it is installed in the open air, provide appropriate drainage for rainwater, by taking into account the base-plate shape. Flow low shrinkage cement under the base-plate up to the level indicated in detail B. Do not use mechanical vibrators which may compromise the surface levelling obtained.

9. Wait few days up to obtain a complete drying.

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

2.3.3 TRANSMISSION

Any coupling element is protected by an aluminum guard.

2.3.3.1 Direct transmission

Direct drive ensures the machine rotational speed is equal to the one of the motor. The coupling commonly used is "lamellar" type. A spacer enables the replacement of the ball bearing at the coupling end, without disturbing the alignment.

The coupling must be in compliance with ATEX 2014/34/UE directive.

2.3.3.2 V-belt drive

V-belts drive is widely used. It allows the choice of the optimum rotation speed and optimizing the efficiency of the machine. If desired, it allows changing the

performance curves of the machine to a certain extent by the simple change of pulleys set. In many cases the use of 4-pole motors is possible to lower the overall noise level of the unit. Refer to § 5.2.2.2 for alignment and tensioning of the transmission belts.

NB:

- The belts used must imperatively be of anti-static execution
- The machine shall never exceed plated speed without preliminary authorization of CONTINENTAL

2.3.3.3 Gearbox transmission

We use a gearbox when we want to use the machine at a higher speed than the motor and when the power is too high for using a V-belt.

The position of the gearbox, mounted directly on fabricated holder, is fixed.

The alignment is achieved only by longitudinal and lateral movements of the machine and the motor with the screws provided for this purpose. Any height adjustments are obtained by changing the value of shims under the brackets of the machine and the motor.

The lubrication circuit of the gearbox requires additional controls: refer to the instructions of the gearbox.

The gearbox must be in compliance with ATEX directive 2014/34/UE.

2.3.4 PAINTING

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

The corrosive atmospheres will be the subject of a detailed attention; to keep the safety level required, the painting of protection is only performed at the factory.





2.4 MOTORS

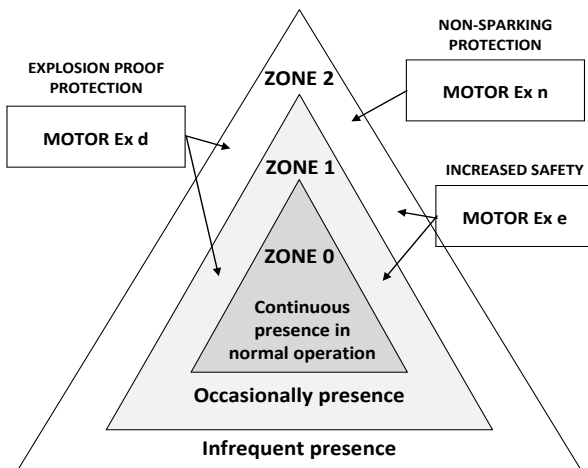
The mechanical energy required to run CONTINENTAL blowers and exhausters is in the majority of cases taken from an electric motor.

NOTE: Usual instructions for motor have to be strictly respected (number of consecutive starts, etc...).

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 to.

These motors are delivered with specific instructions and ATEX certificate. It is imperative to conform to these instructions for the installation, the start up and the maintenance of the motors. If the documents are not available please contact CONTINENTAL INDUSTRIE.



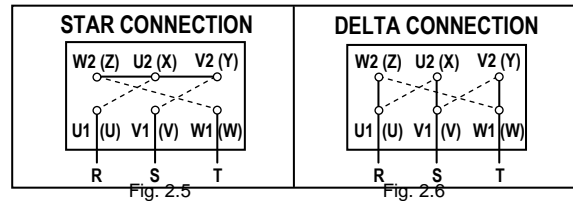
2.4.2 MOTOR CONNECTION

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

All electrical motors must be individually earthed using a cable of appropriate size.

Commonly, electric motors are fed with three-phase alternative current.

The windings of the electric motor lead to 6 terminals in a terminal box with cable glands for the alimentation. The terminal box is located on the top or on the side of the motor. The terminals are arranged and designated as illustrated in Fig. 2.5 and Fig. 2.6.



In some cases, there can also be terminals to connect special devices such as resistance heaters or RTDs (resistance temperature detectors) to measure the windings temperature. The main characteristic data is stamped on the metal name plate of every motor. The motors must always be connected downstream from suitable protection against overloads and short circuits. The motors may be designed to operate in a single direction of rotation. Often, the cooling fan vanes are orientated according to that rotation direction, in order to get a better cooling efficiency and cause less noise.

2.4.2.1 Star connection

The star connection is used where the line voltage is equal to the higher of the two voltages given on the nameplate (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. 2.5

At the first start-up, the rotation direction must always be checked; if necessary it can be changed, 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 equal to the lower of the two voltages given on the nameplate (the line voltage is the potential difference between two of the three conductors R, S and T).

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

Direct start-up consists of powering the motor directly at standard operating voltage. This allows the motor to develop the maximal 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.

2.4.3 STAR/DELTA START-UP

To reduce the load on the supply line and to contain the absorption peaks, star-delta start-up is often used for motors with power over 7.5 kW.





The star-delta start-up consists of powering the motor at a voltage lower than the nominal one until its rotation speed is close to the nominal one (some seconds) and then moving to a full voltage supply.

This is only possible 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 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 removing all the terminal box strips and connecting six separate cables, one for each corresponding 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 multistage centrifugal blowers and exhausters, the use of thermal protection is recommended downstream to the electrical supply contactor.

2.5 ACCESSORIES

Depending on the application for which CONTINENTAL blowers and exhausters are intended, they can be provided with certain accessories to enhance the installation and enable it to be used correctly. The accessories mounting must not involve stresses or moments superior to those defined into § 3.3.3.

If there is a risk of electrical continuity disruption between the different elements, a flange to flange electrical wire must be installed.

2.5.1 EXPANSION JOINT

The expansion joint is made in stainless steel and the flanges, in galvanized steel. It is used to connect the machine to flange-equipments. The expansion joint enables thermal expansion to be absorbed and prevents

the transmission of vibrations from and to the machine. The equipments and the pipes linked to the expansion joint must be appropriately fixed, to not produce too much stress, and to not modify significantly its free length.

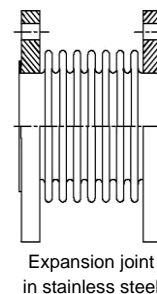


Fig. 2.7

2.5.2 BUTTERFLY VALVES

The CONTINENTAL compressors can be provided with manually, pneumatically or electrically operated butterfly valves.

In explosive atmosphere, those valves must be equipped with protection according to the zone where the material has to be installed.

The valves must imperatively be in compliance with ATEX 2014/34/UE directive and accompanied by a conformity certificate specifying the zone where it can be installed.

Specific instructions are provided separately if required.

2.5.3 ANTI-SURGE CIRCUIT

To assure stable operation even for low flow rates an anti-surge system can be required (§ 2.2.1).

The anti-surge control must never create an additional ATEX zone (the compressor transfers often a rich mixture which would create an external ATEX zone).

To avoid the surge zone running, some specific solutions exist: minimum intensity control, recycling ...

2.5.4 INLET FILTERING

The inlet filter has to assure the retention of any undesirable elements influencing the machine operation and the downstream process. The filter has to be in compliance with ATEX 2014/34/UE directive.

The ATEX zone 2 is the most exigent zone tolerated into our machines.

The inlet filtration system has to allow keeping this zone.





2.5.5 SILENCER

IMPORTANT: to indicate the flow direction, a mark “S” is written onto the downstream part of the silencer,

The inlet and outlet openings are the main sources of noise in the machine. The purpose of the silencer is to attenuate the propagation of that noise into the atmosphere.

The low pressure drop absorption silencers, full-flow or annular, are generally used:

- Onto the anti-surge pipe
- At the Inlet for a blower
- At the outlet for an exhauster

All silencers must generally be isolated from the machine by expansion joints or flexible sleeves and must be fixed with suitable brackets. They must be fitted as close as possible to the respective openings of the machine.

2.5.6 INSTRUMENTATION

Blowers and exhausters can be connected to instruments to display some of the operating parameters and also provide signals used for regulation, alarms and cut-off in case of break down.

2.5.6.1 Manometer

The pressure gauge can be used to determine the value of pressure generated by a blower. If it is fitted in a direction perpendicular to the one of the flow:

- Just downstream to the outlet opening, it provides the static outlet value of the load feeding the system
Just upstream to the inlet opening, it provides the static inlet value which, if it is a gauge measurement, is, for an exhauster, equal to the useable depression.

2.5.6.2 Thermometer - Thermostat

The flow temperature can be monitored continuously through a thermometer or a thermostat: alarm or cut-off, if limit values are exceeded.

Others instruments can be used: pressure switch, flow-meter, ...

All instruments have to be in compliance with ATEX 2014/34/UE directive.

2.5.7 EQUIPOTENTIAL WIRING

All earthing clamps must be connected to the ground by cables in compliance with EN 60079 (section equivalent to those of the supply cables).

An equipotential wiring of the accessories must be used in order to prevent from electrostatic load accumulation.

2.6 SAFETY DEVICES

All safety elements have to be in compliance with ATEX 2014/34/UE directive.

2.6.1 BEARING TEMPERATURE

For an outside zone 1, CONTINENTAL blowers and exhausters are equipped with temperature probes for monitoring the temperature of the two bearings. These probes must be connected to a suitable electric alarm and/or shut-off circuit in compliance to ATEX directive.

The threshold values of alarm and shut-off for the bearing temperatures are:

T alarm = 120°C and T cut-off = 140°C

The restarting of the system must be done manually.

The correct operation of the temperature probes must be checked regularly and, in particular, during start-up.

2.6.2 VIBRATIONS

The installation of a fixed vibration sensor at each bearing allowing a continuous monitoring:

- Avoids regular readings with portable instruments
- Can be required (§ 5)

The threshold values of alarm and shut-off for the bearing vibrations are:

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

The restarting of the system must be done after manual validation.

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





2.7 ATEX GAS MARKING

The CONTINENTAL blowers and exhausters designed to operate in potentially explosive atmosphere are equipped with a special red name plate. This one indicates the conformity to 2014/34/UE ATEX directive, the equipment category and the protection mode used.

IMPORTANT:

The machine must never run above the maximal speed marked on the plate. If performances modifications are necessary, they have to be studied and approved by CONTINENTAL before.

Temperature and vibrations probes are a protection against overheating and abnormal vibrations, if and only if, they are connected to a circuit of alarm and cut-off, suitable for ATEX zone.

EXAMPLES OF MARKING:



Fig. 2.8



Fig. 2.9

Label of conformity to the applicable European directives

Label of conformity to ATEX directive 2014/34/UE and related standards

« b » : equipment protected by Control of ignition source

« c » : equipment protected by constructional safety

Equipments of group II		ATEX marking
Inside	Outside	
Category 3G (Zone 2)	Category 2G (Zone 1)	II 3/2G b, c T3
Category 3G (Zone 2)	Category 3G (Zone 2)	II 3/3G c T3

T3 mean that the maximum surface temperature is 200°C.

A specific use can lead to a corresponding specific marking.

Only machines with specific ATEX marking can be installed in potentially explosive areas. The operator must check if the equipment is intended to be installed in the concerned zone.

ATTENTION: Any noteworthy modification of the machine supplied by CONTINENTAL INDUSTRIE, and/or the addition of equipments none suitable to ATEX 2014/34/UE directive, will cancel certification of the aforesaid equipment.

Any material provided for the use in potentially explosive atmospheres will have to respect the ATEX 1999/92/CE directive concerning the minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.

3. RECEIPT, STORAGE, AND INSTALLATION OF THE MACHINE

3.1 MACHINE RECEIPT

3.1.1 PRELIMINARY CONTROLS

When machinery is taken directly from the workshop 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 customer order number.





The packaging or the equipment itself must be checked for any obvious signs of damage incurred during handling or transport. If such damage is found, delivery reservations must be addressed directly to the carrier. Ensure that is clearly mentioned reservations on the delivery note before signing it. CONTINENTAL must also be informed promptly about, 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 in charge of unloading operations and therefore, shall manage them in the best conditions, according to the size of the machinery and the difficulty presented by the operation.

3.1.3 CHECKS

A check shall be made quickly, that all the equipment received corresponds to the order. Any irregularities shall immediately be advised to CONTINENTAL for the necessary corrective action. It is particularly recommended:

- to check all the accessories ordered and, eventually, 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 to ATEX certification

3.1.4 RECOMMENDATIONS FOR LIFTING

Due the large quantity of models produced by CONTINENTAL and the special features possible for each individual order, the handling shall be done by qualified people.

When handling by using cranes or overhead travelling cranes, the slings should be hung only to the rings destined for this purpose. (Fig. 3.10 – Example of advised handling)

Never use bearing housings for the lifting and the handling (except for model 008 to 051A).

Check that the connection between the CONTINENTAL blower or exhauster 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 MACHINE STORAGE

3.2.1 SHORT TERM STORAGE

No particular storage precautions are required, when a period of machine inactivity is planned as not more than 60 days. The protections, foreseen before its dispatch from the workshop CONTINENTAL, are thus sufficient, if the considering machine and all additional parts (spare, reserve, ...) is:

- in a clean and dry environment (RH < 70%)
- sheltered from vibrations and shocks
- with the covers on the inlet and outlet openings
- outside ATEX zone

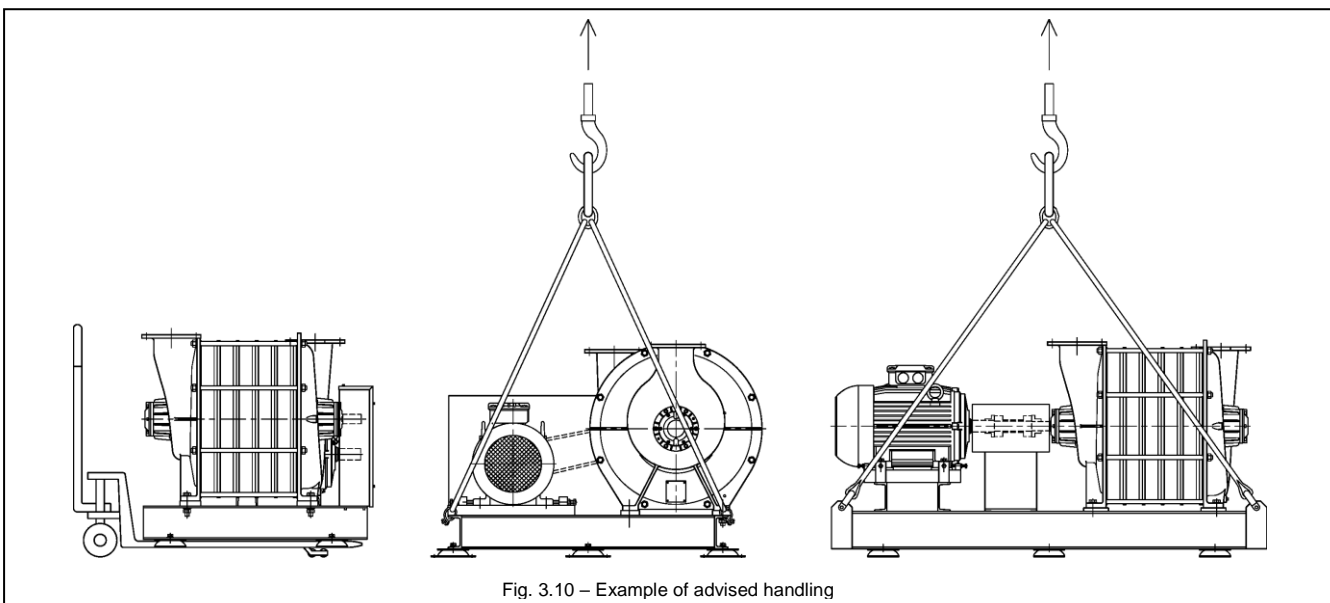


Fig. 3.10 – Example of advised handling





3.2.2 LONG TERM STORAGE

For inactivity periods over 60 days, in addition to the recommendations of the § 3.2.1, the below precautions must be followed:

- Check the inlet and outlet openings are properly sealed
- Slacken any transmission belts
- Fill any oil-lubricated bearing housing in accordance with the instructions given in § 5.2
- Frequently check the condition of machined and unpainted surfaces (shaft ends, fulcrum, etc.) and add, when necessary, the protective coating provided by the factory.
- 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.

If there is a doubt about grease ageing, contact CONTINENTAL to eventually replace it.

It is also necessary to prevent the machine from being subject to frequent or sudden changes in temperature causing the formation of condensation, especially inside machines and motors and inside bearing housings.

When the possibility of condensation can be foreseen, the following shall be carried out:

- Hang, in an accessible way, a well-sized bag of a hygroscopic substance (example: silica gel) inside the inlet opening and inside the outlet opening, immediately replacing the respective protective sealing.
- Place a well-sized bag of a hygroscopic substance at the opening of each bearing housing.
- Isolate the equipment from the ambient atmosphere, if possible by using impermeable bags or by using impermeable covers carefully placed to minimize air circulation.

The hygroscopic substance bags shall be removed before the use of the equipment.

3.3 INSTALLATION

Throughout the installation phases, the two machine flanges must be kept closed.

Before beginning the installation, the following items must be taken into account:

- 3.1.2 UNLOADING AND HANDLING
- 3.1.4 RECOMMENDATIONS FOR LIFTING
- 2.3.1 BASE PLATE
- 2.3.2.1 RESILIENT PADS
- 2.3.2.2 LEVELLING PLATES AND FIXING BOLTS

The CONTINENTAL blowers and exhausters must be assembled in the position of installation for which they were designed and arranged. Consult the dimensional drawing specific to the project.

3.3.1 INSTALLATION SITE CHARACTERISTICS

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

If the equipment must be installed at ambient temperatures higher than 40°C or lower than -20°C contact CONTINENTAL INDUSTRIE.

The site, where the CONTINENTAL blowers and exhausters will be erected, must be in compliance with the local standards, the national regulations and the safety requirements.

To preserve integrity of the equipment, it is advised:

- Install safe from any aggression of the environment (at least on its upper part)
- Don't expose the equipment to attack from surrounding process: exhausts of air or other fluids, vibrations, radiations...
- All the precautions must be taken to avoid any vertical fall of object on the equipment or any intake of object by fall.

If installed in a closed room, it is necessary to ensure sufficient ventilation, in particular making it possible to keep an ambient temperature lower than 40°C. Contact CONTINENTAL INDUSTRIE if that is not possible.

The machine must be installed in order to allow an easy access to facilitate the preventive and routine maintenance.

After analyze site hazards, and according to the related regulation, the installer is responsible about the choice of the using equipment.





3.3.2 INLET CONDITIONS

In general, the air or the gas admitted in the blower or the exhauster must be at a temperature ranging between - 20°C and +40°C.

3.3.3 ADMISSIBLE STATIC STRESSES ON FLANGES

It is always advisable to support the weight of the piping and accessories (at inlet, outlet, and surge line) to avoid stress on the compressor.

Nevertheless inlet and outlet or discharge openings can tolerate static stresses of forces and moments, with reference to their centre of gravity. That loads must not exceed the values given in tables 3.1 and 3.2 and in

Fig. 3.2.

If flanges with horizontal axis are used, stress must be reduced to the maximum.

It is important to keep in mind that installation of piping and accessories must consider the dilatation due to the working (use of expansion joints required). If not correctly fitted, equipments and piping can produce far higher stresses than their weight.

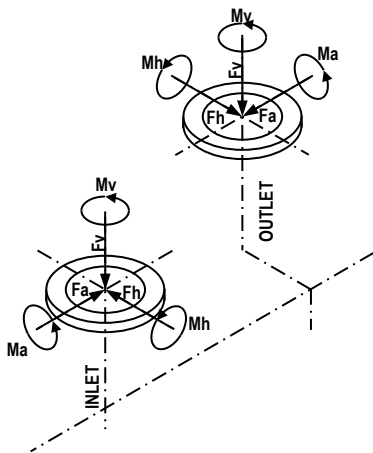


Fig. 3.2

Unit: daN	INLET			OUTLET		
MODEL	FV	FH	FA	FV	FH	FA
008	50	40	15	35	25	15
020	75	60	30	65	50	25
031A	75	60	30	75	60	30
051A	75	60	30	75	60	30
077A1	100	80	40	100	80	40
151A	150	120	60	150	120	60
251A	175	140	70	175	140	70
400A	225	180	90	175	140	70
451	200	160	85	200	150	80
500	225	180	90	200	160	80
600A	300	240	120	250	200	100
700	370	290	140	300	240	120

Tab. 3.1 – Admissible forces on vertical flanges

Unit: daN.m	INLET			OUTLET		
MODEL	Mv	Mh	Ma	Mv	Mh	Ma
008	15	15	30	9	9	18
020	22	22	45	18	18	36
031A	22	22	45	22	22	45
051A	22	22	45	22	22	45
077A1	30	30	60	30	30	60
151A	45	45	90	45	45	90
251A	52	52	105	52	52	105
400A	67	67	135	52	52	105
451	65	65	125	55	55	110
500	67	67	135	60	60	120
600A	90	90	180	75	75	150
700	105	105	230	90	90	180

Tab 3.2 – Admissible moments on vertical flanges

3.3.3.1 Accessories

Accessories installation, described into § 2.5, must deal with the previous load limits.

3.3.3.2 Piping

Piping must be accurately designed according to the nominal performances of the machine. An excessive pressure drop would significantly reduce performance.

Normally, piping is fitted after having definitely installed the machine in its final position.

Before erecting piping, it is essential to keep the machine covers. That prevents foreign bodies from getting into the machine during that phase. These covers must be removed before using the machine.





Respect the following advices for compressor connecting:

- If necessary, clean the inside of the inlet, outlet or surge piping, to avoid the penetration of any foreign object
- Check the inner cleanliness of any accessories
- Clean the cover on the openings using a damp cloth.
- Remove the cover and hygroscopic bags from the openings.
- Connect accessories and piping.

Piping must be erected with care and must be appropriately fixed to prevent excessive stress on the machine flanges, during mounting and operation.

The piping connected to the blower must be tight.

3.4 CONNECTIONS - UTILITIES

Once the machine has been installed and connected, 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 corresponding electrical diagram, the indications given in the specific instructions notice of the motor and related particular electric components.

All the operations of electric connection must be carried out only by qualified personnel.

To prevent operations under voltage, the power supply components involved must be off and locked in this state with the displayed warning.

Check first the absence of voltage.

For motors and other accessories where the electrical current can be a source of ignition, ATEX junction boxes are required; that means:

- The use of ATEX cable glands,
- The use of ATEX suitable seal for the not-used openings,
- The special marking on cables and terminal block,
- The keeping of a clean and dry atmosphere inside
- The earthing of the junction boxes.

4. START-UP

The instructions given below are generic and must be completed by the technician in charge of the start-up considering the installation specificity.

4.1 PREPARATION

To prepare the machine for start-up, the following must be carried out:

- To ensure that main piping is absolutely clear: no cover, valves open ...
- Refill the bearing housing oil as instructed in § 5.2.
- Direct transmission: during motor uncoupled, turn the shaft manually to check that it is not blocked, then mount the transmission element (according to manufacturer instructions)
- V-belt: Check alignment and tension of belts as instructed in § 5.2.2.2

4.2 CHECKS

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

- Check that the baseplate of the machine has been installed as instructed in § 2.3.1 and 2.3.2.
- Check the compatibility of supply voltage of the electric motor and the other electrical equipments.
- Check the connection of the electric motor (§ 2.4.2) and other electrical equipments referring to the indications provided in the specific manuals.
- Check the installation of equipments and safety device, referring to the instructions given in § 2.5 and 2.6.
- Check that the inlet line has been fitted correctly and that all flanges are tight.
- Check that the outlet line has been fitted correctly and that all the flanges are tight.
- Check that the anti-surge 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 any screws and any 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 bearing housings and in any other oil-lubricated components.
- Check that all protective guards have been correctly fitted.
- Check the compatibility of the rotation sense of motor and compressor (to see the marking on the outlet head and eventually on motor fan guard).





4.3 VALVES MOUNTING AND SETTING

Refer to hereby drawing for the mounting of the valves. In particular, the following points shall be checked (Fig. 4.1):

- Shaft of the butterfly mounted perpendicular to the blower shaft.
- Lower part of the open valve towards the outside of the blower.

These instructions shall be carefully observed in order to ensure the correct process air flow operation of the unit.

Non observation of these instructions may void factory warranty.

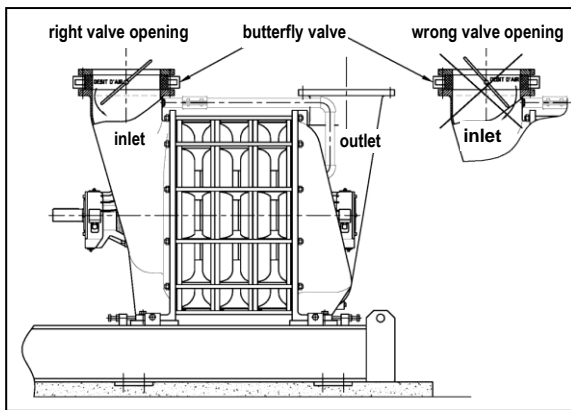


Fig. 4.1

All the valves must be checked:

- Manual and regulation valves for utilities must be adjusted.
- Isolation valves for any instruments used must be open.
- Valves assigned to the fluid process must be appropriately set for the following purposes:
 - Controlling the flow of the fluid processed depending on the specific requirements of the system served.
 - Minimize the start-up time.
 - Preventing the machine from surge operation (see § 2.2.1).

4.3.1 INLET VALVE

The degree to which the inlet valve is opened determines the compressor load (outlet valve opened).

To keep the start-up time as short as 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 nearly closed.

Other machines must be started up with the inlet valve set for a capacity slightly greater than that the one foreseen for the surging. As this setting depends on the ambient temperatures, it can only be determined experimentally: the first start-up should be with an opening of 15°; that setting can be adjusted to optimize the start-up time.

4.3.2 OUTLET VALVE

This valve must be kept open when running.

NOTE:

When stopped, all the valves must be kept close.





4.4 ROTATION DIRECTION

The compressor shaft must rotate as indicated by the arrow on the outlet head. The rotation direction of the complete unit can be inverted by switching 2 phases of the supply cable (that direction must be compatible with motor one).

4.5 FIRST START-UP

- 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 up to its nominal speed, paying particular attention to irregular noise or high levels of vibrations; if any doubt appears regarding working quality, stop the machine immediately and carry out the necessary checks before any new start-up.
 - In the case of star/delta start-up check the start-up time to optimize timer regulation for commutation to delta.
 - Check power absorption and correct as follows:
 - If power consumption is unstable, the machine is in surge operation and volume must be increased using the valve(s).
 - If power consumption is excessive, the volume needs to be reduced by closing the valve(s) or by reducing the speed (Variable Frequency Drive).
 - Let the machine run for approximately 30 minutes, then check the vibration level and the temperatures (see § 2.6).
 - If everything is normal, let the machine run for a further 30 minutes, then stop it and carry out the following operations:
 - check the tension of the belts as instructed in § 5.2.2.2.
 - check the alignment of transmission couplings when hot as instructed in § 5.2.3.
- After carrying out all that steps the process check can be done.

5. BLOWERS AND EXHAUSTERS MAINTENANCE

The CONTINENTAL blowers and exhausters are delivered in perfect operating condition. To maintain the characteristics of the equipment and to ensure its high reliability, it is important to set up a plan of maintenance,

Jobsite maintenance and service operations must not compromise the integrity of the equipment. All the operations necessitating the dismantling of the compressors can be carried out only by CONTINENTAL or qualified personnel trained by CONTINENTAL (§ 1).

Regarding to the maintenance of the accessories delivered with the blowers/exhausters, and in particular, the electric motor, please refer to the specific instructions attached.

CAUTION:



The ATEX certification of the blowers and exhausters is conditioned by good maintenance of the equipment.

The maintenance notebooks of the equipment must be consultable.





5.1 MAINTENANCE SCHEDULE

MAINTENANCE OPERATIONS

5.2

During routine maintenance schedule to keep the machine efficient, components subject to wear must be checked. Preventive maintenance planning prevents unexpected stop.

	SUBJECT	MAXIMUM INTERVAL (*)	REQUIRED ACTION	POSSIBLE CORRECTION	
			Record in the maintenance notebook	Correction on site	Replacement
Preventive maintenance	Replacement - ball bearings (§5.2.4) - V-belts (§5.2.2) - Sealing parts	2 years	X		
	Visual check for oil in the oil feeder (§5.2.1.2)	1 week	X	X	
Maintenance - Repair	Oil replacement (§5.2.1.2)	1 year (operation <3000h/year)	X		
	Bearings greasing (§5.2.1.1)	1 month	X		
	Direct drive : Fixation, alignment and general state (§5.2.3)	4 months	X	X	X
	V-belts drive : tension and V-belts wear, fixation, alignment and general state (§5.2.2)	1 week	X	X	X
	Electrical wirings (power supply and earthing): Fixation and general state (§2.5.7 and §2.4.2)	1 week	X	X	X
	Machine integrity: - parts fixation - coating state and corrosion	1 week	X	X	X
	Machine cleanliness	Everyday		X	
	Good operation of the safety devices (§2.6)	Everyday			X
	Bearings temperature level (§2.6.1)	1 week (Zone 1 : Continuously)	X		
Operation monitoring	Bearings vibration level (§2.6.2)	Zone 1 : everyday (077A1 and 151A: continuously)	X		
		Zone 2 : 1 week			
	Noise level (§0)	1 week	X		

Tab 5.1

(*) After a long period of stop (> 2 weeks) all the points must be checked





In addition to the normal lubrication operations to be carried out at pre-set intervals, it is asked to keep a report for each machine, about the progress over time of parameters which reflect how good the parts most commonly subject to wear are.

Continental recommends regular measurement of vibration levels for bearing housing. With a large record of values, the operator is able to better inform maintenance staff of replacement intervals.

5.2.1 LUBRICATION

5.2.1.1 GREASE LUBRICATION

The ball bearings lubrication is essential for the following reasons:

- to avoid metal-to-metal contact
- 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 temperature range of use and the rust proofing properties are the main determining factors when choosing grease.

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

Sample of grease characteristics used with CONTINENTAL blowers and exhausters:

GREASE HP-ST 3		
Grade NLGI	.....	3
Soap	.....	Lithium
Color	.....	Brown
Flash point	.....	> 190°C
Aspect	.....	smooth
Temperature range	.....	-20°C/ +140°C

Equivalent grease:

ESSO	.....	BEACON 3
		MOBILUX
MOBIL	.....	EP3

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

Re-lubrication with greases of a different type is not recommended as this creates the risk of mixing incompatible greases with each other. Consistency and maximum admissible temperature values could, indeed, fall below the typical values required.

To ensure efficient lubrication, limit the grease volume to the volume strictly required.

If there is grease excess, the temperature of the bearing increases suddenly, that substantially reduces its service lifespan and can cause irreversible damage. In such conditions, the bearing operates at temperatures far higher than those of its design and is subjected to premature wear.

In practice, it is enough that the grease does not take up more than 30 - 50% of the free space in the housing; if the quantities in Tab 5.2 are respected, that requirement is achieved.

TYPE	Grease quantity per bearing (g)
008	5
020	5
031A	10
051A	10
077A1- 151A	20

Tab 5.2

All bearings on CONTINENTAL INDUSTRIE machines are fitted with grease slingers to, automatically (when running):

- allow its circulation
- prevent its accumulation into the bearing housing
- avoid ball bearing overheating

However, some of the grease is consumed; it must be completed according to the periodicity defined in the Tab 5.1.

The plug located at the bottom must be removed prior to the re-lubrication. **Do not forget replacing it after this operation.**

Bearings on CONTINENTAL machines are fitted with hydraulic greasers. Use a manual pump to re-lubricate.

NOTE:

The bearings are filled with grease at the CONTINENTAL factory for mechanical running tests; so there is no need to grease the machine before start up.





If the delay of three months from delivery date is exceeded repeat the re-lubrication according to Tab 5.2.

5.2.1.2 OIL LUBRICATION

Oil lubrication is used where the rotation speed or the operating temperature exceed the grease employability limit.

All oil-lubricated machines are fitted with a tank, directly mounted on the bearing housing. The oil level is maintained by a constant level oil feeder and an oil nozzle disc.

During operation, oil-lubricated machines produce actual oil circulation inside the housing. This oil circulation provides lubrication and cooling action on the bearing and immediately removes any pollutants which may affect it.

Particle pollutants of a magnetic nature are caught by the drain magnetic plug. Other pollutants deposit at the bottom of the tank. For the lubrication of ball bearings, mineral oils are generally used with the addition of additives, to improve both resistance to oxidation and the lubricating film adherence.

Viscosity is one of the main characteristics of lubricating oil. Viscosity decreases when the temperature rises. Therefore when choosing oil, it is essential to check that at the design maximum operating temperature, the viscosity remains at values which enable a lubricating film of an adequate thickness.

Sample of oil characteristics used by CONTINENTAL blowers and exhausters:

JAROGEAR Z .150	
Properties:	
Extreme pressure, anti-oxidizing, anti-corrosive, anti-foam, anti-rust, high temperature resistance.	
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
Other equivalent oils:	
ESSO	SPARTAN EP 150
Q8	GOYA 150
TOTAL	CARTER EP 150
SHELL	OMALA S2 G 150

→ **Periodicity of oil replacement, every 3000 hours or at least, once per year.**

Also excessive lubrication causes temperature rise and reduces lifespan for bearings.

Housing refilling

The housing refilling must be done with precaution, machine stopped. Ensure that oil level does not exceed the one maintained by the action of the constant-level oil feeder.

We can make the correct filling by introducing the oil through opening corresponding to the plug 1 (see Fig. 5.3) until the level is reached, checked by a small leakage through the opening corresponding to the plug 2. Then replace plugs 1 and 2 to add oil by oil feeder (as shown on Fig. 5.4) until the level stabilizes. The handling of the oil feeder must be done quickly to not destabilize the oil level inside the bearing.

To avoid incompatible oils mixing, we recommend to use the same oil.

Bearing housings in CONTINENTAL machines are partly drained after mechanical testing to prevent oil leakage during transport. Therefore, the housings must be refilled as described.

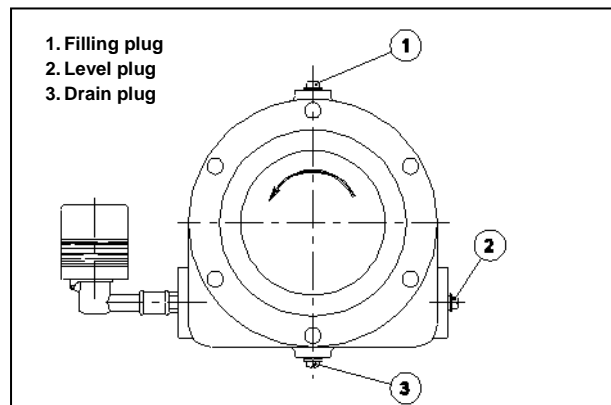


Fig. 5.3



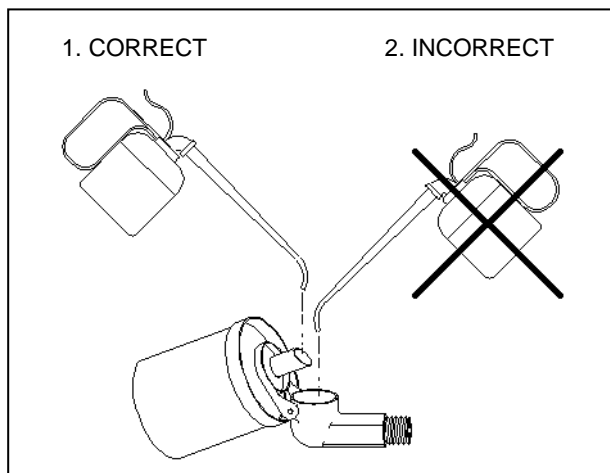


Fig. 5.4

The quantities of oil required for filling, depending on the machine model, are shown in table Tab. 5.5 hereafter.

CAPACITY OF OIL-LUBRICATED MACHINES (liters)

MODEL	PER HOUSING	PER OILER	TOTAL PER MACHINE
077A1	0.56 or 1.56	0.11	1.34 or 3.34
151A	0.56 or 1.56	0.11	1.34 or 3.34
251A / 400A / 451 / 500	1.8	0.11	3.82
600A / 700	5	0.11	10.22

Tab. 5.5

Filling oil feeder

The oil feeder is a reserve of oil to keep the oil level constant in the housing bearing. **It is not a visual indicator of oil level.**

It is not necessary to add oil to the oil feeder until it is empty.

Some precautions has to be followed to renew this reserve:

1. Swing quickly the oil feeder
2. Observe Fig. 5.4

At the first start, a relatively quick decrease of the oil inside the glass may occur. Stabilization is achieved after a few hours of operation

5.2.2 V-BELTS DRIVE

5.2.2.1 V-belts replacement

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 rare maintenance operation during the first 2 years of operation if the following conditions are maintained:

- Minimum tension but enough to ensure minimum slipping
- Pulleys alignment according to § 5.2.2.2

The operation of the blower or the exhauster, above the maximum capacity authorized by the belts, is prohibited. It is recommended to avoid frequent starts, because they significantly decrease the lifespan of the belts.

It is recommended to check belt tension regularly and to correct it if necessary, ensuring that pulley alignment is observed. This verification must be done frequently during the first hours of operating.

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

On the opposite, the machine position relative to its base-plate must not be changed in any way.

It is very important that each belt transmits its part of power: the transfer of required power needs all the belts. In the opposite case, all the power is transmitted by only some of the belts which, as they are overloaded, wear prematurely.

To avoid that, the pulleys must be well-aligned. It is essential that all the belts are identical: it is necessary that belts are come from the same production batch.

→ Therefore, the belts should not be replaced separately, but the complete set must be replaced.

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

The belts used must imperatively be of anti-static execution.

Before the belts replacement, its cause must be determined: normal wear or other reasons? In that last case, dysfunctions which produce premature wear must be located and eliminated.

Once the set of belts replaced, it is necessary to proceed to the alignment and the tension of the belts (§5.2.2.2).





5.2.2.2 V-belts transmission alignment

The alignment of the pulleys and the correct tension of the belts guaranties maximum lifespan of the ball bearings and the belts themselves.

The external faces of the 2 pulleys must be on the same vertical plane and that is generally carried out by placing an straight iron bar as shown in Fig. 5.6.

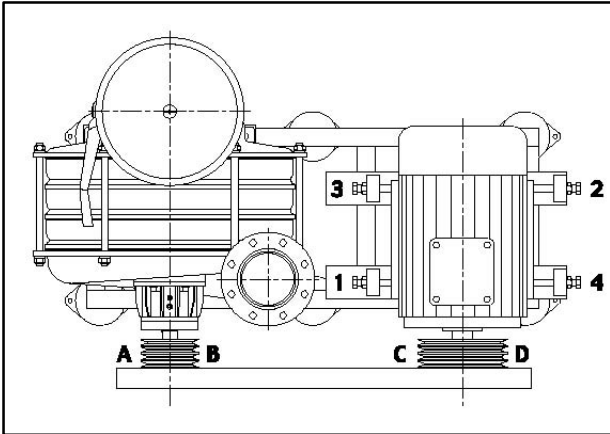


Fig. 5.6

The face of the machine pulley is taken as a reference (Point A and B) and the bar is placed on it, checking contact points C and D.

If the faces aren't parallel, a correction is necessary by using the adjustment screws 1, 2, 3 and 4.

Note that:

- Adjust belt tension via screw 1
- Correct angle between pulleys via screw 2
- Use screw 3 and 4 for blocking position

Method:

1. Loose slightly motor fixing screws to allow motor moving
2. Loose screws 3 and 4 and then 2
3. Adjust belt tension by using screw 1. Turn motor pulley manually to distribute tension equally
4. Adjust parallelism via screw 2
5. To align the pulleys planes, it can be necessary to move the motor pulley: to allow the pulley hub axial motion, loose its hub screws.
6. Use the iron bar to check that the points A, B, C and D are in contact. Adjust if necessary via screw 1 and 2.
7. When parallelism and alignment are correct, tighten the four motor screws.
8. Tighten screw 3 and 4 to contact.

9. Block the locknuts of screws 1, 2, 3 and 4
10. Finish the tightening of motor pulley hub screws
11. check the belts tension

Always carry out alignment when setting and adjusting the belt tension.

Carry out alignment and tension setting until you obtain in the same time the desired alignment and tension.

ATTENTION, alignment operation is critic:

Misalignment:

- causes asymmetric wear of the belts
- makes the load not uniformly distributed on the belts
- results, so, in a premature change of the complete belts set

Excessive belt tension increases:

- load on the ball bearings
- bending torque of the shaft
- the risk of shaft break due to fatigue

Low belt tension causes

- slipping
- overheating (by friction)
- premature wear
- irreversible damages (pulleys included)

In each of the three previous cases, a wrong setting can provide an overheating incompatible with ATEX zone limit required.





5.2.2.3 V-belts tension

Specific data to set correctly belt tension is necessary.

Fmin and Fmax are the values between the F force must be. When applied in the middle of the two axes on a single belt and perpendicular to it, as shown below, is produces a deflection equal to f mm.

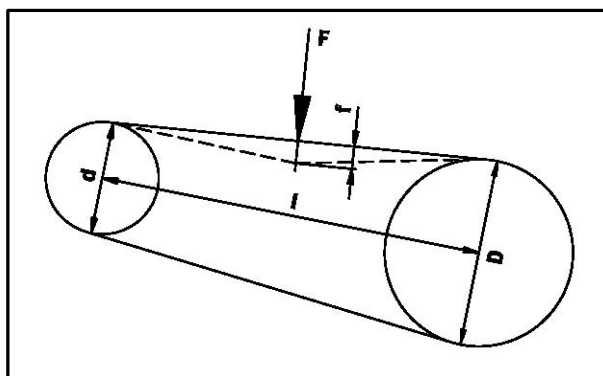


Fig. 5.7

MODEL 008		Deflection (f) (in mm)	Force (in daN)	
			Fmin	Fmax
P	4 kW	5	1.0	1.5
	7.5 kW		1.0	1.5
	11 kW		1.5	2.0
	15 kW		1.5	2.0
	18.5 kW		1.5	2.0

MODEL 020		Deflection (f) (in mm)	Force (in daN)	
			Fmin	Fmax
P	4 kW	5	1.0	1.5
	7.5 kW		1.0	1.5
	11 kW		1.5	2.0
	15 kW	6	1.5	2.0
	22 kW		1.5	2.0
	30 kW		1.5	2.0
	37 kW	1.5	2.0	

MODEL 031A/051A		Deflection (f) (in mm)	Force (in daN)	
			Fmin	Fmax
P	11 kW	8	1.5	2.0
	15 kW		1.5	2.0
	22 kW		1.5	2.0
	30 kW		1.5	2.0
	37 kW		2.0	3.0
	45 kW		2.5	3.0
	55 kW		2.5	3.0
	75 kW		3.0	4.0

MODEL 077A1		Deflection (f) (in mm)	Force (in daN)	
			Fmin	Fmax
P	15 kW	9	1.5	2.0
	30 kW		1.5	2.0
	37 kW		2.0	2.5
	45 kW		2.0	2.5
	55 kW		2.5	3.0
	75 kW		2.5	3.5
	90 kW		2.5	3.5
	110 kW		2.5	3.5
	132 kW	3.5	4.0	

MODEL 151A		Deflection (f) (in mm)	Force (in daN)	
			Fmin	Fmax
P	15 kW	11	1.2	2.0
	37 kW		2.0	2.5
	45 kW		2.0	2.5
	55 kW		2.5	3.5
	75 kW		2.5	3.5
	90 kW		3.0	4.0
	120 kW		3.0	4.0
	132 kW	3.0	4.0	

If the belts are new, Fmin and Fmax need to be increased by 30% to take into account the rapid fall in tension occurring during the running-in period.

Tensioning is checked after the first 4 hours of operation.

5.2.3 COUPLING ALIGNMENT

This operation must be carried out for the first start-up and after each displacement of the compressor or the motor.

The correct alignment of the transmission coupling minimizes vibration during operation and ensures the maximum lifespan of the ball bearings.

Before carrying out that operation, it is essential to read the §2.3.3.1, Direct transmission.

The alignment allows to:

- Place the axes of the two shafts coupled on the same vertical plane or on two parallel vertical planes, with a specified distance between them.
- Place the axes of the two shafts coupled on the same horizontal plane or on two parallel horizontal planes, with a specified distance between them.
- Keep a specified distance between the ends of the two coupled shafts, or better, between the two faces of the half couplings.





Radial misalignment and angular misalignment are shown in Fig. 5.8. Naturally, these can be present together.

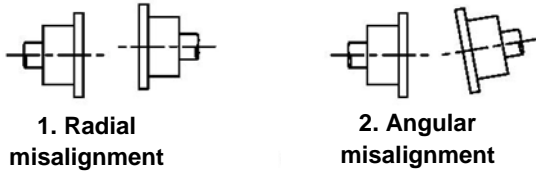


Fig. 5.8

Due to the thermal expansion, the relative position of the two shafts coupled varies from the cold start up ("cold") and the steady state operation ("hot").

The final alignment must be the hot in steady state operation ("hot").

From cold alignment, a compensation of compressor dilatation is generally necessary.

Maximum admissible misalignment when hot can vary depending on the type of coupling; however, if no specific instructions are given, the following tolerances must be used:

distance between the half coupling faces	180 mm (+0,5 mm / -0)
radial misalignment (T.I.R.)	0,05 mm
angular misalignment	0,02 mm (for Ø 100 mm)

We recommend using a laser measurement tool to carry out alignment.

5.2.4 BALL BEARING REPLACEMENT

When one ball bearing becomes too noisy or the vibrations level makes fear a nearest rupture, the two ball bearings replacement must be considered.

An efficient preventive operation allows managing such jobsite situation. The operation must be carried out by CONTINENTAL or by qualified personnel by CONTINENTAL.

A bearing dismantled must be never reassembly. It must be replaced by a new one.

In the case of sudden breakage, the repair operation can involve far more than a simple replacement of the ball bearing, and, in some cases, can even involve the replacement of the rotor.

If a ball bearing break is suspected, the machine must be stopped and CONTINENTAL INDUSTRIE must be contacted.

Regular maintenance of the equipment (§5.1) decreases considerably the risk of rupture of the ball bearing.

5.3 SPARE PARTS

CONTINENTAL blowers and exhausters can operate for extremely long periods before spare parts are needed. It is advised to keep a stock of the recommended set of spare parts.

The damaged parts must be replaced only with original parts and by personnel qualified and authorized by CONTINENTAL INDUSTRIE.

5.3.1 RECOMMENDED LIST

Spare parts for any particular components and/or equipments must be provided in addition:

- bearing cover gasket
- bearing lock nut
- bearing lock washer
- ball bearing
- bearing housing gasket (if present)
- Graphite or carbon ring housing gasket (if present)
- Graphite or carbon ring (if present)
- oil or grease feeder (if present)
- set of transmission belts (if present)

5.3.2 CONSUMABLES

They are restricted to:

- filter cartridges (if present)
- lubricant

5.3.3 ORDER

The reference number of the spare parts can be found on the sectional drawing of the machine and eventually on the corresponding components list.

When ordering spare parts, it is asked to give the serial number of the machine.

All spare parts must be ordered to:

CONTINENTAL INDUSTRIE
Route de Baneins
01990 Saint Trivier sur Moignans, FRANCE
TEL.: + 33 (0)4 74 55 88 77
FAX: + 33 (0)4 74 55 86 04
Email: export@continental-industrie.com





6. TROUBLE SHOOTING

CONTINENTAL blowers and exhausters are designed for keeping their performances unchanged over time. The efficiency, the noise level and the operating temperatures remain at their initial values.

As soon as appears a doubt about the capacity of the equipment to ensure a total safety, it must be put immediately out of service and locked in off position.

All the following operations must be carried out in conformity with the state of art required for this type of equipment. As ATEX equipment is involved, each of that operations may be critic, and that requires to:

- Clearly identify the cause of malfunction
- After carry out the remedy, the equipment stay in compliance with ATEX 2014/34/UE directive

If there is any doubt about the two previous points you have to think about a return of the machine to CONTINENTAL

Frequently apparition of one undermentioned malfunction is not compatible with ATEX use. You must eliminate permanently its cause.

6.1 PERFORMANCES REDUCING

These can occur through a flow and consecutive differential pressure reduction, or by a significant variation of consumed power.

POSSIBLE CAUSE	RECOMMENDED REMEDY (INDICATIVE)
Inlet filter clogged	➡ Replace filter elements
Upstream or downstream valves not correctly adjusted	➡ Check and correct §4.3
Upstream or downstream pipe clogged	➡ Check and clean if needed (internal zone must be unchanged)
Direction of rotation reversed following maintenance operations on the motor or electrical equipment	➡ Check and correct §4.4
Rotation speed lower than nominal (motor with VFD)	➡ Check and correct
Partial blocking of the impellers or intermediate sections (presence of clogging elements in the processed fluid)	➡ General overhaul of the machine. Consult CONTINENTAL INDUSTRIE

6.2 NOISE PRESSURE LEVEL VARIATION

The sound pressure level cannot exceed a lot the value obtained during the first start-up.

The noise level emitted by the machine with its accessories is generally lower than 95 dB (A). The variations of the noise level produced by the equipment can indicate a possible malfunction.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY (INDICATIVE)
Beating	➡ Surge operation	➡ Increase the flow rate
Presence of high frequency vibrations	➡ Ball bearings damage	➡ Replace the ball bearings (§ 5.2.4)





Increase of the vibrations level following to a maintenance operation	<p>➡ Check and correct the alignment (§5.2.3)</p>
	<p>➡ Check and correct the alignment of the mounting feet of the machine and those of the motor with the corresponding supports of the baseplate</p>
	<p>➡ Check and correct the contact of the baseplate with the resilients pads or the anchor bolts</p>
<p>Regular noise following:</p> <ul style="list-style-type: none"> • Operation at excessive temperature • Presence of unforeseen particles or foreign bodies in the processed fluid 	<p>➡ General overhaul of the machine. Consult CONTINENTAL INDUSTRIE (internal zone must be unchanged)</p>

6.3 EXCESSIVE OUTLET TEMPERATURE

Except particular cases, outlet temperatures are considered as excessive when whatever authorized flow, they exceed the values of 140°C.

POSSIBLE CAUSE	RECOMMENDED REMEDY (INDICATIVE)
Increase of inlet temperature	➡ Check and correct upstream process
Decrease of fluid processed flow	➡ Increase the flow rate

6.4 EXCESSIVE BEARING TEMPERATURE

The temperature of the bearings measured on the external ring is considered excessive when it is above 120°C.

POSSIBLE CAUSE	RECOMMENDED REMEDY (INDICATIVE)
Excessive outlet temperature	➡ Check and correct process
Lack of lubrication	➡ Check and correct

6.5 EXCESSIVE ABSORBED POWER

Power absorption is proportional to the mass flow of the fluid processed.

Any decrease of pressure drop, at inlet or outlet, leads in a capacity increase and, therefore, the one of the consumed power.

POSSIBLE CAUSE	RECOMMENDED REMEDY (INDICATIVE)
Upstream or downstream valves not correctly adjusted	➡ Check and correct §4.3
Modification of inlet conditions (increase of molecular weight)	➡ Decrease the flow rate
Upstream or downstream valves too open (difficulties to start)	➡ Check and correct §4.3
Presence of water inside the machine	➡ Bleed by removing the drain plugs of all intermediate parts and the outlet head. Put back the plugs (+ PTFE film) once bleeding carried out.





6.6 HIGH VIBRATION LEVEL

POSSIBLE PROBLEM AND CAUSE	RECOMMENDED REMEDY (INDICATIVE)
Defective ball bearings	➡ Change the ball bearings (§ 5.2.4)
Misalignment following operation of maintenance	➡ Check and correct alignment (§ 5.2.3)
Bad contact between mounting feet of the machine and the motor with the baseplate, following operation of maintenance	➡ Check and correct the contact of compressor mounting feet and those of the motor with the baseplate
Bad contact between the baseplate and its supports on the foundations	➡ Check and correct the contact between the baseplate and the corresponding supports
Defective belts	➡ Change the set of belts §5.2.2
Rotor elastic deformation due to excessive belts tension during operation of maintenance	➡ Check an correct §5.2.2
Rotor permanent deformation due to excessive belts tension during operation of maintenance	➡ General overhaul of the machine. Consult CONTINENTAL INDUSTRIE
Rotor unbalance following defect modifying its geometry	➡ General overhaul of the machine. Consult CONTINENTAL INDUSTRIE
Vibrations transmitted to the foundations due to start-up of nearby equipment	➡ Check and reinforce the relative insulation

7. SUPPORT

Requests for technical support should be addressed to:

CONTINENTAL INDUSTRIE Route de Baneins 01990 Saint Trivier sur Moignans, France	
TEL. :	+33 (0)4 74 55 88 77
FAX :	+33 (0)4 74 55 86 04
Email :	export@continental-industrie.com

7.1 JOBSITE INTERVENTION

For ATEX certified equipment, only the preventive maintenance actions and the routine repairs described in the § 5, can be realized on site by:

- the personnel of the service
- the authorized and qualified personal by CONTINENTAL INDUSTRIE (required for ball bearings replacement)
- respecting all environment obligations required by the considered ATEX Zone

The services will be provided on the basis of tariff in force to the date of the intervention and will have to be the subject of a purchase order in due form.

7.2 WORKSHOP SERVICE

Any intervention other than those described in the Maintenance part of this handbook (§5), realized by the owner without the specific authorization of CONTINENTAL INDUSTRIE will be likely to cancel the engagement of conformity.

In particular, the later modifications and works on the blowers and exhausters CONTINENTAL INDUSTRIE can be carried out only by CONTINENTAL INDUSTRIE or services approved by CONTINENTAL INDUSTRIE.

As any modification of the compressor geometry can go against the safety requirements, the operations like boring of holes, the machining of parts, ..., are prohibited.

For the integrity of all internal parts, ATEX certified equipment must be sent back to our factory for overhaul which is done after client's acceptance of the corresponding quotation.

During overhaul:

- The machine is completely dismantled
- All the parts are cleaned, checked and replaced if necessary
- Rotor is balanced dynamically
- The revised machine is tested mechanically
- The machine is painted.

All the replaced parts of a revised machine are guaranteed 6 months.





BLOWERS & EXHAUSTERS INSTALLATION, OPERATION & MAINTENANCE MANUAL
CONTINENTAL INDUSTRIE S.A.S
ROUTE DE BANEINS - 01990 SAINT TRIVIER SUR MOIGNANS - FRANCE