M-D Pneumatics®

M-D Pneumatics®
Rotary Positive Displacement Blower

Manual 2009 Rev C p/n 002009 0000

WARNING: Do Not Operate Before Reading Manual

PD Plus®
OPERATOR'S MANUAL

Models

1215	1236
1224	1248
1230	

Seal/Lube Series 5 or 19/86 Series - Lip-Labyrinth (Air Service)
Seal/Lube Series 8 or 55/82 Series - Single Envelope Gastight
Seal/Lube Series 9 or 66/69 Series - Double Envelope Gastight

800.825.6937 | www.mdpneumatics.com

Original Instructions

Disclaimer Statement:
All information, illustrations and specifications in this manual are based on the latest information available at the time of publishing. The illustrations used in this manual are intended as representative reference views only. Products are under a continuous improvement policy. Thus, information, illustrations and/or specifications to explain and or exemplify a product, service or maintenance improvement may be changed at any time without notice.

Product information and specifications subject to change.

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01 INTRODUCTION

CONGRATULATIONS on the purchase of a new **PD PLUS® Rotary Positive Displacement Blower** from **M-D Pneumatics®**. Please examine the blower for shipping damage, and if any damage is found, report it immediately to the carrier. If the blower is to be installed at a later date, make sure it is stored in a clean, dry location and rotated regularly. Make sure covers are kept on all openings. If blower is stored outdoors, be sure to protect it from weather and corrosion.

PD PLUS blowers are built to exacting standards and, if properly installed and maintained, will provide many years of reliable service. Read and follow every step of these instructions when installing and maintaining your blower.

NOTE: Record the blower model and serial numbers of the machine in the OPERATING DATA form on the inside back cover of this manual. Use this identification on any replacement part orders, or if service or application assistance is required.

APPLICABLE DOCUMENTATION

The applicable documents associated with this manual are:

- 2006/42/CE – Machinery Directive
- EN 1012-1:1996 - Compressors and vacuum pumps - Safety Requirements - Part 1: Compressors

SCOPE OF MANUAL

The scope of this manual includes the bare shaft rotary positive displacement blower.

02

CONVENTIONS AND DATA PLATE

GRAPHIC CONVENTIONS IN THIS MANUAL

This manual is the result of a risk assessment according to the applicable documents referenced in ***Applicable Documentation on page 1***. The following hazard levels are referenced within this manual:

⚠ DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation that can cause damage to the engine, personal property, and/or the environment or cause the equipment to operate improperly.

NOTE: Indicates a procedure, practice, or condition that should be followed in order for the equipment to function in the manner intended.

⚠ CAUTION

Read manual before operation or bodily harm may result. Attention should be given to the safety related sections of this manual.

DATA PLATE

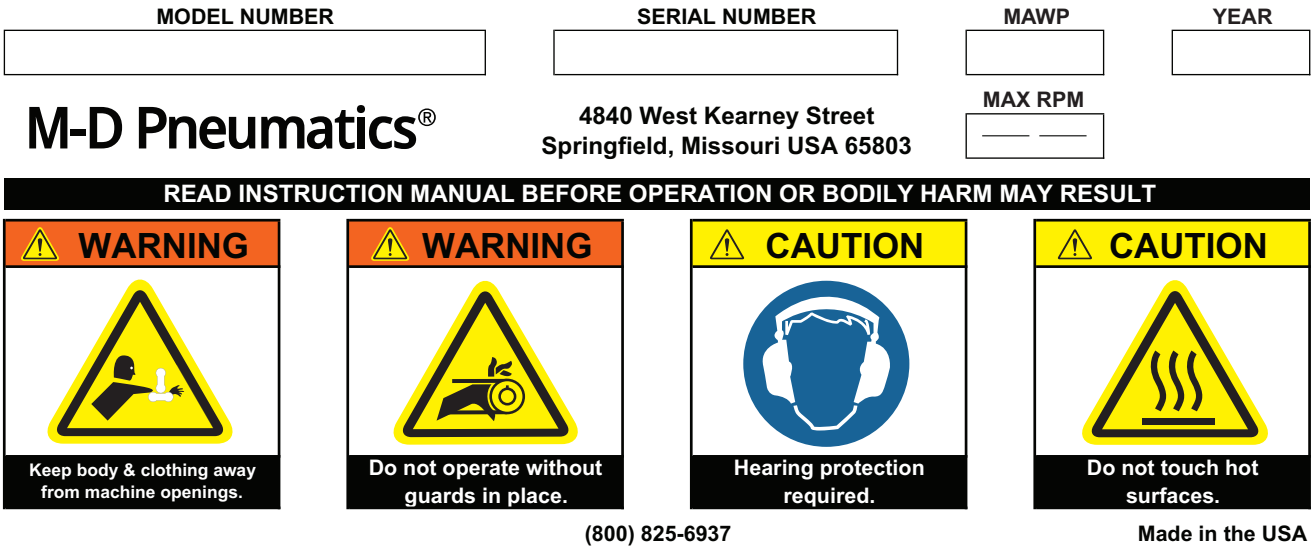


Figure 2-1 – General Operation and Symbols on Data Plate

The following information is contained on the data plate:

⚠ WARNING

Keep body and clothing away from machine.

During operation, keep body and clothing away from inlet and outlet of the blower.

⚠ WARNING

Do not operate without guards in place.

⚠ CAUTION

Hearing protection is required while the blower is in operation. Noise levels may reach as high as 81 dBA.

⚠ CAUTION

Do not touch hot surfaces.

The upper limit of the blower operation is 400°F (205°C). Do not touch the blower while it is in operation and assure blower is cool when not in operation.

MODEL NUMBER:	The specific model of the blower
SERIAL NUMBER:	Unique to each blower
YEAR:	Year of manufacture
MAWP:	Maximum Allowable Working Pressure The standard MAWP is per ***Table 4-2 – Maximum Operating Limits on page 8***. The MAWP shall not be exceeded.

03 LIFTING

⚠ WARNING

The blower must be handled using an appropriate device such as a fork truck or appropriate lifting device. *See Table 4-1 on page 8* for approximate weights. Care should be taken to assure blower does not over-turn during handling and installation.

04

DESCRIPTION

NOTE: Refer to diagrams in this manual for proper rotation and orientation in inlet and discharge.

M-D Pneumatics model 1200 rotary lobe blowers are positive displacement type blowers, whose pumping capacity is determined by size, operating speed, and differential pressure conditions. Blowers employ rotors rotating in opposite directions within a housing closed at the ends by end plates.

The inlet to the discharge is sealed with operating clearances that are very small. Internal lubrication is not needed, as there is no moving contact.

Clearances between the rotors during rotation are maintained by a pair of accurately machined helical timing gears, mounted on the two shafts extended outside the air chamber. The intermeshing rotary lobes are designed to rotate and trap air or gas between each rotor and the housing. As the rotor lobes rotate past the edge of the suction port, the trapped air or gas is essentially at suction pressure and temperature. Since the blower is a constant volume device, the trapped air remains at suction pressure until the leading rotor lobe opens into the discharge port. The close clearances between the rotors inhibit back slippage of the trapped volume from between the rotors and the trapped volume is forced into the discharge piping. Compression occurs not internal to the blower but by the amount of restriction, either downstream of the blower discharge port or upstream of the blower inlet port.

Figure 4-1 – General Operation Principle illustrates the air movement within the machine. The air moves not between the rotors but between the rotors and the side of the housing.

The machine is bi-directional, meaning that the direction of rotation of the blower can make either side the inlet or discharge. Also, ***see Figure 4-2 – Flow Direction by Rotation on page 7***.

Never attempt to control capacity by means of a throttle valve in the intake or discharge piping. This will increase the power load on the drive system, will increase operating temperatures, and can overload and/or seriously damage the blower. Likewise, if a possibility exists that flow to the blower inlet may be cut off during normal operation of a process, install an adequate vacuum relief valve near the blower. A pressure-type relief valve in the discharge line near the blower is also recommended for protection against cutoff or blocking in this line. Use check valves on each blower when more than one blower is connected to a discharge line.

When a belt drive is used, it is possible to adjust blower speed to obtain the desired capacity by changing the diameter of one or both sheaves, or by using a variable-speed motor pulley. In a direct-coupled arrangement, a variable-speed motor or transmission is required, or excess air or gas may be blown off through a manually controlled unloading valve and silencer. Gas units can use bypasses, but some applications may require additional cooling. If there is a large volume of high-pressure air or gas downstream of the blower, a check valve in the piping downstream of the blower will protect the blower from overspeeding in a backward direction upon shutdown.

Consult a M-D Pneumatics sales professional if questions arise.

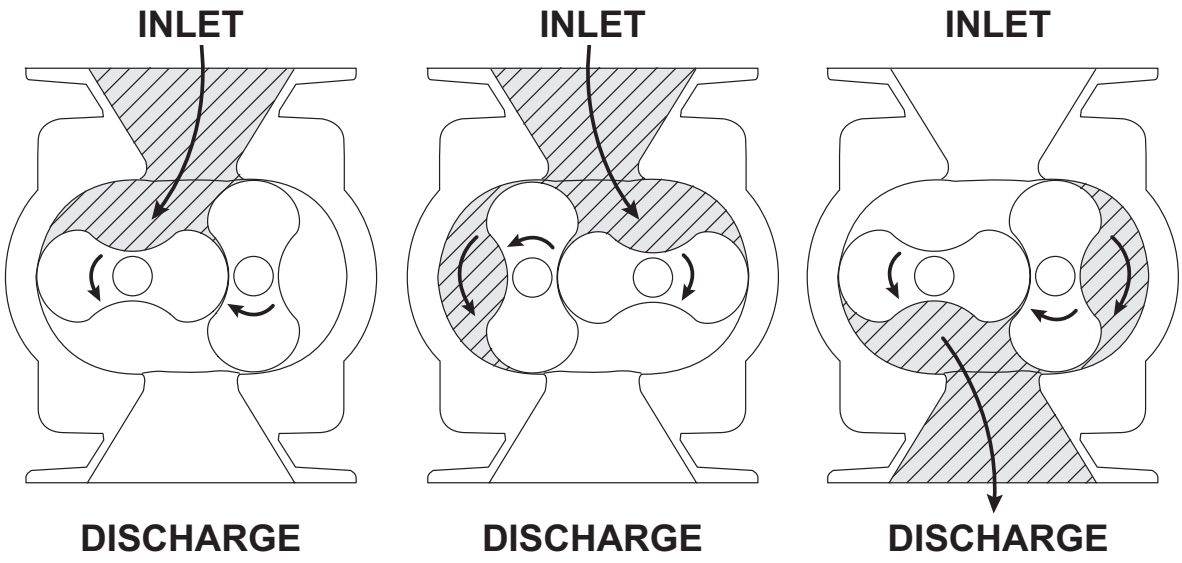


Figure 4-1 – General Operation Principle

FLOW BY DIRECTION

⚠ WARNING

Refer to diagrams in this manual for proper rotation and orientation in inlet and discharge.

NOTICE

Refer to specific data sheets for flow capacities and vacuum capacities.

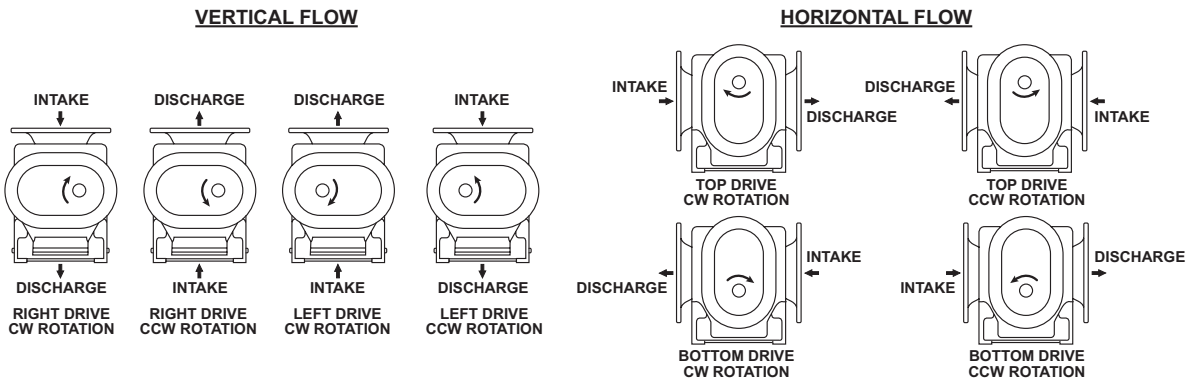


Figure 4-2 – Flow Direction by Rotation

SPECIFICATIONS

MODEL	APPROXIMATE OIL CAPACITY		PORT SIZE	MAX RPM	APPROXIMATE WEIGHT	
	VERTICAL FLOW 86 / 82 / 69	HORIZONTAL FLOW 19 / 55 / 66			VERTICAL FLOW 86 / 82 / 69	HORIZONTAL FLOW 19 / 55 / 66
1215	10.0 gal (37.9 L)	7.0 gal (26.5 L)	12 in. (305 mm)	1800	4200 lb (1905 kg)	4200 lb (1905 kg)
1224	10.0 gal (37.9 L)	7.0 gal (26.5 L)	14 in. (356 mm)	1800	4900 lb (2222 kg)	4900 lb (2222 kg)
1230	10.0 gal (37.9 L)	7.0 gal (26.5 L)	14 in. (356 mm)	1800	5400 lb (2449 kg)	5400 lb (2449 kg)
1236	10.0 gal (37.9 L)	7.0 gal (26.5 L)	18 in. (457 mm)	1800	5900 lb (2676 kg)	5900 lb (2676 kg)
1248	10.0 gal (37.9 L)	7.0 gal (26.5 L)	20 in. (508 mm)	1400	6850 lb (3107 kg)	6850 lb (3107 kg)

Table 4-1 – Specifications

MODEL	MAXIMUM RPM	MAXIMUM PRESSURE DIFFERENTIAL	MAXIMUM VACUUM	MAXIMUM TEMPERATURE RISE	MAWP
1215	1800	15 psi (1,034 mbar)	15 inch-Hg (508 mbar)	280°F (156°C)	100 psi (6.8 bar)
1224	1800	15 psi (1,034 mbar)	15 inch-Hg (508 mbar)	280°F (156°C)	
1230	1800	14 psi (965 mbar)	15 inch-Hg (508 mbar)	280°F (156°C)	
1236	1800	9 psi (620 mbar)	12 inch-Hg (406 mbar)	230°F (127°C)	
1248	1400	6 psi (413 mbar)	10 inch-Hg (338 mbar)	190°F (105°C)	

Table 4-2 – Maximum Operating Limits

⚠ WARNING

The maximum pressure differential is based on the difference between the inlet pressure and the outlet pressure. The maximum pressure differential shall not be exceeded. Exceeding the maximum pressure differential will cause serious damage to the equipment and could cause bodily injury.

⚠ WARNING

The maximum allowable working pressure (MAWP) is based on the absolute pressure of the blower housing and is NOT the maximum allowable pressure differential. Exceeding the MAWP will cause serious damage to the equipment and could cause bodily injury.

To permit continued satisfactory performance, a blower must be operated within certain approved limiting conditions. The manufacturer's warranty is, of course, also contingent on such operation.

Maximum limits for pressure, temperature, and speed are specified in ***Table 4-2 on page 8*** for various blower sizes when operated under the standard atmospheric conditions. Do not exceed any of these limits.

NOTICE

*Specially ordered blowers with nonstandard construction, or with rotor end clearances greater than shown in **Assembly Clearances on page 40**, will not have the operating limits specified here. Contact your M-D Pneumatics sales representative for specific information.*

NOTICE

Special attention must be paid when a blower has a higher than standard ambient suction temperature. Special recommendations for operating parameters and/or additional cooling may be recommended. Consult the factory or local representative for appropriate information.

05

INSTALLATION

GENERAL

⚠ DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.

⚠ DANGER

It is the responsibility of the installer to assure that proper guarding is in place and compliant with all applicable regulatory requirements.

⚠ WARNING

The bare shaft blower can generate excessive noise. Methods to reduce the noise levels by installing inlet and outlet silencers will be required. Even with inlet and outlet silencers, hearing protection will be required.

⚠ WARNING

Customers are warned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards in the installation and operation of this equipment in the system or facility.

⚠ WARNING

The standard MAWP is per *Table 4-2*. The MAWP shall not be exceeded unless specific factory testing of the pressure containing components of the blower has been performed.

⚠ WARNING

***Table 4-2* states the maximum operating speed in RPM (rotations per minute) and maximum temperature. Do not exceed these limits. The installation of the booster shall take these critical operating parameters into account and adequate control features implemented.**

⚠ WARNING

Upon completion of the installation, and before applying power, rotate the drive shaft by hand. It must move freely. If it does not, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment or any other cause of binding. If blower is removed and still does not move freely, check inside the blower housing for foreign material.

NOTICE

Remove the protective covers from the shaft and inspect for damage.

Carefully check to ensure that no transit damage has been sustained. If damage has occurred from shipment a claim must be filed with the carrier immediately; preserve the shipping container for inspection by the carrier.

NOTICE

In the event that your unit sustains damage while being shipped to your facility, do not return it to the factory without first obtaining shipping instructions from us.

Do not remove protective covers and plugs until the connection is being made. Mount the blower on a flat, level surface. Use a baseplate that is a rigid, solidly supported, and structurally sound. Shim under the legs where necessary so that each leg of the blower supports an equal share of the blower weight. This is necessary to prevent eventual twisting of the blower. Make sure feet rest evenly on the mounting surface before fastening down. Twisting or cramping the blower during mounting will cause rotor contact and binding during operation, resulting in a condition called “soft foot.” ***See Soft Foot on page 13*** for further details and preventative measures.

A blower that is factory-mounted on a base should not require such adjustments. However, since the assembly can become twisted in shipping or installation, check for soft foot after installing the base. Shims may be needed for alignment. Loosen the foot hold-down screws to check foot contact with the mounting surface. Mount the base on a solid foundation or heavy flooring, using shims as necessary at bolting points to prevent warping the assembly. ***See Foundation on page 12*** for more information.

Transmission of small operating vibrations to a support structure may be objectionable in some cases. Use of vibration isolators or vibration absorbing materials can be effective in overcoming this transmission. To avoid casing distortion, apply the treatment under the common motor/blower base or mounting plate rather than directly under the feet alone.

Make sure piping is accurately squared with the blower and supported independently. Stress imparted from incorrectly aligned piping or mounting will create problems with bearing and seal life, possibly leading to premature internal contact. The blower should sit stress-free and evenly on its supporting surface. Take care to evenly tighten the mounting bolts to avoid imparting undue stress into the blower. Stress can be checked in a free state with feeler stock or verified on a previously installed blower with the aid of a dial indicator. Spring or gap should be found less than 0.002 in. (0.05 mm).

Use only clean, new pipe and make certain it is free of scale, cuttings, weld beads, dirt, or any other foreign material. To guard against damage to the blower, make sure an inlet filter is used. Clean the filter of collected debris after a few hours of operation and periodically thereafter. ***See Piping Connections on page 18*** for additional details.

Figure 5-1 shows a typical complete installation of blower and accessories. Note the absence of throttle or shut-off valves in both discharge and intake piping. If it is possible for air flow to be cut off in either line, add a pressure and/or vacuum relief valve. In some installations, it may be desirable to use only an inlet silencer-cleaner supported directly from the blower connection. Keep the weight of accessories and piping to a minimum to prevent blower casing distortion. If the weight exceeds 10% of blower weight, support the components independently of the blower and connect them with a flexible hose or connectors. The approximate weights of the blowers are listed in ***Table 4-1 on page 8*** and ***Table 4-2 on page 8***.

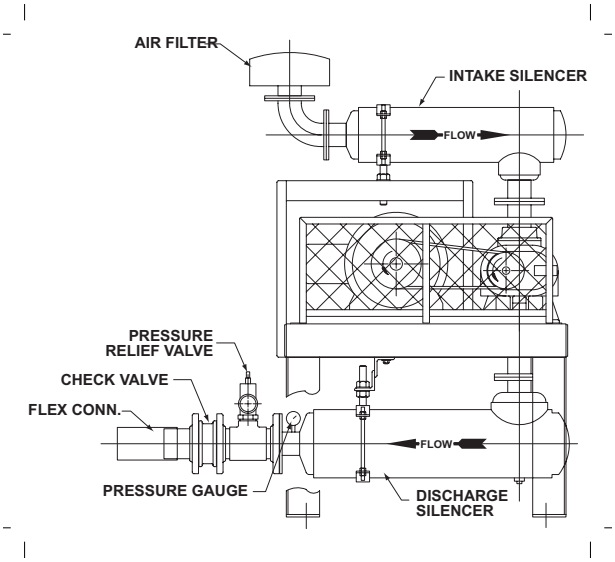


Figure 5-1 – Typical Blower Installation

A blower may be driven by direct-coupling to the driver or by V-belt drive for the purpose of obtaining other speeds within the approved range. ***See Motor Drives on page 20*** for more information.

Blowers from M-D Pneumatics are internally and externally treated after factory assembly and testing to protect against rusting in normal atmospheric conditions prior to installation. The maximum period of internal protection is considered to be up to 6 months under average conditions, provided closing plugs and seals are not removed. Protection against chemical or salt-water atmosphere is not provided. Avoid opening the blower until ready to begin installation, as protection will be quickly lost due to evaporation. For recommended preparations for long-term storage (longer than 6 months), ***see Long-Term Storage on page 31***.

Location

Install the blower in a room or outdoor area that supplies adequate space and lighting for routine maintenance. Make sure indoor installation areas are well ventilated and kept as cool as possible, because operating the blower at elevated temperatures can result in nuisance overload or temperature shutdowns. An unprotected outdoor installation is satisfactory only when correct lubrication for expected temperatures is provided. ***See Recommended Lubricants on page 42***.

Foundation

The blower does not need a special foundation. However, it does require a solid, level floor and adequate frame support. Bolt the blower system to the floor, and seal any cracks.

Blower Air Intake

To minimize maintenance, supply the blower with the cleanest air possible. The air must not contain any flammable or toxic gases, as the blower will concentrate these gases. This could result in damage to the blower and surrounding property, and could lead to personal injury or death. Do not block or restrict the opening of the blower and/or motor, as they could overheat and fail.

Do not use blowers on explosive or hazardous gases. Do not exceed the limits described in ***Table 4-2 on page 8***. Each size blower has limits on performance criteria such as pressure differential, running speed, and discharge temperature.

If it is necessary to take air from a remote source, such as in a vacuum application, make sure the diameter of the piping is at least equal to the diameter of the blower inlet. For distances greater than 20 ft (6 m), enlarge the pipe diameter to reduce inlet restriction. Excessive restriction will reduce the efficiency of the blower and elevate its discharge temperature. The piping used should also be corrosion-resistant and free of scale and dirt. Keep the inlet covered to keep out precipitation, insects, and small animals. Vacuum kits are available.

Soft Foot

Soft foot is a condition in which one of the blower feet does not sit flat on the base. Soft foot is usually due to irregularities in the surface to which the blower is mounted. When the bolt on the foot is tightened, a slight distortion occurs that can affect bearing and seal life as well as cause premature internal contact between the rotors and the housing.

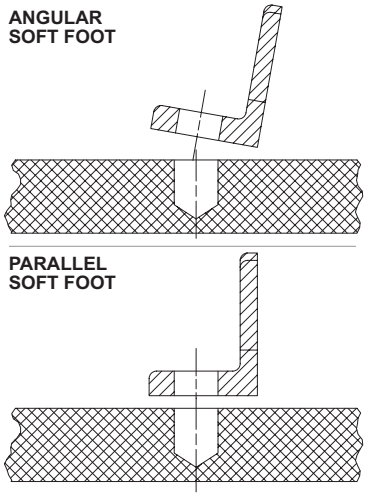


Figure 5-2 – Illustrations of Soft Foot

1. Place the blower on the base.
2. Check each foot for gaps between the foot and base (soft foot). Shim as necessary to fill gap within 0.002 in. (0.05 mm).
   Figure 5-2 shows the two most common types of soft foot conditions. If either type is present at a measurement of more than 0.003 in. (0.076 mm), the blower may fail prematurely.
3. Tighten all bolts.
4. Mount a dial indicator on the base contacting one foot at 12 o'clock position.
5. Loosen the bolt on that foot. Observe indicator travel and add shims as needed to reduce "spring" to less than 0.002 in. (0.05 mm). Repeat steps 4 and 5 on the remaining feet.

SAFETY

M-D Pneumatics recommends the use of relief valves to protect against excessive pressure or vacuum conditions. Test these valves at initial start-up to be sure they are properly adjusted to relieve at or below the maximum pressure differential rating of the blower.

⚠ DANGER

It is the responsibility of the installer to assure that proper guarding is in place and compliant with all applicable regulatory requirements.

⚠ DANGER

Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. The blower should never be run with the inlet or discharge piping removed. If it becomes necessary to inspect the rotating parts of the blower or to change V-belts, be absolutely sure that all power to the motor controls has been shut off, the motor controls are locked out, and properly tagged before proceeding.

⚠ DANGER

Assure that properly sized vacuum breaks/ relief valves are used on the inlet side of the blower. Also assure that properly sized pressure relief valves are used on the outlet of the blower. The sizing shall be such to assure that the proper flow can be achieved without exceeding the rated vacuum and pressure ratings.

⚠ DANGER

Blower housing and associated piping or accessories may become hot enough to cause major skin burns on contact.

⚠ WARNING

Use lock out/tag out procedures to disable the electrical energy source before any service or work is done on the blower.

⚠ WARNING

Avoid extended exposure in close proximity to machinery with high intensity noise levels. Wear adequate ear protection.

NOTE: Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.

LUBRICATION

Every blower from M-D Pneumatics is factory-tested, oil drained, and shipped dry to its installation point. Fill both independent oil reservoirs to the proper level before operation. Oil reservoirs are under vacuum.

The blower incorporates pressure lubrication with an integral oil pump, pressure relief valve, filter, and oil-to-coolant heat exchanger. Before starting the blower, fill oil sumps as shown in ***Filling Procedure on page 14***. ***See Recommended Lubricants on page 42*** for suggested lubricants.

⚠ WARNING

Never attempt to change or add lubrication while the blower is running. Failure to heed this warning could result in damage to the equipment or personal injury. Oil must be checked when the blower is NOT running.

⚠ WARNING

Properly dispose of the spent lubricants. Refer to the manufacturer of the lubricant and any regulations to assure proper and safe disposal.

⚠ WARNING

Do not start the blower until you are sure oil has been put in the gear housing and rear cover. Operation of the blower without proper lubrication will cause the blower to fail and void the warranty.

Filling Procedure

See Figure 5-3. See Recommended Lubricants on page 42 for suggested lubricants and grease.

1. Remove the fill plugs or breathers from both gear end and drive end plates.

2. Slowly pour oil through the fill until oil appears in the oil sight glass. Bring the oil level to the center of the sight glass.

3. Verify oil level is at proper level in both gear end and drive end sight glasses.

4. Replace the fill plugs or breathers that were removed in step 1.

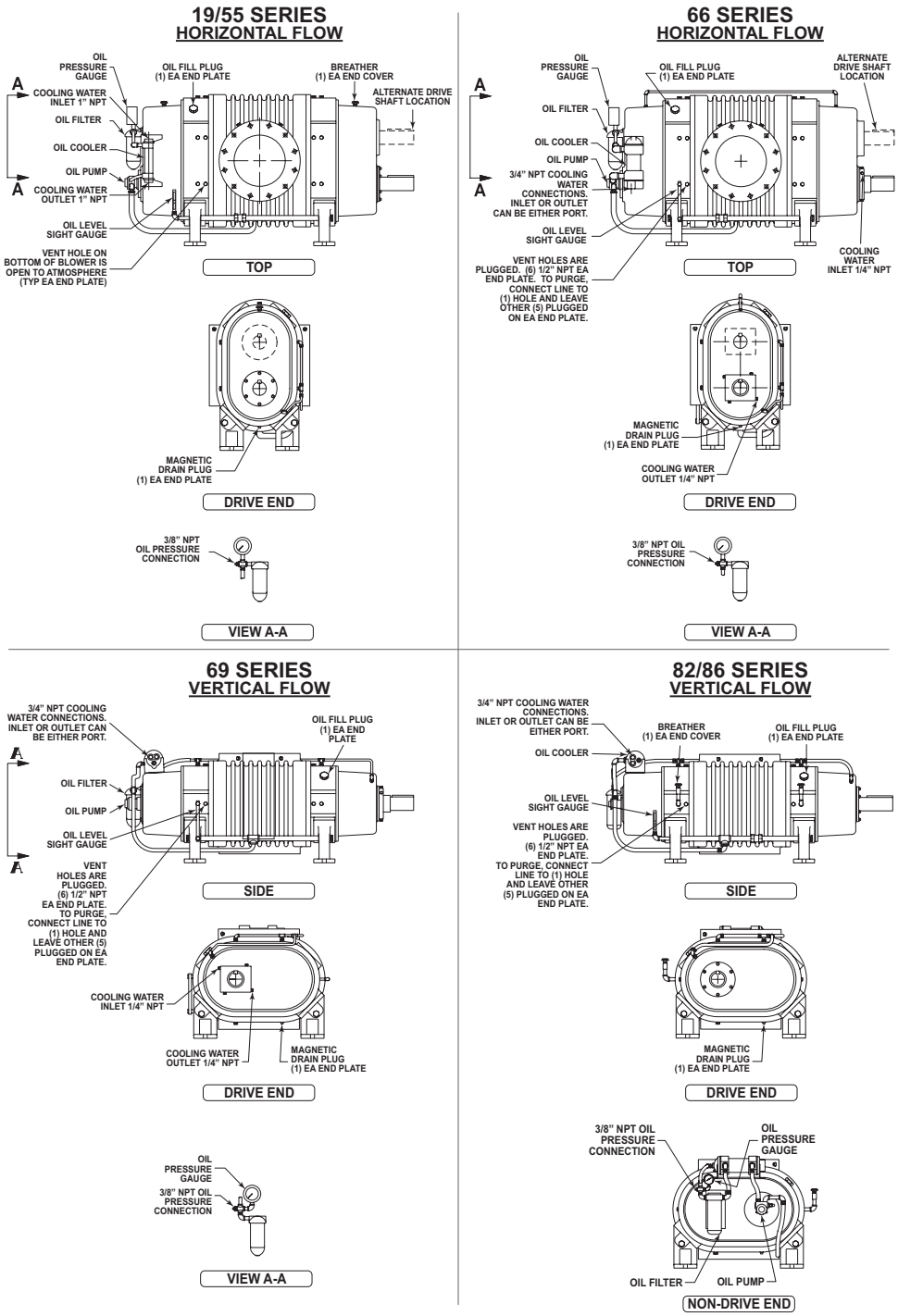


Figure 5-3 – Oil Fill, Drain, Level Gauges and Cooling Connections on Blowers with Splash Lubrication

The end cover oil reservoirs are connected together by passageways external to the rotor housing. To change oil, drain from the one-inch square head plug located in bottom of cover, or the on-half inch plug in the oil pump cover.

Check oil levels frequently. Shut down the blower to properly check oil level.

Frequently Asked Questions Regarding Lubrication

What is the functional detriment if the "wrong oil" is used?

The lubricant is selected based on bearing speed, gear speed, and operating temperature. If the lubricant is too light, it increases wear by not separating the sliding surfaces and it will not remove the heat adequately. If the lubricant is too thick, the drag in the bearings is increased, causing them to run hotter. Thicker lubricant will not flow as readily into the gears and it will reduce the available backlash. Lubricants at our conditions are incompressible.

What is the functional detriment if the oil is not serviced?

If the lubricant is not serviced at the proper interval, the shearing action in the bearing and the gears will begin to take its toll and the lubricant will thicken. The blower will run hotter and the wear on moving parts will increase. The lubricant will generally appear dirtier, caused by material rubbing off the components. The lubricant will discolor because of overheating. An indicator of the breakdown of a lubricant is the increase in the TAN (Total Acid Number), and a change of 10 percent in the base viscosity.

Several things are happening as the lubricant goes through the blower. First, it is absorbing frictional energy in the form of heat. This heat has to be dissipated through either surface contact with cooler materials or in a rest volume of lubricant. While reducing the friction, the lubricant is also going through a shearing process and the molecular structure is broken down.

The result is that the lubricant will begin to thicken because of the shorter molecular chains and the drop out of additive packages. The thickened lubricant will cause more drag, increasing the friction and heat, and further degrading the lubricant.

Operation of the blower (environment, run time, speed, and pressure) has a direct effect on duty cycles. The published cycles are based on worst-case conditions.

Recommended Oil Change Intervals

Use ***Table 5-1*** as an approximate guide. For best results, M-D Pneumatics recommends an oil sampling program.

The initial oil change should occur after the first 200 hours of operation. Thereafter, frequency of oil changes will depend on the operating conditions. Check for oil contamination periodically. Time between oil changes should never exceed 6 months.

In addition, ***see Recommended Lubricants on page 42***.

PRESSURE RANGE (PSIG) OR VACUUM RANGE (INCHES HG)	PRESSURE	VACUUM	OPERATING TIME BETWEEN OIL CHANGES
1-5	70-345 mbar	34-170 mbar	1500 hr
6-10	410-690 mbar	203-339 mbar	1000 hr
11-15	760-1035 mbar	370-508 mbar	500 hr

Table 5-1 – Operating Conditions (Pressure/Vacuum)

Hazards Associated With Breakdown or Ignition of Lubrication

⚠ DANGER

There is a risk associated with the lubrication media breaking down and resulting in a hazardous fluid or vapor. There may also be a hazard associated with the ignition of the lubrication media. Refer to the lubrication manufacturer's applicable instruction for safety precautions.

LUBRICATION – INTEGRAL PRESSURE

Oil Filter

Change the oil filter element and its shell gasket at every oil change. The oil filter element (P/N 91999-1) and shell gasket (P/H 12102-6) are available from M-D Pneumatics in Springfield, Missouri, or from any authorized distributor or service center.

⚠ CAUTION

Factory-supplied filters are engineered to provide the proper restriction in the oil lubrication system. Using filters other than those available from M-D Pneumatics may result in lubrication problems and possibly unwarrantable damage to the booster.

Oil Pressure Adjustment

The oil pressure on each blower has been preset at the factory during the load testing. The oil pressure should not require adjustment once the blower is installed and in operation. However, in rare cases, some adjustment may be needed due to speed and oil temperature. The oil pump itself has no adjustment. The oil bypass relief valve located in the oil feed line after the oil filter can be used for the same purpose.

To adjust the blower to the proper oil pressure:

1. Remove the hex cap shown in ***Figure 5-4***.
2. Loosen the lock nut.
3. Turn the set screw clockwise to increase the pressure or counterclockwise to decrease the pressure.
4. Tighten the lock nut and replace the cap.
5. Read the oil pressure. Oil pressure may vary between 5 psig (34 kPa) and 30 psig (207 kPa). The blower's oil system can operate satisfactorily at 1 psig (6.9 kPa), if necessary, and still have sufficient flow. Always allow the blower to reach operating temperature before adjusting the oil pressure to the proper range. Set the oil pressure to 15 psig (103 kPa).

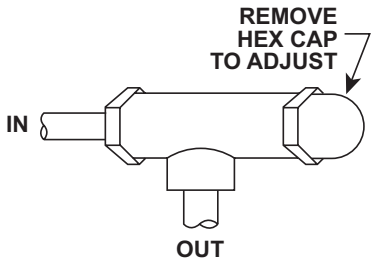


Figure 5-4 – Pressure Relief Valve

Oil Cooler

All versions are supplied with four-pass coolers. Either hole can be used for water inlet with no effect on performance. For most applications, 2-5 gpm (7.5-20 L/min) of 60°F (15°C) water is sufficient. Actual water usage will depend on operating conditions. Ideal oil temperature is 140-160°F (60-72°C).

All standard coolers are designed for use with fresh water only. Do not use brackish or salt water. The liquid to be cooled (oil) flows around the tubes and the cooling liquid (water) flows through the tubes.

⚠ WARNING

If the unit is to be located outside or in a building where ambient temperatures can fall below freezing, then care must be taken to ensure the water or liquid used for cooling does not freeze and damage the booster. Oil cooler must be drained of liquid during downtime unless a re-circulating unit using a glycol mixture has been installed.

PIPING CONNECTIONS

⚠ WARNING

Pipe loading on the blower should be negligible as pipe loading can cause distortion of the blower. Use proper supports and pipe hangers to assure that there is no loading.

NOTICE

Remove the protective covers from the inlet and outlet ports and inspect for dirt and foreign material.

NOTICE

If the blower is to be located outdoors or in a building where the temperature surrounding the blower or the water supply and return piping can fall below 35°F (2°C), then care must be taken to ensure that the water (or other cooling liquid) does not freeze and cause damage. Heat exchanger and cooling lines must be drained of liquid during downtime unless a recirculating unit using a glycol mixture has been installed.

NOTICE

Units are never shipped from the manufacturer with liquid in the heat exchanger or cooling lines.

Inlet and outlet connections on all blowers are large enough to handle maximum volume with minimum friction loss. Maintain same-diameter piping. Do not support silencers by the blower. Avoid stress loads and bending moments.

Be certain all piping is clean internally before connecting to the blower. Place a 16-mesh wire screen backed with hardware cloth at or near the inlet connections for the first 50 hours of use until the system is clean. Clean the screen after a few hours of operation and completely discard it once the system is clean, as it will eventually deteriorate and small pieces going into the blower can cause serious damage. A horizontal or vertical airflow piping configuration is easily achieved by rearranging the mounting feet position.

Hazards Associated With Hazardous Process Fluids

⚠ DANGER

It shall be the responsibility of the installer to ensure that piping is adequate, sealing between pipe joints is adequate for the process fluids and proper process and pressure protection devices are in place. It is also the responsibility of the installer to assure that process gasses are not vented in a manner that would be hazardous.

Refer to the manufacturer of the process media to assure that proper safety precautions are in place.

Blockage or Restriction

⚠ WARNING

Damage to the blower could occur if there is blockage in the inlet or outlet ports or piping. Care should be taken when installing the blower to assure that there are no foreign objects or restrictions in the ports or piping.

MOTOR DRIVES

Two drive connections commonly used are direct drive and V-belt drive.

Direct Coupled

When installing the motor directly to the blower, align the shafts to the coupling according to the coupling manufacturer's instructions. Blowers shipped with motor directly coupled and mounted on a common base have been aligned prior to shipment. Further alignment is normally not necessary, but be sure to check the alignment if necessary prior to starting the blower.

Coupling halves must correctly fit the blower and drive shafts so that only light tapping is required to install each half. The two shafts must be accurately aligned. A direct-coupled blower and motor must be aligned with the two shafts not having more than 0.005 in. (13 mm) Total Indicator Reading (T.I.R.). Make sure the face is aligned within 0.002 in. (0.05 mm).

Establish proper gap between coupling halves according to coupling manufacturer's instructions with the motor armature. Proper gap will minimize the chance for end thrust on the blower shaft. Re-align and grease all direct-coupled base-mounted blowers after field installation.

V-Belts

If the motor and blower are V-belt connected, the sheaves on both the motor and blower shafts should be as close to the shaft bearings as possible. Blower sheave is not more than 1/4 in. (6.5 mm) from the blower drive end cover. The drive sheave is as close to the driver bearing as possible. Take care when installing sheaves on the blower and motor shafts. Make sure the face is accurately in line to minimize belt wear.

Adjust the belt tension to the manufacturer's specifications using a belt tension tester. Check new belts for proper tension after 24 hours of run time. When manufacturer data is not available, industry guidelines are 1/64 in. deflection for each inch of span (0.157 mm per centimeter of span) at 8 – 10 lb (3.6 – 4.5 kg) of force in the center of the belt.

Insufficient tensioning is often indicated by slipping (squealing) at start-up. Do not use belt dressing on V-belts. Keep sheaves and V-belts free of oil and grease. Remove tension from belts if the drive is to be inactive for an extended period of time. For more specific information, consult the drive manufacturer. In a V-belt drive, the blower sheave must fit its shaft accurately, run true, and be mounted as close to the bearing housing as possible to minimize bearing loads.

A tight or driving fit will force the drive shaft out of its normal position and cause internal damage. A loose fit will result in shaft damage or breaking. Make sure the motor sheave fits correctly and is properly aligned with the blower sheave.

Adjust the motor position on its sliding base so that belt tension is in accordance with the drive manufacturer's instructions. Always avoid excessive belt tension. Recheck tension after the first 10 hours of operation and periodically thereafter to avoid slippage and loss of blower speed.

Check blower after installation and before applying power by rotating the drive shaft by hand. If it does not rotate freely:

- Look for uneven mounting, piping strain, excessive belt tension, or coupling misalignment.
- Check the blower to make sure oil was added to the reservoirs.

Setting V-Belt Tension

Proper belt tension is essential to long blower life. ***Figure 5-5***, ***Figure 5-6***, and the following procedure are provided to aid in field-adjusting V-belts (when the blower is so equipped) for maximum performance. A visual inspection of the V-belt drive should yield the appearance shown in ***Figure 5-5***.

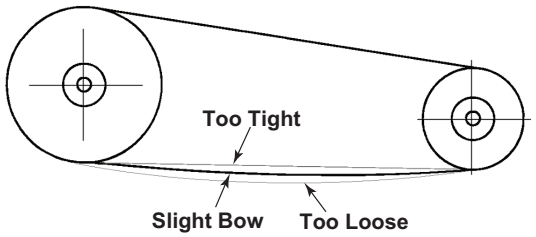


Figure 5-5 – General Appearance of a V-belt Drive

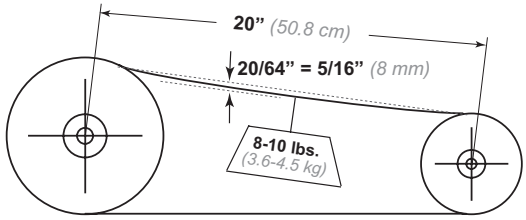


Figure 5-6 – Setting of Proper Tension for a V-belt Drive

Factors outside the control of the belt tensioning system used on an individual blower package assembly, such as environmental factors and quality of the belts installed, may contribute to decreased belt life. Such factors can cause wear of the belts beyond the ability of the tensioning system to compensate.

As such, it is recommended to check belt tension monthly and make any manual adjustments found necessary.

1. Turn off and lock out power.
2. Remove the fasteners from the belt guard (if equipped).
3. Remove the belt guard.
4. Check and adjust the belt tension as necessary. Tension should be 1/64 in. deflection per inch of span (0.157 mm deflection per centimeter of span) between sheaves, with 8 – 10 lb (3.6 – 4.5 kg) force applied at the center point of the top section of the belt.
5. Install the belt guard, making sure that all drive components are free of contact with the guard.
6. Install the belt guard fasteners that were removed in step 2.
7. Unlock the power and start the blower.
8. Resume normal operation.

V-Belt Troubleshooting

PROBLEM	POSSIBLE CAUSES	SOLUTION
Belts slip (sidewalls glazed)	Not enough tension	Replace belts; apply proper tension.
Drive squeals	Shock load	Apply proper tension.
	Not enough arc of contact	Increase center distance.
	Heavy starting load	Increase belt tension.
Belt(s) turned over	Broken cord caused by prying on sheave	Replace set of belts and install correctly.
	Overloaded drive	Redesign drive.
	Impulse loads	Apply proper tension.
	Misalignment of sheave and shaft	Re-align drive.
	Worn sheave grooves	Replace sheaves.
	Excessive belt vibration	Check drive design. Check equipment for solid mounting. Consider use of banded belts.
Mismatched belts	New belts installed with old belts	Replace belts in matched sets only.
Breakage of belt(s)	Shock loads	Apply proper tension; recheck drive.
	Heavy starting loads	Apply proper tension; recheck drive. Use compensator starting.
	Belt pried over sheaves	Replace set of belts correctly.
	Foreign objects in drives	Provide drive guard.
Rapid belt wear	Sheave grooves worn	Replace sheaves.
	Sheave diameter too small	Redesign drive.
	Mismatched belts	Replace with matched belts.
	Drive overloaded	Redesign drive.
	Belt slips	Increase tension.
	Sheaves misaligned	Align sheaves.
	Oil or heat condition	Eliminate oil. Ventilate drive.

Motor and Electrical Connections

⚠ WARNING

The motor and connections shall be protected to assure that product and environmental condensation does not come in contact with the electrical connections.

NOTICE

It is the responsibility of the installer to assure that the motor is in compliance with the latest edition of IEC 60204-1 and all electrical connections are performed per IEC 60204-1, this includes overcurrent protection.

Wire the motor and other electrical devices, such as solenoid valves and temperature switch, to the proper voltage and amperage as indicated on the nameplate of the component being wired. Turn the blower by hand after wiring is completed to determine that there are no obstructions and that the blower turns freely. Then, momentarily start the blower to check the direction of rotation.
Figure 4-2 shows direction of airflow in relation to rotor rotation. The airflow direction can be reversed by reversing the appropriate motor leads.

06

OPERATION

GENERAL

⚠ DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.

⚠ WARNING

Do not operate without guards in place.

⚠ WARNING

Maximum operating speed: *Table 4-2* states the maximum operating speed in RPM (rotations per minute), the maximum pressure differential, maximum vacuum and maximum temperature rise. Do not exceed these limits.

Before starting the blower for the first time under power, recheck the installation thoroughly to reduce the likelihood of difficulties. Use the following checklist as a guide, but also consider any other special conditions in your installation.

1. Be certain no bolts, rags, or dirt have been left in the blower.
2. Be certain that inlet piping is free of debris. If an open outdoor air intake is used, be sure the opening is clean and protected by an inlet filter. This also applies to indoor use.
3. If installation is not recent, check blower leveling, drive alignment, belt tension, and tightness of all mounting bolts.
4. Be certain the proper volume of oil is in the oil reservoir chambers.
5. Be certain the driving motor is properly lubricated and that it is connected through suitable electrical overload devices.
6. With electrical power off and locked out to prevent accidental starting, rotate the blower shaft several times by hand to make sure the blower is rotating freely. Unevenness or tight spots are indicators of a condition that should be corrected before progressing.
7. Check motor rotation by momentarily pushing the START button and then checking the flow direction of the blower. Reverse the motor connections if flow is in the wrong direction.

Carry out initial operation under “no load” conditions by opening all valves and venting the discharge to atmosphere, if possible. Then, start the motor briefly, listen for unusual noises, and make sure the blower coasts freely to a stop. If no problem appears, repeat this check and let the motor run slightly longer. If any questions exist, investigate before proceeding.

Assuming all tests are satisfactory, the blower will now be ready for continuous full-load operation. During the first several days, check periodically to make sure all conditions remain acceptable and steady. These checks may be particularly important if the blower is part of a process system where conditions may vary. At the first opportunity, stop the blower and clean or remove the inlet filter. Also, recheck leveling, coupling alignment or belt tension, and mountlng bolts for tightness.

START-UP CHECKLIST

It is recommended that these start-up procedures be followed in sequence and checked off (☑) in the boxes provided in any of the following cases.

• During initial installation • After any shutdown period	• After maintenance work has been performed • After blower has been moved to a new location
DATES CHECKED:	☐ ☐ ☐
☐☐☐☐	Check the unit for proper lubrication. Proper oil level is critical. ***See Lubrication on page 14***. ***See Recommended Lubricants on page 42*** for information on acceptable lubricants for the product.
☐☐☐☐	Check the V-belt drive for proper belt alignment and tension.
☐☐☐☐	Carefully turn the rotors by hand to be certain they do not bind.

⚠ WARNING

Disconnect power. Make certain power is off and locked out before touching any rotating element of the blower, motor, or drive components.

☐☐☐☐	“Bump” the unit with the motor to check rotation (counterclockwise when facing the shaft) and to be certain it turns freely and smoothly.
☐☐☐☐	Start the unit and operate it for 30 minutes at no load. During this time, feel the cylinder for hot spots. If minor hot spots occur, ***see Troubleshooting on page 38.***
☐☐☐☐	Apply the load and observe the operation of the unit for 1 hour.
☐☐☐☐	If minor malfunctions occur, discontinue operation and ***see Troubleshooting on page 38***.

OPERATING

The upper temperature limit for blower operation is 400°F (205°C), measured in the exhaust gas stream with a low-mass thermocouple. When this temperature limit switch is installed, as the temperature exceeds the predetermined temperature, the blower motor will stop and cannot be restarted until the temperature drops below the trip setting of the temperature switch.

⚠ DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support. Gas application units must be fully approved by the Tuthill factory prior to the purchase of the product and must be designed specifically for the gas application.

⚠ WARNING

Physical harm may occur if human body parts are in contact or exposed to the process vacuum. Assure that all connections are protected from human contact.

⚠ WARNING

If rated vacuum or pressure levels are exceeded, process fluids will migrate to other parts of the blower and system.

⚠ WARNING

The blower can generate excessive noise, hearing protection is required while the unit is in operation.

⚠ CAUTION

Do not touch hot surfaces.

The upper limit of the blower operation is 400º F (205º C). Do not touch the blower while it is in operation and assure blower is cool when not in operation.

⚠ CAUTION

Use of a thermowell insulates the thermocouple. Invalid and delayed readings will result. This can result in ineffective protection devices.

NOTICE

The upper temperature limits are not intended for continuous operation. Consult with factory for detailed information assistance.

STOPPING

⚠ CAUTION

Do not stop the blower if there are high outlet pressures in the outlet piping. Unload the outlet piping prior to shutting down the blower.

Stop the blower by turning off the motor. Isolate the blower from the vacuum system, and vent the blower to atmosphere. Turn off the cooling water if the blower is water cooled. Stop the backing pump. See the component instruction manual.

WATER-INJECTED BLOWERS

Water injected into the inlet of a blower operating on vacuum service will cool the blower. The water absorbs the heat of compression as it passes through the blower along with the air/gas being compressed. A blower cooled in this manner can operate safely at higher vacuums or higher inlet temperatures than a normally uncooled blower.

The amount of water required depends on the inlet air/gas temperature, inlet vacuum, water temperature, and maximum discharge temperature desired. Check with the factory or sales representative for additional guidance.

Operation

1. Check the oil level in the sight glass of the blower and make sure all fittings are tight.
2. Check the water injection system to make sure water is available.
3. Operate the blower dry for a few minutes at no load to check for correct rotation and smooth operation.
4. Turn the water on and adjust flow as recommended for the individual blower. Make sure the water discharges freely from the outlet piping.
5. Apply vacuum and observe operation at the desired inlet condition.

Shutdown

It is possible to shut down the blower for brief periods by relieving the inlet vacuum, shutting off the water, and then stopping the blower.

To avoid rusting during a slightly longer shutdown period, operate the blower under a partial vacuum without the water injection, allowing the blower to heat within safe limits. The heat will tend to drive off residual moisture.

For extended shutdown, oil may be injected into the inlet of the heated blower just prior to shutting down the blower. The oil will provide a protective coating on the internal components. Make sure the water is completely shut off after shutdown.

Special coatings or platings are available to minimize rusting or corrosion in applications where blowers can remain wet.

Always use vertical-flow blowers with two-lobed, plugged rotors. Always orient the system with the blower intake at the top and discharge at the bottom.

⚠ CAUTION

Water injection can cause lime build-up on rotors. Check water supply for hardness. The use of water softeners, other chemicals, or distilled water may be necessary to prevent or remove this build-up. However, due to the wide variations in mineral content, pH, and chemical content of water that can be injected, M-D Pneumatics cannot be responsible for damage which may result should this build-up occur. Units should be inspected regularly to determine any problems.

NOTICE

For liquid injection other than water, consult the factory.

RECOMMENDED SHUTDOWN PROCEDURE TO MINIMIZE RISK OF FREEZING OR CORROSION

When an air piping system has high humidity or moisture, water condensation can occur after the blower is shut down and it begins to cool. Condensation creates an environment favorable to corrosion of the iron internal surfaces and to ice formation in cold weather. Both conditions can close the operating clearances, causing the blower to fail upon future start-up.

The following shutdown procedure minimizes the risk of moisture condensation, corrosion, and freezing.

NOTICE

Care must be taken so as not to overload or overheat the blower during this procedure.

1. Isolate the blower from the moist system piping, allowing the blower to intake atmospheric air. Operate the blower under a slight load, allowing the blower to heat within safe limits. The heat generated by the blower will quickly evaporate residual moisture.

2. For carpet cleaning applications, after the work is completed, simply allow the blower to run 3 – 5 minutes with the suction hose and wand attached. The suction hose and wand will provide enough load to the blower to evaporate the moisture quickly.

3. For extended shutdown, inject a small amount of a light lubricating oil such as 3-in-One® or a spray lubricant such as WD-40® into the inlet of the blower just before shutdown *(3-in-One and WD-40 are registered trademarks of WD-40 Company)*. The lubricant will provide an excellent protective coating on the internal surfaces. If using a spray lubricant, take care to prevent the applicator tube from getting sucked into the blower. The applicator tube will damage the blower, likely to a degree where repair would be required.

4. If the blower is being taken out of commission for an extended period of time, ***see Long-Term Storage on page 31***.

07 MAINTENANCE

GENERAL

Regular inspection of the blower and its installation, along with complete checks on operating conditions, will pay dividends in added life and usefulness. Also, service the drive per the manufacturer's instructions and lubricate the coupling or check the belt drive tension. Use thermometers and gauges to make sure blower operating temperature and pressure remain within allowed limits.

⚠ DANGER

The blower and parts may contain hazardous media. Assure that pump and parts are evacuated of hazardous media prior to servicing.

⚠ CAUTION

The electrical service must be isolated and de-energized prior to maintenance. Apply appropriate procedures to assure electrical supply is de-energized and cannot be inadvertently energized during maintenance.

Assure piping and product is isolated prior to maintenance of blower. Apply appropriate procedures to assure piping and product is isolated and that inadvertent opening of valves cannot occur during maintenance.

⚠ CAUTION

During routine maintenance, inspect and assure that guards are in place and secure.

Pay special attention to lubrication of timing gears and bearings according to the information in ***Lubrication on page 14***.

When a blower is taken out of service, it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgment based on existing conditions as well as length of downtime. Under atmospheric conditions producing rapid corrosion, protect the blower immediately. ***See Long-Term Storage on page 31***.

REGULAR MAINTENANCE

A well-designed maintenance program will add years of service to the blower.

Check a newly installed blower frequently during the first month of operation, especially lubrication. With the blower at rest, check the oil level in both the gear (drive) end and free (non-drive) end of the blower and add oil as needed. Complete oil changes are recommended every 1,000 – 1,200 operating hours, or more frequently depending on the type of oil and operating temperature. Also, change the oil more frequently if pumping corrosive vapors or where excessive operating temperatures are encountered. The following is recommended as a minimum maintenance program.

DAILY	WEEKLY	MONTHLY
1. Check and maintain oil level, and add oil as necessary. 2. Check for unusual noise or vibration (***See Troubleshooting on page 38***).	1. Clean all air filters. A clogged air filter can seriously affect the efficiency of the blower and cause overheating and oil usage. 2. Check the relief valve to make sure it is operating properly.	1. Inspect the entire system for leaks. 2. Inspect the condition of the oil and change if necessary. 3. Check drive belt tension and tighten if necessary.

NOTICE

Oil levels should be checked every 24 hours of operation.

Proper oil drain schedules require that oil be changed before the contaminant load becomes so great that the lubricating function of the oil is impaired or heavy disposition of suspended contaminants occurs. To check the condition of the oil, drain a sampling into a clean container and check for the presence of water or solids. Slight discoloration of the oil should not necessitate an oil change.

SPARE PARTS

Should adjustments or replacement eventually be needed, repairs can often be performed locally as described in this manual after obtaining required parts. Personnel should have a good mechanical background and be thoroughly familiar with the procedures outlined in this manual. For major repairs not covered in this manual, contact the nearest M-D Pneumatics service representative.

When ordering parts, supply all blower nameplate information, as well as the item number and parts description as per the parts lists and assembly drawings. Repair kits are available for all models. These kits contain all the seals, bearings, O-rings, locks, and special retaining screws necessary for an overhaul. For convenience when ordering parts, complete the **Operating Data Form** included on the inside back cover of this manual.

In developing a stock of spare parts, consider the following factors:

- The degree of importance in maintaining the blower in a “ready” condition
- The time lag in parts procurement
- Cost
- Shelf life (seals and O-rings)

FACTORY SERVICE AND REPAIR

With proper care, M-D Pneumatics blowers will give years of reliable service. The parts are machined to close tolerances and require special tools by mechanics who are skilled at this work. Blowers that are still under warranty must be returned to the factory, freight prepaid, for service. Contact a customer service representative for information on how to return the blower for warranty evaluation.

NOTICE

Current regulations require Material Safety Data Sheet to be completed and forwarded to M-D Pneumatics on any unit being returned for any reason which has been handling or involved with hazardous gases or materials. This is for the protection of the employees of M-D Pneumatics who are required to perform service on this equipment. Failure to do so will result in service delays.

NOTICE

When returning a blower to the factory for repair, under warranty, please note the factory will not accept any unit that arrives without authorization. Contact the Service Department for return authorization.

LONG-TERM STORAGE

Any time the blower will be stored for an extended period of time, make sure it is protected from corrosion by following this procedure:

1. Spray the interior (lobes, housing, and end plates) with rust preventative. Repeat as conditions dictate and at least on a yearly basis.
2. Fill both end covers completely full of oil.
3. Firmly attach a prominent tag stating that the end covers are full of oil and must be drained and refilled to proper levels before start-up.
4. Apply a rust-preventative grease to the drive shaft.
5. Spray all exposed surfaces, including the inlet and discharge flanges, with rust preventative.
6. Seal inlet, discharge, and vent openings. It is not recommended that the blower be set in place, piped to the system, and allowed to remain idle for a prolonged amount of time. If any component is left open to the atmosphere, the rust preventative will escape and lose its effectiveness.
7. During storage, ensure that the blower does not experience excessive vibration.
8. Attach a desiccant bag to one of the covers to prevent condensation from occurring inside the blower. Make sure any desiccant bag (or bags) is so attached to the covers that they will be removed before start-up of the blower.
9. Store the blower in an air conditioned and heated building if possible. If air conditioned and heated storage is not possible, make conditions as dry as possible.
10. If possible, rotate the drive shaft by hand at least monthly in order to prevent seals from setting in one position.

08

DISASSEMBLY AND REASSEMBLY

DISASSEMBLY OF BLOWER

1. Drain lubricant from either end and disconnect all external oil lines. Do not attempt to remove oil distribution line bushing in the non-drive end plate until the end cover has been removed and the internal fittings are disconnected. The oil filter and heat exchanger may be removed or left fastened to the cover. Mark piping and other parts so they can be placed in their original position when reassembling.

Free End Disassembly

2. Support free end cover using a lifting strap. Remove cap screws and install two of them as jacking screws in the tapped holes next to the dowel pins. Use two studs 8 in. (203 mm) long to assist in supporting the cover until it has cleared the dowel pins. It is not necessary to remove oil pump and the adapter plate from the cover unless these items are being replaced.

3. Remove large O-ring, four slinger cap screws (5/16-12 point socket required), and oil slinger. Tap the drive shaft lightly with a mallet to remove it from the rotor shaft. Remove cap screws and the oil retaining rings.

Gear End Disassembly

4. Remove drive shaft key. Remove all burrs and other defacements from the drive shaft. **All series except Seal/Lube Series 9 or Series 66/69:** Remove cap screws and place two screws in jackscrew holes provided to remove seal adapter plate. Tap out the seal and discard O-ring.

   Seal/Lube Series 9 or Series 66/69: Remove cap screws. Remove seal housing and remove stator portion of the mechanical seal. Using a spanner wrench, remove the adapter sleeve by turning counterclockwise. Remove mating ring and O-rings.

5. Support drive end cover as done on the non-drive end. Remove cap screws. The drive end cover also has jacking screw holes, but it must slide off the spherical roller bearing on the drive shaft. To keep the bearing outer race from cocking, use the drive shaft bearing pressing tool. ***See Figure 13-2 on page 44***.

6. Remove cap screws and the drive shaft. Pull the bearing at this time unless it is to be pressed apart after the drive shaft has been removed.

7. Stand the blower up on the non-drive end on 6 in. × 6 in. (152 × 152 mm) blocks. Remove cap screws from the driven gear and align the match marks on the timing gear teeth. Using a suitable puller or extended pry bar, remove the gear shell from their hubs. The shell and hub are matched. Do not interchange. Re-mark if the original markings are no longer visible.

8. Unlock spanner nut lock washers and remove spanner nut and lockwashers. Remove gear hubs with the puller. Remove gear keys.

9. Remove oil sight gauge. Remove cap screws and mounting feet (Series 66 and 69). All feet are mounted on 1-1/8 in. (28.7 mm) hollow locating dowels from which they should easily

disengage by tapping lightly with a mallet. Discard O-rings.

10. Remove cap screws, bearing retainer rings, and end plate cap screws.

End Plate and Rotor Disassembly

11. The end plate, with the bearings, must be pulled from the rotor shafts. Make up two bearing pressing fixture plates as shown in ***Special Tool Drawings on page 44*** along with eight pieces of 1/2"-13 all-thread flat washers and hex nuts. The use of a hydraulic ram is also recommended, but some modifications may be necessary depending on the type of equipment available. Install each plate to the bearing retainer ring mounting holes and apply pressure equally to the ends of the rotor shaft by tightening the nuts on the threaded rods. Install spacers under the plate after rotor shafts become flush with the top of the bearing. Use a hoist to pick up the end plate once the bearings have cleared the shaft.

12. After the end plate is removed, tap out the bearings. Remove the large O-ring.

    Seal/Lube Series 5 or Series 19/86: Tap out lip seals.

    Seal/Lube Series 8, 9, or Series 55/82/66/69: Pull out by hand the stator portion on the mechanical seal. Retain the seal adapter for reassembly.

NOTICE

If the rotor shaft sleeves were removed with the end plate, pull them out by hand on the 19/86 series. On the other series you must drive them out with the bearings. To avoid damage to the sleeves do not use any hard faced hammers or steel punches to drive the sleeves out. Separate the mating rings from the sleeves.

13. To replace the PTFE washers of the labyrinth seals, remove the retaining ring, two wave springs, steel spacers, and PTFE washers.

NOTICE

Older units will contain six PTFE and seven steel washers in each bore. The current PTFE washers are thicker, therefore you will only use five PTFE and six steel washers when reassembling.

14. Reinstall the end plate without the bearings and seals, and secure with six cap screws equally spaced. Turn the blower over and support with blocks under the gear end plate.

15. Repeat steps 8, 11, 12 and 13 to remove non-drive end plate.

NOTICE

Do not damage bearing spacer when removing bearings. This spacer is only used on the free end.

16. Lift the rotors out of the housing. Unbolt the gear end plate and lift the housing off. Clean all parts and inspect for wear. It is not necessary to remove the oil distribution fittings on the end plates and the gear cover, but check them with compressed air to be sure the five orifices are not clogged.

ASSEMBLY

The assembly procedure is generally the same for all series, but notations are made where there are differences. All joints between housing, end plate, and covers are O-ring sealed. An RTV silicone sealer or the equivalent is used on the lip seals and mounting feet.

Dowel pins are used to locate end plate, housing, and covers in the proper location relative to each other. It is recommended that the gear end rotor shaft bearings, along with all other replacement parts, be purchased from M-D Pneumatics to ensure the rotor location is correct with the proper end clearance relative to the gear end plate.

Preparation of End Plates

1. Make sure all parts are clean and free of nicks or burrs caused by disassembly. ***See Figure 8-2 on page 36*** for dimension of seal pressing tools.

2. Position end plate with bearing bores up (flange side down) and install components of the labyrinth seals. Starting with a PTFE washer, alternately stack five PTFE and five steel spacers in each bore. Add two wave springs, one more steel spacer and a retaining ring. Compress to seat seal.

NOTICE

Two wave springs are necessary for the proper pressure on the seal, but because of the pressure a tool as shown on page 44 is needed to press the retainer ring into its groove. The tool will center the labyrinth seal as it presses the retainer ring in place.

3. **Seal/Lube Series 5 or Series 19/86:** Apply sealer to the outside diameter (O.D.) of the lip seal. Install with lip facing upward. Tap in place with installation tool. ***See Figure 13-2 on page 44***. Apply grease to lip of seal.

   Seal/Lube Series 8,9, or Series 55/82/66/69: Install seal adapter. The adapter is used to anchor the stator portion of the mechanical seal. To install the seal, grease both the O-ring and seal bore, and then push the seal, by hand, into the bore and against the seal adapter. Make sure the two dimples on the bottom of the seal case are aligned with the holes in the seal adapter. Clean the surface with soft tissue and acetone.

NOTICE

Never drive mechanical seal or seal tool with any type of hammer. This could result in damage to the carbon or its ability to properly seal.

Gear End Assembly

4. Place the non-drive end plate on 6 in. × 6 in. (152 mm × 152 mm) blocks with the solid side up. The end plate must be blocked up so rotor shafts will not touch the floor when they are installed. Grease and install O-ring in end plate groove. Install housing, making sure dowel pins are in place. Do not bolt in place at this time.

5. Lay two pieces of steel approximately 2 in. × 2 in. × 1/8 in. (51 mm × 51 mm × 3 mm) thick at the bottom of the housing as shown in ***Figure 8-1*** with the end (long shafts) up. The rotor lobes will be above the end of the housing, which is necessary when assembling this end.

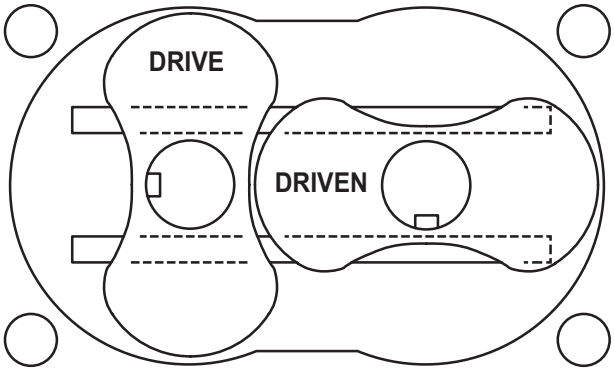


Figure 8-1 – Rotors in Housing

6. Grease and install O-ring in groove of gear end plate. Use sufficient grease to hold it in place when the end plate is turned over.

7. Install the end plate on the rotors and housing. The end plate will rest on the ends of the rotor lobes, and there will be a space between the housing and the plate. Install all cap screws and tighten end plate to housing until tight.

8. Use six cap screws equally spaced and secure non-drive end plate against shims at bottom end of rotors. Do not torque these bolts.

9. Grease O-ring and start onto rotor shaft.

Seal/Lube Series 5 or Series 19/86: Start sleeve over shaft (larger diameter down) while forcing O-ring into step at the bottom of the sleeve. Slide sleeve down the shaft until seated. You may encounter interference as the sleeve passes through the PTFE rings. Tap sleeve with mallet to seat if necessary.

Seal/Lube Series 8, 9, or Series 55/82/66/69: Grease internal O-ring of mating ring portion of seal. Assemble mating ring over sleeve with lapped surface down. Slot in mating ring must line up with pin in sleeve and be flush with top of sleeve when properly installed. Clean lapped surface of mating ring with soft tissue and acetone. Lubricate surface and start sleeve over rotor shaft while forcing O-ring into step at bottom of sleeve. Carefully slide this assembly down the shaft until seated.

10. Coat the rotor shaft with an anti-seize lubricant and press the bearing on the shaft. The bearing manufacturer numbers and/or an acid dot (inner race) should be up or toward the gears. Use the same plates that were used for disassembly and a sleeve to press on the inner race of the bearing when installing.

11. Loosen cap screws holding non-drive end plate to housing. Install bearing retainer rings and secure with cap screws. Check clearances between the rotor lobes and gear end plate. ***See Assembly Clearances on page 40*** for correct gear end clearances. If clearances are not within specification, re-check parts to find cause of improper clearances before proceeding. Retighten the cap screws on the non-drive end, but do not torque at this time.

12. Install keys into rotor shafts, ensuring a tight fit. Coat shafts and key with anti-seize. If new gears are being installed, disassemble gear shell from hub.

13. Heat the gear hubs to 350°F (177°C). At this temperature, the hubs should fit easily to the rotor shafts.

NOTICE

After heating, handle gear hubs with insulated gloves only.

Secure with lock washers and lock nut immediately after hub is installed. Torque to proper specification. Do not install gear shell until hub has been allowed to cool.

Free End Assembly

14. Turn assembly over and support on blocks. Remove the six cap screws and put jack screws in the holes provided in the flange of the end plate and remove the plate. Take out two shims and check free end clearance between the end of the lobes and housing using a flat bar and feeler gauges or a depth micrometer. ***See Assembly Clearances on page 40***.

    Seal/Lube Series 5 or Series 19/86: Repeat step 9 to install sleeves.

15. **Seal/Lube Series 8, 9, or Series 55/82/66/69:** Re-check carbon of seal to be sure it is clean. **All series:** Reinstall end plate, making sure O-ring is still in its groove and secure with all the cap screws.

16. **Seal/Lube Series 8, 9, or Series 55/82/66/69:** Repeat step 9 to install sleeve and mating ring assemblies.

17. Install bearing spacers, and then repeat step 10 to install bearings. Secure with lock washers and lock nuts. Bend one lock washer tap into spanner nut slot to lock all nuts.

18. Install oil retainer rings and cap screws (only six required).

19. To install mounting feet, make sure the hollow dowel is in the feet. If any of the dowels are in the end plate, remove and transfer to the feet. Grease and install the O-ring over the dowel. Run a bead of silicone sealer 1/4 in. wide around the dowel holes on the foot mounting pad of the end plate. The sealer acts as a backup O-ring to prevent any oil leakage. Secure with cap screw. Reconnect oil pipes and stand unit on its feet.

20. The gear hub should now be cool enough to assemble the gear shells. The dowel pins should be in the hub. Transfer if necessary. Reinstall the timing shim and assemble the shells to their proper hubs, aligning hubs and shell match marks. Install drive gear first (right-hand helix), and then align the match marks on the teeth and assemble driven gear (left-hand helix).

NOTICE

The six cap screws that were in the drive gear are too long without the drive shaft. Temporarily use the six cap screws from the driven gear. Use three in each gear (every other hole).

Adjusting Interlobe Clearance

21. The timing gears are made up of two pieces. The outer gear shells are fastened to the inner hubs with six cap screws and are located with two dowel pins. By adding shims between a gear shell and the inner hub, the gear is moved axially relative to the inner hub which is mounted on the rotor shaft. Being a helical gear, it rotates as it is moved out and the rotor turns, changing the clearances between rotor lobes. Adding 0.012 in. (0.30 mm) shim thickness will change the rotor lobe clearance by 0.003 in. (0.076 mm).

    The timing shim is formed from a number of 0.003 in. (0.076 mm) shims, which have been laminated together. Easily peel them apart as necessary.

    Use feeler gauges to check the clearance at AA (right-hand reading) and BB (left-hand reading) (***see Figure 8-2***). The clearances should be adjusted so they are as equal between all lobes as possible, usually between 0.003 to 0.004 in. (0.076 to 0.10 mm). For best results, use feeler gauges no larger than 0.006 in. (0.15 mm).

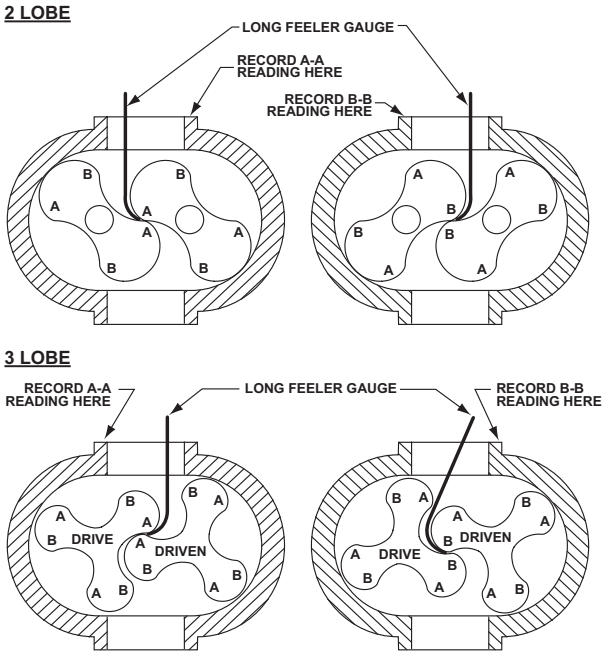


Figure 8-2 – Checking Rotor Interlobe Clearance

Example: If AA reading is 0.030 in. (0.76 mm) and BB reading is 0.022 in. (0.56 mm), removing 0.016 in. (0.40 mm) shim will change the readings one-quarter of this amount or 0.004 in. (0.10 mm). AA reading will drop to 0.026 in. (0.66 mm) and BB reading will increase to 0.026 in. (0.66 mm).

To determine the amount of shim to add or remove from the driven gear, simply subtract the two readings 0.030 in. (0.76 mm - 0.022 in. (0.55 mm) = 0.008 in. (0.21 mm) and double the result 0.008 in. (0.21 mm) × 2 = 0.016 in. (0.42 mm).

To determine whether to add or remove this amount, the following rule will always apply: If the right-hand reading (AA) is greater than the left-hand reading (BB), remove this amount.

If the right-hand reading (AA) is greater than the left-hand reading (BB), remove this amount. If the right-hand reading (AA) is less than the left-hand reading (BB), then add this amount.

NOTICE

If the results require you to remove shim from the driven gear and there are no shims left under this gear, go to the drive gear and add this amount for the same result. When removing or replacing a gear for shimming the timing mark should be matched and on center. Either gear may be pulled in this position.

Completing Gear End Assembly

22. Press drive shaft bearing on drive shaft. Remove the three cap screws from drive gear and install in the drive gear. Clean and remove all burrs from mating surfaces of the gear and drive shaft flange. Install with cap screws.

    Torque gear cap screws at this time. Check drive shaft run-out at the seal journal. Do not exceed 0.005 in. (0.13 mm) T.I.R.
    Series 19/86/55/82: Secure bearing with lock washer and lock nut. Bend over tab to lock in place.

23. Grease and install O-ring. To aid in the installation of the gear cover, a tool as shown in ***Special Tool Drawings on page 44*** should be made to hold the outer race of the bearing square with the shaft. Slide the cover over the tool and secure with cap screws.

24. **Seal/Lube Series 5, 8, or Series 19/86/55/82:** Press lip seal into adapter plate with lip facing inward. Grease lip, install O-ring, and carefully install assembly over drive shaft.

    Seal/Lube Series 9 or Series 66/69: Grease and install O-ring on adapter flange and O-ring in the bore of adapter. Clean mating ring with soft tissue and acetone and install on adapter while aligning pin with slot in mating ring. The larger surface area of the mating ring faces inward. Install retaining ring using spanner wrench. Tighten set screws.

    Lubricate seal O-ring and hand-press seal into the seal housing, making sure to align the two dimples on the bottom of the seal with corresponding holes in the seal housing. Clean carbon surface with soft tissue and acetone. Grease and install O-ring around the seal bore. Place a few drops of lubricating oil on the mating ring, and then carefully install assembly over the drive shaft onto the cover. Secure with cap screws.

Completing Free End Assembly

25. Grease and install O-ring in end plate groove. Install oil pump drive shaft and oil slinger on rotor shaft and secure with cap screws.

26. Align drive shaft slot with oil pump tang and carefully slide cover over shaft and onto dowel pins in end plate. Tap cover gently until contact with O-ring is made. If gap remains, re-check slot and tang alignment for proper engagement. Secure cover with cap screws.

NOTICE

If oil pump assembly is being replaced, install cover first, then install O-ring and oil pump.

27. Complete assembly by reinstalling or connecting all remaining oil lines, sight glass, etc. Oil filter element should always be replaced with factory filter when overhauling a unit. Fill with lubricant to proper level on column sight glass.

09

TROUBLESHOOTING

Although M-D Pneumatics blowers are well designed and manufactured, problems may occur due to normal wear and the need for readjustment. The following chart lists symptoms that may occur along with probable causes and remedies.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Loss of oil	Gear housing not tightened properly	Tighten gear housing bolts.
	Lip seal failure	Disassemble and replace lip seal.
	Insufficient sealant	Remove gear housing and replace sealant. ***See Disassembly and Reassembly on page 32***.
	Loose drain plug	Tighten drain plug.
Excessive bearing or gear wear	Improper lubrication	Correct oil level. Replace dirty oil. ***See Lubrication on page 14***.
	Excessive belt tension	Check belt manufacturer's specifications for tension and adjust accordingly.
	Coupling misalignment	Check carefully. Re-align if necessary.
Lack of volume	Slipping belts	Check belt manufacturer's specifications for tension and adjust accordingly.
	Worn lobe clearances	Check for proper clearances. ***See Assembly Clearances on page 40***.
	Speed too low	Increase blower speed within limits.
	Obstruction in piping	Check system to ensure an open flow path.
Knocking	Blower out of time	Re-time.
	Distortion due to improper mounting or pipe strains	Check mounting alignment and relieve pipe strains.
	Excessive pressure differential	Reduce to manufacturer's recommended pressure. Examine relief valve and reset if necessary.
	Worn gears	Replace timing gears. ***See Disassembly and Reassembly on page 32***.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Excessive blower temperature	Too much or too little oil in gear reservoir	Check oil level. ***See Lubrication on page 14***.
	Too low operating speed	Increase blower speed within limits.
	Clogged filter or silencer	Remove cause of obstruction.
	Excessive pressure differential	Reduce pressure differential across the blower.
	Elevated inlet temperature	Reduce inlet temperature.
	Worn lobe clearances	Check for proper clearances. ***See Assembly Clearances on page 40***.
Rotor end or tip drag	Insufficient assembled clearances	Correct clearances. ***See Assembly Clearances on page 40***.
	Case or frame distortion	Check mounting and pipe strain.
	Excessive operating pressure	Reduce pressure differential.
	Excessive operating temperature	Reduce pressure differential or reduce inlet temperature.
Vibration	Belt or coupling misalignment	Check carefully. Re-align if necessary.
	Lobes rubbing	Check cylinder for hot spots, and then check for lobe contact at these points. Correct clearances. ***See Assembly Clearances on page 40***.
	Worn bearings or gears	Check condition of gears and bearings. Replace if necessary.
	Unbalanced or rubbing lobes	Possible build-up on casing or lobes, or inside lobes. Remove build-up and restore clearances.
	Driver or blower loose	Check mounting and tighten if necessary.
	Piping resonance	Check pipe supports, check resonance of nearby equipment, and check foundation.

10 ASSEMBLY CLEARANCES

MODEL	GEAR END	FREE END	INTERLOBE	TIP-DOWEL	TIP-PORT
1215	0.011 – 0.014 in. (0.28 – 0.36 mm)	0.020 – 0.027 in. (0.51 – 0.69 mm)	0.025 – 0.032 in. (0.64 – 0.81 mm)	0.012 – 0.019 in. (0.30 – 0.48 mm)	0.021 – 0.027 in. (0.53 – 0.69 mm)
1224	0.011 – 0.014 in. (0.28 – 0.36 mm)	0.029 – 0.036 in. (0.74 – 0.91 mm)	0.025 – 0.032 in. (0.64 – 0.81 mm)	0.012 – 0.019 in. (0.30 – 0.48 mm)	0.021 – 0.027 in. (0.53 – 0.69 mm)
1230	0.011 – 0.014 in. (0.28 – 0.36 mm)	0.035 – 0.042 in. (0.89 – 1.07 mm)	0.025 – 0.032 in. (0.64 – 0.81 mm)	0.012 – 0.019 in. (0.30 – 0.48 mm)	0.021 – 0.027 in. (0.53 – 0.69 mm)
1236	0.011 – 0.014 in. (0.28 – 0.36 mm)	0.041 – 0.048 in. (1.04 – 1.22 mm)	0.025 – 0.032 in. (0.64 – 0.81 mm)	0.012 – 0.019 in. (0.30 – 0.48 mm)	0.021 – 0.027 in. (0.53 – 0.69 mm)
1248	0.011 – 0.014 in. (0.28 – 0.36 mm)	0.053 – 0.060 in. (1.35 – 1.52 mm)	0.025 – 0.032 in. (0.64 – 0.81 mm)	0.012 – 0.019 in. (0.30 – 0.48 mm)	0.021 – 0.027 in. (0.53 – 0.69 mm)

11

TORQUE CHART

Please reference torque values printed on ***"Operator's Manual Torque Value Updated November 2017."***

If this insert is missing from your manual, please reference the electronic file available at **online** or contact customer service at **800.825.6937**.

12

RECOMMENDED LUBRICANTS

RECOMMENDED LUBRICANTS FOR BLOWERS AND VACUUM BOOSTERS

Positive displacement blowers and vacuum boosters require proper lubrication for bearings, seals and gears to operate effectively and efficiently. Oil is distributed from the oil reservoir to the critical components by means of oil slingers that are attached to the rotor shaft. In certain models of CP Series blowers, a high-performance grease rated for high temperatures is used on the drive-end bearings.

MD full synthetic lubricants are recommended for blowers and vacuum boosters. MD lubricants are specifically formulated using unique additives that provide maximum protection and extend the life of your product over mineral oils or semi-synthetic lubricants.

⚠ WARNING

Do not overfill the oil sumps. Overfilling can result in gear damage or oil leaks.

⚠ CAUTION

Units are shipped without oil in the sumps. Ensure adequate oil has been added before operating.

MD oils are suitable for a wide range of operating temperatures that are based on model, operating speed and discharge temperature of the product.

FOR OXYGEN-ENRICHED SERVICE

Blowers and vacuum boosters operated in oxygen enriched applications should only use non-flammable, PFPE full synthetic lubricants. Blowers and vacuum boosters used in hydrogen service should only MD full synthetic oil

NOTE: Oxygen-enriched service only applicable for PD Plus blowers and vacuum boosters.

⚠ CAUTION

M-D Pneumatics and Kinney does not accept responsibility for damage caused by use of lubricants that are not recommended by M-D Pneumatics and Kinney.

MD BLOWER & BOOSTER LUBRICANTS SPECIFICATIONS				
PRODUCTS	**MD ONE**	**MD PLUS**	**MD MAX**	**MD FG**
VISCOSITY INDEX	150	154	157	141
@40°C, CST	99.1	231.7	340.9	99.3
@100°C, CST	14.4	27.6	37.2	13.9
FLASH POINT °F (°C)	510 (266)	480 (249)	491 (255)	515 (268)
POUR POINT °F (°C)	- 44 (-43)	-49 (-45)	-54 (-48)	-60 (-51)

NOTE: MD One Vapor Pressure: (mm Hg) 100ºF <0.00004; 200ºF <0.00018

MD BLOWER & BOOSTER LUBRICANTS OPTIONS					
MD OIL TYPE	**1 QUART**	**1 GALLON**	**5 GALLON**	**55 GALLON BARREL**	**CASE 12 QUARTS**
MD ONE	16444-MD1-Q	16444-MD1-G	16444-MD1-5G	16444-MD1-B	16444-MD1-Q-C
MD PLUS	16444-MD2-Q	16444-MD2-G	16444-MD2-5G	16444-MD2-B	16444-MD2-Q-C
MD MAX	16444-MD3-Q	16444-MD3-G	16444-MD3-5G	16444-MD3-B	16444-MD3-Q-C
MD FG	16444-MD1-Q-FG	16444-MD1-G-FG	16444-MD1-5G-FG	16444-MD1-B-FG	16444-MD1-Q-C-FG

13

SPECIAL TOOL DRAWINGS

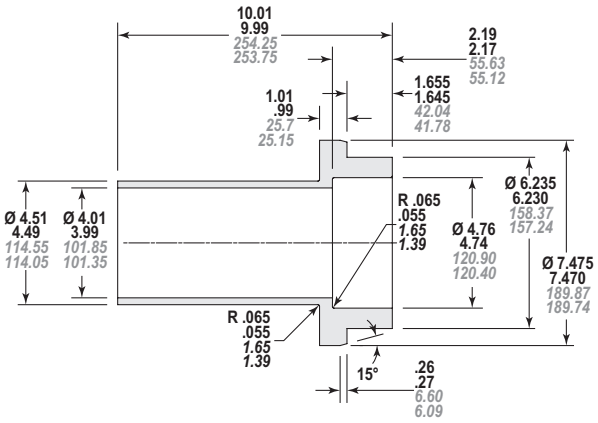


Figure 13-1 – Lip Seal Installation Tool

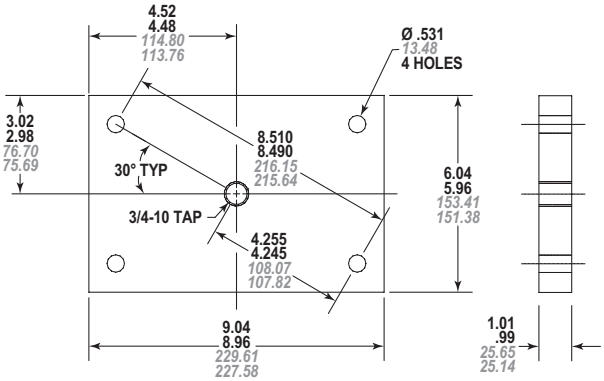


Figure 13-2 – Bearing Pressing Fixture Tool

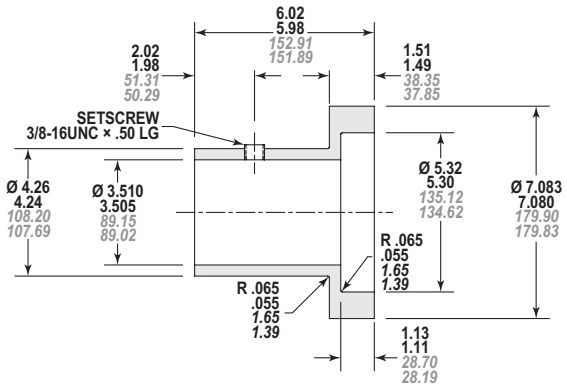


Figure 13-3 – Drive Shaft Bearing Alignment Tool

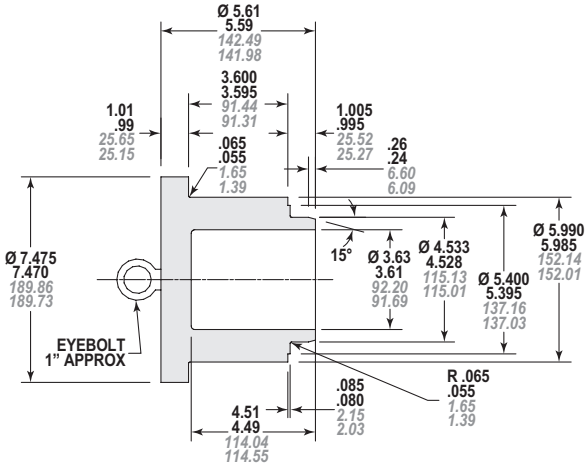


Figure 13-4 – Labyrinth Seal Installation Tool

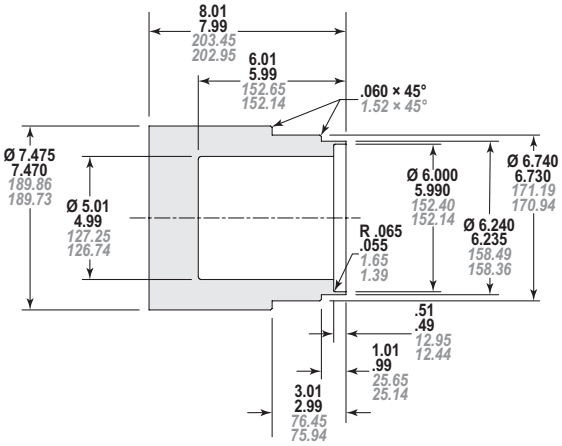


Figure 13-5 – Mechanical Seal Installation Tool (for Press Fit Seals only)

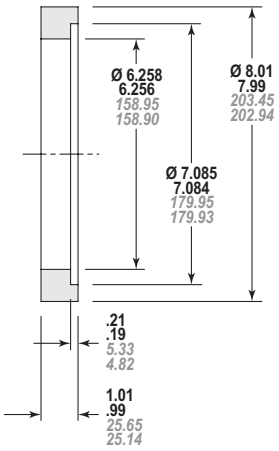


Figure 13-6 – Pilot Tool for Mechanical Seal (Installation in Drive Shaft Seal Housing)

PARTS LIST

Parts List for Model 1200 Seal/Lube Series 5 or 19/86 Series Blowers

ITEM NO.	PART DESCRIPTION	19 QTY	86 QTY
1	Mechanical Seal Rotor	2	2
3	Housing	1	1
4	End Plate	2	2
6	Drive End Cover	1	1
7	Free End Cover	1	1
8	Timing Gear Set	1	1
9	Bearing, Drive End	2	2
10	Bearing, Free End	2	2
12	Lip Seal	4	4
13	Lip Seal	1	1
14	Retainer	2	2
15	Retainer	2	2
16	Timing Gear Shim	2	2
20	Oil Slinger	1	1
22	Dowel Pin	4	4
23	Drive Shaft Key	1	1
24	Gear Key	2	2
26	Cap Screw	48	48
27	Lock Washer	6	6
30	Cap Screw	36	36
31	Magnetic Plug	2	2
32	Hose	1	13
35	Lock Nut	4	4
36	Lock Washer	4	4
37	Breather	2	2
41	Lock Washer	4	4
42	Tag - Booster, CE Mark	1	1
44	Hose	2	9
45	Drive Shaft	1	1
46	Seal Adapter	1	1
50	Roller Bearing	1	1
66	Cap Screw	6	6
70	Oil Sight Gauge	1	1
73	Hose	1	30
80	Bevel Washer	2	2
84	Hose	1	18
103	Hose Clamp	10	10
104	Cap Screw	4	4
105	Pipe	6	6
106	Pipe	-	2
107	Hose	1	5
109	Pipe Plug	3	3
110	Hex Head Cap Screw	6	6
117	Lock Washer	3	3
120	Bush	1	1
121	Pipe Plug	1	1
123	Bearing Spacer	2	2
124	Spin-On Oil Filter	1	1
125	Bracket	1	1
126	Dowel Pin	4	4
132	Pipe	5	5
144	Oil Pump	1	1
149	Pipe	3	7
152	Ell, ST	2	3
166	Hose Connector	10	10
167	Pipe	3	3
168	Reducer Bushing	1	1
170	Street Elbow	-	2
171	Ell, ST	-	1
172	Bushing	1	1
173	Heat Exchanger	1	1
174	Pipe Plug	26	24
176	O-Ring	2	2
181	Hose, I.D. 1	1	7
186	Bracket	1	1
189	Hex Nut	4	4
219	Retaining Ring	4	4
228	Cap Screw	3	3
239	Sleeve	4	4
257	Cross NPT	1	1
258	Elbow, NPT	3	6
259	Tee	2	2
260	Reducing Tee	2	2
262	Gauge	1	1
263	Reducing Elbow	3	3
266	Hose Clamp	6	6
274	Hose	1	36
280	Washer, PFTE	20	20
281	Spacer	24	24
282	Wave Spring, STL	8	8
283	Pipe	-	1
284	Pipe Dresser	2	2
285	Pipe	2	2
286	Pipe Tube	1	1
287	Pipe Toe	2	2
289	Tee	1	1
290	Reducer Bushing	2	2
298	Reducer Bushing	1	1
301	Cap Screw	48	48
302	O-Ring	2	2
304	Mounting Foot	4	4
305	O-Ring	4	4
306	Sleeve	4	4
307	Cap Screw	16	16
309	Cap Screw	4	4
310	Oil Pump Assembly	1	1
313	Oil Pump Adapter	1	1
314	O-Ring	2	2
319	Lock Nut	1	1
320	Washer	1	1
325	O-Ring	1	1
329	Plug, Straight Thread	2	2
331	O-Ring	4	4
336	Orifice Fitting	5	5
349	Pipe	1	1
351	Pipe	4	4
354	Reducer Bushing	5	5

NOTES:

- QUANTITIES SHOWN ARE MAXIMUM VALUES. QUANTITIES MAY VARY BETWEEN BLOWER.

PARTS KITS ARE AVAILABLE AS FOLLOWS:
19/86 – P/N 29219

Parts List for Model 1200 Seal/Lube Series 8 or 55/82 Series Blowers

ITEM NO.	PART DESCRIPTION	55 QTY	82 QTY
1	Mechanical Seal Rotor	2	2
3	Housing	1	1
4	End Plate	2	2
6	Drive End Cover	1	1
7	Free End Cover	1	1
8	Timing Gear Set	1	1
9	Bearing, Drive End	2	2
10	Bearing, Free End	2	2
13	Lip Seal	1	1
14	Retainer	2	2
15	Retainer	2	2
16	Timing Gear Shim	2	2
20	Oil Slinger	1	1
22	Dowel Pin	4	4
23	Drive Shaft Key	1	1
24	Gear Key	2	2
26	Cap Screw	48	48
27	Lock Washer	2	2
30	Cap Screw	36	36
31	Magnetic Plug	2	2
32	Hose	1	1
35	Lock Nut	4	4
36	Lock Washer	4	4
37	Breather	2	2
41	Lock Washer	4	4
42	Tag - Booster, CE Mark	1	1
44	Hose	2	2
45	Drive Shaft	1	1
46	Seal Adapter	1	1
50	Roller Bearing	1	1
54	Mechanical Seal	4	4
66	Cap Screw	6	6
70	Oil Sight Gauge	1	1
73	Hose	1	1
80	Bevel Washer	2	2
84	Hose	1	1
103	Hose Clamp	10	10
104	Cap Screw	4	4
105	Pipe	6	6
106	Pipe	-	2
107	Hose	1	1
109	Pipe Plug	3	3
110	Hex Head Cap Screw	2	2
117	Lock Washer	3	3
120	Bush	1	1
121	Pipe Plug	1	1
123	Bearing Spacer	2	2
124	Spin-On Oil Filter	1	1
126	Dowel Pin	4	4
132	Pipe	5	5
144	Oil Pump	1	1
149	Pipe	2	7
152	Street Elbow	2	3
166	Hose Connector	10	10
167	Pipe	3	3
168	Reducer Bushing	1	1
170	Street Elbow	-	2
171	Ell, ST	-	1
172	Bushing	1	1
173	Heat Exchanger	1	1
174	Pipe Plug	28	28
176	O-Ring	2	2
181	Hose, I.D. 1	1	1
219	Retaining Ring	4	4
228	Cap Screw	3	3
239	Sleeve	4	4
257	Cross NPT	1	1
258	Elbow, NPT	3	6
259	Tee	2	2
260	Reducing Tee	2	2
262	Gauge	1	1
263	Reducing Elbow	3	3
266	Hose Clamp	6	6
274	Hose	1	1
280	Washer, PFTE	20	20
281	Spacer	24	24
282	Wave Spring, STL	8	8
283	Pipe	-	1
284	Pipe Dresser	2	2
285	Pipe	2	2
286	Pipe Tube	1	1
287	Pipe Toe	2	2
289	Tee	1	1
290	Reducer Bushing	4	4
298	Reducer Bushing	1	1
300	Roll Pin	4	4
301	Cap Screw	48	48
302	O-Ring	2	2
304	Mounting Foot	4	4
305	O-Ring	4	4
306	Sleeve	4	4
307	Cap Screw	16	16
309	Cap Screw	4	4
310	Oil Pump Assembly	1	1
313	Oil Pump Adapter	1	1
314	O-Ring	2	2
325	O-Ring	1	1
329	Plug, Straight Thread	1	1
331	O-Ring	1	1
336	Orifice Fitting	2	2
349	Pipe	4	4
351	Pipe	5	5
354	Reducer Bushing	1	1
369	Tube	4	4
408	Foot Assembly, Mtg Vert	5	5

NOTES:

- QUANTITIES SHOWN ARE MAXIMUM VALUES. QUANTITIES MAY VARY BETWEEN BLOWER.

PARTS KITS ARE AVAILABLE AS FOLLOWS:
55/82 – P/N 29216

Parts List for Model 1200 Seal/Lube Series 9 or 66/69 Series Blowers

ITEM NO.	PART DESCRIPTION	66 QTY	69 QTY
1	Mechanical Seal Rotor	2	2
3	Housing	1	1
4	End Plate	2	2
6	Drive End Cover	1	1
7	Free End Cover	1	1
8	Timing Gear Set	1	1
9	Bearing, Drive End	2	2
10	Bearing, Free End	2	2
14	Retainer	2	2
15	Retainer	2	2
16	Timing Gear Shim	2	2
20	Oil Slinger	1	1
22	Dowel Pin	4	4
23	Drive Shaft Key	1	1
24	Gear Key	2	2
26	Cap Screw	48	48
27	Lock Washer	2	2
30	Cap Screw	32	32
31	Magnetic Plug	2	2
32	Hose	1	1
35	Lock Nut	4	4
36	Lock Washer	4	4
41	Lock Washer	4	4
42	Tag - Booster, CE Mark	1	1
44	Hose	2	2
45	Drive Shaft	1	1
50	Roller Bearing	1	1
54	Mechanical Seal	4	4
66	Cap Screw	6	6
70	Oil Sight Gauge	1	1
71	Adapter	1	1
72	Adapter	1	1
73	Hose	1	36
76	Seal Rotor / Seal Stator	1	1
78	Retaining Collar	1	1
80	Bevel Washer	2	2
84	Hose	1	1
85	Pipe Plug	4	4
87	Adapter	1	1
88	O-Ring	1	1
90	Set Screw	2	2
91	Seal Adapter	1	1
93	Cap Screw	4	4
103	Hose Clamp	10	10
104	Cap Screw	4	4
105	Pipe	6	6
107	Hose	1	1
109	Pipe Plug	4	4
110	Hex Head Cap Screw	2	2
117	Lock Washer	3	3
120	Bush	1	1
121	Pipe Plug	1	1
123	Bearing Spacer	2	2
124	Spin-On Oil Filter	1	1
126	Dowel Pin	4	4
132	Pipe	5	5
140	O-Ring	1	1
144	Oil Pump	1	1
149	Pipe	2	2
152	Street Elbow	2	3
166	Hose Connector	10	10
167	Pipe	3	3

ITEM NO.	PART DESCRIPTION	66 QTY	69 QTY
170	Street Elbow	-	2
171	Street Elbow	-	1
172	Bushing	1	1
173	Heat Exchanger	1	1
174	Pipe Plug	27	27
176	O-Ring	2	2
178	Tube Connector	2	2
181	Hose, I.D.	1	1
219	Retaining Ring	4	4
220	Retaining Ring	1	1
228	Cap Screw	3	3
239	Sleeve	4	4
255	Roll Pin	1	1
257	Cross NPT	1	1
258	Elbow, NPT	4	5
259	Tee	2	2
260	Reducing Tee	2	2
262	Gauge	1	1
263	Reducing Elbow	3	3
266	Hose Clamp	6	6
274	Hose	1	41
280	Washer	20	20
281	Spacer	24	24
282	Wave Spring, STL	8	8
283	Pipe	2	3
284	Pipe Dresser	2	2
285	Pipe	2	2
286	Pipe Tube	1	1
287	Pipe Toe	2	2
289	Tee	1	1
290	Reducer Bushing	3	3
298	Reducer Bushing	1	1
300	Roll Pin	4	4
301	Cap Screw	48	48
302	O-Ring	2	2
304	Mounting Foot	3	3
305	O-Ring	4	4
306	Sleeve	4	4
307	Cap Screw	16	16
309	Cap Screw	4	4
310	Oil Pump Assembly	1	1
313	Oil Pump Adapter	1	1
314	O-Ring	2	2
325	O-Ring	1	1
329	Plug, Straight Thread	2	2
331	O-Ring	4	4
336	Orifice Fitting	5	5
349	Pipe	1	1
351	Pipe	4	4
354	Reducer Bushing	5	5
369	Tube	1	1
408	Foot Assembly, Mtg Vert	1	1

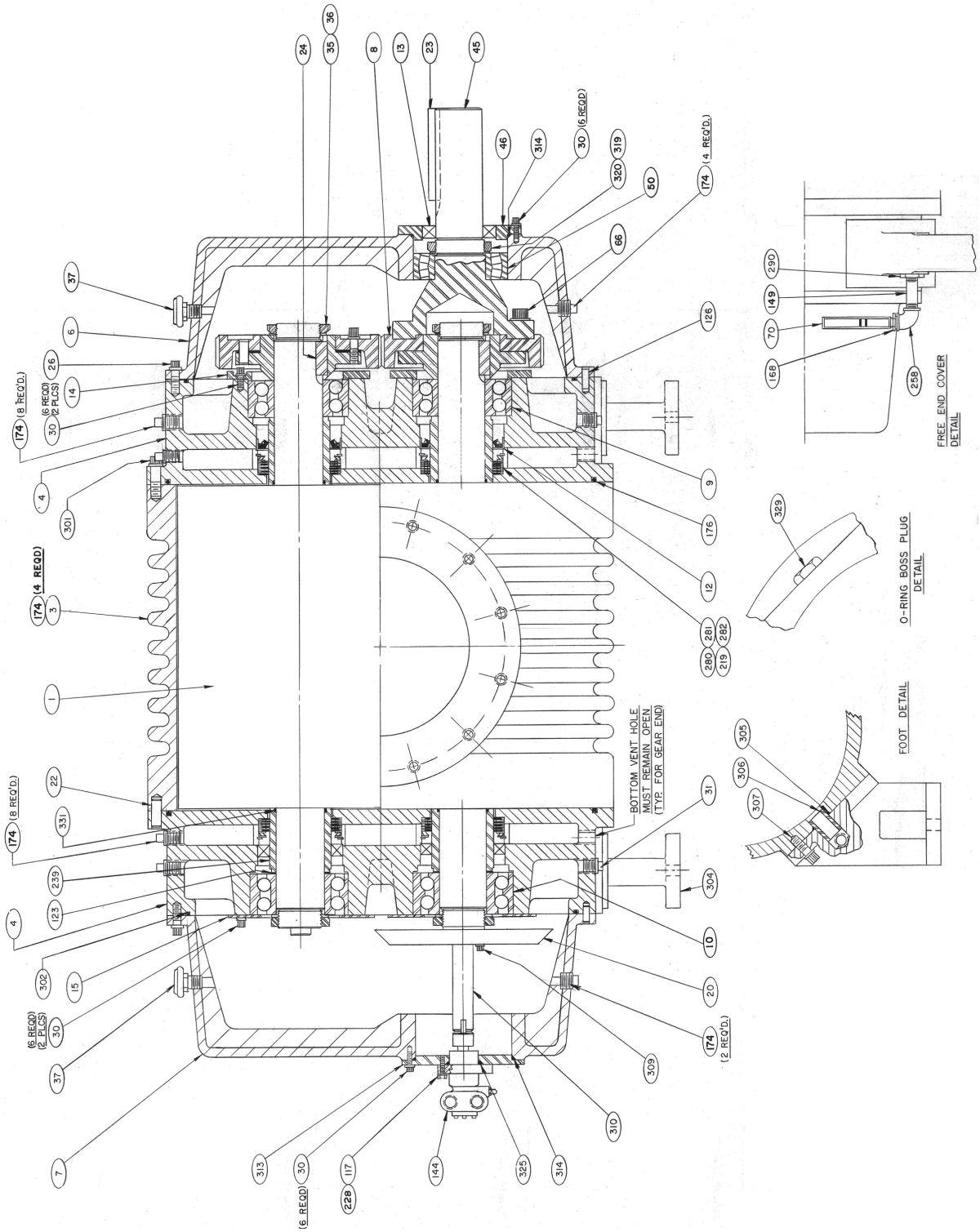
NOTES:

- QUANTITIES SHOWN ARE MAXIMUM VALUES. QUANTITIES MAY VARY BETWEEN BLOWER.

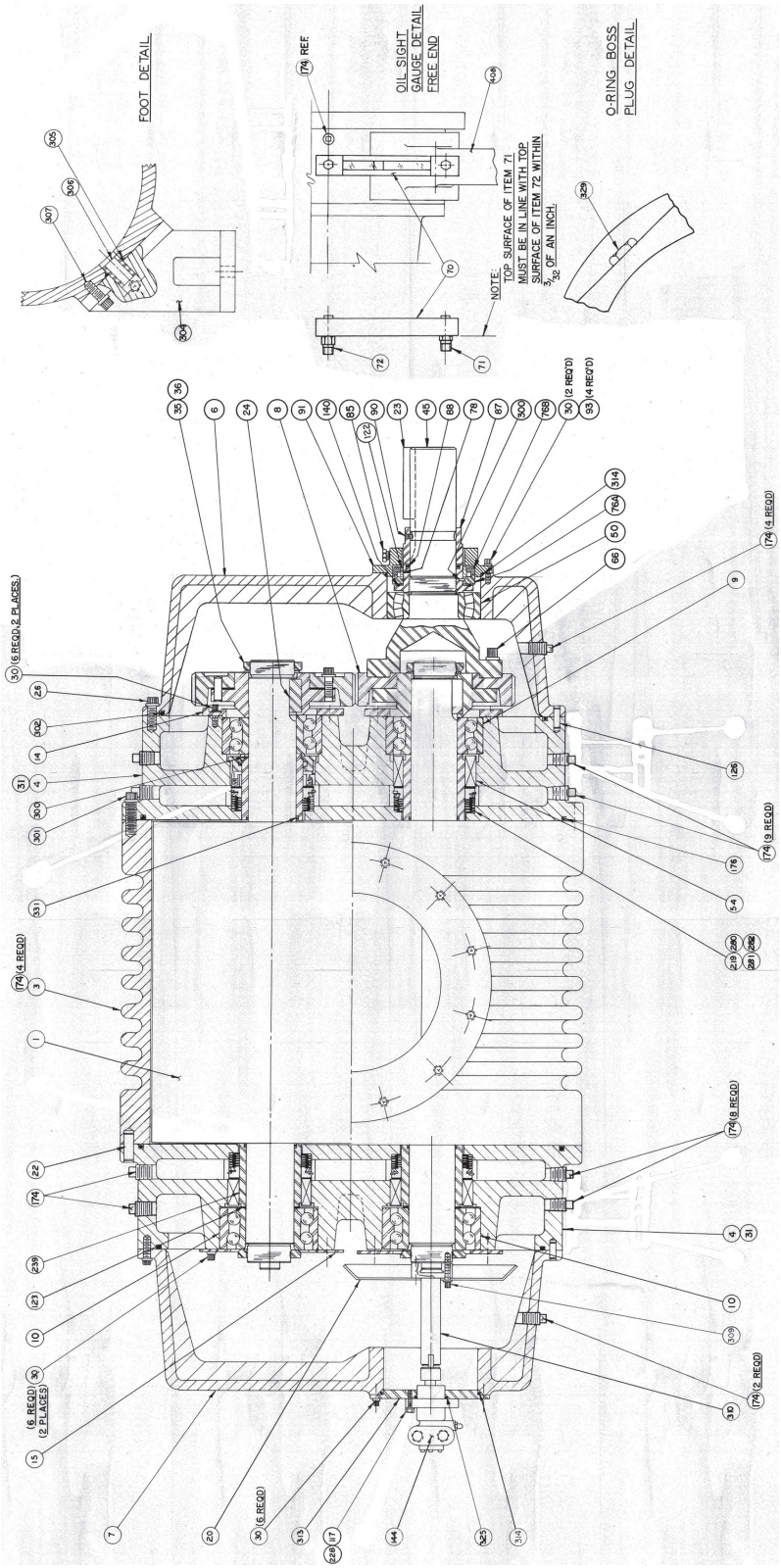
PARTS KITS ARE AVAILABLE AS FOLLOWS:
66/69 – P/N 29217

ASSEMBLY DRAWINGS

Model 1200 Seal/Lube Series 5, 8, or 19/86/55/82 – Cutaway View



Model 1200 Seal/Lube Series 9 or 66/69 – Cutaway View



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WARRANTY – BLOWER PRODUCTS

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, M-D Pneumatics (the Seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation)

PRODUCT TYPE	TYPE OF APPLICATION	
	ATMOSPHERIC AIR OR PROCESS AIR WITHOUT LIQUIDS PRESENT	**PROCESS GASES OTHER THAN AIR, OR ANY LIQUID INJECTED APPLICATION**
New *(Qx™ models only)*	30 months from date of shipment, or 24 months after initial startup date, whichever occurs first.	Consult Factory
New *(all other models)*	24 months from date of shipment, or 18 months after initial startup date, whichever occurs first	18 months from date of shipment, or 12 months after initial startup date, whichever occurs first
Repair	12 months from date of shipment, or remaining warranty period, whichever is greater	12 months from date of shipment, or remaining warranty period, whichever is greater

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

May 2008

OPERATING DATA FORM / PRODUCT REGISTRATION

It is to the user's advantage to have the requested data filled in below and available in the event a problem should develop in the blower or the system. This information is also helpful when ordering spare parts.

Model No. _____ V-Belt Size _____ Length _____

Serial No. _____ Type of Lubrication _____

Startup Date _____ _____

Pump RPM _____ Operating Vacuum _____

Pump Sheave Diameter _____ Any other Special Accessories Supplied or in use:

Motor Sheave Diameter _____ _____

Motor RPM _____ HP _____ _____

NOTES: _____

_____

_____

_____

IMPORTANT

All blowers manufactured by M-D Pneumatics are date coded at time of shipment. In order to assure you of the full benefits of the product warranty, please complete, tear out and return the product registration card. You may also register your product online at www.mdpneumatics.com or contact Customer Service.

M-D Pneumatics®

For Service & Repair, Technical Support, or Product Sales contact:

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