

hibon®

Roots Type Packaged Blower

PSB NX 2, PSB NX 3, PSB NX 5, PSB NX 8
PSB NX 12, PSB NX 26, PSB NX 43,
PSB NX 54, PSB NX 80, PSB NX 100, PSB 120

Installation, Maintenance and
Operating Manual

CE

19423384/IST/20

WARNING:
Please read this manual carefully
before operating the Blower Unit.



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EC-ATTESTATION CERTIFICATE

AT-ONAY SERTİFİKASI

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For and on behalf of
SGS Supervise Gözetme Etüd
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19423384



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1.1 Scope and definitions

This manual provides installation, operation and maintenance instruction for the Ingersoll Rand Pressure Blower and Vacuum Exhauster Blowering equipment. You must use this equipment as specified in this manual.

Read this manual before attempting to install and operate this equipment. Important safety information which is highlighted as WARNING and CAUTION instruction. You must obey these instructions. The use of WARNINGS AND CAUTIONS is defined below.

⚠ WARNING
Warnings are given where failure to observe the instruction could result in injury or death to people
⚠ CAUTION
Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and process.



The blower is delivered without lube oil in the casing. Refer to the section 5.6 and 5.7 for the first filling. The following IEC warning labels appear on the Blower: Warning refer to accompanying documentation.



Warning hot surfaces.



Warning danger of injury from rotating parts.



Warning noise level exceeds 80 dbA.

The units used throughout this manual conform to the SI international system of units of measurement

1.2 Pressure Blower/ Vacuum Exhauster

The Ingersoll Rand Pressure Blower package is designed for use in applications requiring high volumetric air flow at a low differential pressure. The package can be supplied as a blower, where positive pressure is supplied to the process, or as an exhauster, where vacuum pressure is applied to the process. This package comprises a positive displacement blower, driven by a timing or V belt drive, connected to a motor and mounted on a common base frame, which may be housed within an acoustic enclosure. Additional system components such as intake filters, unloading valve and silencers can be specified according to the application.

Table 1 details the performance characteristics for blowers.

1.3 System configuration

Depending upon your application and requirements, the system supplied to you will be configured with a various options and accessories. The exact configuration of your system is defined by the model number, which is prefixed with the letters PB.

Blower	NX 5	NX 8	NX 12	NX 18	NX 26	NX 43
Flow (m ³ /h)	1200	1490	2500	3180	4170	5110
Differential pressure max (mbar)	1000	1050	1000	1100	1000	1000
Vacuum max. (mbar abs.)	500	500	500	500	500	500
Pressure range						

01 Blower	06 Motor arms	11 Unloading valve	16 Acoustic enclosure
02 Motor	07 Tensioning device	12 Flexible connecting pipe	17 Pressure gauge
03 Silencer base frame	08 Filter silencer	13 Air fan	18 Fouling indicator
04 V-belt drive	09 Relief valve	14 Anti vibratory support	19 Temperature gauge
05 Drive guard	10 Non return valve	15 Anchor bolt	

Figure 1 - The Pressure Blower package

01 Blower	06 Motor arms	11 Silencer connecting pipe	16 Acoustic enclosure
02 Motor	07 Tensioning device	12 Outlet silencer	17 Fan
03 Silencer base frame	08 Filter silencer	13 Flexible connecting pipe	18 Fouling switch
04 V-Belt drive	09 Relief valve	14 Anti vibratory support	19 Temperature gauge
05 Drive guard	10 No return valve	15 Anchor bolt	20 Pressure gauge

Figure 2 - The Vacuum Exhauster package

1.4. System components

The following sub-sections describe various components and options that may be specified via the standard matrix. Some of these components may not be fitted to your system.

Note: It is possible that non-standard options may also be fitted. Description of the non-standard equipment will be contained in the supplementary instructions supplied with the system.

1.4.1 Blower

The blower is a three lobes positive displacement machine manufactured in cast iron. There are a number of capacities available, the correct choice depends upon your application.

1.4.2 Blower base/silencer unit

The blower base incorporates a primary silencer, additional optional silencer stages may also be supplied with the package depending upon the system configuration.

1.4.3 Acoustic enclosure

The acoustic enclosure provides sound attenuation for environments where it is necessary to reduce the sound level to an acceptable level. Removable panels provide access for maintenance and inspections.

The enclosure is equipped with an internal fan for removing warm air generated by the Blower and motor. If the enclosure is specified as a ducted version, the warmed enclosure air can be connected to a room air extraction system.

Note: The acoustic enclosure only reduces mechanical noise emitted by the Blower body and motor. Silencers on the intake and exhaust are necessary in order to reduce the sound pressure pulses generated by the Blower mechanism.

1.4.4 Suction filter

The suction filter acts as an air intake filter and sound attenuator. A disposable filter cartridge removes particulates that would otherwise cause premature wear within the Blower.

1.4.5 Silencer (vacuum package)

The exhaust silencer system is comprised of up to three stages. The primary stage is mounted directly to the outlet of the Blower, normally within the acoustic enclosure. The secondary stage is mounted downstream of the primary silencer, in the exhaust line. The final stage is an exhaust snubber, located at the end of the exhaust line.

1.4.6 Motor

The electric motor is mounted on the base frame and transmits power to the Blower through a pulley and drive belt arrangement. The size of motor fitted to the package will depend upon the desired flowrate of Blowered gas and the working pressure differential (inlet and exhaust).



CAUTION
If the pumping application changes e.g. the pressure or flow conditions change, it is important to ensure that the blower and motor power requirements do not exceed their design limits.

EN

1.4.7 Drive

The Blower has an indirect drive arrangement. The drive comprises of pulleys mounted to both the motor and Blower shafts. Depending upon the blower model, a set of Vee belts or timing belts transmit the power from the motor to the Blower.

1.4.8 Non-return valve

The non-return valve ensures that there is no reversal in gas flow when the Blower is shut down. The valve is a wafer type with a polymer or metal hinge.

1.4.9 Pressure relief valve

The pressure relief valve ensures that the discharge pressure does not exceed the design limits. It is not a pressure control valve and must not be adjusted to perform this function. The relief valve is factory pre-set to 10% above your specified discharge pressure.



CAUTION
Do not attempt to adjust the pressure relief valve setting as this may damage the equipment. Adjustment must only be performed qualified by Ingersoll Rand service personnel.

1.4.10 Enclosure lifting base

The mounting base provides a common platform for both the Blower and drive motor combination, and the acoustic enclosure. The base incorporates steel channels, allowing the unit to be positioned using a fork-lift truck.

1.4.11 Additional standard components

Other optional components such as pressure gauge, flexible pipe-line connections and anti-vibration mounts may also be supplied.

1.4.12 Instrumentation/options

- Unloading valve
- Various gauges and switches may also be fitted to the package.
- Enclosure temperature switch
- Inlet temperature gauge
- Discharge pressure switch
- Suction vacuum switch
- Blocked filter switch
- Two set point pressure switch
- Discharge temperature switch and/or gauge

1.5 Limits of use

1.5.1 Performance limits

The following table defines the performance limits for each size of blower that may be installed in this equipment.

Size	Tr/min		P1 (mbar)		P2-P1 (mbar)	P2/P1	T1 (°C)		T2 (°C)	T2-T1 (°C)
	MAX	MIN (1)	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MAX
NX 5	4100	1200	PO+1500	PO-500	1000	2	50	-25	140	120
NX8	3800	1200	PO+1500	PO-500	1050	2	50	-25	140	120
NX12	3800	1200	PO+1500	PO-500	1000	2	50	-25	140	120
NX 18	3100	1200	PO+1500	PO-500	1100	2	50	-25	140	120
NX 26	3000	1200	PO+1500	PO-500	1000	2	50	-25	140	120
NX 43	2250	1200	PO+1500	PO-500	1000	2	50	-25	140	120

PO: Atmospheric pressure
 T1: Blower inlet temperature
 P1: Blower inlet absolute pressure
 T2: Blower outlet temperature
 P2: Blower outlet absolute pressure
 REV MIN: Minimum speed needed for lubrication

Table 2 - Performance Limits

1.5.2 Operational limits

This equipment is not designed or licensed for use in hazardous applications or environments.

Operation of the equipment outside the specified pressure or flow characteristics may cause serious damage to the Blower and motor.

The suctioned air or the process gas must be cleaned, without impurities, non-corrosive and non-chemical. In case of doubt concerning your process, contact the customer service.

It is your responsibility to prevent any particles more than 200 mg/m³ and 25µm from penetrating blower.

The unit must not be started at full load.



WARNING
 Do not use equipment for pumping toxic, explosive or dangerous gases



CAUTION
 Do not allow fluids or liquid to enter the pump as this will cause permanent damage



CAUTION
 Do not re-circulate gases from the exhaust to the inlet. Otherwise the gas temperature rise will causing the pump to seize.

2 TECHNICAL DATA

2.1 Operating and storage conditions

Ambient (environmental) temperature: Operating range Storage range	- 10° C to 40° C - 30° C to 70° C (non condensing)
Maximum allowable temperature within enclosure	50° C
Maximum humidity in operation	80%
Maximum humidity for storage	80 %
The blower package is not stackable	
Do not walk on the roof of the package	
Do not remove the piping cover protection during storage	
If the unit is equipped with a belt driven machine, the V-belt should be slackened during storage	
If the unit is used in a very rainy or snowy area, the unit must be installed under a roof If the ambient temperature is inferior to -20°C, the unit must be inside pre heated before start up If the unit is installed in a very windy area, the suction grid must be protected with windbreak wall. Make sure that the suction is not clogged in any case. If the unit is installed in the sandstorm area, install a special filter or separator to avoid dust going inside the blower.	

2.2 Physical data

Dimensions: see figures 3 and 4

Bower Type	NX 5	NX 8	NX12	NX18	NX 26	NX 43
Power (kW)	45	45	90	90	132	132
Weight (kg) with acoustic ennclosure	900	1035	1640	1870	2525	2825
Weight (kg) without acoustic enclosure	700	835	1375	1600	2090	2380

Table 3 - Silent Flow Plus Package mass and power

Note: The figure in the table above are maximum values, refer to the system rating plate for exact details of the supplied system.

2.3 Services

Electrical supply

Motor see the unit rating plate
enclosure fan see the fan motor rating plate

2.4 Interface

Inlet connection	see Table 4
Exhaust connection	see Table 4

2.5 Performance

see Table 1

2.6 Vibration

The vibration of the blower package will mainly depends on the installation and the concrete foundation. Refer to the section 3.4. for the installation requirements. In case of abnormal vibration observed, contact the customer service.

Figure 3: DIMENSIONS

- PRESSURE

Figure 4: DIMENSIONS - VACUUM



3 INSTALLATION

3.3 Unpack and inspect

EN

3.1 Safety



WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

WARNING

This equipment must be positioned under good lighting conditions.

- A suitably trained technician must install this equipment.
- Ensure that the installation technician is familiar with the safety procedures which relate to the Blower gases.
- Safely route and secure all cables, hoses and pipes during installation, so that people cannot trip over them. • Vent and purge the process system before you start installation work.
- Check that all the required components are available and of the correct type before you start.
- Isolate the other components in the process system from the electrical supply so that they cannot be operated accidentally.
- The sound power level of systems supplied without an acoustic enclosure may exceed 95dbA under certain conditions. When approaching unenclosed units or if opening doors on systems supplied with acoustic enclosures always wear ear defenders.
- If necessary, contact Ingersoll Rand or your supplier for advice on isolation-valves, or other components suitable for your application and system design.
- Consult the Safety Information booklet, publication number P400-40-100 for further advice on safety issues.
- Do not perform any welding operation inside the unit.

3.2 System design considerations

The inlet and exhaust pipe diameter must be equal or greater than those on the unit.



WARNING

All lifting operations must use identified lifting points or lugs and appropriate lifting equipment.

WARNING

The blower lubricating oil is drained before shipping.

1. Use a forklift truck or overhead crane and slings to place the unit in a convenient position.
2. Remove the plastic wrap which covers the unit. If the unit has an enclosure, remove the side panels to allow access to the 4 holding down bolts.
3. Note: For overseas export the palatalised unit will be fully enclosed with removable plywood panels.
4. Please keep the panels for re-packing if return shipment for service or repair may be required in the future.
5. Inspect the equipment. If any of the components are damaged, notify your supplier and the carrier in writing within three days; state the item number of the unit together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the unit if it is damaged.
6. Check that you have received all the ordered items. If any of these items is missing, notify your supplier in writing within three days.
7. If the Blower is not to be used immediately, replace the packing materials. Store the Blower in suitable conditions as described in Section 6.1.

Unit size	3		4		5	
Silent Flow type	5	8	12	18	26 S	43
Inlet connection (for canalised version only)	tube 114,3	tube 139,7	tube 168,3	bride DN200 ISO PN10	bride DN200 ISO PN10	bride DN250 ISO PN10
Discharge connection	tube 114,3	tube 114,3	tube 168,3	tube 168,3	bride DN200 ISO PN10	bride DN200 ISO PN10

Table 4 - Process connections

It is recommended that an outlet isolation valve and a pressure gauge fitted in the exhaust line will enable the pressure relief valve to be periodically tested.

3.4 Lifting instruction

If the shipping crate/pallet is to be positioned by crane it may be lifted whilst on its pallet by using strops slung underneath and with a spreader frame or bars overhead to prevent compression loads on the enclosure.

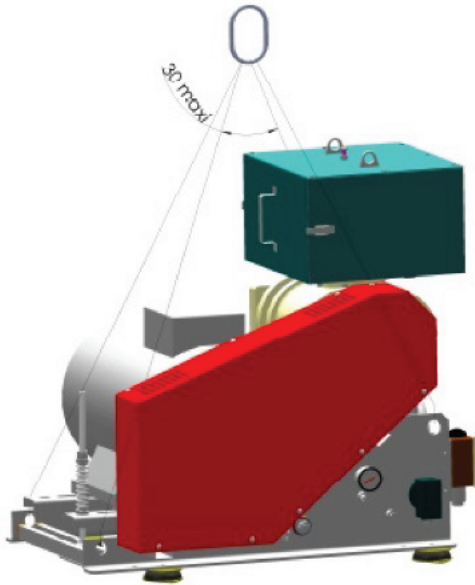


Figure 5 - Lifting the unit without an enclosure fitted

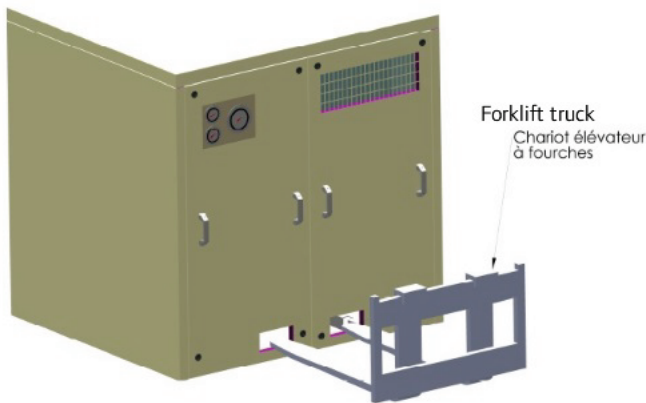


Figure 6 - Lifting the unit with an enclosure fitted

To remove the unit from its pallet:

- If an acoustic enclosure is fitted, remove the forklift way cover
- Release the 4 holding-down bolts attaching the base frame to the pallet cross-members
- Using a fork-lift truck or overhead crane, lift the package as shown in Figures 5 or 6

3.5 Foundation requirements

The unit must be mounted on a solid base. Prepare a concrete foundation at least 150mm thick with outside dimensions at least the same as that of the unit. The foundation surface is to be level and flat to within 2 mm.

The concrete should have a resistance about 30-40 N/mm²

The weight of the concrete foundation should be minimum three times superior to the complete unit weight.

The flatness and the angular tolerance of the concrete must be as per DIN 18202:

Flatness:

	Position deviations (limit values), in mm, for distances between measuring points, in m, up to				
	0,1	1	4	10	>15
Dimension in mm	2	4	10	12	15

Angular :

	Perpendicular offsets in mm for nominal dimension in m				
	1	3	6	15	>30
Dimension in mm	6	8	16	20	30

3.6 Locating the unit

If the unit is to be mounted indoors, ensure that there is sufficient space around the equipment to remove the inspection panels, the Blower and motor.

Ensure that there is sufficient room ventilation, especially if the unit's intake is supplied by room air.

Do not install the unit close to a heat source

Do not clog the suction area of the package. Ensure enough space between the suction grid and the other equipment or the wall.

Do not install the unit on an overhead metallic structure. There is a risk due to the vibration

The total room ventilation air flow required is calculated as:

$$Q_v = Q_b + N_o \times 30$$

With:

Q_v = Room volumetric flow rate (m³ h⁻¹) of replacement room air required per hour

Q_b = Blower volumetric flow rate (m³ h⁻¹) see tables 1 (only applicable if unit consumes room air)

N_o = Total power in kW of all motors installed in the room.

Note: The room air velocity should not exceed 4 m s⁻¹

3.7 Mechanical installation

A common frame earth (ground) bond is fitted to this unit, ensure that it is connected to the facility earth point. Ensure also that the blower and ventilation fan motors are connected to the common frame earth.

3.7.1 Unit with an acoustic enclosure

- Lift the unit as described in section 3.3.1
- Position and level the unit centrally on the prepared foundations
- Locate the four anchor bolt-holes in the cross-members of the base frame
- Drill the foundation using the anchor bolt-hole locations as a template and fit 4 off 12mm diameter x 130 mm long expanding bolts with large diameter washers
- Remove the 4 off transit bolts situated adjacent to the flexible mounts
- Connect the unit inlet (if a piped inlet) and outlet connections to the system pipework

CAUTION



Do not allow loads to be transmitted from the process pipework of the unit's inlet or outlet connections.

- Fill the Blower casings with oil (ref section 5.6)
- Check the drive belt tension (ref section 5.3)
- Check the alignment of the pulleys (see section 5.4) and the presence of sufficient space between the housing and the pulleys.

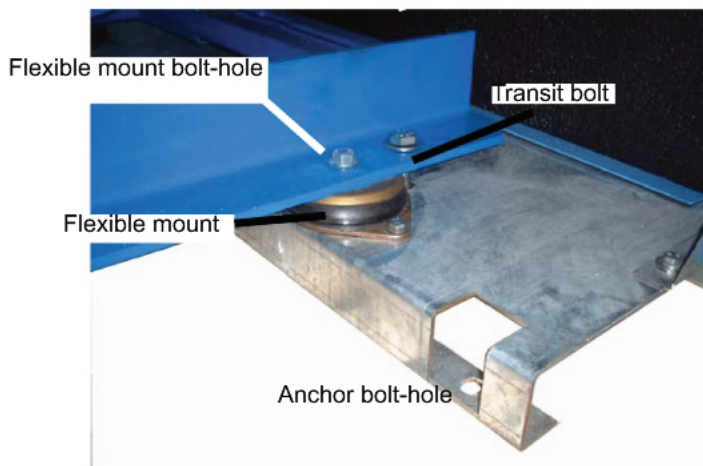


Figure 8 - Bolting down arrangement

3.7.2 Unit without an enclosure

- Lift the unit as described in section 3.3.1. Fit the four off flexible mounts enclosed in the unit packaging using the M8 hexagon machine screws and washers provided.
- Position and level the unit centrally on the prepared foundations
- Drill the foundation using the flexible mount bolt-holes as a template.
 - Unit size 3 : Fit 8 of 10mm diameter x 95 mm long

expanding bolts with large diameter washers

- Unit size 4 and 5 : Fit 8 of 12 mm diameter x 130 mm long with large diameter washers

CAUTION



Do not allow loads to be transmitted from the process pipework of the unit's inlet or outlet connections.

- Connect the unit inlet (if a piped inlet) and outlet connections to the system pipework.
- Fill the Blower casings with oil (ref section 5.6)
- Check the drive belt tension (ref section 5.3)

3.8 Electrical installation

The installation of this equipment must be performed by skilled technicians familiar with current E.U. and local electrical regulations. The user must ensure that the electrical installation of the package fulfils the requirements of EN 60204-1 & EN 60204-3. Consult the manual of the manufacturer's motor for the installation.

WARNING



Ensure that the electrical installation of the unit conforms with your local and national safety requirements. Ensure all incoming power is connected through a mains isolation switch.

A cable bulk-head gland plate is fitted on the rear panel of the acoustic enclosure providing a secure cable entry location. A common frame earth (ground) bond is fitted to this unit, ensure that it is connected to the facility earth. Ensure also that the blower and ventilation fan motors are connected to the common frame earth.

Note: There are no electrical controls fitted to this unit. It is the customer's responsibility to ensure that the correct hardware and cables are used.

Protection devices and switches shall be so designed and connected as to be "fail safe". Start/stop devices shall be easy to operate, be clearly marked in accordance with EN 418, or IEC 417. The user shall ensure provision of over current protection of the power circuit. The safety system shall be so designed so as not to give rise to a hazardous situation in the case of disturbances such as:

- Short circuit
- External impacts
- Variations in supply voltage
- Electromagnetic fields (see EN 61326)
- Earthing faults.

After a stop caused by the safety devices, restart shall only be possible by the intentional operation of a manual reset. In the case of the loss or partial loss of main or auxiliary power, the compressor shall be brought to a safe condition by the safety system.

3.8.1 Motor connection

Connect the electrical supply from the isolator to the Blower motor as described below.

- Remove the cover from the motor terminal box.
- Fit a suitable strain relief cable-gland and nut to the entry hole, then pass the supply cable through the cable-gland and tighten the gland. The cable-gland you use must be rated to provide seal protection of IP55 (in IEC 529) or better to the terminal-box.
- Ensure that the links are correctly configured for your installation.

Note: Configuration details are supplied inside the motor terminal box.

- Connect the phase conductors of the supply cable to the terminals. We recommend that you use ring crimp connectors.
- Connect the earth (ground) wire to the earth (ground) terminal. We recommend the use of ring crimp connectors. Check that a motor to frame ground bond is installed and connected.
- Tighten the cable-gland nut strain-relief screws.
- Refit the terminal box cover.
- Check the direction of rotation is correct by momentarily starting the motor.

Note: The rotation direction arrow is located on the Blower, above the drive shaft pulley.

3.8.2 Enclosure fan connection

The enclosure ventilation fan is factory wired to the local termination block.

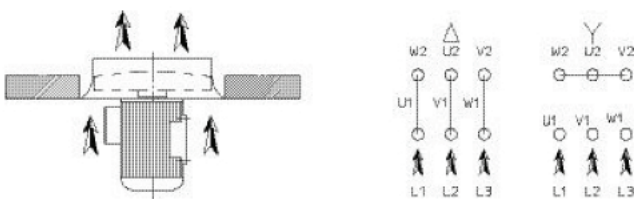


Figure 9 - Fan connection details

It is recommended that the ventilation fan operates for a further ten minutes after the Blower is shut-down to remove residual heat from the enclosure.

3.8.3 Instrument switches

If optional instrument switches are fitted to the unit, these should be wired into your control system. The switch contacts are type SPDT (normally closed & normally open) contact. Data sheets are provided as supplementary instructions to this manual.

3.8.4 Over current protection

Separate and appropriately rated over current protection devices for the blower and enclosure fan motors must be provided and installed by the user.

Note: Refer to the Unit/motor rating plates to confirm the exact voltage and current requirements for motors supplied with your unit.

3.8.5 Frequency Converter

The frequency operation range must be : [35 Hz : 60 Hz]

The maximum changeover speed must be 1 Hz / Sec for acceleration and deceleration.

4 OPERATION

4.1 Introduction

This unit is not supplied with an electrical control box or motor starters. The following sections only provides a guide for the correct operation of this unit. Some of the components are optional and may not be fitted to your system, or additional components may be supplied as non-standard options.

If in doubt, please refer to Ingersoll Rand applications specialists for further information or guidance.



WARNING

Before starting the unit, ensure that the enclosure panels and drive belt guards are in position and secured.



CAUTION

Some surfaces of the package (such as the discharge line) may become very hot during normal operation.

Ensure that additional guarding is fitted as necessary to prevent accidental skin contact.

4.2 Pre-start conditions

- Fill the blower with oil (both end cases). See section 5.6. There is a risk of damage in case of low or high oil level
- Check drive belt tension. See section 5.3
- Electrical power and control is available
- Process line isolation valves are open
- Before start up, verify the value of the manometer. It should indicate 0 barg.
- Normal start sequence (initial operation)

4.3 Normal start sequence (initial operation)

- Connect to the process and make sure that the valves are opened. If the machine suction side is piped, it is advisable that a metal inlet strainer with 0.5 mm filter tow (according to DIN 24041 R6.3-8) is fitted on the suction side during system commissioning. The strainer will trap any debris and impurities that might come through the process lines (see figure 10). The maximum allowable differential pressure created by the strainer must be 45 mbar. After 15 minutes of initial operation, clean the strainer and after a further 24 hours, remove it and replace with a spacer.

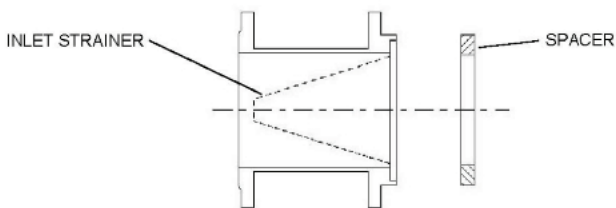


Figure 10 – Inlet strainer

Note: An Inlet strainer or spacer is not normally provided with the standard package. Please contact Ingersoll Rand sales if you require either these items.

- The unit must not be started at full load (maximum differential pressure)
- Start the enclosure fan motor (if fitted) and then start the blower motor
- Verify the blower direction of rotation

4.4 Normal running

- Check that the unloading valve closes after approximately 30 seconds (if supplied)
- Check that the pressure relief valve is not opening under normal conditions. The PRV must not be used as a recycle valve.
- Check that the suction filter gauge indicator does not show red
- It is your responsibility to prevent any particules more than 200 mg/m³ and 25µm from penetrating blower.
- The maximum allowable start of the unit is 5 per hour for a motor up to 160KW and 3 per hour after 200 KW.

4.5 Shutdown sequence

- Stop the blower motor.
- After a further 10 minutes, stop the enclosure ventilation fan motor.
- Isolate from the process system (if appropriate).

4.6 Alarm conditions

The following alarm conditions may be applicable to your system. Any alarm condition should illuminate a warning lamp or shutdown the unit, as required.

- Enclosure temperature switch activated
- Inlet filter switch activated
- Vacuum or pressure switch activated
- Discharge temperature switch activated

4.7 Emergency stop

An emergency stop button should be provided within your control circuit. Activation of the emergency stop should remove all power from the unit and prevent the unit from being re-energised until a manual reset button is pressed.

5 MAINTENANCE

The following routine maintenance schedule should be adopted to maintain the unit in full operating condition. Major servicing of the component parts (i.e. Blower overhaul) will require the component to be removed from the unit; the instructions for such procedures are outside of the scope of this manual and it is advised that any such activity is performed by Ingersoll Rand service personnel.



WARNING

There are no safety interlocks on the cabinet panels. ensure that the electrical supply is isolated and locked out, before starting any maintenance work.

5.1 Safety information



WARNING

Please follow the safety instructions given below

Observe the following guidelines when carrying out maintenance on your unit:

- Ensure that maintenance is performed by a suitably trained technician. Obey your local and national safety requirements.
- Ensure that the installation technician is familiar with the safety procedures which relate to the Blowered gases.
- Check that all the required parts are available and are of the correct type before you start work.
- Isolate the Blower and other components from the electrical supply so that they cannot be operated accidentally.
- Allow the Blower to cool (so that it is at a safe temperature for skin contact) before you start maintenance work.
- If cleaning becomes necessary for any reason, ensure that only non-flammable solutions are used. Avoid the use of solvents which may congeal and obstruct internals, or lead to corrosion.

5.2 Maintenance plan

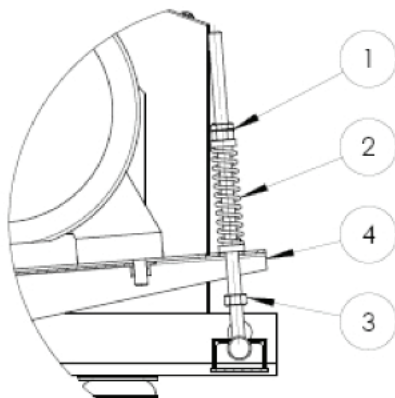
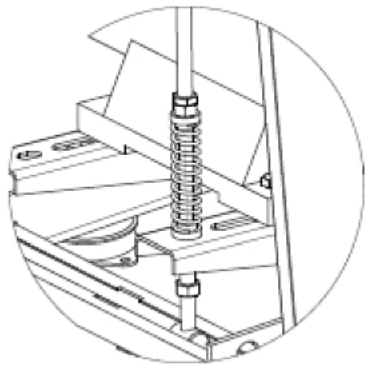
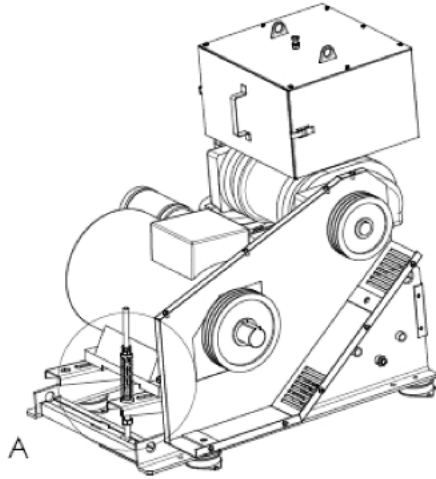
More frequent maintenance may be required if the unit is used to Blower abrasive gases and vapours, or if the Blower is operated continuously at the extremes of its performance or environment limits. If necessary, adjust the maintenance plan according to your experience.

Table 5 - Maintenance plan

	One-time			Routine				
	After 30 min use	After 24h use	After 2 weeks (200h use)	Every week	Every 6 weeks (1000h)	Every 6 months	Every year (8000h)	Every 3 years
Check belt tension	X							
Check belt condition		X						
Drain and replace oil			X					
Check oil level				X				
Check inlet filter condition (clogging)				X				
Check that the enclosure air vents are not blocked					X			
Test pressure relief valve					X			
Drain and replace oil if discharge temperature is >120°C						X		
Drain and replace blower oil							X	
Grease drive belt tension rod							X	
Check wear of pulleys							X	
Replace filter cartridge							X	
Inspect non-return valve							X	
Replace drive belts							X	
Inspect acoustic foam							X	
Perform standard revision of blower (replacement of bearings, seals and gaskets)								X

5.3 Check drive belt tension

For units 3, 4, 5, the drive belts are maintained under the correct tension by the weight of the motor. As the V-belts wear it will be necessary to periodically check that the motor arm don't seat on the nut. (see figure 11 - right hand view)



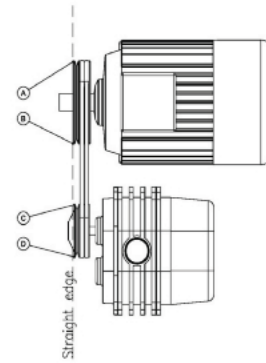
- 1 Spring locking nuts
- 3 Spacer sleeve
- 2 Spring
- 4 Motor arm

Figure 11 – Check drive belt tension

5.4 Drive pulley alignment

Visually check that the motor and Blower pulleys are correctly aligned using a long straight edge or steel rule. Alignment is correct when all points A,B,C,D touch the straight edge. It is also important that the pulleys are positioned as close as possible to the motor and Blower casings, to avoid excessive loads on the shaft bearings. If necessary, correct the misalignment by adjusting the motor.

Figure 12 – Drive pulley alignment



5.5 Drive belt inspection and replacement

Visually inspect the drive belts for signs of wear. If any of the belts show significant wear or are cracked replace all the belts as a complete set.



To replace the drive belts, remove the locking nuts and spring tension nut on the tension rod.

Lift the motor mounting plate and use the space sleeve with the nut (see item 3 figure 11) in order to block the motor in the high position during the operation. During all the operation, the motor must be lifted. Fit a new set of belts, unscrew the nut (item 3) and refit the locking nuts and tension spring.

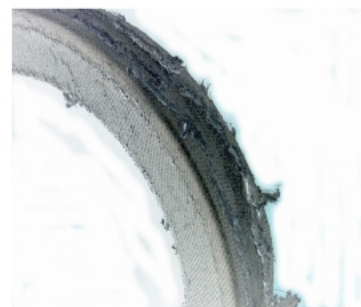


Figure 13 – Drive belt inspection

5.6 Check oil levels

The Blowers have two oil cases, one at the drive end and one at the non drive end. The oil levels should be checked when the Blower is not running. The normal level should be the middle of the sight glass. Use HIBON LUBE.

Blower type	Drive end oil capacity (l)	Non drive end oil capacity (l)
NX 5	0,66	1,11
NX 8	1,5	2,1
NX 12	1,5	2,1
NX 18	2,21	3,61
NX 26	2,21	3,61
NX 43	6.5	6

Table 6 - Oil case capacities

Note: Ingersoll Rand Material Safety Data Sheets for some of the oils and greases referenced in this publication are available upon request.

HIBON LUBE CHARACTERISTICS

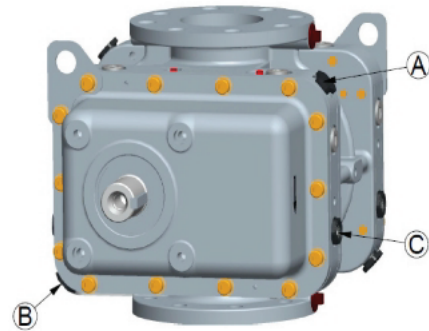
PROPERTY	5220
ISO Grade	220
Viscosity, 40°CST	220
Viscosity, 100°C, cST	25.9
Viscosity Index	160
Flash Point, °C (°F)	268 (515)
Pour Point, °C (°F)	-48 (-55)
Rust Protection	
With water	Pass
With Saline	Pass
4-Ball Wear, mm	0.31
4-Ball EP Weld Point, kg	240
Copper strip corrosion	1B
Foam tendency, ml (Seq I, II, III)	0/10/0
FZG Gear Test, Pass Stage	13
Timken OK Load, lbs	>80

5.7 Blower oil draining



WARNING
Allow the pump to cool to room temperature before draining the oil

- Unscrew the filler plug
- Unscrew the drain plug.
- Drain the oil into a suitable container
- Replace the drain plug
- Fill with correct grade of oil to mid-way on the indicator glass
- Replace filler plug



A Filling plug
B Drain plug
C Oil level sight glass

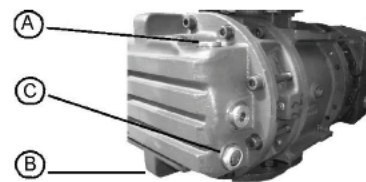


Figure 14 - Blower oil filling and drain points (For SNH version at bottom and NX version at top)

The hold lube oil drained shall be recycled.

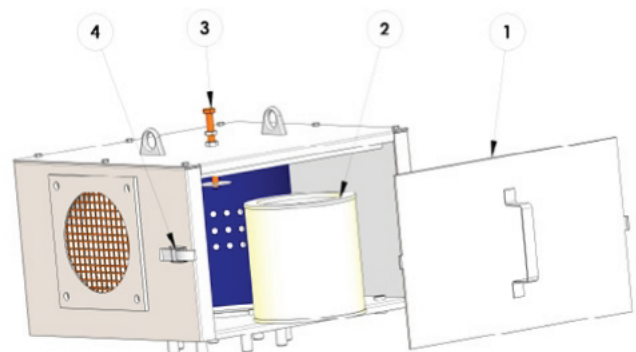
5.8 Filter cartridge replacement

5.8.1 Pressure blower

Open the door retaining clips on the access door (if applicable). Remove the filter element retaining nuts. Remove the filter cartridge and refit the new cartridge as shown below.

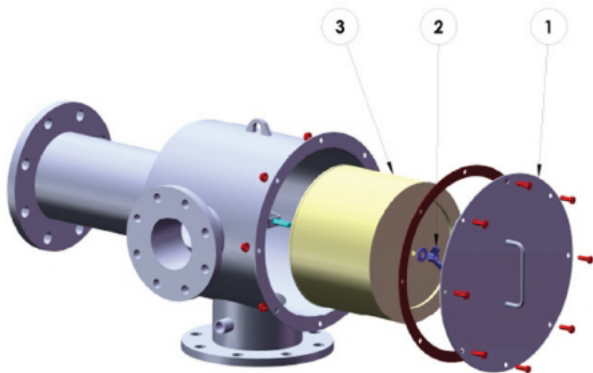
- 1 - Access door
- 2 - Filter cartridge
- 3 - Fitting screw
- 4 - Clips

Figure 15 - Vacuum exhauster filter cartridge replacement



5.8.2 Vacuum exhauster

- Refer to the figure 16 above. Remove the cover plate fixings and the sealing gasket (1).
- Unscrew the nut (2) and remove it.
- Install a new filtering cartridge (3) and replace the nut (2) to maintain it in position.
- Replace the cover plate fixings and the sealing gasket (1).



1. Cover plate fixings end sealing gasket
2. Nut
3. Filtering cartridge

Figure 16 – Vacuum exhauster filter cartridge replacement

5.9 Testing the pressure relief valve

To test the pressure relief valve the process line should be fitted with an exhaust isolation valve and pressure gauge. With the unit running, slowly close the isolation valve until the pressure relief valve begins to lift. Check that the pressure gauge reading matches the pressure relief valve setting. The relief valve pressure setting is factory set at 10% above the specified discharge pressure (see the unit's rating plate for discharge pressure).

5.10 Inspection of the non-return valve

Disconnect the process line and remove the non-return valve. Visually inspect the valve seat and check the operation of the hinged flap. Replace if there are any signs of cracking or damage to the hinge or flap.

5.11 Inspection of the acoustic foam

Remove the acoustic enclosure panels and visually inspect the surface of the acoustic foam for signs of wear or deterioration. If defects are noticed, call Ingersoll Rand Service centre for repair or replacement.

5.12 Fault finding

The following table provides a guide to solving some common problems.

Table 7 - Fault finding

Symptom	Possible cause	Action
The machine fails to start or seizes.	The rotors are touching. Considerable overload applied to machine. Foreign matter has entered the machine. Machine seized. Belt alignment defective	Visually check for signs of damage. Check pressure and temperature. Inspect condition of rotors and casing. Return to Ingersoll Rand Service centre Check and re-adjust. Refer to section 5.3/5.4
Machine emits high noise.	Rotors touching. Excessive gear clearance. Excessive bearing clearance. Rotors unbalanced.	Visually check for signs of damage. Consult Ingersoll Rand Service. Consult Ingersoll Rand Service. Carryout complete rotor/housing cleaning. Check clearances.
Machine overheating	Suction filter blocked Excessive differential pressure. Oil level or viscosity too high. Clearance between rotors or rotors and casings excessive. Cover vent blocked. Defective fan.	Clean or replace filter. Refer to section 5.8 Check valve circuit and calibration. Refer to section 5.9 Replace oil or readjust level. Refer to section 5.6 Consult Ingersoll Rand Service. Clean. Repair/replace fan.
Oil in gas stream.	Oil level too high. Sealing rings deteriorated.	Reestablish normal level after purging. Refer to section 5.6 Consult Ingersoll Rand Service
Shaft seals leak	Lip seal damaged	Consult Ingersoll Rand Service
Low volume flow	Suction Filter blocked. Blower operating outside its specified duty Clearances have become excessive due to wear	Clean or replace filter. Refer to section 5.8 Consult Ingersoll Rand Sales Visually check for signs of damage. Return to Ingersoll Rand Service centre
Absorbed power too high	Blower operating outside its specified duty Differential pressure has increased due to blocking of suction filter	Consult Ingersoll Rand Sales Replace filter. Refer to section 5.8
After stopping the blower runs in reverse	Non-return valve defective	Replace valve

6. STORAGE AND DISPOSAL

6.1 Storage

The blower package is not stackable.
Do not walk on the roof of the package.
Do not remove the piping cover protection during the storage.

In order to maintain a satisfactory service life of the unit, the following procedures should be adopted during storage:

1. Prepare the system for storage by:
2. Wipe clean and dry all surfaces especially those where condensation may have formed
3. Inspect the Blower for oil leakage and cap all openings with covers or blanks
4. Store the unit in a dry, even temperature compound or in an air conditioned and humidity controlled environment.
5. For storage more than six weeks:
6. Fill the Blower end casings with protection oil (see table 9) up to the sight glass and turn the machine over manually a few revolutions.
7. Spray protection oil into the compression chamber, after removing the inlet filter cartridge.
8. Turn the machine over a quarter-turn every two weeks to prevent degradation of the bearings.
9. When removing the unit from storage inspect the equipment, including panel seals, for signs of deterioration, renew any defective parts.

Before re-commissioning, drain the Blower end casings of the protective oil and clean the compression chamber with a suitable solvent. Refill the Blower end casings with fresh lubricating oil.

External parts	Internal parts
Mobil-Mobilarma778	Mobil-Mobilarma523 or 524
Esso → Rust ban 324	Esso→Lub MZ20W/20
Shell → V Product 9703	Shell → Ensis motor oil 20

Table 8 -Protection oils

6.2 Disposal

Dispose of the Blower, deposits removed from the Blower, used Blower oil, grease, used filter elements and any components safely and in accordance with all local and national safety and environmental requirements.

WARNING

Care must be taken if disassembling the pump or disposing of used components. In particular, care should be taken with fluoro elastomer products (e.g. seals) which may have decomposed as the result of being subjected to high temperatures. Care must be taken to ensure that components that have been exposed to oil must be disposed of as hazardous waste.



7 SPARES AND ACCESSORIES

7.1 Introduction

Ingersoll Rand products, spares & accessories are available from Ingersoll Rand companies in Belgium, Brazil, Canada, France, Germany, Hong Kong, Italy, Japan, Korea, Switzerland, UK, USA and a worldwide network of distributors. The majority of these centres employ Service Engineers who have undergone comprehensive Ingersoll Rand training courses.

Order spare parts and accessories from your nearest Ingersoll Rand company or distributor. When you order, state for each part required:

- Model number of your equipment
- Unit serial number
- Item number and description of part

Return of Ingersoll Rand Equipment - Procedure (Form HS1)

Introduction

Before you return your equipment you must warn your supplier if the substances you used (and produced) in the equipment can be dangerous. You must do this to comply with health and safety at work laws.

You must complete the Declaration (HS2) on the next page and send it to your supplier before you dispatch the equipment. If you do not, your supplier will assume that the equipment is dangerous and he will refuse to accept it. If the Declaration is not completed correctly, there may be a delay in processing your equipment.

Guidelines

Take note of the following guidelines:

- Your equipment is 'uncontaminated' if it has not been used or if it has only been used with substances that are not dangerous. Your equipment is 'contaminated' if it has been used with any dangerous substances.
- If your equipment has been used with radioactive substances, you must decontaminate it before you return it to your supplier. You must send independent proof of decontamination (for example a certificate of analysis) to your supplier with the Declaration (HS2). Phone your supplier for advice.
- We recommend that contaminated equipment is transported in vehicles where the driver does not share the same air space as the equipment.

PROCEDURE

Use the following procedure:

1. Contact your supplier and obtain a Return Authorisation Number for your equipment.
2. Turn to the next page(s), photocopy and then complete the Declaration (HS2).
3. Remove all traces of dangerous gases: pass an inert gas through the equipment and any accessories which will be returned to your supplier. Drain all fluids and lubricants from the equipment and its accessories.
4. Disconnect all accessories from the equipment. Safely dispose of the filter elements from any oil mist filters.
5. Seal up all of the equipment's inlets and outlets (including those where accessories were attached). You may seal the inlets and outlets with blanking flanges or heavy gauge PVC tape.
6. Seal contaminated equipment in a thick polythene bag. If you do not have a polythene bag large enough to contain the equipment, you can use a thick polythene sheet.
7. If the equipment is large, strap the equipment and its accessories to a wooden pallet. Preferably, the pallet should be no larger than 510mm x 915mm (20» x 35»); contact your supplier if you cannot meet this requirement.
8. If the equipment is too small to be strapped to a pallet, pack it in a suitable strong box.
9. If the equipment is contaminated, label the pallet (or box) in accordance with laws covering the transport of dangerous substances.
10. Fax or post a copy of the Declaration (HS2) to your supplier. The Declaration must arrive before the equipment.
11. Give a copy of the Declaration to the carrier. You must tell the carrier if the equipment is contaminated.
12. Seal the original Declaration in a suitable envelope; attach the envelope securely to the outside of the equipment package.

WRITE YOUR RETURN AUTHORISATION NUMBER CLEARLY ON THE OUTSIDE OF THE ENVELOPE OR ON THE OUTSIDE OF THE EQUIPMENT PACKAGE.

HS2

RETURN OF Ingersoll Rand EQUIPMENT - DECLARATION

Return Authorization Number: _____

You must:

Know about all of the substances which have been used and produced in the equipment before you complete this Declaration

- Read the Procedure on the previous page before you attempt to complete this Declaration
- Contact your supplier to obtain a Return Authorization Number and to obtain advice if you have any questions
- Send this form to your supplier before you return your equipment

SECTION 1 : EQUIPMENT

Equipment model _____

Serial Number _____

Has the equipment been used, tested or operated?

Yes Go to Section 2 No Go to Section 4

FOR SEMICONDUCTOR APPLICATIONS ONLY :

Tool Reference Number _____

Process _____

Failure Date _____

Serial Number of Replacement Equipment _____

SECTION 2 : SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Are any of the substances used or produced in the equipment

- Radioactive
- Biologically active
- Dangerous to human health and safety?

If you have answered 'no' to all of these questions, go to Section 4.

Your supplier will not accept delivery of any equipment that is contaminated with radioactive substances, unless you:

- Decontaminate the equipment
- Provide proof of decontamination

YOU MUST CONTACT YOUR SUPPLIER FOR ADVICE BEFORE YOU RETURN SUCH EQUIPMENT

SECTION 3 : LIST OF SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Substance name	Chemical symbol	Precautions required (for example, use protective gloves, etc.)	Action required after spillage or human contact
1.			
2.			
3.			
4.			
5.			
6.			

SECTION 4 : RETURN INFORMATION

Reason for return and symptoms of malfunction: _____

If you have a warranty claim:

- Who did you buy the equipment from ? _____
- give the supplier's invoice number _____

SECTION 5 : DECLARATION

Print your name: _____ Print your job title: _____

Print your organization _____

Print your address _____

Telephone number : _____ Date of equipment delivery: _____

I have made reasonable enquiry and I have supplied accurate information in this Declaration. I have not withheld any information. I have followed the Return of **Ingersoll Rand** Equipment Procedure on the previous page.

Signed: _____ Date: _____