PARTS LIST
OPERATING AND SERVICE MANUAL

Gardner Denver

BLOWERS/VACUUM PUMPS

5CDL-R-SERIES

37-1-613
Version 05
October 9, 2018

MAINTAIN BLOWER RELIABILITY AND PERFORMANCE WITH GENUINE GARDNER DENVER PARTS AND SUPPORT SERVICES

Factory genuine parts, manufactured to design tolerances, are developed for optimum dependability - - - specifically for your blower. Design and material innovations are born from years of experience with hundreds of different blower applications. When you specify factory genuine parts you are assured of receiving parts that incorporate the most current design advancements .manufactured in our state-of-the-art blower factory under exacting quality standards.

Your AUTHORIZED DISTRIBUTOR offers all the backup you require. A worldwide network of authorized distributors provides the finest product support in the blower industry.

1. Trained parts technical representatives to assist you in selecting the correct replacement parts.

2. Complete inventory of new machines and new, genuine factory parts.

3. A full line of factory tested AEONÊ PD blower lubricants specifically formulated for optimum performance in all blowers.

4. Authorized distributor service technicians are factory-trained and skilled in blower maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair service.

For the location of your local authorized Gardner Denver blower distributor refer to the yellow pages of your phone directory, check the Web site at www.gardnerdenver.com or contact:

Gardner Denver Compressor Division
1800 Gardner Expressway
Quincy, IL 62305
Phone: (217) 222-5400
Fax: (217) 221-8780

GARDNER DENVER LUBRICANT ORDER INFORMATION

Re-order Part Numbers for Factory-Recommended lubricants.

AEON PD Synthetic Lubricant or AEON PD-Food Grade Synthetic Lubricant

AEON PD Synthetic Lubricant

Description	Part Number
1 Quart	28G23
Case/12Quarts	28G24
5 Gallon Pail	28G25
55 Gallon Drum	28G28

AEON PD- Food Grade Synthetic Lubricant

Description	Part Number
1 Quart	28H97
Case/12Quarts	28H98
5 Gallon Pail	28H99
55 Gallon Drum	28H100

Call your local CycloBlower Distributor to place your order for Gardner Denver lubricants. Your Authorized Gardner Denver Distributor is:

_____

_____

_____

FOREWORD

CycloBlower® blowers are the result of advanced engineering and skilled manufacturing. To be assured of receiving maximum service from this machine, the owner must exercise care in its operation and maintenance. This book is written to give the operator and maintenance department essential information for day-to-day operation, maintenance and adjustment. Careful adherence to these instructions will result in economical operation and minimum downtime.

⚠ DANGER
Danger is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ WARNING
Warning is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION
Caution is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

NOTICE
Notice is used to notify people of installation, operation or maintenance information which is important but not hazard-related.

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SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious. Some general safety precautions are given below:

⚠ DANGER

Failure to observe these notices could result in injury to or death of personnel.

- **Keep fingers and clothing away from revolving fan, drive coupling, etc.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers the thermostatic mixing valve or break any connections, etc., in the compressor air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Blower unit must be grounded in accordance with the National Electrical Code. A ground jumper equal to the size of the equipment ground conductor must be used to connect the blower motor base to the unit base.**
- **Open main disconnect switch, tag and lockout before working on the control.**
- **Disconnect the blower from its power source, tag and lockout before working on the unit – this machine is automatically controlled and may start at any time.**

⚠ WARNING

Failure to observe these notices could result in damage to equipment.

- **Stop the unit if any repairs or adjustments on or around the compressor are required.**
- **Disconnect the blower from its power source, tag and lockout before working on the unit – this machine is automatically controlled and may start at any time.**
- **Do not exceed the rated maximum pressure values shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

INTRODUCTION

YOUR KEY TO TROUBLE FREE SERVICE

Although Gardner Denver blowers are sturdy, precision-engineered machines, there are several relatively simple but basic installation and maintenance procedures that must be observed to assure optimum performance. As there is no guesswork in the manufacture of these highly advanced units, there must be none in preparing them to get the job done in the field. It is the purpose of this manual to help you properly install, maintain and service your Gardner Denver blower. It is important that no section be overlooked when preparing to install your blower.

Follow the instructions carefully and you will be rewarded with years of trouble-free operation.

SECTION 1
EQUIPMENT CHECK

Before uncrating, check the packing slip carefully to be sure all the parts have been received. All accessories are listed as separate items on the packing slip, and small important accessories such as relief valves can be overlooked or lost. After every item on the packing slip has been checked off, uncrate carefully. Register a claim with the carrier for lost or damaged equipment.

⚠ WARNING

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

STORAGE

Your Gardner Denver Blower was packaged at the factory with adequate protection to permit normal storage for up to six (6) months.

If the unit is to be stored under adverse conditions or for extended periods of time, the following additional measures should be taken to prevent damage.

1. Store the blower in a clean, dry, heated (if possible) area.
2. Make certain inlet and discharge air ports are tightly covered to prevent foreign material from entering the air box.
3. All exposed, non-painted surfaces should be protected against rust and corrosion.
4. Provide adequate protection to avoid accidental mechanical damage.
5. In high humidity or corrosive environments, additional measures may be required to prevent rusting of the blower internal surfaces.
6. To prevent rusting of gears, bearings, etc., the oil reservoirs may be filled with normal operating oil.

⚠ CAUTION

Before running the blower, drain the oil and replace to the proper operating level with clean, fresh lubricant.

7. Rotate the blower shaft (10 to 25 turns) monthly during storage. Inspect the blower shaft (near the shaft seal area) monthly and spray with rust inhibitor if needed.
8. For long term storage (over six (6) months), contact Gardner Denver Compressor Division Customer Service for recommendations

SECTION 2
INSTALLATION

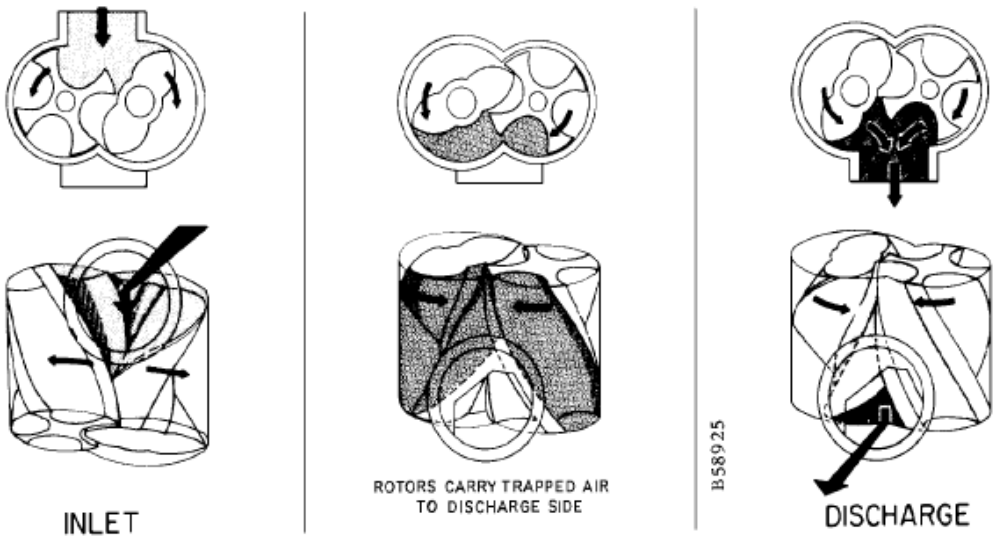


FIGURE 2- 1 – OPERATING PRINCIPLE

GENERAL ï The CycloBlower® is a compact, rotary lobe type axial flow blower/compressor. The meshing of two screw type rotors synchronized by timing gears provides controlled compression of the air for maximum efficiency and pulsation-free discharge.

OPERATING PRINCIPLE ï Compression is effected by the main (2 lobe) and gate (4 flute) rotors meshing enclosed in the housing. The timing gears maintain close rotor clearances. The rotors do not touch each other, the housing, or the bearing carries. Although clearances are small, lubrication in the compression chamber is not required, insuring oil-free air delivery.

The compression cycle (**Error! Reference source not found.**) begins as the rotors unmesh at the inlet port. Air is drawn into the rotor cavities, trapped, and compressed by the reducing cavities as rotation continues. When proper compression is made, the cavities cross the discharge port, completing the cycle. The cycle occurs twice each revolution of the main bearing rotor and is continuous.

CONSTRUCTION ï All models of the 5CDL Series CycloBlower are of similar design and construction except for rotor length. The housing is a oneð piece casting with flanged inlet and discharge openings.

The rotors are ductile iron with integral shaft. Rotors are dynamically balanced for vibration--free operation. Helical timing gears are of alloy steel, hobbed and shaved for quiet operation.

Two heavy--duty duplex mounted angular contact ball bearings are used on each rotor shaft, at the discharge end, as fixed bearings to maintain rotor end clearance.

A radial bearing is used on each rotor shaft at the gear end as a floating bearing.

All gears and bearings are oil splash lubricated.

Standard construction is top inlet, bottom discharge, with drive shaft extension from main rotor at the discharge end. Rotation is clockwise facing the drive shaft. Blowers may be mounted for either V--belt or direct--coupled drive. The gate rotor speed is half (1/2) the main rotor or drive speed.

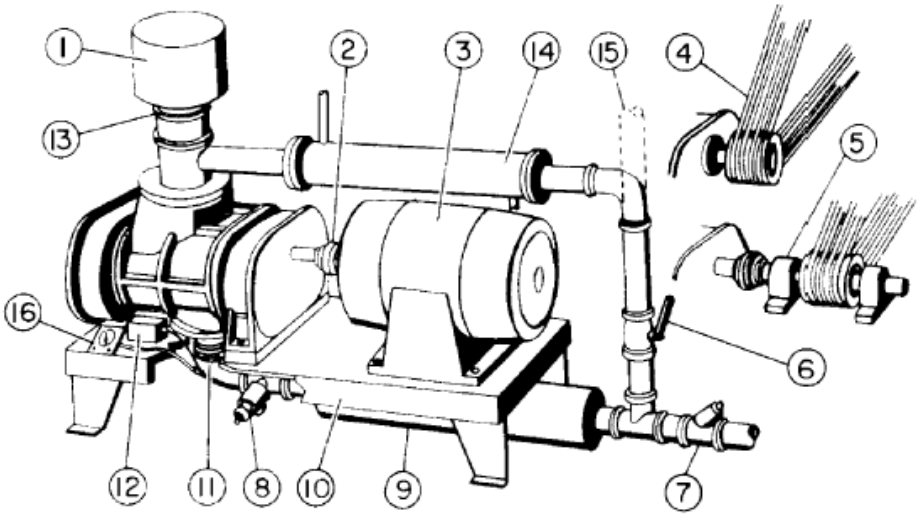


FIGURE 2- 2 – ACCESSORIES AND SAFETY DEVICES

LOCATION – Select a clean, dry, well-ventilated area for installing blower and allow ample room for normal maintenance. Proper ventilation is necessary for blower cooling and cool air intake.

⚠WARNING
Do not electric weld on the blower or base; bearings can be damaged by the passage of current.

FOUNDATIONS – Correct supporting is important. Distortion by incorrect supporting will affect internal operating clearances. The foundation or base must provide a level, rigid, nonworking support for the blower. It must be on uniform and solid footing. Complete foundation design cannot be given because of varying conditions. If necessary, use shims under feet for leveling to prevent distortion when foundation bolts are tightened. After installation on the foundation is complete, check alignment of the coupling or drive before starting blower.

ACCESSORIES (**FIGURE 2- 2**) ï The type of service determines the accessory group required. The typical items are listed as follows:

1. Inlet Filter or Filter-silencer.
2. Flexible Coupling
3. Driver.
4. Simple V-Belt Drive.
5. Jackshaft V-Belt Drive.
6. Bypass Valve.
7. Check Valve.
8. Relief Valve, Vacuum or Pressure.
9. Discharge Silencer.
10. Base Plate.
11. Expansion Joint(s) ï Inlet and/or Discharge.
12. Temperature or Pressure Shutdown Switch.
13. Check Valve (Inlet Bypass).
14. Heat Exchanger.
15. Bypass to atmosphere (alternate).
16. Pressure Gauge or Vacuum Gauge.

Inlet Filter or Filter-Silencer ï For pressure service handling air, the blower inlet must be protected by a filter or suitable size to allow full flow of air to the blower inlet. The filter must be of adequate efficiency to trap any foreign materials which may be in the general area of the air inlet. If noise is a factor, filter-silencers are available.

⚠WARNING

Rotating components will cause severe injury in case of personal contact. Keep hands away from the blower inlet and discharge ports.

In choosing a location for the filter, consideration should be given to a source of cool, clean air, and most important, access for maintenance.

Filters generally used for blower service fall under three types:

Oil-wetted Screen Type
Oil Bath
Dry Type

Filter-silencers are also available in the above types.

For vacuum service, the type of system used and materials being handled will determine the necessity for an in-line filter.

Couplings ï For direct-coupled units, a flexible type coupling, accurately aligned, should be used between the blower and power unit. Misaligned couplings may cause vibration, additional bearing loads and stresses which will affect life of parts involved. DO NOT drive the couplings on shaft. Check shaft and coupling bore for burrs. Polish the shaft and bore if necessary for proper fit. Fit keys to keyways. Check coupling alignment. Exact alignment will vary with the type of couplings; however, it is not uncommon to hold alignment within .003ò in all directions. With lubricated or special couplings, follow the manufacturerôs instructions for installation and maintenance.

DRIVE INSTALLATION

V-Belt Drive ï Follow normal specifications recommended by the belt manufacturers for installation of belt drive on blowers. To provide the most compact drive, it is suggested the high capacity V-belt drives be used. Blower shaft and power unit shaft should be parallel, with sheaves aligned on shafts so belts run true. Use only matched belt sets and replace belts in complete sets only. Belt tension should be according to manufacturerôs recommendations. Slippage can be detected by belt squeal, overheating or loss of speed. A few hours after initial starting with new belts, it is advisable to recheck belt tension and provide tension adjustment as necessary.

⚠WARNING

Over tightening belts lead to heavy bearing loads and premature failure.

When selecting a V-belt drive, check to be sure the maximum allowable moment limitation is not exceeded. Refer to Figure 2-3, for belt drive overhung load calculations.

NOTICE

When a simple V-belt drive is not available, to stay within the maximum allowable moment, a jackshaft V-belt drive is required.

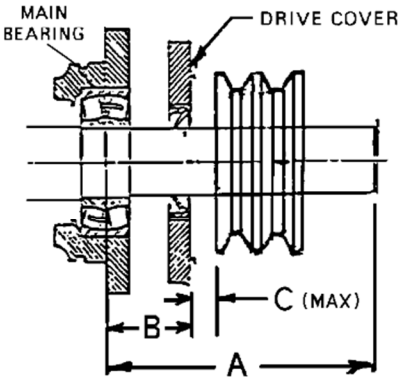
Belt drives must be carefully aligned. Motor and blower pulleys must be parallel to each other and in the same plane within 1/16 inch. Belt tension should be carefully adjusted and belts tightened only enough to prevent slippage and per the belt manufacturerÕs recommendations.

NOTICE
The sheave should be positioned as close as possible to the drive cover. This will reduce the overhung load and extend the bearing life.

On direct connected units, alignment and lubrication of the couplings to specifications of the coupling manufacturer are very important. When mounted drives are supplied from the factory, proper alignment has been established before shipment. However, during shipping, handling and installation, it is likely that the alignment has been disturbed and final adjustment must be made before startup.

5CDL Drive Shaft Location	Dimensions (Inches)			Maximum Allowable Moment
	A	B	C (Max)	(LB-IN)
Discharge End (Standard)	6.99	3.04	0.5	2,675
Gear End (Optional)	9.09	4.85	0.5	2,675

MAXIMUM ALLOWABLE MOMENT



DRIVE SHAFT ILLUSTRATION

Z	Ac	Z	Ac	Z	Ac	Z	Ac	Z	Ac	Z	Ac
0.000	1.000	0.250	0.966	0.500	0.926	0.750	0.879	1.000	0.823	1.250	0.751
0.025	0.997	0.275	0.962	0.525	0.922	0.775	0.874	1.025	0.816	1.275	0.742
0.050	0.994	0.300	0.958	0.550	0.917	0.800	0.869	1.050	0.810	1.300	0.734
0.075	0.990	0.325	0.954	0.575	0.913	0.825	0.864	1.075	0.803	1.325	0.725
0.100	0.987	0.350	0.951	0.600	0.908	0.850	0.858	1.100	0.796	1.350	0.716
0.125	0.983	0.375	0.947	0.625	0.904	0.875	0.852	1.125	0.789	1.375	0.706
0.150	0.980	0.400	0.943	0.650	0.899	0.900	0.847	1.150	0.782	1.400	0.697
0.175	0.977	0.425	0.939	0.675	0.894	0.925	0.841	1.175	0.774	1.425	0.687
0.200	0.973	0.450	0.935	0.700	0.889	0.950	0.835	1.200	0.767		
0.225	0.969	0.475	0.930	0.725	0.884	0.975	0.829	1.225	0.759		

ARC OF CONTACT FACTORS

$$\text{Belt Pull} = \left[\frac{2.5 - Ac}{Ac}\right]\left[\frac{125954 \times Hp \times S.F.}{D \times RPM}\right]$$

Key:
- Ac = Arc of Contact Factor (Refer to Arc of Contact Factors Chart above)
- Hp = Blower Horsepower for Operating Conditions
- S.F. = Actual Drive Service Factor
- D = Blower Sheave Pitch Diameter in Inches
- RPM = Blower Sheave Speed
- Z = $\dfrac{\text{Large Sheave Pitch Diameter (in)} - \text{Small Sheave Pitch Diameter (in)}}{\text{Sheave Center Distance (in)}}$

CALCULATION OF BELT PULL

$$\text{Shaft Moment (LB-IN)} = \text{Belt Pull} \times \left[B + C + \left(\frac{\text{Sheave Width}}{2}\right)\right]$$

CALCULATION OF SHAFT MOMENT

FIGURE 2- 3 – BELT DRIVE OVERHUNG LOAD CALCULATIONS

Bypass Valve ï Installation of a bypass valve at the blower discharge (FIGURE 2- *2*) will allow the blower to be started under no-load. Bypass line may be discharged at atmosphere or to blower inlet depending on local requirements or material being handled.

Heat Exchanger ï When the bypass line discharges to blower inlet, a heat exchanger must be included in the line between blower discharge and blower inlet, to remove the heat of compression before the gas is reintroduced into the blower inlet. A check valve (Figure 2-2) should also be placed in the inlet line between the bypass line and the inlet filter or silencer, to prevent discharging backwards through the filter or silencer.

SAFETY DEVICES – For all installations the following safety devices are a requirement for safe blower operation. Numbers shown are reference numbers used in FIGURE 2- 2.

7. Check Valve, Blower Discharge Line
8. Relief Valve, Vacuum or Pressure
12. High Discharge Air Temperature Switch

Check Valve (FIGURE 2- 2*)* ï When the blower is used in a pneumatic conveying system, a check valve must be used to prevent backflow of material into the blower. In any system it is a safety device preventing the down stream pressure from motoring the blower through shutdown periods. A check valve must be provided for each blower when several blowers are manifold into a common system.

Relief Valve (FIGURE 2- 2) ï The relief valve must be installed as close to blower ports as possible. There should be no accessories such as valves, check valves, silencers, etc. between the relief valve and blower ports. It should be set 2 to 3 PSI above normal blower operating pressure (1/2ò to 1ò Hg. In vacuum service), but not to exceed 2 PSI above maximum differential pressure rating of the blower for pressure service.

NOTICE
Relief valves should be placed as close as possible to the blower inlet port (vacuum operation) or discharge port (pressure operation).

High Temperature and High Pressure Shutdown ï All blower installations should be protected with a high temperature shutdown switch. The controls should be set to stop the blower when the discharge temperature reaches 355°F or temperature rise reaches 255°F. In some installations a high pressure shutdown switch may also be advisable. The sensing element of these controls should be installed as close to the blower discharge as possible. See FIGURE 2- 2. On remote or unattended installations these controls are normally mandatory.

INLET PIPING ï During the installation of piping make sure dirt and other foreign materials do not enter blower openings. When inlet piping is used IT MUST BE CLEAN, AND FREE OF SCALE AND OTHER FOREIGN MATERIALS WHICH COULD ENTER THE BLOWER. It is suggested that an expansion joint be installed near blower openings to prevent stressing of the blower housing. Support the pipe to relieve weight on the expansion joint and the blower. Make sure the pipe size is adequate and as straight as possible to prevent pressure drop at the blower inlet. Where bends are necessary use long radius fittings. All connections must be air tight.

For vacuum service, an accurate vacuum gauge must be used near the blower inlet to indicate operating vacuum and a suitable vacuum relief valve must be used. A vacuum blower in pneumatic conveying service requires pre-inlet separation and filtering to prevent material carry-over into the blower.

Inlet pipe size is determined as follows:

0 to 10 feet long, use pipe size equal to blower inlet flange size.

10 to 17 feet long, use pipe size larger than blower inlet.

17 to 33 feet long, two pipe sizes larger than blower inlet

DISCHARGE PIPING ï In general, the type system used will govern the piping arrangement. However, the following suggestions should be followed for blower protection and efficiency.

An expansion joint should be installed as close to the blower opening as possible to protect the blower housing from stresses. All pipe connections should be square and even to prevent distortion from misalignment.

An accurate pressure gauge must be provided near the blower discharge to indicate operation pressure. If noise level is a factor, a discharge silencer should be used. The discharge line should be as straight as possible. Where bends are necessary, use long radius fittings. Provision for condensate drainage at the lowest point in the piping may be required.

VENTILATION – If the blower is to operate in a housing or enclosure, proper ventilation must be provided for adequate blower cooling. Cooling air should be taken from outside the enclosure.

OUTLINE DRAWINGS ï Certified outline drawings are available upon request. All important dimensions are shown in Figure 2-4, page 16.

TOP INLET, MAIN ROTOR DRIVE

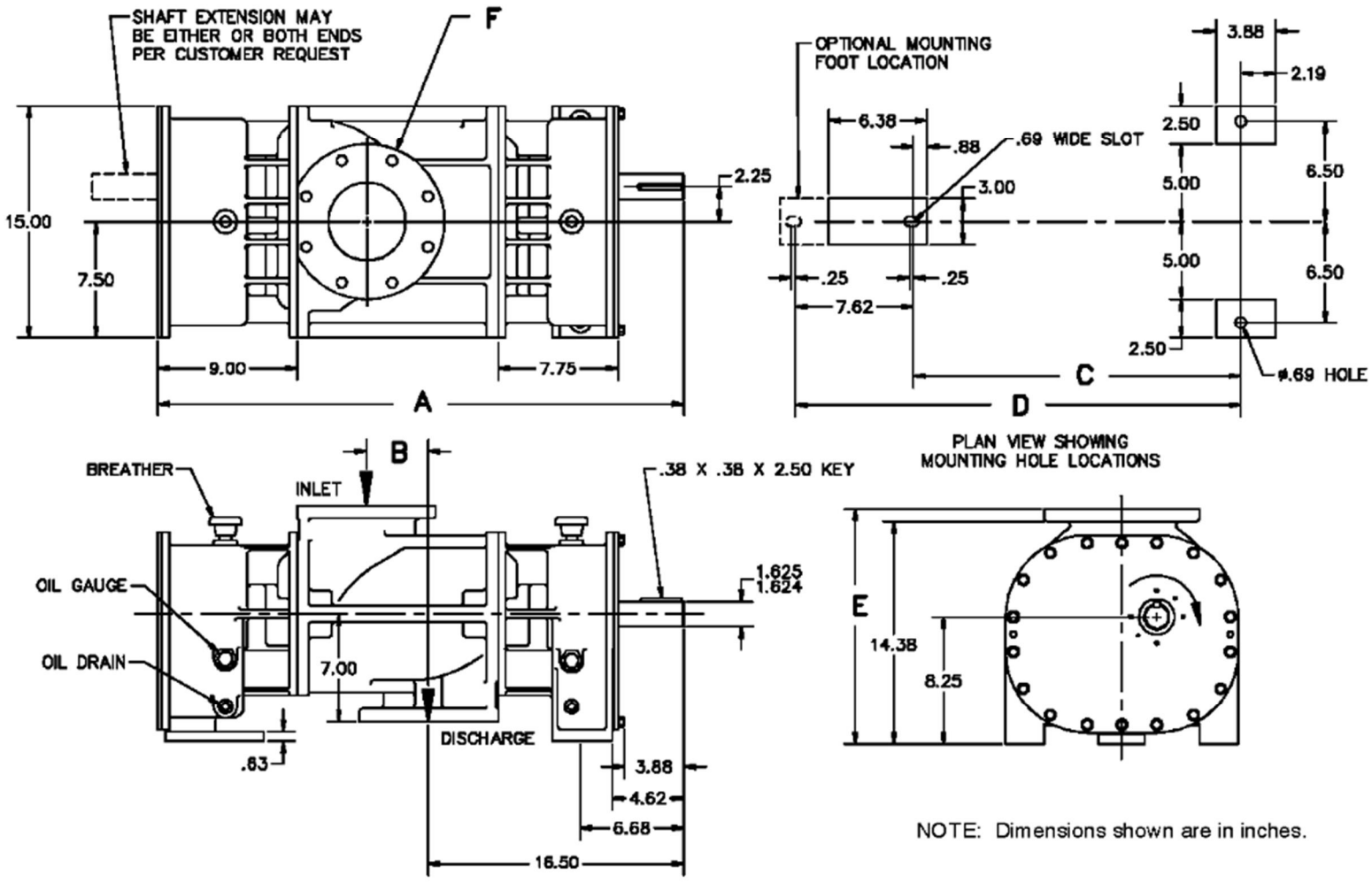


FIGURE 2- 4 — OUTLINE DIMENSIONS

TOP INLET, MAIN ROTOR DRIVE

MODEL	WT. (lbs.)	A (Inches)	B (Inches)	C (Inches)	D (Inches)	OUTLINE DIMENSIONS DRAWING NO.
5CDL5R	370	26	0	13.25	20.87	303CBH800
5CDL9R	414	30	0	17.25	24.87	304CBH800
5CDL13R	459	34	4	21.25	28.87	305CBH800

MODEL	E (Inches)	F - INLET & DISCHARGE
5CDL5R	15.28	3òFLANGE, 7- 1/2òO.D., 4 HOLES, 5/8ò- 11 UNC TAP, 6òB.C.
5CDL9R	15.25	5òFLANGE, 10òO.D., 8 HOLES, 3/4ò- 10 UNC TAP, 8.5òDIA. B.C.
5CDL13R	15.25	5òFLANGE, 10òO.D., 8 HOLES, 3/4ò- 10 UNC TAP, 8.5òDIA. B.C.

FIGURE 2- 5 - OUTLINE DIMENSIONS (CONTINUED)

SECTION 3
OPERATION

Future operating problems can be avoided if proper precautions are observed when the equipment is first put into service.

Before starting under power, the blower should be turned over by hand to make certain there is no binding or internal contact.

Each size blower has limits on pressure differential, running speed, and discharge temperature which must not be exceeded. These limits are shown in the following tabulation.

GENERAL ï A new blower from the factory must be checked and serviced before operation. The blower must be lubricated and operated according to the following instructions. Blower failure can be caused by operation at above rated pressure or below rated minimum speed. Both cause excessive discharge temperature and seizure of rotating parts.

STARTING BLOWER ï Start at reduced speed and no-load if possible. If speed is fixed, start without load by bleeding discharge to atmosphere. Starting should be smooth and free of vibrations. After initial no-load start, and operation is satisfactory, apply load gradually until maximum operating conditions are attained. BE SURE OPERATING CONDITIONS ARE WITHIN BLOWER RATINGS. Maintain a close check for severe vibrations, unusual noise, leaks and undue heating. The blower will gradually heat up due to compression, but after a reasonable length of time, temperature will stabilize. With very cold ambient conditions, warm up blower at no-load before going into full load service.

If the blower is used as part of a specific system, check the systemôs manual for any procedures that may be necessary when starting the blower.

PRESTART CHECK (For New or Overhauled Blower) ï see ñBlower Startup Checklist,òpage 24.

ROTATION ï Facing the main rotor drive shaft, rotation is clockwise when the shaft extension is at discharge end, and counterclockwise when the shaft extension is at the inlet end. An arrow indicating rotation is attached to the blower end cover near the drive shaft.

DAILY CHECK

1. Air filter tight, clean and serviced.
2. Proper oil level in oil sumps.
3. Observe pressure.
4. Relief valve functions.
5. Blower turns freely.

⚠WARNING

Over tightening belts lead to heavy bearing loads and premature failure.

R Series Models	Drive Shaft Speed (RPM)	Discharge Pressure* Sea Level (PSIG)	Dry Vacuum* (Inches Hg.)	Wet Vacuum* (Inches Hg.)
5CDL5, 5CDL9, 5CDL13	5000	20	17	--------
5CDL5, 5CDL9, 5CDL13	4000	---------	--------	24

* Pressures or vacuums are gauged at immediate blower discharge or inlet. For suggested maximum ratings at reduced speeds, see Figure 3-6, page 22.

FIGURE 3- 1 – MAXIMUM RATING

TYPE OF SERVICE – The blower can be operated in either pressure or vacuum service.

Pressure ï Never operate the blower above the maximum pressure shown in Figure 3-1. Excessive pressure may cause overheating and blower failure, it is therefore most important to have an accurate pressure gauge in the discharge line as close to the blower discharge as possible. Reduced speeds have a direct bearing on allowable pressure (Figure 3-6). A bypass valve to bleed air from the discharge to atmosphere (Figure 3-5) may be used to control the pressure. NEVER reduce the blower speed to maintain a certain pressure before it is determined if the reduced speed is adequate for that pressure. An accurate pressure gauge must be maintained.

Vacuum ï The blower may be operated either in dry vacuum or wet vacuum service. Do not operate the blower above the maximum vacuums shown in Figure 3-1, or below the minimum speed shown in Figure3-6. All vacuum ratings are based on standard atmospheric discharge. An accurate vacuum gauge and vacuum relief valve must be used as close to the blower inlet as possible.

Wet vacuum service employs a suitable liquid, normally water, injected into the system near the blower inlet to control temperature rise and increase the degree of vacuum developed. The liquid used MUST BE clean and free of foreign matter, chemical contaminants and hardness, which may cause corrosion, deposits, or damage in the rotor chamber. See Figure 3-4, for typical installation, and Figure 3-6, for water quality requirements. If the proposed water supply is questionable, or does not meet the water specification, a reputable water treatment service company should be contacted. They can recommend treatment and equipment to satisfy this specification.

pH Range at 25° C	**6.5 – 8.0**
Conductivity at 25°C (MICROMHO/cm)	**Less than 250**
Total hardness as $CaCo_3$ (ppm)	**Less than 100**
Total Alkalinity as $CaCo_3$ (ppm)	**Less than 70**
Chloride ion; Cl^- (ppm)	**Less than 30**
Sulfate ion SO_4^{-2} (ppm)	**Less than 50**
Total iron; Fe (ppm)	**Less than 0.3**
Silica; SiO_2 (ppm)	**Less than 20**
Sulfide ion S^{-2} (ppm)	**0**
Ammonium ion; NH_4+ (ppm)	**0**

FIGURE 3- 2 – WATER QUALITY REQUIREMENTS

If the injection water supply is allowed to run after blower shutdown, both the blower and adjacent discharge piping may fill with water and present a serious overload problem at the next attempted start. To prevent this, it is strongly recommended that an electric solenoid valve (normally open) be installed at the lowest point in the discharge elbow and/or connecting piping. The valve will open on blower shutdown and drain any water which might accumulate in the discharge piping. It is also recommended that a time delay be used between injection water shutoff and blower/motor shutdown to allow the interior of the blower to dry out prior to shutdown. Up to five minutes time delay may be required for larger blowers running under no load.

On wet vacuum service, temperature control and a minimum amount of rotor sealing is obtained with small quantities (1 gallon per minute) of injected liquid. Best performance is attained by using the amount of injected liquid that maintains the discharge air temperature in the range of 100°F to 150°F.

The maximum permissible liquid rate on any size machine is shown in Error! Reference source not found.. **DO NOT EXCEED THIS.**

Liquid Rate (GPM)	5CDL5	5CDL9	5CDL13
	1-1/4	2-1/4	3-1/2

FIGURE 3- 3 – LIQUID RATE

In applications where liquid carry-over from the upstream system may exceed these quantities, even for momentary periods, separation prior to blower inlet must be employed to reduce water flow to this figure or less.

Where inlet injection of water is used, it may be introduced in any convenient manner. No particular water pressure is required, only that sufficient to deliver the water to the injection point. A reliable metering device, such as a rotameter, to indicate water injection rate is supplied.

Since water injection is used primarily for discharge temperature reduction and control, overheating will occur with water shutoff or supply failure. Provisions against inadvertent water shutoff should be incorporated in every water-injected blower system.

A high discharge temperature safety shutdown switch should be used to protect the blower.

Individual system requirements will determine whether downstream (discharge side) separation of injection water may be required. Combination discharge silencers and separators are available.

See Engineering Data Sheet 37-1-432, for complete wet vacuum details.

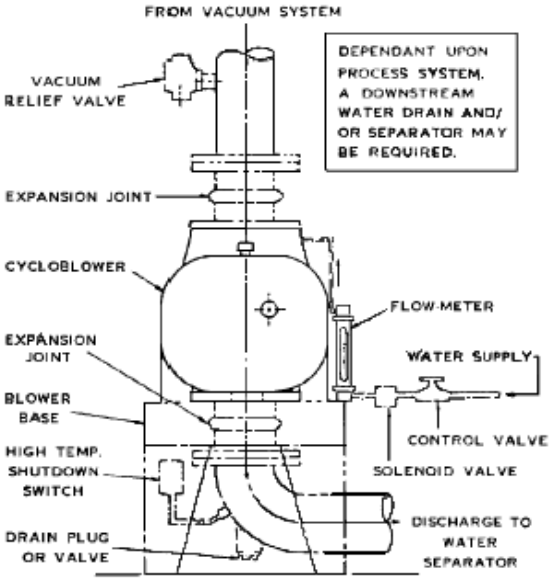


FIGURE 3- 4 – INLET WATER INJECTION DIAGRAM

Altitude (Feet above See Level)	Maximum Discharge Pressure*	Maximum Inlet Vacuum*
1000	19.3 PSIG	16.4 Inches Hg.
2000	18.6 PSIG	15.8 Inches Hg.
3000	17.9 PSIG	15.3 Inches Hg.
4000	17.3 PSIG	14.7 Inches Hg.
5000	16.7 PSIG	14.2 Inches Hg.

*** Gauge readings are taken as close as possible to blower openings and include inlet and discharge losses. Above 5000 feet, consult the nearest Gardner Denver Compressor Division Customer Service.**

FIGURE 3- 5 – ALTITUDE – PRESSURE/VACUUM

ALTITUDE ï Maximum allowable discharge pressure and/or inlet vacuum with be decreased with operation at altitudes. See Figure 3-5, page21.

SPEED ï Refer to Figure 3-1, page18, for maximum and Figure 3-6, page 22 for minimum speeds. Never operate the blower below the minimum or above the maximum speed shown. There is a definite relationship between blower speed, discharge pressure and/or inlet vacuum, and the resulting discharge air temperature. Reduced speed at high pressure or vacuum can cause excessive heating which may result in rapid blower failure. For engine-driven units provide an accurate speed indicator.

Examples of minimum allowable speed at given pressures or vacuums are listed in Figure 3-6, as speed is reduced, pressure or vacuum must also be reduced.

EXAMPLE: Using a 5CDL5 blower, operating against 18 PSIG, minimum allowable speed is 2700 RPM.

NOTICE

Blower speed, line losses, elevation, and increased inlet temperatures will affect the maximum operating limitations.

OPERATING TEMPERATURE ï Blower air discharge temperature will increase with higher operating pressures or vacuums. Maximum allowable discharge is 355°F. Maximum allowable temperature rise is 255°F. If the discharge temperature continues to exceed 355°F., or temperature rise continues to exceed 255°F, stop the blower at once and correct the trouble.

⚠WARNING

Do not continue to run a blower that is overheating. Check the blower for damage before restarting.

Lubricating oil temperature will increase with increasing discharge air temperature. Oil temperature in the discharge end sump will exceed that in the inlet end sump. Oil sump temperatures at the discharge end in the 200 ï 250° F. range are not uncommon.

STOPPING BLOWER ï Where possible, reduce the system pressure to zero gauge before stopping the blower. To prevent backflow of foreign material into the blower on shutdown, provide a check valve in the discharge line.

On engine-driven units, idle the engine for a few minutes prior to shutdown.

EMERGENCIES – In event of system failures, shutdown the blower immediately. Inspect the blower for foreign material backflow. If materials are found inside the blower housing, a thorough cleaning is necessary before restarting.

⚠WARNING

Do not operate a blower which is noisy, vibrating, or heating excessively.

Models	Minimum Speed (RPM) - Dry Pressure		
	Up To 15 PSIG	18 PSIG	20 PSIG
5CDL5	1900	2700	4200
5CDL9	1780	2300	2900
5CDL13	1625	2300	2900

Models	Minimum Speed (RPM)		
	Dry Vacuum	Wet Vacuum	
	Up To 17” Hg.	Up To 22” Hg.	24” Hg.
5CDL5	2950	1500	2000
5CDL9	2900	1500	1500
5CDL13	2850	1500	1500

FIGURE 3- 6 – MINIMUM SPEED, MAXIMUM PRESSURE OR VACUUM

BLOWER STARTUP CHECKLIST

This startup procedure should be followed during the initial installation and after any shutdown periods or after the blower has been worked on or moved to a new location. It is suggested that the steps be followed in sequence and checked off (✓) in the boxes provided.

☐ 1. Check the unit and all piping for foreign material and clean if required.

☐ 2. Check the flatness of the feet and the alignment of the drive. Feet that are bolted down in a bind can cause housing distortion and internal rubbing. Misaligned V-drives can cause the rotors to rub against the headplates and cause a reduction in the volumetric efficiency of the unit. Misaligned couplings can ruin bearings.

☐ 3. If the blower is V-belt driven, check the belt tension and alignment. Over-tensioned belts create heavy bearing/shaft loads which lead to premature failure.

☐ 4. Be sure adequate drive guards are in place to protect the operator from severe personal injury from incidental contact.

☐ 5. Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating and can ruin gears and cause other damage. Insure that grease lubricated bearings are properly lubricated.

☐ 6. Turn the driveshaft by hand to be certain the rotors do not bind.

☐ 7. ñJogò the unit with the motor a few times to check that rotation is in the proper direction, and to be certain it turns freely and smoothly.

☐ 8. Start the unit and operate 15 minutes at no load. During this time, check for hot spots and other indications of interference.

☐ 9. Apply the load and observe the operation of the unit for one hour. Check frequently during the first day of operation.

☐ 10. If malfunctions occur, do not continue to operate. Problems such as knocking rotors can cause serious damage if the unit is operated without correction.

SECTION 4
MAINTENANCE

Blower efficiency and life depend on the quality of maintenance the blower receives. Maintenance must be done regularly and with care. Clean work space, tools, solvents, and wiping rags are necessary to avoid transferring dirt into the unit. A maintenance chart listing each blower is a valuable tool for scheduling regular checks of each unit. A good program, well carried out, will insure long trouble-free service from the blower.

LUBRICATION

Gears and bearings are splash lubricated. The discharge end sump requires 2 quarts and the gear end sump requires 3 quarts of oil.

RECOMMENDED LUBRICANT

The factory recommended lubricant is AEON PD Synthetic Lubricant. AEON PD is formulated especially for positive displacement blower service to provide maximum blower protection at any temperature. One filling of AEON PD will last a minimum of 4 times longer than a premium mineral oil, depending on actual operating conditions. AEON PD contains a special additive package designed for greater rust and corrosion protection.

AEON PD LUBRICANT

DESCRIPTION	PART NUMBER
1 quart	28G23
Case 12 quarts	28G24
5 gallon pail	28G25
55 gallon drum	28G28

AEON PD FOOD GRADE LUBRICANT

DESCRIPTION	PART NUMBER
1 Quart	28H97
Case 12 quarts	28H98
5 gallon pail	28H99
55 gallon drum	28H100

FIGURE 4-1 – AEON PD SYNTHETIC LUBRICANT

NOTICE

Machines are shipped without oil in the sumps. Do not operate before adding lubricant.

LUBRICATION INSTRUCTIONS

Oil is add through the oil fill hole at the top of each bearing carrier. Check the oil level at both ends of the blower daily. Add fresh oil as required to maintain the proper level. The oil level should be at the middle of the sight glass when the machine is not operating.

⚠WARNING

Do not overfill as this will tend to cause excessive heading of the gears and may damage the unit.

AEON PD Synthetic Lubricant should be drained after 6000 hours of operation. Re-fill with fresh AEON PD oil. If mineral oil is used, perform the above oil-change maintenance every 1500 hours. Recommended service intervals are for normal blower operating conditions. Severe operating conditions may warrant more frequent oil changes. Laboratory analysis of the oil should be used to help determine the optimum oil change interval.

For best performance and equipment protection, use AEON PD Synthetic Lubricant, which has been specifically formulated for positive displacement blowers.

If you choose not to use AEON PD Synthetic Blower Synthetic Blower Lubricant, select an oil with rust and oxidation inhibitors, anti-foam additives, and the viscosities listed in Figure 4-2. Do not use and oil that contains EP additivies.

NOTICE

Machines are shipped without oil in the sumps. Do not operate before adding lubricant.

Flush the oil whenever a change is made from one type of oil to another. Drain the currant lubricant as thoroughly as possible. Refill with new lubricant. Fill to the normal level of the blower, which is the middle of the sight glass

Blower Discharge Temperature	Ambient Temperature			
	Less than10_ F *	10_ F to 32_ F **	32_ F to 90_ F	Greater than 90_ F
Less than 32° F (0_ C)	ISO 100 ÿ	ISO 100 ÿ		
32° F to 100° F (0° C to 38° C)	ISO 100 ÿ	ISO 100 ÿ	ISO 150 ÿ	
100° F to 225° F (38°C to 105° C)	ISO 100 ÿ	ISO 100 ÿ	ISO 150 ÿ	ISO 220 ÿ
225 248°F to 300° F (105°C to 149°C)	ISO 150 ÿ	ISO 150 ÿ	ISO 220 ÿ	ISO 220 ÿ
Greater than 300° F (149°C)			*** ÿ	*** ÿ

* For ambient temperatures less than 10° F, but not less than - 20° F, the use of oil sump heaters, heated enclosures or synthetic lubricant is required.

** For ambient temperatures 10° F to 32° F, the use of oil sump heaters, heated enclosures or synthetic lubricant is recommended.

*** The lubricant viscosity must be 70 SUS minimum at the lubricant operating temperature.

The pour point of the lubricant should be at least 5° to 10° F below the minimum expected ambient temperature.

For continuous operation, where the lubricant temperature exceeds 200° F, synthetic lubricant is recommended.

ÿ The recommended operating range for AEON PD Synthetic Lubricant.

FIGURE 4- 2 – VISCOSITY RECOMMENDATION

when the machine is not operating. Run the blower for one hour. Shut off the blower and drain the lubricant completely. Refill the blower with the new lubricant.

MAINTENANCE
AIR FILTERS AND FILTER-SILENCERS

⚠WARNING

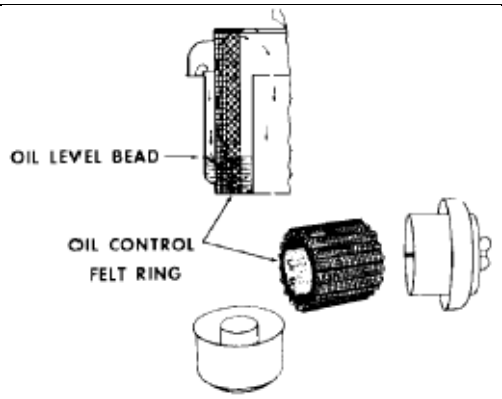
Servicing the air filters is one of the most important maintenace operations to be performed to insure long blower life.

Servicing frequency of filter elements is not time predictable. A differential pressure indicator, with a continuous gauge reading, should be installed across the inlet filter. It will tell how much of the service life of the filter element has been used. It will also eliminate
both premature filter servicing and premature blower failure due to a plugged filter when the filter pressure drop is used to establish maintenance points.

In all cases refer to the filter manufacturer's service instructions. Due to the many types of filters, it is not practical to give specific instructions covering all models; however, the following paragraphs describe some of those most commonly used.

NOTICE

No matter what type of filter is used, always make sure all seals, gaskets, clamps and hose connections on the filter and inlet line are absolutely air tight. Each time the filter is serviced, inspect interior of the blower for dirt.



TEMPERATURE	OIL USED
-20° F to 0° F	Mixture of 2/3 SAE 10W and1/3 Diesel Fuel
0° to 30° F	SAE 10W
30° to 50° F	SAE 20
50° to 110° F	SAE 30
110° to 112° F	SAE 50

FIGURE 4- 3 – OIL BATH FILTER

Oil Bath Filter (Figure 4-3) ï The following instructions also apply when the filter is equipped with a silencing chamber:

1. Remove cover, screen and bowl form the base.
2. Wash the screen and bowl.
3. Fill the bowl to oil level bead with oil listed.
4. Place the end of the screen bonded with felt down into the oil. Upside-down installation will result in heavy oil carryover.
5. Replace the cover and tighten wing nut securely.
6. Make sure all connections to the air filter are tight.

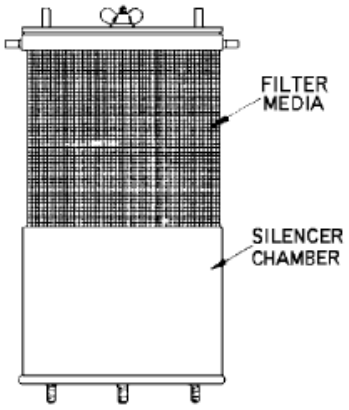


FIGURE 4- 4 – OIL WETTED FILTER-SILENCER

Oil Wetted Filter-Silencer (Figure 4-4) ï Cleaning of the filtering media is accomplished by thoroughly washing in a commercial solvent and blowing dry with air. Blow from inside to outside to dislodge dirt particles from the finer screen sections. After the media is cleaned, recharge by dipping in oil. The filter silencer can be supplied with an all-weather hood. If an oil wetter filter without silencer is used, the service instructions in the previous section will also apply.

Dry Type Filter and Filter-Silencer (Figure 4-5) ï When the outside surface of the element appears to be evenly coated with dirt, it should be cleaned as follows:

1. Remove wing nuts and lift off the hood.
2. Loosen the outside retaining strap to remove the media.
3. Vibrate or blow off heavy dirt accumulation.
4. If required, wash the media in any carbon base commercial solvent and blow off the excess solvent.
5. Allow to dry and examine for damage or conditions requiring replacement.

Because the media in the dry type filter is of wool felt, it may become impregnated with oil or water, if present in any large degree. Corrosive gases may also attack the media. While such conditions are not common, they should be kept in mind.

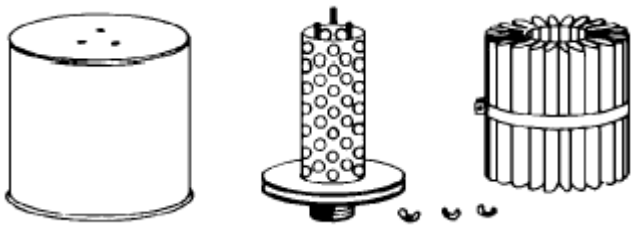


FIGURE 4- 5 – DRY TYPE FILTER AND FILTER-SILENCER

DISCHARGE SILENCER ï A drain may be provided in the silencer at the lowest point for draining condensate. Draining intervals will depend upon humidity conditions and must be established by the user.

ROTOR SHAFT SEALS ï Rotors have a labyrinth type shaft air seal to minimize air leakage along the shaft from the compression chamber. More air will leak through the seals at the discharge end since they are under higher air pressure. Excessive air leakage indicates shaft seal failure.

The air seal consists of two parts, a hardened steel bearing spacer with grooves cut into the outside diameter, and a steel-backed babbitt ring (shaft seal) pressed into the bearing carrier. The grooved end of the spacer and the shaft seal bore have a close fit when cold. When the blower reaches operating temperature for the first time, the babbitt embeds slightly into the grooves, forming a close running fit to control air leakage along shaft. No maintenance is required, except that bearing carrier removal usually will destroy the babbitt grooving and the shaft seal must be replaced. Shaft seals that have been in operation should not be reused as excessive leakage may result. The bearing spacer can be reused unless damaged. After installation of new seals, rotation of the blower may be tight for a few turns until bearing spacer grooves cut running ways into the babbitt. For seal replacement refer to Disassembly Section, page 36, and Assembly Section, page 40

BEARING OIL SEALS ï Oil leakage along each shaft from the oil sumps is prevented by a lip type seal pressed into the bearing carrier. These seals are unidirectional lip seals. The hydrodynamic spiral in the Teflon lip pumps the oil back into the sump. Usual causes of seal failure are: high temperature, rough surface on bearing spacer, damage during installation, and improper seal used. The radius at the end of the bearing spacer and O.D. should be highly polished to prevent seal lip damage during installation. Use only seals shown in parts list as they have been selected for blower service. They must be installed in the correct location and with the proper orientation or the oil will be pumped out of the pump. Rotation arrows and color coding are used to distinguish clockwise seals from counterclockwise seals, see FIGURE 7-13, Assembly Instructions page 44.

PERIODIC INSPECTIONS ï A well-organized maintenance program will provide for periodic inspection of the blower, drive and components. These inspections may prevent major repair and downtime.

1. Observe the blower for vibration, heating, noise, oil seal leaks, and excessive shaft air leaks.
2. Check for proper operation of the filters, coupling, drive, power unit, relief and check valves, gauges and other controls.
3. Disconnect the drive and turn the blower by hand to check for drag, tight spots, bearing wear (radial and axial) and gear backlash. Rotation should be free with no indication of drag or metallic interference.
4. Inspect the interior through the inlet or discharge port for cleanliness, corrosion or parts contact.

⚠WARNING

Rotating components will cause severe injury in case of personal contact. Keep hands sway from the blower inlet and discharge ports.

5. Check tightness of all screws and bolts.

SOME COMMON CAUSES OF BLOWER FAILURE

1. Poor air filter maintenance or incorrect selection.
2. Inadequate lubrication (wrong, dirty or low oil).
3. Backflow of materials into the blower.
4. Discharge pressure or inlet vacuum above blower rating.
5. Blower speed below minimum rating.
6. Blower speed too low for discharge pressure or inlet vacuum.

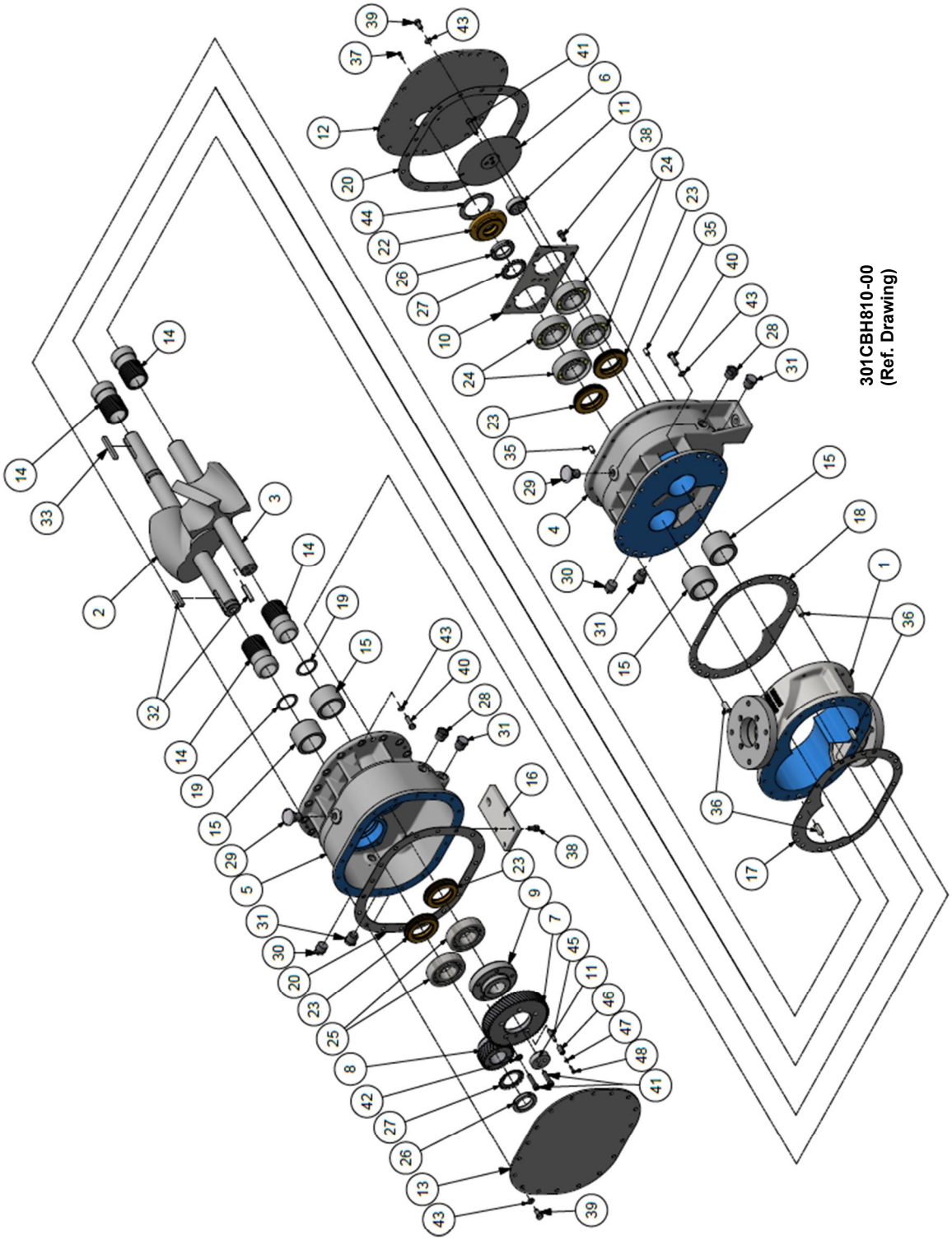
BLOWER OVERHAUL ï Refer to Disassembly Section, page 36, and Assembly Section, page 40.

REPAIR PARTS ï When ordering parts, specify Blower Model, Size and Serial Number.

Reference numbers shown in the left hand column of the parts list are used to help locate parts shown on the drawing and sectional view**. DO NOT ORDER BY REFERENCE NUMBERS**.

After locating the reference number, the part number may be found for your particular blower under the correct Model Number Column. Specify exactly the number of parts required (see column ñQty.ò). **DO NOT ORDER BY SETS.**

Teflon is a register trademark of DuPont



FOR LIST OF PARTS SEE PAGES 30 & 31.

Order by Part Number and Description. Reference Numbers are for your convenience only.

Ref. No	Name of Part	Qty.	Models 5CDL5R Part No.	Models 5CDL9R Part No.	Models 5CDL13R Part No.
1	Housing	1	303CBH002	304CBH002	305CBH002
	Rotor Group (Incl. Ref. Nos. 2 & 3)	1	200CBH010E	200CBH010A	300CBH4028
2	Rotor- Main				
3	Rotor- Gate				
4	Bearing Carrier (Discharge End)	1	8501214	8501102	8501096
5	Bearing Carrier (Inlet End)	1	8501207	8501176	8501176
6	Slinger- Oil	1	8500419	8500419	8500419
	Gear Kit, (Incl. Ref. Nos. 7 & 8)	1	200CTH6008	200CTH6008	200CTH6008
7	Gear				
8	Gear- Pinion				
9	Hub- Gear	1	8500011	8500011	8500011
10	Clamp Plate- Bearing	1	8500012	8500012	8500012
11	Clamp Plate- Shaft	2	8500414	8500414	8500414
12**	Cover- End	1	8500013	8500013	8500013
13	Cover- End	1	8500014	8500014	8500014
14	Spacer- Bearing	4	8500035	8500035	8500035
15	Seal-Rotor Shaft	4	8500388	8500388	8500388
16	Mounting Pad	1	8500031	8500031	8500031
17	Shim- Housing	1	8500023	8500023	8500023
18	Shim- Housing Set	1	300CBH732	300CBH732	300CBH732
20	Gasket- Cover	2	8500015	8500015	8500015
22**	Seal- Oil	1	305CBH199	305CBH199	305CBH199
23	Seal-Oil	4	304CBH199	304CBH199	304CBH199
24	Bearing- Angular Contact	4	8500409	8500409	8500409
25	Bearing- Ball (Single Row)	2	8500167	8500167	8500167
26	Bearing Locknut	2	50Z9	50Z9	50Z9
27	Bearing Lockwasher	2	95W25	95W25	95W25
28	Gauge- Oil Level	2	40P45	40P45	40P45
29	Breather Filter	2	5L223	5L223	5L223
30	Pipe Plug - Square Head	2	64AA3	64AA3	64AA3
31	Plug- Magnetic	4	8501248	8501248	8501248
32	Key- Square	2	8500109	8500109	8500109
33**	Key- Square	1	8500113	8500113	8500113
35**	Pin- Dowel	2	62M48	62M48	62M48
36	Pin- Dowel	4	62M83	62M83	62M83
37**	Screw- Socket Head Lock	4	75P12P	75P12P	75P12P
38	Screw- Socket Head Lock	9	75P6N	75P6N	75P6N
39	Screw- Hex Head	36	655ED030	655ED030	655ED030
40	Screw- Hex Head	32	655ED050	655ED050	655ED050
41	Screw- Socket Head Lock	10	75P57P	75P57P	75P57P

Order by Part Number and Description. Reference Numbers are for your convenience only.

Ref. No	Name of Part	Qty.	Models 5CDL5R Part No.	Models 5CDL9R Part No.	Models 5CDL13R Part No.
42	Washer	4	95U3	95U3	95U3
43	Lockwasher	68	95B3	95B3	95B3
44**	Gasket- Seal Adaptor	1	8500144	8500144	8500144
45	Pin Timing	1	8504125	8504125	8504125
46	Bushing- Timing	1	8504126	8504126	8504126
47	Washer	1	95W17	95W17	95W17
48	Screw- Socket Head Lock	1	75LM12N	75LM12N	75LM12N

** Double the quantity required for double extended driveshaft construction

OVERHAUL KIT - 307CBH6010

Description	Qty.	Part No.
Installation Tool for Oil Seal	1	302CBH074
Installation Tool for Drive Seal	1	303CBH074
Bearing Spacer	4	8500035
Shaft Air Seal	4	8500388
Housing Shim	1	8500023
Housing Shim Set	1	8500029
Shaft Shim Set	2	8501269
End Cover Gasket	2	8500015
Shaft Oil Seal	1	305CBH199
Bearing Oil Seal	4	304CBH199
Ball Bearing (Angular Contact)	4	8500409
Ball Bearing (Single Row)	2	8500167
Bearing Lockwasher	2	95W25
Bearing Locknut	2	50Z9
Screw - Socket Head Lock	4	75P12N
Screw - Socket Head Lock	9	75P6N
Screw - Socket Head Lock	11	75P57N
Timing Washer	5	95W48
Seal Adaptor Gasket	1	8500144
Screw - Socket Head Cap	1	75LM12N
Washer	1	95W17
Washer	4	95U3
Adhesive	1	25BC886
Parts List and Service Manual	1	37-1-613

IMPORTANT: For spare parts requirement in remote areas, export or where more than one unit is operating, a spare gear set is recommended. For 5CDL series order Gear Kit Part Number 200CTH6008.

NOTE: Overhaul kit is recommended for spare parts and/or scheduled maintenance or overhaul requirements.

The installation tools are reusable. The overhaul kit without the installation tools is part number 306CBH6010.

Order by Part Number and Description. Reference Numbers are for your convenience only.
5CDL WITH MECHANICAL SEALS

Ref. No	Name of Part	Qty.	Models 5CDL5R Part No.	Models 5CDL9R Part No.	Models 5CDL13R Part No.
1	Housing	1	303CBH002	304CBH002	305CBH002
	Rotor Group (Incl. Ref. Nos. 2 & 3)	1	200CBH010E	200CBH010A	300CBH4028
2	Rotor- Main				
3	Rotor- Gate				
4	Bearing Carrier (Discharge End)	1	8501214	8501102	8501096
5	Bearing Carrier (Inlet End)	1	8501207	8501176	8501176
6	Slinger- Oil	1	8500419	8500419	8500419
	Gear Kit, (Incl. Ref. Nos. 7 & 8)	1	200CTH6008	200CTH6008	200CTH6008
7	Gear				
8	Gear- Pinion				
9	Hub- Gear	1	8500011	8500011	8500011
10	Clamp Plate- Bearing	1	8500012	8500012	8500012
11	Clamp Plate- Shaft	2	8500414	8500414	8500414
12**	Cover- End	1	8500013	8500013	8500013
13	Cover- End	1	8500014	8500014	8500014
14	Spacer- Bearing	4	8500828	8500828	8500828
15	Seal-Rotor-Shaft	4	300CBH732	300CBH732	300CBH732
16	Mounting Pad	1	8500031	8500031	8500031
17	Shim- Housing	1	8500023	8500023	8500023
18	Shim- Housing Set	1	300CBH732	300CBH732	300CBH732
20	Gasket- Cover	2	8500015	8500015	8500015
22**	Seal- Oil	1	305CBH199	305CBH199	305CBH199
23	Mechanical-Oil	4	8501038	8501038	8501038
24	Bearing- Angular Contact	4	8500409	8500409	8500409
25	Bearing- Ball (Single Row)	2	8500167	8500167	8500167
26	Bearing Locknut	2	50Z9	50Z9	50Z9
27	Bearing Lockwasher	2	95W25	95W25	95W25
28	Gauge- Oil Level	2	40P45	40P45	40P45
29	Breather Filter	2	5L223	5L223	5L223
30	Pipe Plug - Square Head	2	64AA3	64AA3	64AA3
31	Plug- Magnetic	4	8501248	8501248	8501248
32	Key- Square	2	8500109	8500109	8500109
33**	Key- Square	1	8500113	8500113	8500113
35**	Pin- Dowel	2	62M48	62M48	62M48
36	Pin- Dowel	4	62M83	62M83	62M83
37**	Screw- Socket Head Lock	4	75P12P	75P12P	75P12P
38	Screw- Socket Head Lock	9	75P6N	75P6N	75P6N
39	Screw- Hex Head	36	655ED030	655ED030	655ED030
40	Screw- Hex Head	32	655ED050	655ED050	655ED050
41	Screw- Socket Head Lock	10	75P57P	75P57P	75P57P

Order by Part Number and Description. Reference Numbers are for your convenience only.
5CDL WITH MECHANICAL SEALS

Ref. No	Name of Part	Qty.	Models 5CDL5R Part No.	Models 5CDL9R Part No.	Models 5CDL13R Part No.
42	Washer	4	95U3	95U3	95U3
43	Lockwasher	68	95B3	95B3	95B3
44**	Gasket- Seal Adaptor	1	8500144	8500144	8500144
45	Pin Timing	1	8504125	8504125	8504125
46	Bushing- Timing	1	8504126	8504126	8504126
47	Washer	1	95W17	95W17	95W17
48	Screw- Socket Head Lock	1	75LM12N	75LM12N	75LM12N
49	Adaptor Seal	4	8500830	8500830	8500830
50	Spacer Shaft	4	8500829	8500829	8500829
51	Ring-Retaining	4	65W59	65W59	65W59
52	Spacer-Ring	4	8500831	8500831	8500831
53	O-Ring	4	54C225	54C225	54C225

** Double the quantity required for double extended driveshaft construction

MECHANICAL SEAL - OVERHAUL KIT - 308CBH6010

Description	Qty.	Part No.
Installation Tool for Drive Seal	1	304CBH074
Bearing Spacer	4	8500828
Shaft Air Seal	4	8500388
Housing Shim	1	8500023
Housing Shim Set	1	8500029
Shaft Shim Set	2	8501269
End Cover Gasket	2	8500015
Shaft Oil Seal	1	305CBH199
Mechanical Seal	4	8501038
Ball Bearing (Angular Contact)	4	8500409
Ball Bearing (Single Row)	2	8500167
Bearing Lockwasher	2	95W25
Bearing Locknut	2	50Z9
Screw - Socket Head Lock	4	75P12P
Screw - Socket Head Lock	9	75P6N
Screw - Socket Head Lock	11	75P57P
Timing Washer	5	95W48
Seal Adaptor Gasket	1	8500144
Screw - Socket Head Cap	1	75LM12P
Washer	1	95W17
Washer	4	95U3
Adhesive	1	25BC886
O-Ring	1	54C225
Sealant	4	25BC465
Adhesive	1	25BC886
Parts List and Service Manual	1	37-1-613

IMPORTANT: For spare parts requirement in remote areas, export or where more than one unit is operating, a spare gear set is recommended. For 5CDL series order Gear Kit Part Number 200CTH6008.

NOTE: Overhaul kit is recommended for spare parts and/or scheduled maintenance or overhaul requirements.

SECTION 6

DISASSEMBLY INSTRUCTIONS

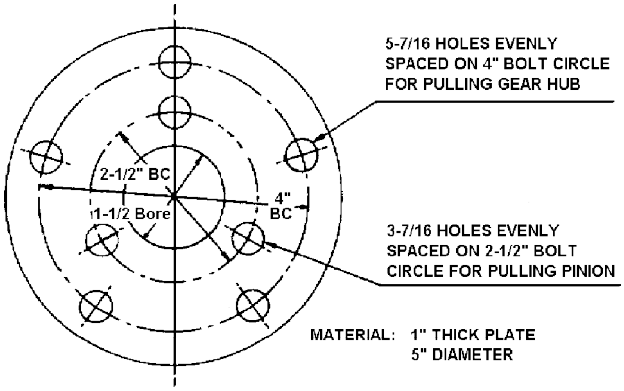


FIGURE 6- 1 – ADAPTOR PLATE

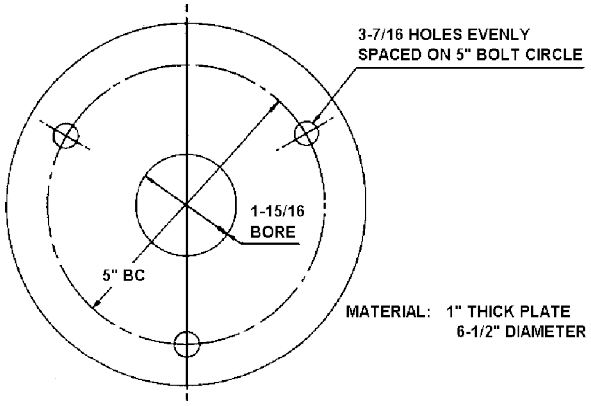


FIGURE 6- 2 – BEARING PRESS PLATE

NOTICE

Illustrations for Disassembly Instructions are taken from various sizes of CycloBlower. Minor variations in construction of some parts need cause no concern.

1. Provide adaptor plate, FIGURE6 - 1, for pulling the gear hub and pinion gear. Pulling directly on pinion teeth will damage teeth making timing difficult and will cause gear wear. Pulling directly on the gear hub flange will distort the flange causing gear run- out. The adaptor plates shown are designed for a jaw type hydraulic puller, FIGURE6-4 and FIGURE6-5.

   Other type pullers are available, and if used, suitable adaptor plates should be provided.

2. Provide bearing press plate, FIGURE6-2, for pressing out rotors and installing bearings.

FIGURE 6- 3 ï SPANNER WRENCH

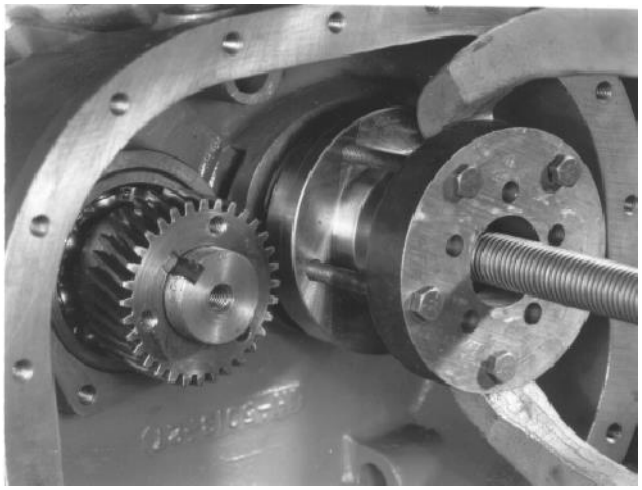


FIGURE 6- 4

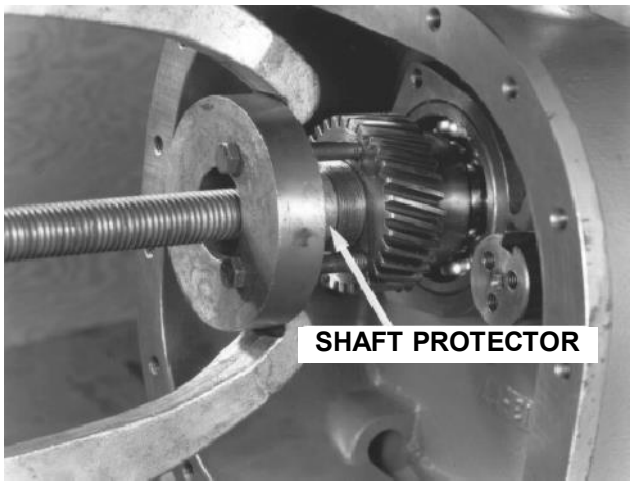


FIGURE 6- 5

3. Place the unit in a horizontal position, on a solid blocking, so the gear end bearing carrier hangs free. Drain oil from both carriers. At the gear end remove the cover, hub retainer plate, gear (slip fit on hub) and pinion locknut. A spanner wrench similar to that shown in FIGURE6-3, should be made to prevent damaging the lock- nuts. This wrench is especially useful at assembly in saving time, and, more important, assures proper tightening of the nuts.

4. Mount the adaptor plate and puller (FIGURE6-4, page 23), and pull the gear hub. Be sure to use a shaft protector to prevent damage to the end of the shaft. Remove the key from the shaft.

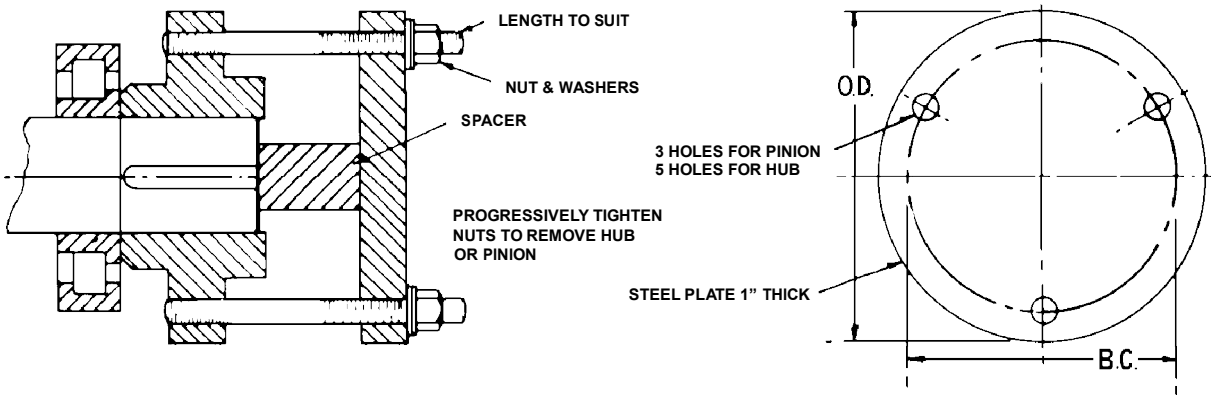
5. Mount the adaptor plate and puller (FIGURE6-5), and pull the pinion. Use a shaft protector. Remove the key from the shaft.

6. If a hydraulic puller is not available, the hub and pinion may be pulled as shown in FIGURE6 - 6.

⚠WARNING

Do not use a torch to heat the pinion to aid in removal. The pinion can be damaged by concentrated heat.

7. Remove all gear end bearing carrier to housing screws. With four jack screws in tapped holes in the carrier flange, FIGURE6-7, page 35, pull the carrier. This also pulls bearings from the rotor shaft. Tighten jack screws evenly to prevent bind- ing carrier on dowel pins and bearings. Support the carrier so it does not drop and damage shaft extensions. When the carrier is free, remove the bearing retainers, bearings, lip type oil seal and shaft seals. If the bearings are to be reused, handle with care.



DIMENSIONS FOR 5CDL SERIES

PINION				GEAR HUB			
O.D.	B.C.	Holes	Stud	O.D.	B.C.	Holes	Stud
3- 3/4ò	2-1/2ò	(3) 7/16ò	3/8ò- 16 UNC	5ò	4ò	(5) 7/16ò	3/8ò- 16 UNC

FIGURE 6- 6 – ALTERNATE ADAPTOR PLATES

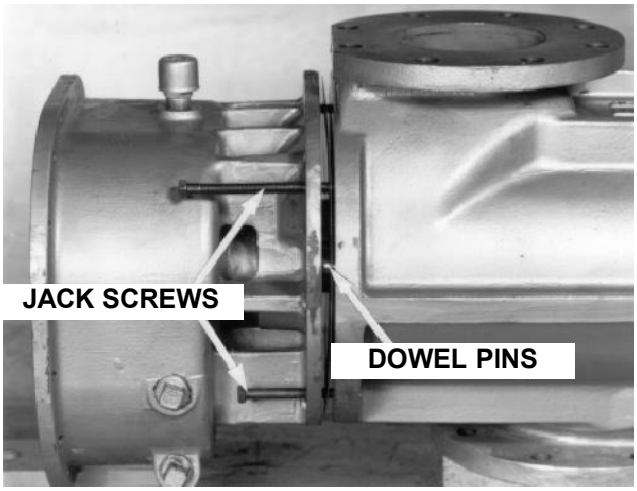


FIGURE 6- 7

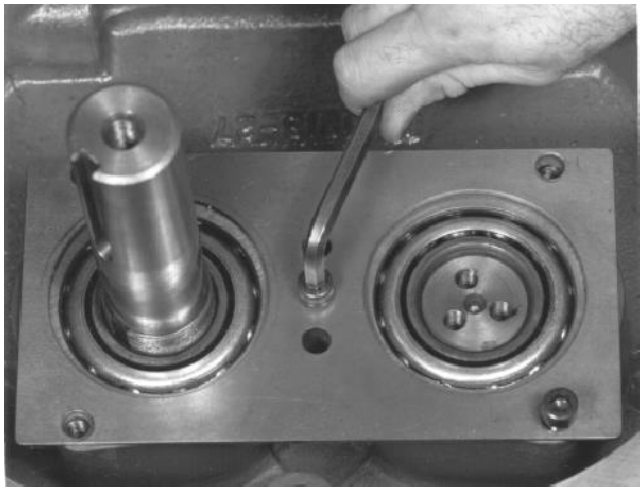


FIGURE 6- 8

NOTICE

Never reuse shaft seals that have been in operation. Refer to "Rotor Shaft Seal," page 17.

8. Remove the discharge end carrier cover, oil slinger, clamp plate, bearing locknut and bearing clamp plates. See FIGURE 8.

9. Rig the plate (shown in FIGURE6-2, page 33) and the puller as shown in FIGURE6-9 and press the rotor shaft through the bearings. Use a shaft protector. Be sure the bolts holding the plate are threaded into the tapped holes of the bearing housing far enough to prevent stripping of the threads, and evenly adjusted so the plate is square with the shaft. Press one rotor through the bearing at a time, then proceed to Step 10. Repeat Steps 9 and 10 on the second rotor.

10. When the rotor shaft is free of bearings, work the rotor through the housing and rig a sling to complete removal of the rotor from the housing, FIGURE6-10, page 31. Handle with care to prevent burrs on rotors and housing.

11. After removal of the rotors, rearrange blocking so the discharge end bearing carrier hangs free. Remove all screws and jack the carrier evenly from the dowel pins, FIGURE 11, page 36 Support the carrier as it is removed.

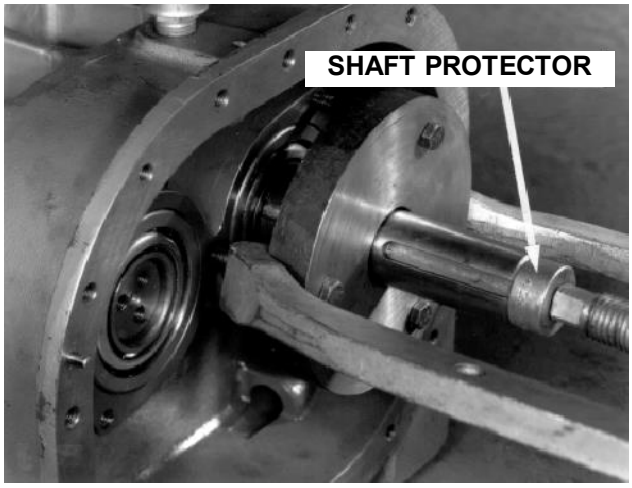


FIGURE 6- 9

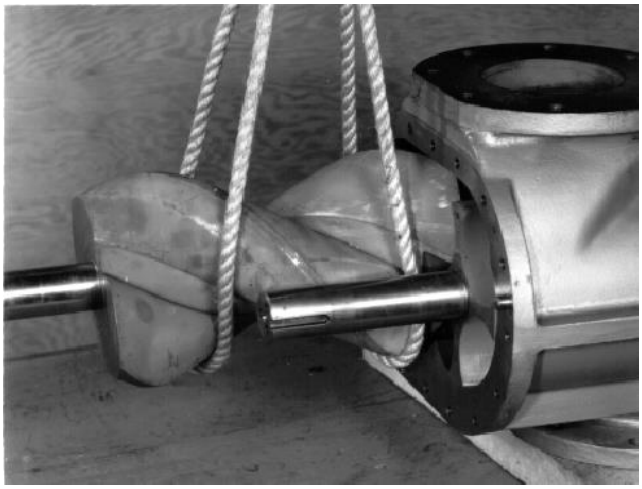


FIGURE 6- 10

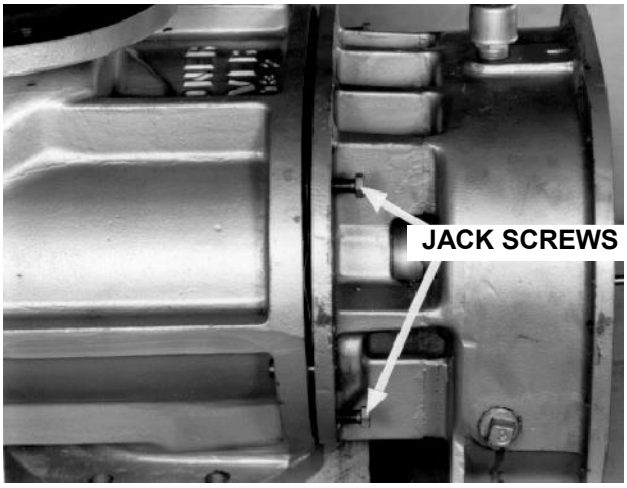


FIGURE 6- 11

SECTION 7
ASSEMBLY INSTRUCTIONS

NOTICE

Illustrations for Assembly Instructions are taken from various sizes of CycloBlower. Minor variations in construction of some parts should not cause concern.

NOTICE

Numbers in parentheses ( ) refer to key numbers in assembly drawings on pages 23 and 24.

The CycloBlower® is manufactured with close tolerances for efficient operation. All parts must be handled carefully to prevent burrs which will give false clearance readings and/or cause rapid wear.

All parts and oil passages must be thoroughly cleaned of dirt which will cause galling of close running parts. Clean work area, washing tank, tools, and wiping rags must be provided.

Refer to Parts List, Section 5, pages 24 and 25, for sectional views showing complete assembly of parts.

NOTICE

The following illustrations are of a standard blower with top inlet, bottom discharge, main rotor discharge end drive. Some variations will be noticed in the following illustrations for blowers of other arrangements.

There may be cases where foreign materials have entered the blower, or other causes have resulted in galling of the rotor ends, carrier faces, rotor lobes, or housing walls. Since the blower is designed with no contact of parts within the rotor chambers, these parts may be cleaned and polished for reuse unless galling is severe. Reuse of parts severely galled may result in loss of blower efficiency. All damaged parts which have been reworked should be checked for run out or warpage before reuse.

Assembly of the ñRò Series CycloBlower differs from earlier models in the approach to installing the oil seals. On previous models the installation of the lip seals into the bearing carriers was the first step in the assembly process. On the ñRòSeries, the Impro seals are not installed into the bearing carriers until after the rotors have been assembled. This requires that the Impro seal is slipped over the rotor shaft using an Impro installation too.

1. Oil the O.D. of the rotor shaft seals (15) to prevent seizure and press into each bore of the inlet end carrier (5) (FIGURE 1, page 28). NEVER REUSE SHAFT SEALS. Refer to ñRotor Shaft Seals,òpage 22, for an explanation. A simple press utiliz- ing a bolt and two bars, one across the seal and one underneath across the bearing bore, is an ef- fective method for installing the seal. Tightening the nut on the bolt presses the seal into place. Press the seal .010òto .015ò below the face of the carrier to prevent the end of the rotor from rubbing the end of the seal. A simple method is to place a .010òto .015òshim on the end of the seal under the press bar which will allow the seal to be pressed the correct distance below the face of the carrier. Handle the seal with care to prevent damage to the babbitt lining.

2. To ease assembly in later steps, fit the bearing spacers (14) to the seals (15) (Figure 7-2, page 338). Be sure there are no burrs on the spacer O.D. and seal I.D. Spacer should be SLIP FIT in the seal. A sloppy fit will cause excess air leakage and decrease blower efficiency. Do not drive the spacer through the seal as damage to the babbitt will result. It may be necessary to polish the high spots from the seal I.D. to allow slip fit of the spacer. USE CROCUS CLOTH, not emery cloth.

   Never push the grooved end of the spacer through the bearing oil seal as the lip of the seal may be damaged. Apply Loctite 620 to the ID of the bearing spacer. When the spacers are fitted, slide them on the gear end shaft extension of the rotors (2, 3)

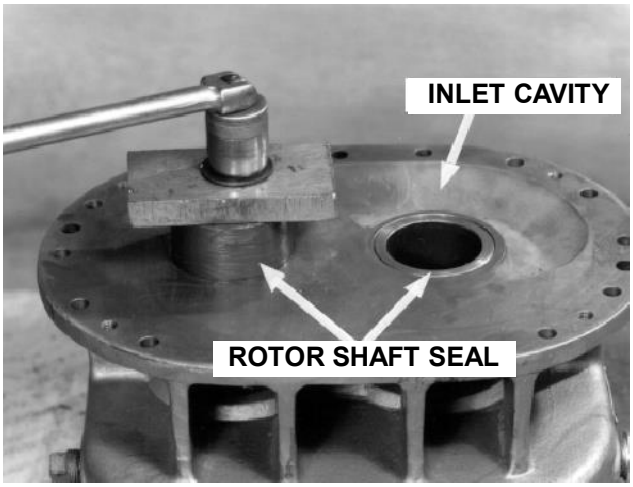


FIGURE 7- 1

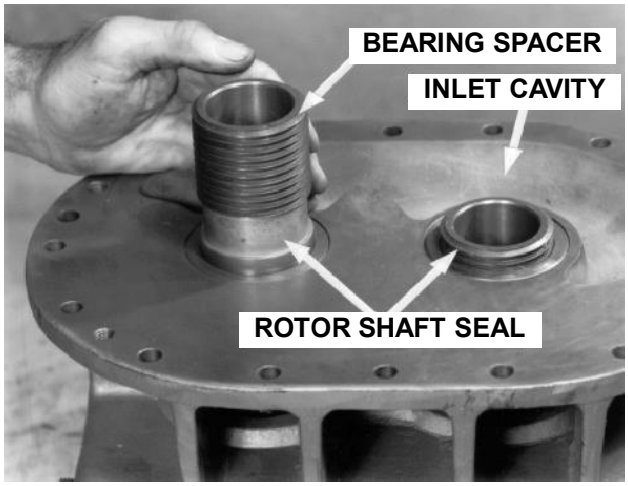


FIGURE 7- 2

with the grooved end toward the rotor. Make sure there are no burrs on either end of the spacer or end of the rotor. Place tape around the shaft to prevent the spacer from sliding off as shown in FIGURE 7 - 4.

3. Place .030òthick aluminum shim (17) on the bearing carrier. The pointed section of the shim is positioned on the machined surface of the carrier to match the contour of the housing (1). Lower the housing, as level as possible, onto the carrier with the discharge opening up (FIGURE 7-3), and the in- let opening matching the cavity side (Figure 7-1, page38), of the carrier. Engage the dowel pins (36) with matching holes in the carrier with care.

Tighten the carrier to housing screws (40, 43) evenly so the dowel pins will not be damaged.

4. Be sure the ends of the rotors and machined face of the carrier are free of burrs and dirt. Lower the gate rotor (3) into the housing (1) first (Figure 7-4). The gear end shaft extension, with the bearing spacer installed in Step 2, goes down. Rotors must be suspended plumb when lowering so the shaft extension and bearing spacer can be carefully guided through the close fit of the shaft seal without damage to the babbit of the air seal. On older models, match timing marks on the end of the rotor lobes as shown inFigure7-9, page 40. Rotors must be used in matched pairs. Identifying

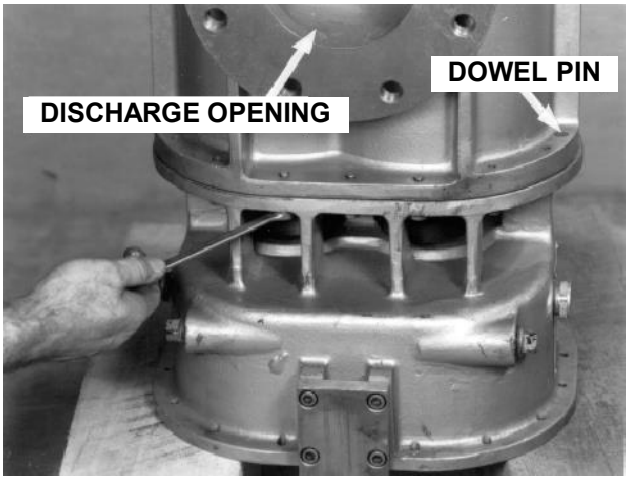


FIGURE 7- 3

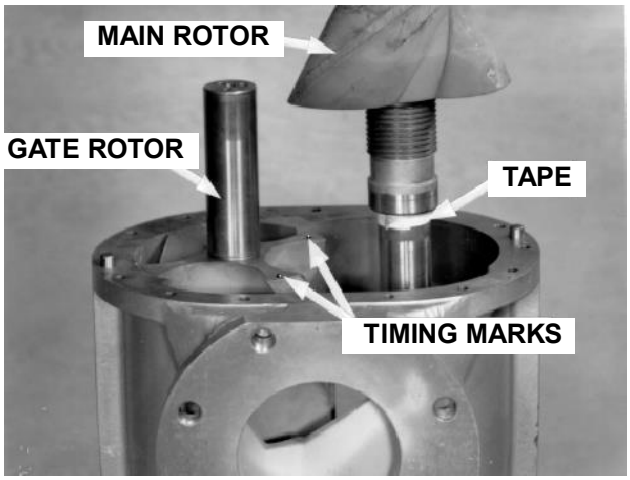


FIGURE 7- 4

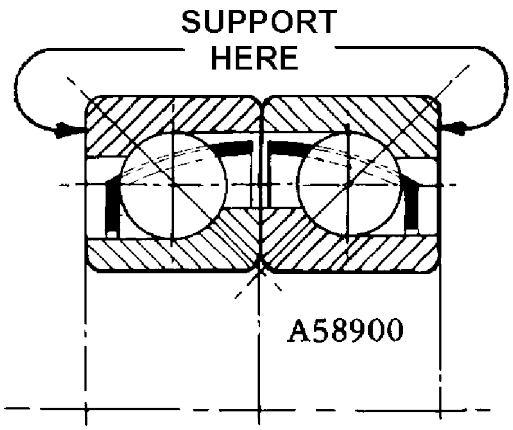


FIGURE 7- 5 – ANGULAR CONTACT BEARING ASSEMBLY

FIGURE 7- 6

marks are stamped on the O.D. of the rotors on the same lobe as the timing marks.

NOTICE

If rotors are installed in reverse of above instructions, the gate rotor bearing spacer O.D. will drag on the main rotor lobe and be damaged.

The CycloBlower is designed for no metal-to-metal contact with parts within the housing. To achieve this, some preliminary measurements are necessary before completing the assembly. **The first set of measurements are used to determine the shaft shim set (19) thickness necessary for positioning the rotors in the housing to give the required clearance between the end of the rotors and the carrier face at the discharge end.** End clearance is maintained at the discharge end by two angular contact bearings (24), bearing spacer (14) and shim set (19). The shaft shim set is determined as outlined in Steps 5 thru 8.

5. The angular contact bearings (24) must be assembled as shown in FIGURE 7- 7 to assure a "fixed" bearing. The marked face of the inner bearing is placed down in the bearing bore; the marked face of the outer bearing is placed up.

6. Install the shaft seal (15), and fit the bearing spacers (14) in the discharge end bearing carrier (4) using the same method as outlined in Steps 1 and 2, page 32. To prepare for shim set measurement, slip bearings (24) into the bore and install bearing retainer plate (10), Figure 7-6. **Bearings must be assembled as directed in Step 7.** Bearings are slip fit in the bore.

7. Inspect bearing spacers for burrs on either end and polished area of O.D. Slip bearing spacer through the shaft seal with the polished end toward the bearing. Make sure the spacer is resting solidly against the bearing. With depth micrometer, measure the distance from the face of the carrier to the end of each of the bearing spacers, FIGURE 7- 7.

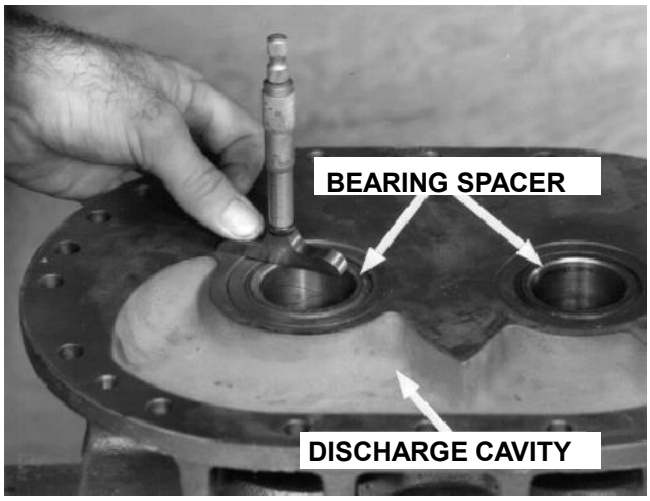


FIGURE 7- 7

Models	Total End Clearance (Suction & Discharge)	Suction End	Discharge End
5CDL5	.011	.006	.005
5CDL9	.016	.011	.005
5CDL13	.021	.016	.005

Dimensions are for Ideal Clearances. Allow +/- .001 for Tolerance

FIGURE 7- 8 – ROTOR END CLEARANCE CHART (UNIT COLD)

8. To the micrometer reading add discharge end clearance shown in clearance chart, FIGURE 7- 8 and .002ò for crush fit of shims and parts. This sum gives the thickness of the shim set for positioning the rotor the required distance from the face of the carrier for running clearance at the discharge end.

   EXAMPLE FOR 5CDL13 BLOWER:
   Micrometer reading of .015ò plus .005ò discharge end clearance, FIGURE 7 - 8, plus .002ò crush gives shim set thickness of .022ò

   Figure shim set for each rotor and record measurements which will be used later in the assembly under Steps 15 and 16.

The second set of measurements is used to determine total end clearance. To give proper rotor end clearance at both inlet and discharge ends (referred to as total end clearance) the distance between the face of the bearing carriers must be equal to the rotor length plus both end clearances. Total end clearance is obtained by adding shims as required between the flange of the housing and the discharge end bearing carrier. The thickness of the shim set is determined as outlined in Steps 9 and 10.

9. With a depth micrometer (Figure 7-9), measure the distance from the end of the rotor lobes to the end of the housing. Rotate rotors to check each lobe and record the **largest micrometer reading**. If the measurement varies more than .005ò remove the rotors and check for burrs on the gear end carrier face and the end of the rotors. To the largest micrometer reading add the Total End Clearance shown in the clearance chart, FIGURE 7 - 8, plus .002ò for crush fit, to determine the thickness of the shim set.

   EXAMPLE FOR 5CDL13 BLOWER:
   Micrometer reading of .005ò plus .021ò total end clearance plus .002ò for crush gives a shim set thickness of .028ò

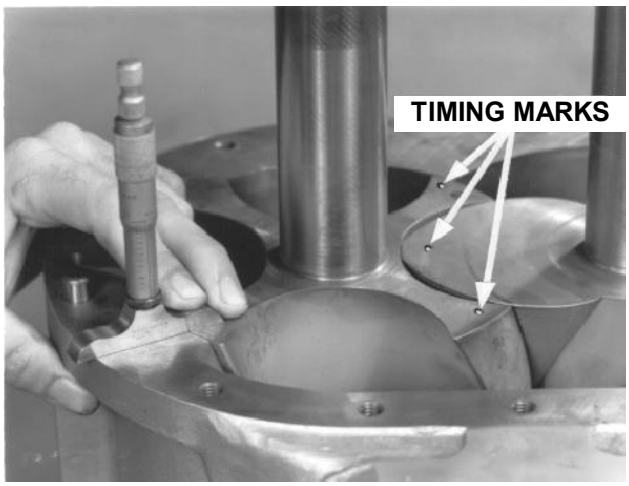


FIGURE 7- 9

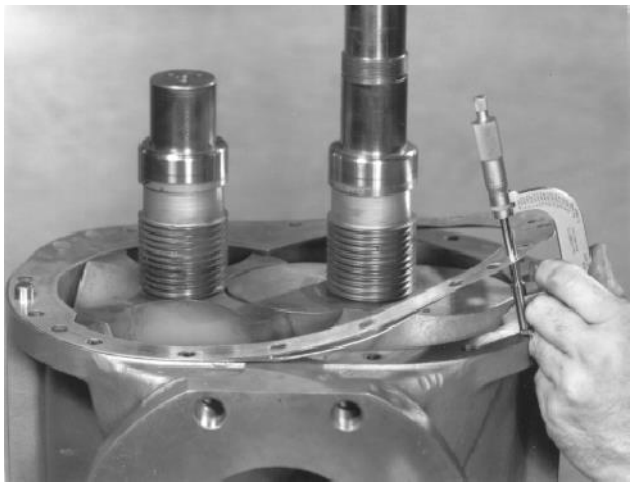


FIGURE 7- 10

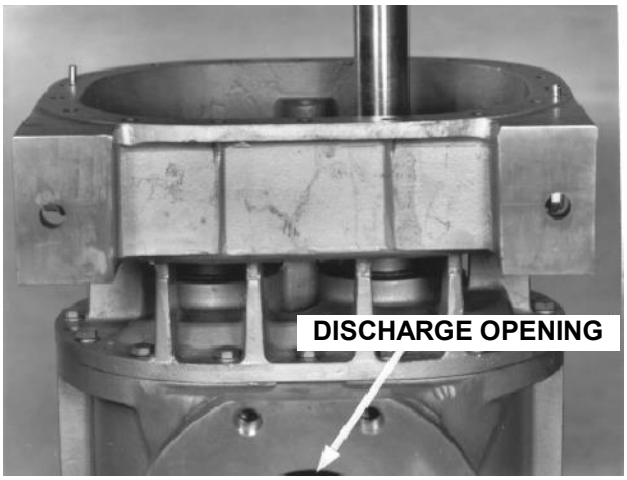


FIGURE 7- 11

FIGURE 7- 12

10. Select the correct thickness of aluminum shims (18) to give the shim set established in Step 9. Check the thickness of the shims with an outside micrometer (FIGURE 10, page 30). Place the shims on the end of the housing, matching the pointed section of the shims with the contour of the housing. Remove bearing spacers from the discharge end bearing carrier, FIGURE 7- **7**, page 34, and place them over the shaft extensions, grooved end toward the rotor. Be sure the spacer fits solidly against the rotor. If measurements in
Step 7 differ, make sure the bearing spacer is placed over its respective shaft extension to assure proper end clearance of each rotor.

11. Coat the I.D. of the shaft seals in the discharge end bearing carrier with ñMolyò type grease. Remove bearings from the carrier. Tag bearings so they will be reassembled in the same bearing bore from which the measurement was made. Match the cavity of the carrier, 34, page
29, with the discharge opening of the housing Figure 7-11, and lower the carrier, suspended plumb, in place on the housing. Be careful not to damage I.D. of the shaft seal by the shaft extension. Be sure there are no shaft shims in place during this operation as sharp edges of shims will damage the seals. Tighten the carrier to housing screws evenly to prevent damage to dowel pins.

12. With the dial indicator attached as shown in FIGURE 7 - 12, check the total end clearance. Set the indicator on zero and lift the rotor with a hoist until the end of the rotor strikes the face of the discharge end bearing carrier. The reading of the indicator will be the total end clearance and should match dimensions listed in the clearance chart, FIGURE 7- 8, page 35. If the indicator reading differs from the chart and allowable tolerance, repeat Steps 9 and 10 as well as check for burrs giving false readings.

NOTICE

Due to allowable machining tolerance of the rotor lengths, there may be cases where one rotor will be within limits and the other slightly over or under.

13. All internal oil seals are directional Impro seals. They must be installed in the correct location and with proper orientation.

    Apply RTV sealant below the o-ring. Expulsion port positioned towards the bottom of the unit.

14. Using the correct installation tool, press the seal down into the bore. Verify that the seal face is below the bearing spacer face. Repeat for other shaft.

15. With a micrometer, FIGURE 7-15, page 43, mea- sure the thickness of shaft shim sets established in Steps 5 thru 8. Be sure shims are clean of dirt and oil for true measurement.

16. Check the end of the bearing spacer for dirt and burrs. Be sure the bearing spacer is solid against the rotor. Slide shim set over the shaft extension, FIGURE 16, page 38, up against the end of the bearing spacer.

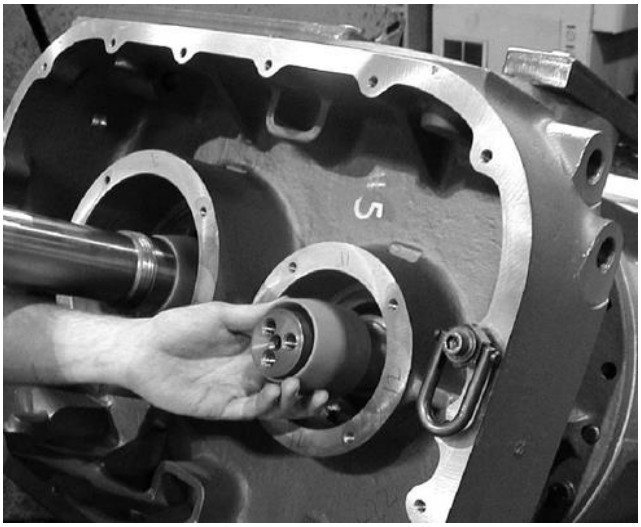


FIGURE 7- 13

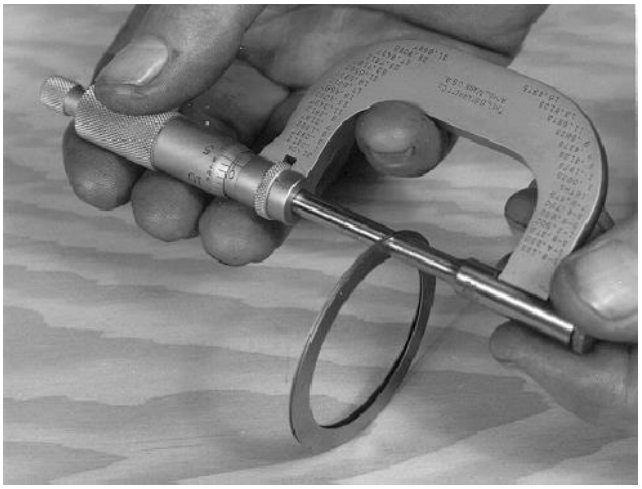


FIGURE 7- 14

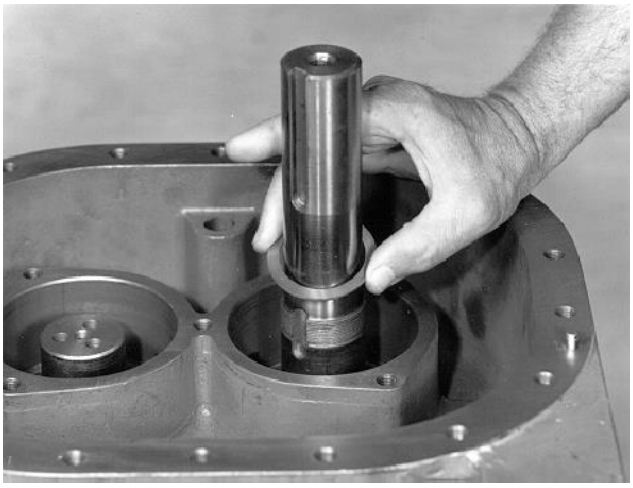


FIGURE 7- 15

17. Lightly coat the shaft extension and bearing bore with oil. Assemble bearings (24), as shown in FIGURE 7- *5*, page 349, on the shaft. Assemble the press plates (refer to Figure 7-2, Disassembly, page 338), on the bearing and install the jack screws, FIGURE 7- *16*. Progressively tightening nuts on the jack screws presses bearings in place. To prevent possible damage to threads on the shaft, press one bearing over the shaft into the bore at a time, rather than with both bearings stacked together. When the first bearing is flush with the top face of the bore, the second bearing may be started. Tighten nuts on the jack screws evenly to prevent cocking of the bearings on the shaft and in the bore.

NOTICE

It is not recommended to hammer bearings of this size in place.

18. Install the bearing clamp plate (10) and four ñylokòtype screws (38), FIGURE 18. Install lock washer (27) and spanner type nut (26) on the main rotor shaft (2) and drive up tight. This operation pulls the rotor shaft through the bearings until the shims and bearing spacer are clamped solidly between the rotor end and bearing, assuring a

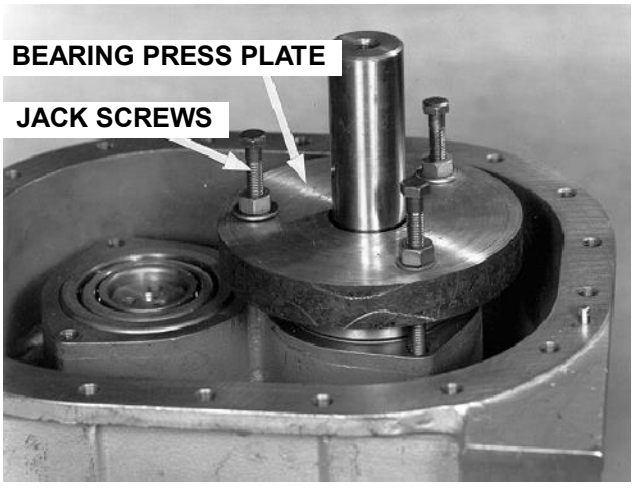


FIGURE 7- 16

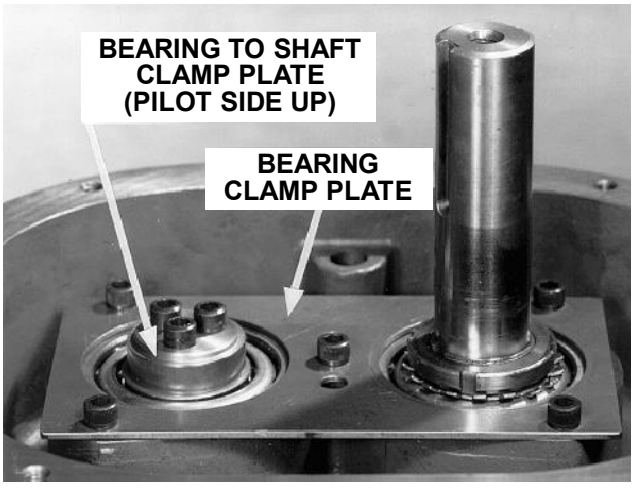


FIGURE 7- 17

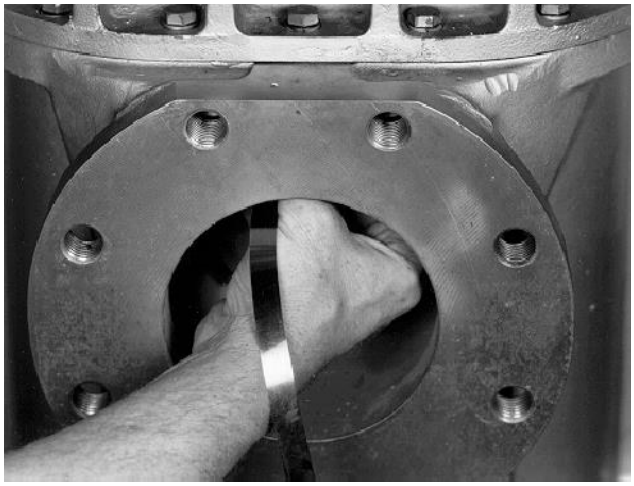


FIGURE 7- 18

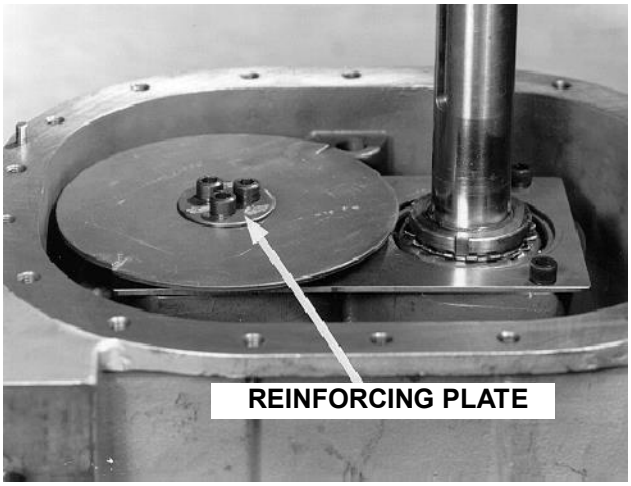


FIGURE 7- 19

fixed position of the rotor. This is an important step in the assembly. The best method for tightening the nuts is with a wrench of the type shown in FIGURE 3, Disassembly, page 23. Install the gate rotor shaft clamp plate (11) and tighten three screws (41) progressively to pull the assembly tight as described above. Note the retainer is installed with the pilot up to prevent marring of the oil slinger side.

19. Check the discharge end clearance of the rotor with a feeler gauge through the discharge opening, FIGURE 19, page 34. Also check rotor end clearance at the inlet end through the inlet opening. Clearance should match those listed in the chart, FIGURE 7 - 8, page 35, keeping in mind the allowable tolerance and possible .002ò variation in rotor lengths. Never allow rotors to run closer than allowable tolerance. Wider clearance will not result in blower failure but may affect efficiency. If the discharge end clearance is too great, make sure the bearing retainer plate is tight, holding the bearing solidly in the bore, and the bearing retainer nuts are tight, which clamp shims and bearing spacer solid against the end of the rotor, Step 18. If clearance is too close, remove the discharge end carrier and repeat the steps to establish shaft shim sets and total end clearance.

20. Bend the ear of the lock washer (27) into the slot of the nuts (26) on the main rotor shaft extension. Oil the bearing generously. Remove the gate rotor retainer plate (11) and install with the pilot side down in the bearing inner race. Place the oil slinger (6), with reinforcing plate up, FIGURE 20, on the retainer plate and pull the assembly tight with three ñNylokò type screws.

21. Check the shaft extension and keyway for burrs. Install keyway tool. Push the oil seal (22) on to the shaft. Install the seal adaptor gasket (44), to the end cover (12) and using four screws (37). Slide the end cover over the shaft extension (FIGURE 7 - 21) and mount the cover to the bearing carrier with screws (39) and washers (43). Remove the keyway tool. Drive dowels (35) into end cover/bearing carrier holes. Expulsion port on the seal should be positioned down, install and tighten temporary bolts. Rotate shaft 6 times. Replace temporary bolts with nylon bolts and tighten. Install drive key (33).

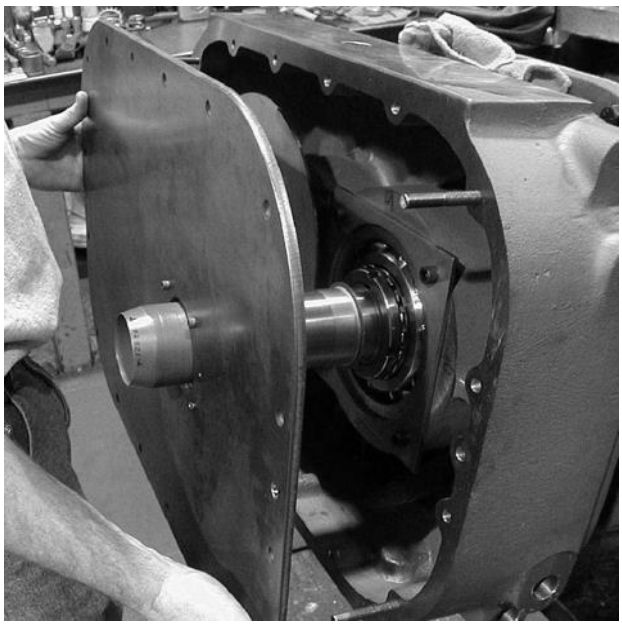


FIGURE 7- 20

FIGURE 7- 21

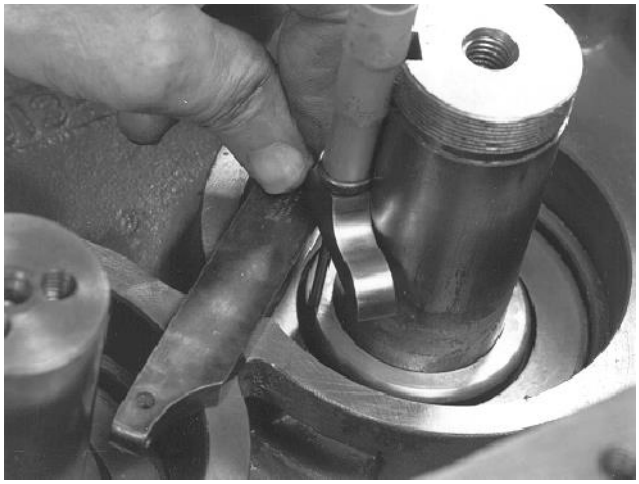


FIGURE 7- 22

22. Turn the unit end for end, gear end up. With a depth micrometer on a perfectly flat parallel bar across the bearing bore, measure the distance to the shoulder in the bearing bore, FIGURE 7-22.

23. Remove tape from the shaft holding the bearing spacers in place. Tap the spacer to be sure it is solidly against the end of the rotor. This is important for the next measurement. With a depth micrometer on the same parallel bar used in Step 21, measure the distance to the end of the bearing spacer, FIGURE 7-23. Measurement to the spacer should be .020ò to .050ò less than the measurement to the shoulder. This clearance insures free bearing float without the use of shims.

24. Install both seals using the installation tools. Expulsion port must be positioned down towards bottom of the unit. Press the seals down and verify seal face is below the bearing spacer face.

25. Coat the shaft extension and bore with oil. Slide the bearing (25) over the shaft. Assemble the press plate as shown in FIGURE 7-46, page 36 and press bearings in place, solidly against the bear- ing spacer. Tighten nuts on the jackscrews evenly to prevent cocking of the bearing. Use the same procedure for both bearings. Bearing retainer plates are not used at this end of the blower.

26. Check the fit of the key (32) in the gear hub (9) and pinion (7). Check the pinion, hub and shaft extensions for burrs. Install the keys in the shafts, making sure of a snug fit. Heat the pinion and hub in oil or dry heat, such as an oven (NEVER USE TORCH) to 350° F for thirty minutes minimum to allow for complete heat penetration. If heating with oil in a confined area, use of cooking oils will prevent undesirable odors.

    Lock the rotors from turning with a piece of hard wood or belting. Install the hub and pinion and pull tight with a locking device, FIGURE 7-27, page 46. Use the hub retainer (11) and screws (41) to pull the hub up tight against the bearing.

    As the hub and pinion cool, check for tightness. The bearing and bearing spacer must be clamped

FIGURE 7- 23

FIGURE 7- 24

tight against the rotor. Bend the ear of the lockwasher (27) into the slot of the nut (26) holding the pinion. Oil the bearings generously.

The final check to be made for running clearances is dividing the interlobe clearance of the rotors to prevent metal- to- metal contact. This is referred to as **"TIMING OF ROTORS"** and is accomplished in the following five steps.

27. Install the gear on the hub (FIGURE 7 - 28), which is a slip fit. If gear teeth were marked at disassembly, line up these marks. New gears are not marked and should be positioned so tapped holes in the hub are centered with holes in the gear to allow radial movement of the gear for timing. Tighten the "Nyloko screws (41) against the flat washers (42) (always use new washers) just tight enough to allow the gear to slip radially on the hub. Mount an indicator and button bracket as shown in FIGURE 28, page 36. In order to accurately follow the next four steps in timing, the indicator must be mounted in a clockwise position from the bracket. The gear has a 3/8- 16 tapped hole for indicator support. When the indicator is mounted, hold the gear from rotating and with a wrench in one of the hub retainer screws, move the shaft in a clockwise direction until all slack is taken out of the gears and rotors to give a metal-to-metal contact. To prepare for the first reading, set the indicator at zero.

28. **FINDING SMALLEST MINUS READING** – FIGURE 7-29, page 47. Hold the gear under clockwise pressure to maintain metal-to-metal contact. Rotate the shaft counterclockwise t**wo complete revolutions** with a wrench. (Do not rotate by moving the gear.) If at any time the indicator hand moves to the plus side, reset at zero, and again rotate two complete revolutions. Notice the place of the smallest reading (this is the smallest number of thousandths from zero, not the smallest figure on the indicator dial). Continue rotation until the smallest reading is again reached and reset the indicator at zero. This is the closest clearance of rotors in this direction of rotation. If the indicator pointer flutters at any time during rotation, check for burrs or dirt on the rotors or gear teeth.

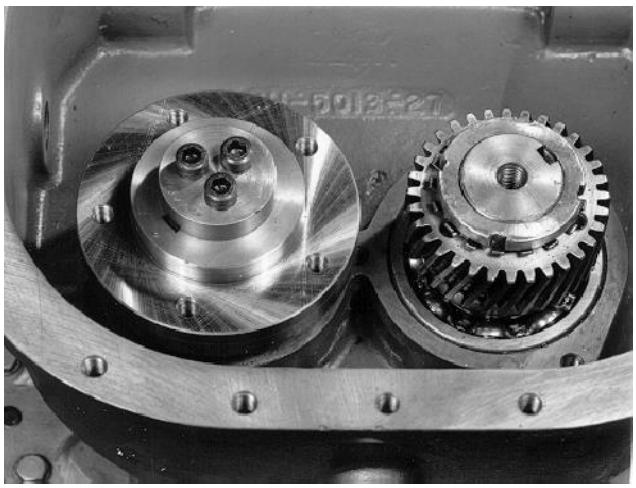


FIGURE 7- 25

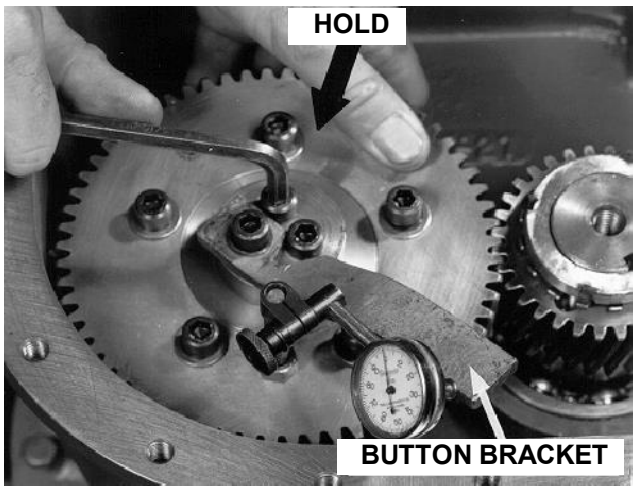


FIGURE 7- 26

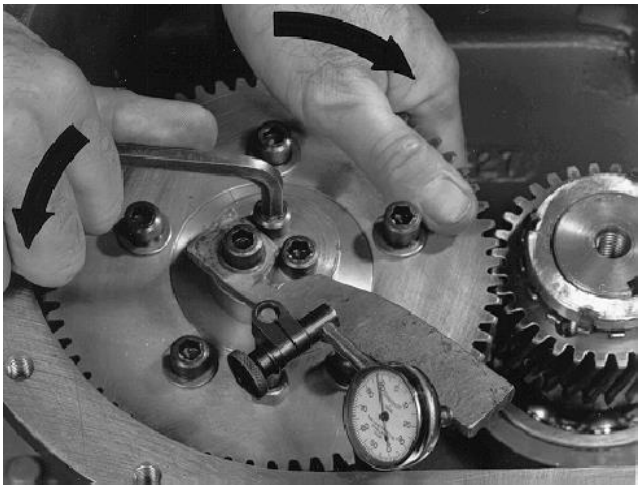


FIGURE 7- 27

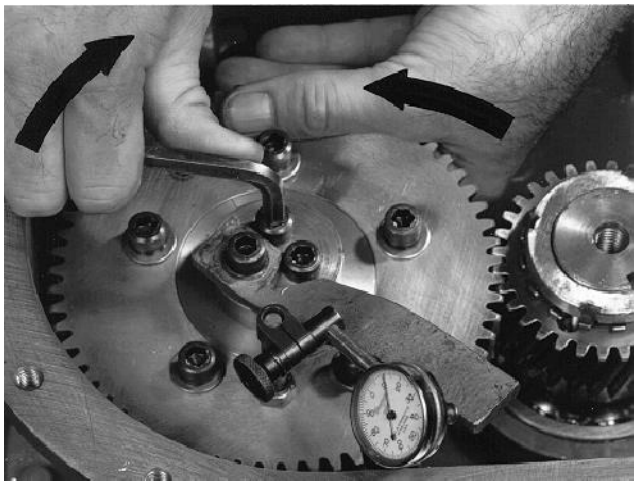


FIGURE 7- 28

29. **FINDING SMALLEST PLUS READING** – FIGURE 7 - 30. Hold the gear under counterclock- wise pressure to take up all slack, and rotate the rotor clockwise **two complete revolutions** with a wrench. Note the place of the smallest plus reading, and continue rotation until the smallest reading is again reached and stop. This is the point of minimum interlobe clearance.

30. **SETTING THE INTERLOBE CLEARANCE** – FIGURE 7 - 31. The interlobe clearance is divided with 2/3 on the discharge side and 1/3 on the suction side. Hold the gear from turning. Move the shaft counterclockwise with a wrench just enough to obtain 2 /3 of the indicator reading obtained in Step 28.

EXAMPLE: The minimum plus reading in Step 29 is +.018; move the rotor until the indicator reads +.012. This divides the interlobe clearance with 2/3 on the discharge side and 1/3 on the suction side.

31. Hold the gear and shaft from turning and evenly tighten four gear to hub ñNylokò screws (41) (FIGURE 7-32). Be sure the indicator reading does not change while tightening the screws.

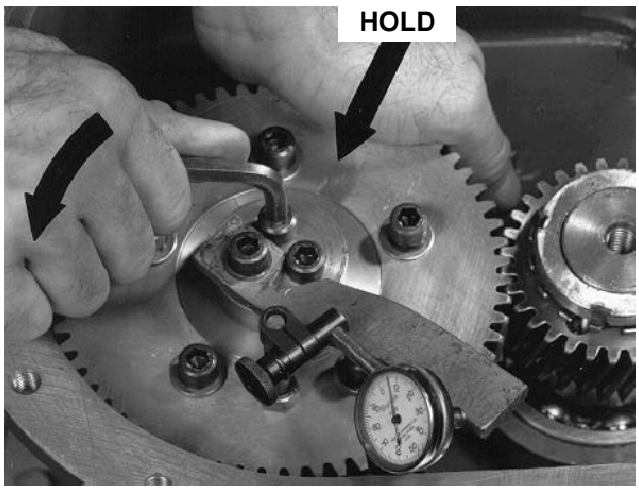


FIGURE 7- 29

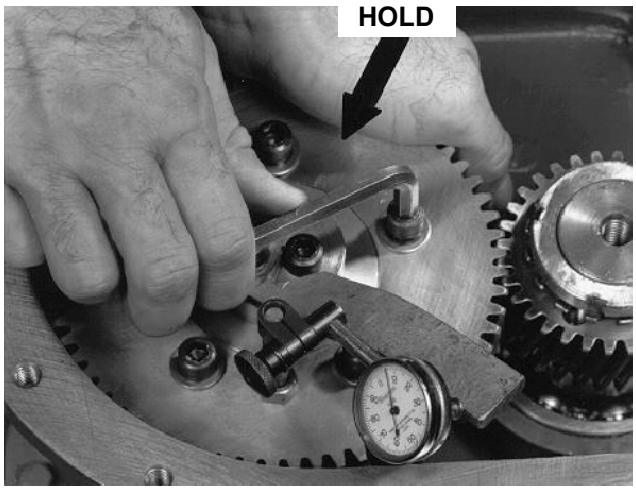


FIGURE 7- 30

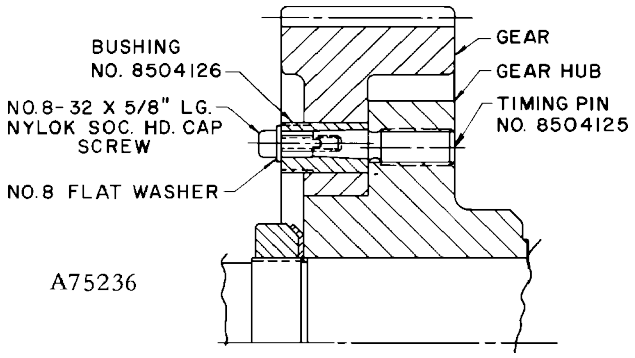


FIGURE 7- 31

32. Installation of timing pin and bushing for all models (see FIGURE 7 - 33).

    a. Install timing pin number 8504125 in the 3/8ö tapped hole in the gear hub. Turn the pin into the hub until the threaded end of the pin is flush with the back of the gear hub.

    b. Place bushing number 8504126 in the 1/2ö diameter hole in the gear over the tapered end of the timing pin. If the tapered hole in the bushing does not line up with the tapered pin, insert a screwdriver through the bushing and turn the pin counterclockwise until the bushing drops down over the pin.

    c. Install number 8-32 x 5/8ölong socket head cap screw (48) and flat washer (47) in the end of the pin and draw up tight.

NOTICE

To remove the bushing from the gear, first loosen and remove four (4) socket head cap screws, then remove No. 8 - 32 screw and flat washer. Install a 1/2" - 12 NC nut on the threaded portion of the bushing, tighten the nut until the bushing is loose and can be lifted from the gear.

When timing is completed, remove the indicator, button bracket and gear hub retainer plate. Install the hub retainer plate (11) with the pilot in the hub bore with three Nylok type screws (41). Install the gasket (20) and carrier cover plate (13). Clean both carrier breathers (29). Referring to ñLubrication,ò page 14, fill the carriers with proper oil. Cover all openings to prevent dirt from entering the blower during transportation and installation. If the blower is to be stored, refer to ñStorageò in the Maintenance Section.

Gardner Denver

WARRANTY

GARDNER DENVER®

CDL SERIES CYCLOBLOWER®

GENERAL PROVISIONS AND LIMITATIONS

Gardner Denver (the ñCompanyò) warrants to each original retail purchaser (ñPurchaserò) of its new products from the Company or its authorized distributor that such products are, at the time of delivery to the Purchaser, made with good material and workmanship. No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Companyôs judgment, as to affect the product adversely.
2. Any product which has, in the Companyôs judgment been subject to negligence, accident, improper storage, or improper installation or application.
3. Any product which has not been operated or maintained in accordance with normal practice and with the recommendations of the Company.
4. Components or accessories manufactured, warranted and serviced by others.
5. Any reconditioned or prior owned product.

Claims for items described in (4) above should be submitted directly to the manufacturer.

WARRANTY PERIOD

The Companyôs obligation under this warranty is limited to repairing or, at its option, replacing, during normal business hours at an authorized service facility of the Company, any part which in its judgment proved not to be as warranted within the applicable Warranty Period as follows.

BARE BLOWERS

Basic bare blowers, consisting of all parts within, are warranted for 12 months from date of initial use or 18 months from date of shipment to the first purchaser, whichever occurs first.

Any disassembly or partial disassembly of the blower, or failure to return the ñunopenedò blower per Company instructions, will be cause for denial of warranty.

OTHER COMPONENTS

All other components are warranted for 12 months from date of initial use or 18 months from date of shipment to first purchaser, whichever comes first.

LABOR TRANSPORTATION AND INSPECTION

The Company will provide labor, by Company representative or authorized service personnel, for repair or replacement of any product or part thereof which in the Companyôs judgment is proved not to be as warranted. Labor shall be limited to the amount specified in the Companyôs labor rate schedule.

Labor costs in excess of the Company rate schedule amounts or labor provided by unauthorized service personnel is not provided for by this warranty.

All costs of transportation of product, labor or parts claimed not to be as warranted and, of repaired or replacement parts to or from such service facilities shall be borne by the Purchaser. The Company may require the return of any part claimed not to be as warranted to one of its facilities as designated by Company, transportation prepaid by Purchaser, to establish a claim under this warranty.

Replacement parts provided under the terms of the warranty are warranted for the remainder of the Warranty Period of the product upon which installed to the same extent as if such parts were original components thereof.

DISCLAIMER

THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESSED, IMPLIED OR STAT- UTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY.

THE REMEDY PROVIDED UNDER THIS WARRAN- TY SHALL BE THE SOLE, EXCLUSIVE AND ONLY REMEDY AVAILABLE TO PURCHASER AND IN NO CASE SHALL THE COMPANY BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES. UNDER NO CIRCUMSTANCES SHALL THE COM- PANY BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOSSES OR DELAYS HOWSOEVER CAUSED.

No statement, representation, agreement, or understanding, oral or written, made by any agent, distributor, representative, or employee of the Company which is not contained in this Warranty will be binding upon the Company unless made in writing and executed by an officer of the Company.

This warranty shall not be effective as to any claim which is not presented within 30 days after the date upon which the product is claimed not to have been as warranted. Any action for breach of this warranty must be commenced within one year after the date upon which the cause of action occurred.

Any adjustment made pursuant to this warranty shall not be construed as an admission by the Company that any product was not as warranted.

For additional information, contact your local representative or

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