MODEL HVP
(HIGH VOLUME PULSE)
DUST COLLECTOR BAGHOUSE

INSTRUCTION, OPERATIONS & MAINTENANCE MANUAL

CAMCORP, INC.
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RECEIVING YOUR UNIT

Prior to accepting shipment, care must be taken to inspect all equipment received both for proper count and for damage. Any and all irregularities must be noted on the carriers' copy of the shipping receipt to assist in settling any claims for damage or shortages. All equipment is shipped FOB point of origin whether on a prepaid or collect freight basis.

ANY CLAIM FOR DAMAGE IN TRANSIT OR SHORTAGES MUST BE BROUGHT AGAINST THE CARRIER BY THE PURCHASER.

Once your claim has been filed with the carrier contact CAMCORP to notify us of the problem(s), and then we will advise the appropriate repair procedure or recommend it to be returned to the factory depending on the extent of damage.

INSPECTION OF UNIT

Housing: Particular attention should be paid to the sheet metal housing of your collector. The unit should be inspected for dents, cracks, or rips. A dented housing may seriously affect the structural integrity of the unit. If any of these signs are present, note them on the shipping receipt and notify CAMCORP immediately. The entire unit should be checked against the certified drawings for correctness and the manufacturer notified immediately if there are any discrepancies. No corrections may be made without the expressed written consent of the manufacturer.

Components: A count should be made of all pieces received and this should be verified against the carrier's manifest. Boxes should be inspected for rough handling, which may have resulted in hidden damage.

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*** SAFETY INFORMATION ***

WARNING!!! - Do not attempt to operate or maintain this piece of equipment until you have read and understand all of the safety information included in the manual. This piece of equipment contains moving which can cause serious injury. If you do not understand anything in this manual seek assistance prior to operations.

LOCKOUT-TAGOUT REQUIREMENTS – Before installation, inspection, or servicing this equipment perform an approved lockout-tagout procedure on the electrical service, air supplies, or any other energy source. Refer to OSHA Standard 1910.147 for guidelines.

SAFETY PRECAUTIONS – Do not operate, inspector, or service this equipment unless all the following safety precautions are in effect:

- Guards, access doors, and covers are in place and secure.
- The equipment has been wired and grounded in accordance with all applicable codes.
- An approved lockout-tagout procedure has been followed before the equipment is inspected, disassembled, and/or serviced. The equipment is automatically controlled and may start without warning unless energy supplies are properly disconnected and locked out/tagged out.
- The control panel enclosure is closed and secured except as is necessary for service or adjustment.
- The service door is closed and secured. Do not enter filter while the system exhaust fan is operating. The airflow can pull service door closed and trap personnel inside.
- A confined space permit, if required by authorities has jurisdiction, as been obtained prior to personnel entering the unit. Check with your company's safety director for special instructions, testing prior to entry, etc. that may be required by the specific application.

RESPONSIBILITY – It is the owner's responsibility to maintain the safety features included with this equipment. The safety features may include, but not necessarily be limited to: guards, access doors and covers, explosions vents, warning decals, cautions decals, and advisory decals. Replacement safety features are available from the following:

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OPERATION PRINCIPLE

A. Solids laden air or gases enter the unit at the hopper or housing inlet.

B. Air passes through the filter media.

C. Solids are retained on the filter media surface.

D. Cleaning consists of a rotating pulse arm with nozzles positioned over the bags that randomly pulses 7-8" PSI air into the bags that reverses the airflow.

   1. This momentarily takes a row of bags off stream through pressure reversal.

   2. Flexing filter bags.

   3. Solids are released to fall towards hopper and through rotary valve or other discharge equipment.

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CAMCORP HVP (High Volume Pulse) Cleaning Mechanism Components

Item	Quantity	Description
1A	1	Pulse Arm (Size Determined by Model)
1B	1	Pulse Arm (Size Determined by Model)
2	1	8” OD Rotary Spool Section
3	1	8” OD Arm Rotation Support
4	1	8” Diaphragm Valve
5	1	Solenoid Valve – NEMA 4 or NEMA 9
6	1	Tank Assembly (Size Determined by Model)
7	1	2” Weighted Relief Valve
8	1	Solid State Timer
9	1	PD Pump Discharge Silencer (Size Determined by Model)
10	1	PD Pump (Size Determined by Model)
11	1	Inlet Filter (Size Determined by Model)
12	1	Motor, TEFC, 1800 RPM, 208-230/460/3/60 (Size Determined by Model)
13	1	0-15” PSI Pressure Gauge
14	2	Drive Mount Table Support Channel
15	1	50TTA2635 x 1” Sprocket & TTA35BS z 1” Torque Limiter Clutch
16	1	50A58 Drive Sprocket
17	1	Roller Chain Tensioner
18	1	206 Gearbox Drive Shaft
19	1	Motor, ½ HP, TEFC, 1800 RPM, 56C, 208-230-460/3/60
20	1	Primary Gear Reducer, 133Q56R20, 20:1 Ratio
21	1	Secondary Gear Reducer, 206Q56L40, 40:1 Ratio
22	1	Bracket Kit, 206S-BK (Secondary Reducer)
23	1	Drive Mount Support Table
24	1	4-Bolt Flange Thrust Bearing, 1 ½”
25	1	Bearing Mounting Plate

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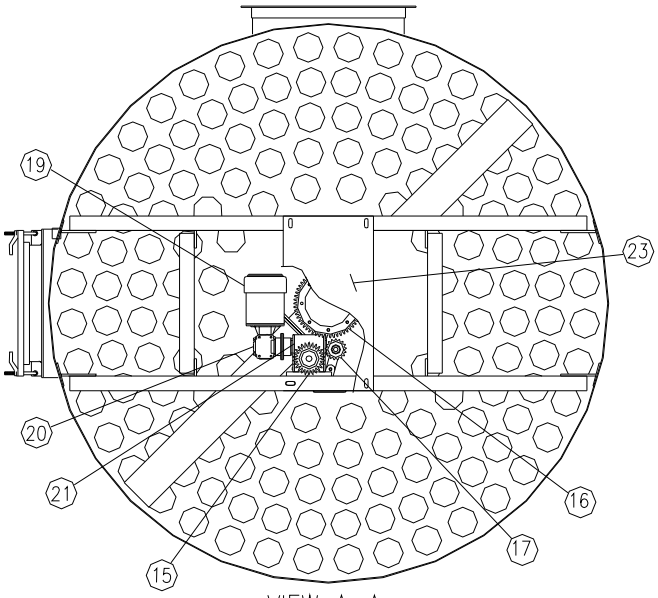
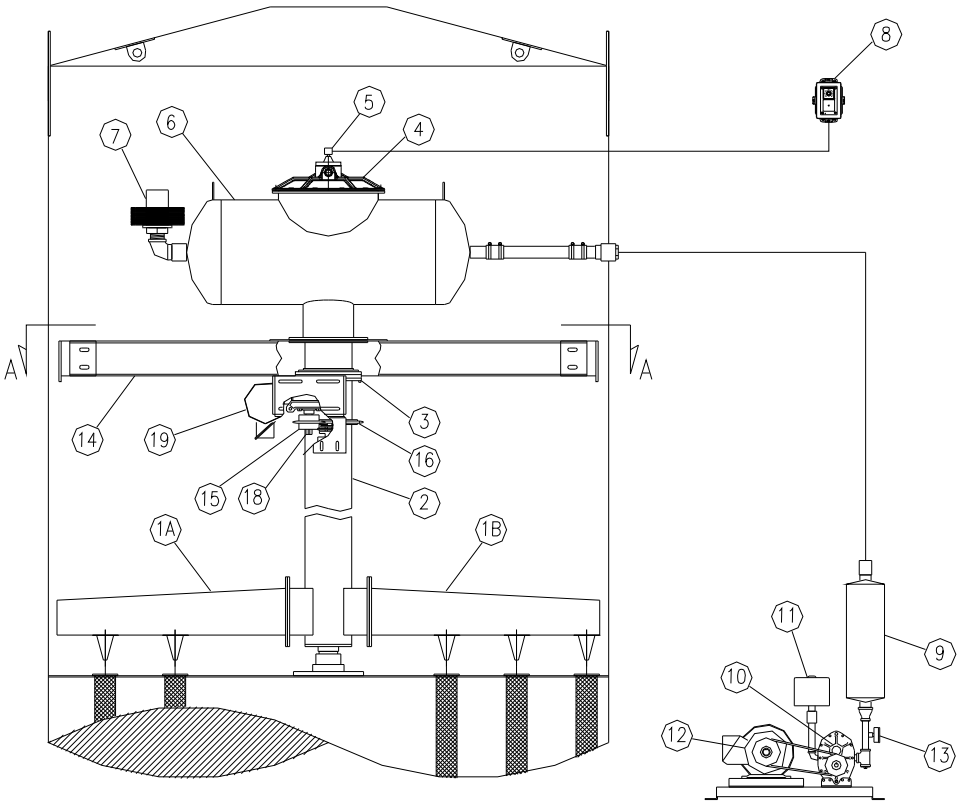


VIEW A–A



TYPICAL HVP CLEANING MECHANISM
WITH PULSE ARM & PD PUMP PACKAGE

PD (POSITIVE DISPLACEMENT) PUMP
** SHOWN WITHOUT GUARD **

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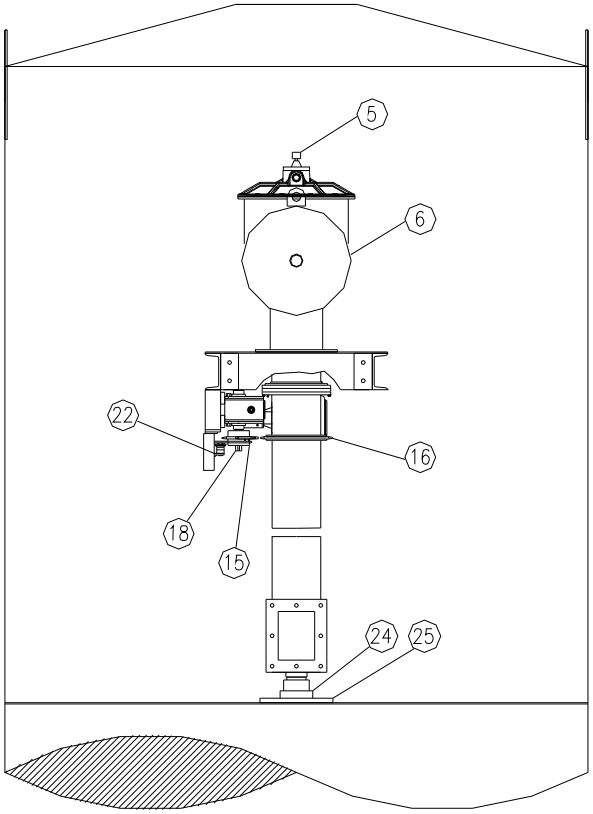

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ON SITE STORAGE RECOMMENDATIONS

I. Baghouse and Housing

1. Housing can be stored outside.
2. Equipment must be blocked up to keep the flanges out of the dirt.
3. Many units are supplied with a plain finish bare steel interior. If storage of more than two week is anticipated, the interior should be prime coated before storage.
4. Covering the unit with a tarp is recommended to keep the interior from rusting or corroding as well as keeping the finish in new condition. However, the tarp is not absolutely necessary.

II. Bags & Cages

1. Bags must be stored inside a cool dry area protected from rodents and insects.
2. For extended storage the boxes for the bags should be wrapped with plastic wrap or stretch wrap to protect from moisture.
3. If the bags get wet for any reason, immediately lay them out with adequate ventilation to dry in order to prevent mold and mildew.
4. It is recommended to store the cages inside a dry area if at all possible.
5. If an inside location is not available, cages can be stored outside as long as they are covered by a tarp.
6. Cages are generally stored horizontally on pallets to keep off the ground.
7. If cages can be stored horizontally, do not stack over three boxes high.
8. If the job site is in an area that may receive a significant snow load, the cages must be stored vertically in order to prevent being crushed by the weight of the snow. Do not stack more than one box high.

III. Accessory Parts

1. This includes all gauges, bag clamps, nylon or copper tubing, gaskets, and other ports not specifically called out.
2. These items should be stored inside a cool dry place protected from insects and rodents.

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ON SITE STORAGE RECOMMENDATIONS (continued)

IV. Fan and Fan Accessories

1. Fans can be stored outside on a pallet or skid to keep out of water and dirt.
2. Equipment should be covered with a tarp to protect from the bags.
3. Fan silencers, outlet dampers, and inlet boxes should also be tarped and stored on a pallet or skid.

V. Ducting

1. Ducting can be stored outside on a pallet or skid to keep it off the ground. It should be positioned so that water does not sit in the equipment.
2. If ducting is unpainted steel, it should be at least primed coated before storage.
3. If ducting is already finish coated, it should be tarped to protect the finish but is not absolutely necessary.

VI. Knife Gate

1. All limit switches, solenoids, and air cylinder ports must be capped and taped to prevent any moisture or dirt from entering.
2. Equipment can sit outside provided it is covered with a tarp and is on a pallet or skid to keep it out of the water and dirt.

VII. Isolation Dampers

1. All limit switches, solenoids, and air cylinder ports must be capped and taped to prevent any moisture or dirt from entering.
2. Equipment can sit outside provided it is covered with a tarp and is on a pallet or skid to keep it out of the water and dirt.

VIII. Rotary Valve

1. Rotor and interior of valve should be well oiled with vegetable oil to prevent rust and to maintain compatibility with product.

2. Unit can be stored outside provided it is covered with a tarp and is on a pallet or skid to keep it out of the water and dirt.

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ON SITE STORAGE RECOMMENDATIONS (continued)

IX. Butterfly (Wafer Valve)

1. All limit switches, solenoids, and air cylinder ports must be capped and taped to prevent any moisture or dirt from entering.
2. Unit can be stored outside provided it is covered with a tarp and is on a pallet or skid to keep it out of the water and dirt and sunlight.

X. Level Indicators

- ❖ Store these items inside a cool dry area protected from rodents

XI. AC Inverters

- ❖ Store these items and all other electrical controls inside a cool dry area protected from rodents.

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SETTING UP YOUR UNIT

CAMCORP dust collectors are shipped in various states of assembly depending on the size and configuration of the unit. Before attempting to move the dust collector or any of its sections, review both the certified general assembly drawing supplied with your unit and the rigging and lifting guidelines included in this manual. Become familiar with the size and number of sections to be assembled, the orientation of inlet(s), outlet(s), access door(s), and fan as well as the number and location of lifting lugs.

Dust collectors of this type are manufactured from steel sheets and are quite flexible. Therefore, even though care has been taken to maintain dimensional accuracy and squareness, some difficulty should be anticipated, and temporary bracing in the field may be required.

Rigging and Lifting Guidelines

1. Do not lift the dust collector by any attachments other than the lifting lugs provided.

2. Use all of the lifting lugs provided on the dust collector, or a section of the dust collector, when making a lift.

3. If the lifting lugs are located below the roof line of the dust collector or below the top of the section of the dust collector, a vertical pull must be made to avoid crushing the top of the unit. Use spreader beams to accomplish this vertical pull.

4. Attach tag lines at several locations to be able to control the unit when lifted and to prevent spinning or swinging.

5. The dust collector should be lifted and lowered at a slow, uniform rate and not allowed to bounce or joggle since this can cause excessive impact stresses at the lift points.

Doors and Flanges: Hold-downs on doors should only be hand tightened. Excessive pressure can distort the door panel itself resulting in leakage. All bolts on flanges should be tight. All holes in the dust collector must be plugged prior to start-up if not being connected.

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Platform Installation: The platform, ladder, handrail, and bracing are to be installed as shown on the special platform detail provided. Use the part ID's to locate the parts in the proper location.

Explosion Vents (where applicable):

1. Figure 6 – The explosion vents are attached with a minimum of standard steel fasteners for shipment. **THESE MUST BE REMOVED** and the PVC Bolts installed that are included in the shipment. Extreme care should be exercised when installing the PVC Bolts as they are very fragile. A gasket is factory installed that will provide a seal between the vent panel and the frame. DO NOT use silicone sealer or any other sealer or adhesive at this joint as this will prevent the vent from operating properly.

2. The area around the vents should be clear of any personnel or obstructions to prevent injury or damage**.**

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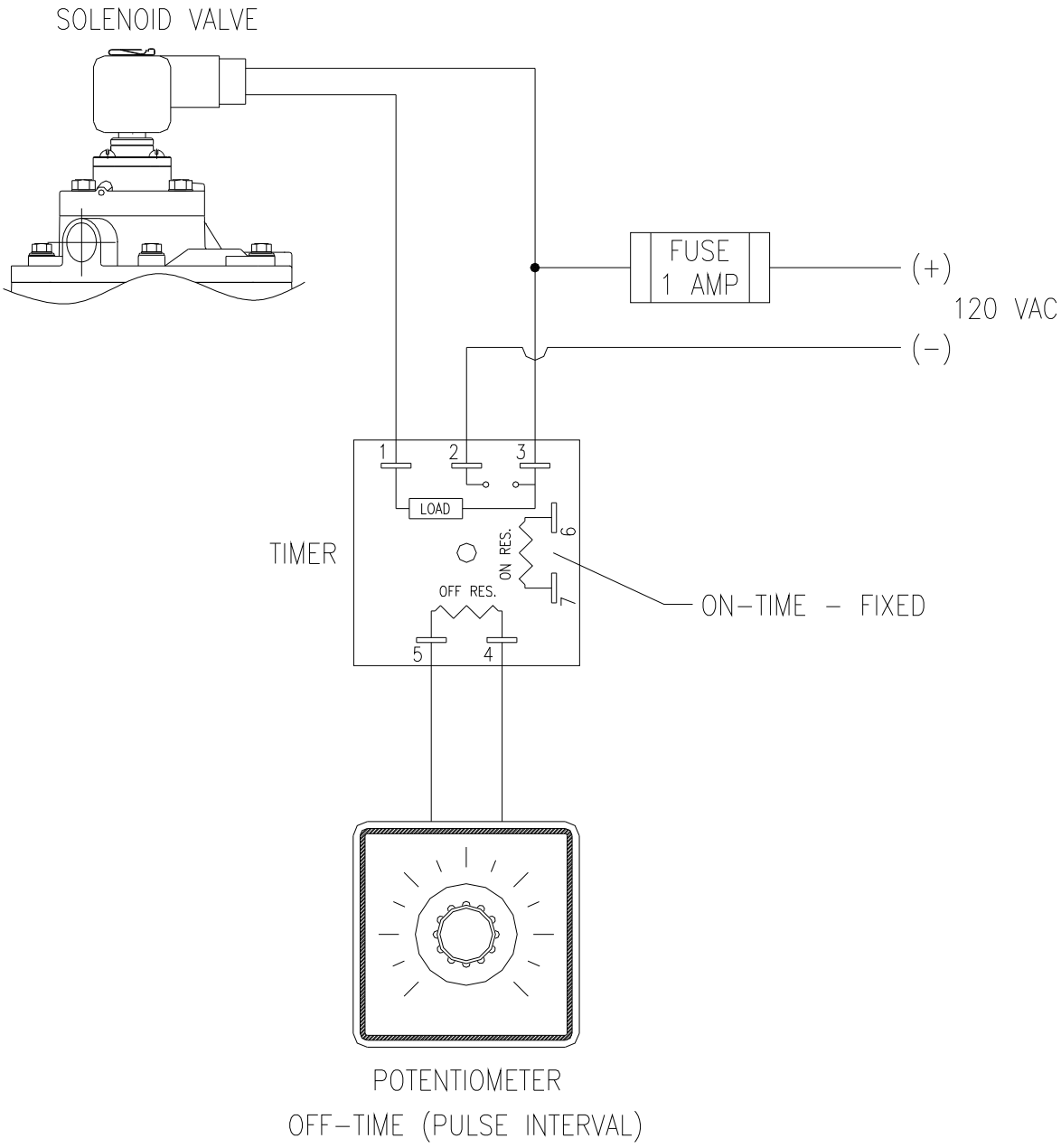
Electrical: A 120-volt, 60-Hertz, 1-Amp circuit is required to operate the dust collector's Solid State Timer. A 230/460V 3-phase circuit is required to run the Pulse Arm drive motor and the Cleaning Air PD (Positive Displacement) pump motor. **Note:** The Adjustable Timer needs to be mounting were the Pressure Gauge on the PD Pump is visible.



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Gauges: Check the pressure differential gauge to make sure that the high-pressure tap is connected below the tube sheet and the low-pressure tap is connected above the tube sheet. Verify that the gauge have been zeroed prior to connection when it is in its permanent mounting position.

Cleaning Air PD Pump: The PD Pump must be install at the base of the filter to accommodate installation of the Air Supply line. Securely anchor in permanent location. Required line size as follows:

Air Supply	
Model:	Pipe Diameter
HVP48 thru 112	1”
HVP 152 thru 256	1-1/2”
HVP 312 thru 504	2”

Auxiliary Equipment: All auxiliary equipment must be installed according to its manufacturer’s specifications and interlocked with the entire system as needed. Direction of rotation of each item must be checked prior to start-up of the entire system.

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TOP LOAD BAG AND CAGE INSTALLATION

1. Inspect the cage for any signs of damage, warping, bent wires, or missing welds.

2. Inspect the filter bag for any signs of mold, mildew, ripped seams, or holes.

3. Lower the closed end of the bag through the hole in the tube sheet.

4. With your hands, "kidney shape" the snap band bag top in order to fit and align it within the tube sheet hole.

5. Fit the groove of the snap band to the I.D. of the tube sheet hole and allow it to expand and audibly snap into place. If the band will not snap into place initially, do **not** push on the "dimple" as doing this will permanently damage the snap band. Instead, kidney shape the snap band from the opposite side of the band. Then you can allow the band to expand and audibly snap into place.

6. Check the fit of the snap band to the tube sheet. It should be even in height above the tube sheet around the entire circumference, which will confirm to the installer that the tube sheet is centered and well secured into the middle groove of the snap band.

7. Lower the cage into the bag and press that cage top down into the bag's snap band I.D. When in position, the rolled flange of the cage top will rest on the tube sheet and the bag and cage assembly will be rigidly mated. The O.D. of the cage top provides a compression fit to the I.D. of the snap band.

8. Disconnect the drive chain to allow the pulse arm to rotate freely to access the holes under the arm if necessary.

9. Replace access doors and tighten accordingly. You are ready to begin start-up procedures if all other preceding tasks and hook-ups are completed.

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START-UP CHECKLIST

1. Installation

   Make sure the unit is secured to grade. The ladder(s) and platform(s) must be tightened and set up according to OSHA requirements. Ducting and piping must be secured and routed out of the way of traffic whenever possible to avoid injury. Ducting must also be free of all debris including moisture.

2. Interior of the dirty air plenum

   A. Make sure that the filter bag assemblies hang straight and the bottoms do **not** touch each other or any part of the collector interior. If this occurs, the bags will have holes worn in them wherever they contact and will require replacement.

   B. High-level alarms should be connected sufficiently below the air inlet(s) to avoid a plugged up inlet or blinded off filter bags.

3. Clean air plenum

   A. Properly install weights onto Weight Relief valve the end of the tank assembly.

   B. All bolts on the flanges must be in place and properly tighten.

   C. Verify that the pulse arm drive is properly installed.

   D. Note: Gear Reducers are shipped without oil. Reference attached Manual for proper level.

4. Positive Displacement Pump

   A. All supply air lines must be clean internally before connecting to blower.

   B. Verify Inlet filter is properly installed.

   C. Verify V-belt alignment and tension.

   D. Note: PD pump is shipped without oil. Reference attached Manual for proper level.

   E. Verify proper rotation.

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5. Exterior of dust collector

   A. Access doors, inspection ports, and relief vents should seat effectively to prevent leakage.

   B. All bolts must be properly tightened.

   C. Operate any equipment connected to the dust discharge of the dust collector. Check the rotation of any motor driven equipment such as rotary airlocks, horizontal unloading valves, live bottom bin activators, and screw conveyors. Check slide gates and butterfly valves for binding.

6. Explosion relief panels – shear bolt style (where applicable)

   A. Inspect for broken or missing bolts.

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START-UP DUST CONTROL SYSTEMS

1. Fan or blower system

   A. Start the fan or blower and check rotation.

   B. Check dust pickup points for proper suction; balance airflow in individual ducts.

   C. Check for air leakage at all flanged connections.

2. Equipment start-up sequence

   A. Start the pulse arm drive motor (direction of rotation is not critical).

   B. Start the PD pump motor and check rotation.

   C. Adjust timer Off-time by watching pressure gauge on PD pump. The pressure in the tank should peak between 7-8 PSI. Increase or Decrease time to obtain the correct pressure. Note: Verify the Weighted relief valve in the clean air plenum is not activating – decrease Off-time if it is bleeding air.

   D. Dust take away equipment such as rotary airlocks, screw conveyors, horizontal unloading valves, live bottom bin activators, and pneumatic conveying systems can now be started in their correct sequence.

   E. Check that all access doors, hatches, ports, and other openings are closed and latched or bolted.

   F. The main exhaust fan can now be started and brought up to speed.

   G. Start the dust laden air through the collector. The collector should be started under partial load to allow the bags to become slowly and evenly coated with dust particles.

      On pneumatic conveying systems, watch the differential pressure gauge closely for the first hour or so. If unstable, the collector discharge system may be too small for the volume it is seeing. A quick fix is to reduce the material feed until the discharge rate can be increased.

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H. Observe the manometer or magnahelic differential pressure gauge reading. As the new filter bags become coated with dust, the efficiency of the filtering action increases, and the differential pressure across the filter bags will also increase. Slowly bring the collector to full load and note the final pressure drop across the filter bags. Never allow the pressure drop across the filter bags to exceed 17" w.g. maximum or filter bags may collapse.

I. Check the main airflow with a Pitot tube, or equivalent measuring device, to establish initial conditions. If the main airflow must be adjusted up or down to suit the process, repeat step 2-H above.

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SHUT-DOWN PROCEDURES

1. Dust control systems

   Reverse start-up procedure, shut down fan, then after 5 or 10 minute delay, shut down the PD pump and pulse arm drive motor.

2. Pneumatic systems

   Reverse start-up procedure, shut down fan, then after 5 or 10 minute delay, shut down the reverse air fan and sweep arm drive motor.

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TROUBLESHOOTING THE DUST COLLECTOR

I. Excessive pressure drop across filter bags

The differential pressure gauge or manometer on your dust collector should read 6" w.g. or less. Higher readings and/or steadily increasing readings are an indication that the main airflow through the dust collector may be restricted, and a potential process problem such as poor suction at duct pickup points may exist. In extreme cases (over 17" w.g.) filter bags will be damaged. Check the following:

A. Pressure Gauge

Check the differential pressure gauge or manometer and the tubing leading to the dust collector for proper operation. Disconnect the lines at the gauge or manometer and clear with compressed air. Look for loose fittings, cracked, broken, or pinched tubing. Make sure the gauge is zeroed or that the manometer is level, zeroed and contains the correct fluid.

B. Bags Loaded with Dust

If the cleaning system is not operating properly refer to the section titled "Troubleshooting the Cleaning System".

A condition known as blinding. If the dust is dry, see paragraph 1-4; if the dust is wet, see paragraphs 5 and 6.

1. Dust Not Discharging from the Hopper

Check hopper for over-loading or bridging across the dust discharge. Correct by repairing dust discharge equipment, replacing with higher capacity equipment, or installing hopper vibrators, etc. as required to keep the hopper clear.

2. Air Flow too High

If the main airflow is too high to allow dust to drop off of the filter bags, an excessive pressure drop across the dust collector will result and dust will build up in the system. In many cases this high pressure drop in turn leads to a reduction in the main air flow so that it is necessary to remove the dust accumulation from the filter bags (and the rest of the system) before measuring the main air flow volume.

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TROUBLESHOOTING THE DUST COLLECTOR (continued)

Visually inspect the bags for heavy caking; if caking is evident, see the note below and take the necessary action to clean the bags. Next, measure the main airflow with a pitot tube or equivalent devise and compare with the original volume for which the unit was designed. If the flow is too high, cut back the main fan to prevent a recurrence of the problem.

3. Particle Size and Dust Load

   If possible, compare the dust particle size and loading with the original design specifications. Finer dust may cause a higher pressure drop. Do not hesitate to call the factory; we have experience with many kinds of dust.

4. Bags Too Tight

   Bags that have shrunk on their cages may not flex sufficiently during the compressed air pulse to loosen caked dust. If the bags were cleaned or laundered, pull a bag tight around its cage; you should be able to "gather" a small fold of material between your fingers.

5. Water Leaks

   Inspect the dust collector housing and ductwork for holes, cracks, or loose gasketing where water could enter the collector.

6. Condensation

   If moisture has been condensing inside the collector, check the dew point temperature of the incoming air stream. If may be necessary to insulate the collector and/or the ductwork leading to the collector to keep surface temperatures above the dew point and prevent condensation of the filter bags.

   NOTE: Collectors that have had blinded or caked bags can possible be put into service by running the pulsing air system for 15 to 30 minutes without the main fan or blower. If the pressure drop is not lower when the main fan is started again, take the bags out of the collector and remove the caked dust by special dry-cleaning. Information pertaining to filter bag cleaning may be obtained by calling your CAMCORP sales representative.

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TROUBLESHOOTING THE DUST COLLECTOR (continued)

II. Extremely Low Pressure Drop

A. Pressure Gauge

Check the differential pressure gauge or manometer and the tubing leading to the dust collector as in I-A of this section.

B. Holes in Filter Bags or Bags Incorrectly Installed.

Inspect the filter bags for holes, rips, tears, or excessive wear. Make sure that the filter bags were installed correctly according to the "Bag & Cage Installation" section.

C. Ductwork and Dampers

Inspect the ductwork to and from the dust collector for air leaks or blockage. Make sure that any dampers in the system are correctly positioned to allow air to flow through the dust collector.

D. Leaks in the Housing

Check the tube sheets (flat steel sheets from which the filter bags are suspended) and the dust collector housing for holes, cracks or loose gasketing that would permit air to bypass the dust collector or filter bags.

III. Continuous Flow of Dust in the Clean Air Exhaust (Primary Dusting)

A. Holes in the Filter Bags or Bags Incorrectly Installed

Inspect the filter bags as in II-B this section.

B. Holes in the Tube Sheets

Check the tube sheets for holes, cracks, or loose bolts that would permit dusty air to bypass the filter bags.

IV. Puff of dust in the clean air exhaust after each pulse (secondary dusting)

A. Worn filter bags

Inspect the filter bags for wear. Thin bags may not stop fine dust when flexed by a compressed air pulse.

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TROUBLESHOOTING THE DUST COLLECTOR (continued)

B. Residual Dust

If dust has gotten into the clean air plenum because of a dropped or torn bag, hole in tube sheet, etc., the pulse air may stir up the dust and allow it to escape into the clean air exhaust. Residual dust may also be driven down inside the filter bags by the pulse air; if the filter bags are filled with several inches of dust, clean both the clean air plenum and the filter bags to avoid further problems.

V. Short Filter Bag Life

This is often a complicated problem to diagnose and we recommend calling the factory for advice. The following list may be helpful in performing some preliminary check:

A. Temperature

Operating Temperature above the recommended limit of the filter bag material.

B. Chemical Attack

Bag material degrades due to attack from certain chemicals in the dust or gasses in the air stream.

C. High Moisture

High moisture content in the collector may cause certain filter bag material to shrink or degrade (more rapidly at elevated temperatures).

D. Localized abrasion

Abrasion of the bags at the dusty air inlet; a dust impingement baffle may be required.

E. Internal Bag Supports Gone Bad

Corroded, rusted or broken filter cages can cause excessive bag wear. Stainless steel or coated cages are available.

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TROUBLESHOOTING THE CLEANING MECHANISM

1. Diaphragm Valve – Pulsing Failure. The Diaphragm assembly consists of (3) components. The main diaphragm valve, the secondary diaphragm valve, and the solenoid valve. Troubleshooting recommendations as follows:

   A. Main Diaphragm and Secondary Diaphragm:

      1. Diaphragm Valve Bleeding Air – Disassemble and inspect both diaphragms for ruptured valves or air bleed holes are restricted. (Reference attached manual) Replace with a repair kit if necessary.

      2. Verify Positive Displacement Pump is operating correctly and producing compressed air.

      3. Verify weighted relief valve is weighted correctly allowing tank to build 7-8 PSI pressure.

   B. Solenoid Valve:

      1. Open or short circuit in wiring between timer and solenoid – Check continuity with ohmmeter or suitable tester and repair as required.

      2. Plastic plug in solenoid exhaust port - Remove and discard plug.

2. Timer – Not Operating

   A. Check for mechanical damage.

   B. Check the wiring from the timer to the solenoids for open or short circuits.

   C. Replace Timer.

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3. Positive Displacement (PD) Pump - Following is a list of possible Symptoms and Troubleshooting Solutions.

Symptom	Possible Causes	Possible Sources
Noisiness	Rotor-to-Rotor Contact	Rust Build up or Rotors Rotors Out of Time Excessive Pressure Ratio Failed Bearings (s) Failed Gears
	Failing Bearing (s)	Faulty Installation Non-spec Oil Contaminated Oil Insufficient Oil Improperly Mounted Sheave Over-tightened Belts
	Failing Gears	Insufficient Backlash Non-spec Oil Contaminated Oil Insufficient Oil Sever Torsional Vibration
	Failing Lubricated Coupling or Joint	Non-spec Grease Contaminated Grease Insufficient Grease
	Loose Attached Hardware	Belt Guard Pump Mounting Bracket Frame Members In/Out Piping Supports
	Air Leakage	Improper Relief Valve Setting Blown Gaskets Loose Piping Joints
	Belt Flutter	Insufficient Static Tension Sheave Misalignment Sever Torsional Vibration

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Symptom	Possible Causes	Possible Sources
Poor Performance	Restricted Inlet	Clogged Filter Element Collapsed Inlet Hose
	Erroneous Pressure	Loose Gauge Connection Gauge Movement Damaged Gauge Inaccurately Calibrated
	Air Leakage	Improper Relief Valve Setting Blown Gaskets Loose Piping Joints
	Insufficient Rotor Speed	Wrong Sheave Set Wrong Motor Speed Slipping Belts
	Excessive Rotor Clearances	Abrasive Wear of Rotor Surfaces Rotor "Lag" Timed
Leaking Oil	Failed Oil Seals	Foreign Material in Seal Bores Faulty Installation Non-spec Oil Contaminated Oil Overheated Rotor Shafts
	End Cover Seams Not Tight	Bolts Loose Gaskets Torn
	Oil Foaming	Non-spec Oil Oil Cavities Overfilled
Chronic Fuse Blowing or Circuit Breaking	Excessive Motor Amperage	Excessive Pump Speed Line Voltage Drop Air Density Increase Loose Electrical Connections Foreign Material in Air Box
	Underrated Fuses	
	Premature Heater Strip Actuation	Unusually High Ambient Temperature Underrated Heater Strips

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Symptom	Possible Causes	Possible Sources
Overheating	Excessive Pressure Ratio	Clogged Filter Element Collapsed Inlet Hose Clogged Dust Vent Filter Undersized Dust Vent Filter Clogged Diffusion Pads
	Insufficient Rotor Speed	Wrong Sheave Set Wrong Motor Speed Slipping Belts

4. Pulse Arm Drive – Motor not rotating.

   A. Remove the motor from the gear drive and check for proper operation. If the motor does not rotate, repair or replace.

   B. If the motor does rotate properly check for binding or roughness in the gear drive. Repair or replace one or both gear boxes as necessary.

5. Pulse Arm Drive – Motor rotating and sweep arm not rotating or rotating intermittently.

   A. Enter the clean air plenum and check for obstructions in the path of the rotating pulse arm. Remove any obstructions

   B. Verify that the pulse arm is rotating parallel to the tubesheet and that the nozzles do not strike the cage tops and cause the sweep arm to stop. If this is not the case call the factory.

   C. Verify that the torque-limiting clutch on the small sprocket is slipping.

   D. Verify that the chain is not binding. If it is then check the sprocket alignment.

   E. Disconnect the drive chain. The pulse arm should rotate freely and with no binding or roughness. If binding is experienced grease the rotary union. If the binding or roughness continues inspect the bearing and replace if necessary.

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SAFETY RECOMMENDATIONS

Because this unit may be under pressure, do not attempt to open any device doors or panels while fans or blowers are running.

If your unit is equipped with a discharge auger or an airlock, be sure chain guards are installed before start-up and servicing is attempted only after electrical power is locked out.

While servicing the filter, it is very important that there are no open flames, welding or grinding sparks. Dust laden air could be highly explosive and extreme care must be taken.

Before entering any dust collector:

1. Run cleaning mechanism 20 minutes with the fan off to clean filter bags.
2. Discharge solids from hopper.
3. Lock out electrical power on all rotating equipment.
4. On toxic operation, purge collector housing and install a blank in the inlet duct.
5. Install catwalks and safety cables.
6. Secure access doors in an open position or remove doors.
7. Use buddy system.
8. Wear a respirator.
9. Use common sense.

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ROUTINE MAINTENANCE

A. Inspection

Frequency will vary as widely as there are operating conditions. In general proceed as follows:

1. Daily – Check unit differential pressure.

2. Weekly – Verify that the pulse arm drive and PD Pump are operating properly.

3. Monthly – Lubricate fan, rotary valve and screw conveyor. Check seals on latter two for dust loss.

4. Quarterly – On Top Access Units, check for dust accumulation in clean air plenum.

B. Repairs

1. Filter bags – Generally replacement, although some applications can be laundered.

2. Rotary Valves – Usually a matter of periodic seal and blade replacement. More detailed information is supplied with the valve.

3. Screw Conveyors – Periodic replacement of "V" belts and shaft seals. Inspect hanger bearings during filter bag change. Failure will be detected by the squeal.

4. PD Pump – "V" belt tension if running rough. Make sure rotor balance is maintained.

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COMPONENT IOM MANUALS

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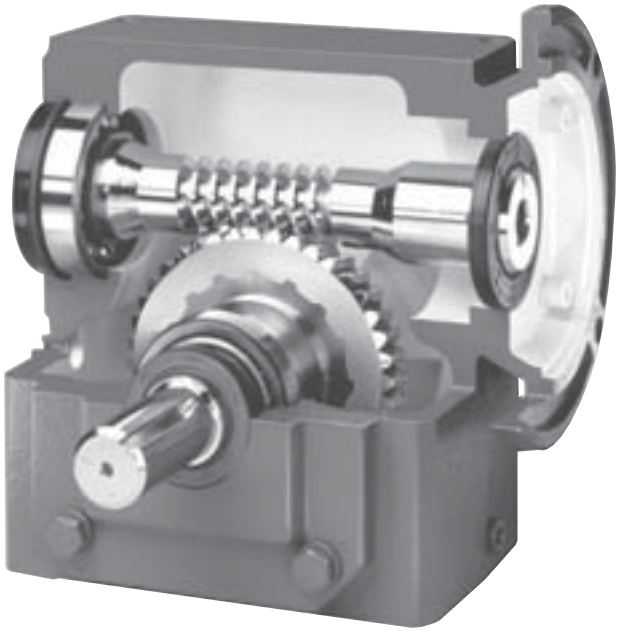
F O R M
8721
March 2003

MAINTENANCE INSTRUCTIONS FOR WORM GEAR SPEED REDUCERS



Center Distances

1.33, 1.54, 1.75, 2.06, 2.37, 2.62, 3.00, 3.25
3.75, 4.50, 5.16 and 6.00

EMERSON POWER TRANSMISSION ™

EMERSON™ Industrial Automation

INTRODUCTION

The following instructions apply to RAIDER® Worm Gear Speed Reducers. When ordering parts or requesting information be sure to provide all the data stamped on the reducer nameplate.

EQUIPMENT REQUIRED

In addition to standard Mechanic's tools, the following equipment is required: arbor press, wheel puller, torque wrench, dial indicator, seal driver, bluing, adhesive sealant, snap ring pliers for internal and external rings.

GENERAL INSTRUCTIONS

Housings - Clean external surfaces of reducer before removing seal cages and end covers to prevent dirt from falling into the unit. Record mounting dimensions of accessories for reference when reassembling. If it is necessary to remove the reducer from its operating area, disconnect all connected equipment and lift reducer from its foundation.

Seals - Replacement of all seals is recommended when a unit is disassembled. However, if seals are not to be replaced, protect seal lips by wrapping shaft with plastic tape coated with oil or grease before removing or replacing seal cage assembly. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

⚠CAUTION If the reducer is painted, extreme care should be taken to mask the shaft extensions and rubber surface of the seals. Paint on the shaft adjacent to the seal or on the seal lip will cause oil leakage.

CAPSCREW TIGHTENING TORQUES

Capscrew Size	Torque (Ft. Lbs)
1/4 - 20	6.25
5/16 - 18	13
3/8 - 16	20
7/16 - 14	35
1/2 - 13	50
5/8 - 11	90

Table 1

TO CHANGE OUTPUT SHAFT DIRECTION

To change the hand of a unit from left hand to right hand, or vice versa, the following instructions apply:

1. Remove drain plug and drain oil from unit.
2. Remove end cover and seal cage capscrews; then while supporting output shaft remove end cover and shims from the unit. (The shims may be between the seal cage/end cover and housing, or between the bearing outer race and seal cage/end cover - do not remove the bearing race unless it is to be replaced).
3. Remove output shaft and seal cage together from extension side.

   NOTE: Keep all shims with their respective seal cage and end cover.
4. Reassemble unit per instructions later in this manual.

UNIT DISASSEMBLY

1. Remove **drain plug** and drain oil from unit.
2. **Low speed shaft** (gear shaft) removal:
   A. Remove end cover and seal cage capscrews.
   B. With a firm hold on the output extension remove end cover and shims (The shims may be between the seal cage/end cover and housing, or between the bearing outer race and seal cage/end cover - do not remove the bearing race unless it is to be replaced).
   C. Carefully slide output shaft assembly and seal cage out extension side.
   D. Slide seal cage off low speed shaft using caution to prevent damage to seal lips.
   E. Wire or tie the shims to their mating end cover and seal cages. (This only applied if the shims are between the seal cage/end cover and housing). They will be available for reference when assembling the unit. Some units are factory assembled with internal shims so this note may not apply.

⚠WARNING Disconnect all before adjusting units

3. High speed shaft (worm shaft) removal:

C-Flange units ***1.33 C.D. through 3.25 C.D.:***

Use a small chisel to make a groove in the stamped steel cover opposite the motor flange. Pry off the cover. Remove internal snap ring from housing bore. Remove motor flange. Using a plastic hammer, gently tap on the motor end of the shaft to feed worm shaft assembly through housing and out.

3.75 C.D. through 6.00 C.D.:

Remove motor flange. Remove seal cage opposite motor face. Keep shims with seal cage for reassembly. Remove bearing nut and washers from end opposite motor. Using a plastic hammer, gently tap the shaft on the motor end. Push shaft assembly through housing until rear bearing outer race is free. Slide bearing inner-races off the shaft and remove worm through front of housing. If a press is available, pressing the shaft out is preferable.

Basic units ***1.33 C.D. through 3.25 C.D.:***

Use a small chisel to make a groove in the stamped steel cover opposite the motor flange. Pry off the cover. Remove internal snap ring from housing bore. Remove motor flange. Using a plastic hammer, gently tap on the extension end of the shaft, to feed worm shaft assembly through housing and out. On units with C.D. of 1.33, 1.54, 2.63, and 3.00, front bearing will remain in housing bore. Use soft tool and plastic hammer to tap bearing out extension end of housing from rear. Be sure to tap on outer-race of bearing. If a press is available, pressing this bearing out is preferable.

3.75 C.D. through 6.00 C.D.:

Remove front and rear seal cages. Keep shims with seal cages for reassembly. Remove bearing nut and washers from end opposite extension. Using a plastic hammer, gently tap the shaft on extension end. Push shaft assembly through housing until rear bearing outer-race is free. Slide bearing inner-races off shaft. Reverse direction and push shaft through extension end of housing and out. If a press is available, pressing the shaft out is preferable.

PARTS SERVICE

1. **Housing** – Clean inside of housing with kerosene or solvent and then dry.
2. **Seal cages and end cover** – Remove dirt from joint faces, wipe clean and dry.
3. **Air vent** – Wash in kerosene, blow clean and dry.
4. **Seals** – To replace seals without dismantling reducer refer to steps C through F below. To replace seals when the entire reducer is dismantled and coupling hubs, sprockets, pulleys, pinions, keys, etc. have been removed the following instructions apply:

   Note: Replacement of all seals is recommended when a unit is disassembled. New seals will leak if the seal lips are damaged or if seal's rubbing surface on the shaft has been altered. Protect seal lips at all times. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

   A. Block up seal cages and press or drive out seal.

   B. Remove old sealing compound from seal seat in cage if it is present. If a seal with rubber coating on the outside diameter is used, no sealant is necessary. If no rubber coating is on seal outside diameter, coat seal cage bore with adhesive sealant immediately before assembly.

      To prevent possible damage to seal lips, do not reassemble seals until high speed and low speed shafts have been reassembled to the housing. Then see steps E and F below.

   C. See Figures 1 through 4 – To replace seals without dismantling reducer, proceed as follows:
      Do not damage shaft; new seals will leak if seal contacting surface is marred. Use punch and place two or more holes in steel casing of seal, Figure 1. (The steel casing may be rubber coated) Insert sheet metal screws, leaving the heads sufficiently exposed so they can be pried up or grasped with pliers, Figure 2. Do not drill holes because chips may get into the unit.

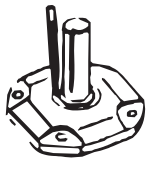


Figure 1

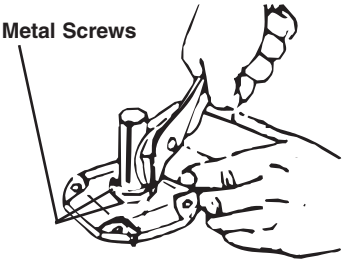


Figure 2

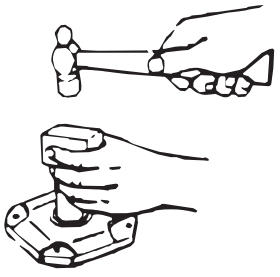


Figure 3

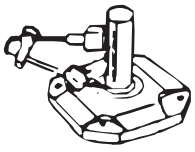


Figure 4

⚠WARNING Disconnect all power before adjusting units

D. Work seal loose. Be careful to keep all metal or dirt particles from entering unit. Remove old sealing compound from seal seat if it is present. Also remove burrs and sharp edges from shaft. Clean with rag moistened with solvent. Do not use abrasive material on shaft seal contacting surface.

E. Protect seal lips when handling; seal leakage will result if these are damaged. If a seal with rubber coating on the outside diameter (O.D.) is used, no sealant is necessary. If no rubber coating is on seal O.D., coat seal cage bore with adhesive sealant. Coat seal lips with oil and carefully work seal into position. Before sliding seal into position, protect seal lips from shaft keyway edges by wrapping shaft with plastic tape coated with oil. Position garter spring toward the inside of the unit. Place a square faced pipe or tube against the seal O.D. and drive or press seal until fully seated as shown in Figure 3. Do not strike seal directly.

F. For best performance, seat the seal square with shaft within .005" at 180°. Check with dial indicator as shown in Figure 4, Page 3, or with a straight edge and feelers, or square and feelers. To straighten a cocked seal, place tubing over the seal and tap the tube lightly at a point diametrically opposite the low point on the seal. Do Not strike seal directly.

5. **Bearings** –
   A. Wash all bearings per bearing manufacturers recommendations and then dry.
   B. Inspect bearings carefully and replace those that are worn or questionable.
      Note: Replacement of all bearings is recommended.
   C. Use a wheel puller or press to remove worm shaft bearings. Apply force to inner race only – not to cage or outer race.
   D. Use a wheel puller or press to remove taper bearing inner races.
   E. To replace tapered bearing inner races and all ball bearings, heat bearings in an oil bath or oven to maximum of 290° F (143° C). Slide high speed shaft bearings onto the oiled shaft until seated against the shoulder or snap ring of the shaft. Slide low speed shaft bearing onto the oiled shaft against the gear spacer.
   F. Thoroughly coat all bearings with lubrication oil.

6. **Worm, gear and shafts**
   A. Worm and high speed shaft – since all worms are integral with the high speed shaft, any wear or damage to the worm will necessitate replacing both.
   B. Press shaft out of bronze worm gear. To reassemble gear and low speed shaft, freeze shaft or heat gear. Do not exceed 200° F (93° C). Insert key into the shaft keyway and press shaft into oiled gear bore.
      Note: It is advisable to replace both the worm and worm gear should either of the assemblies require replacement.

UNIT REASSEMBLY

1. **Preliminary**
   A. Check to see that all worn parts have been replaced, gear and bearings coated with oil and all parts cleaned. Remove all foreign matter from unit feet. The feet must be flat and square with each other.
   B. Before starting to reassemble reducer, clean old shims or replace with new shims of equal thickness.
2. **High Speed Shaft (Worm Shaft) Assembly**

C-Flange units ***1.33 C.D. through 3.25 C.D.:***

Lubricate Bearing Bores of Housing. Press bearing onto end of worm shaft flush to shoulder (or snap ring). Lock bearing onto shaft with external snap ring. Insert shaft assembly from opposite motor end into housing until seated against shoulder in bore. Lock shaft assembly into housing bore with internal snap ring. Coat outside diameter of stamped steel end cover with adhesive sealant (except, if end cover is rubber coated DO NOT use sealant) and press into input bore opposite motor flange until flush with housing.

C-Flange units ***3.75 C.D. through 6.00 C.D.:***

Apply adhesive sealant to both housing input faces. Sub-assemble the two bearing inner-races onto rear of worm shaft and secure with lock nut and washers. Insert shaft assembly into rear bore of housing along with the first bearing outer-race. With plastic hammer gently tap end of shaft until bearing outer-race is seated against shoulder in housing bore. If a press is available, pressing the assemble in is preferable. Press the final bearing outer race in and install the rear seal cage. Adjust end play per instructions below (Item 3C). Install motor flange.

Basic units ***1.75 , 2.06, 2.37 and 3.25 C.D.:***

⚠WARNING Disconnect all power before adjusting units

Lubricate Bearing Bores of Housing. Sub-assemble the rear bearing onto worm shaft. Lock rear bearing onto shaft with external snap ring. Insert shaft assembly from opposite extension end into housing until bearing is seated against shoulder in bore. Lock shaft assembly in housing bore with internal snap ring. Coat outside diameter of stamped steel endcover with adhesive sealant (except, if end cover is rubber coated DO NOT use sealant) and press into input bore opposite extension, until flush with housing.

1.33 , 1.54, 2.62 and 3.00 C.D.:

Lubricate Bearing Bores of Housing. Sub-assemble the rear bearing onto worm shaft. Lock rear bearing onto shaft with external snap ring. Insert shaft assembly from opposite extension end into housing until bearing is seated against shoulder in bore. Lock shaft assembly in housing bore with internal snap ring. Press front bearing into extension side of housing until seated against shoulder or snap ring on the worm shaft. Coat outside diameter of stamped steel endcover with adhesive sealant (except, if end cover is rubber coated DO NOT use sealant) and press into input bore opposite extension, until flush with housing.

3.75 through 6.00 C.D.:

Apply adhesive sealant to both housing input faces. Press extension side bearing inner-race onto worm shaft. Insert worm shaft into extension side bore of housing. Hold worm shaft in place and slip bearing inner-race onto shaft until seated against shoulder. Press rear bearing outer-race into housing bore opposite extension until seal cage can be installed. Install seal cage. Adjust end play per instructions below (Item 3C).

3. **Low Speed Shaft (Gear Shaft) Assembly**
   - A. Determine output shaft direction.
   - B. Assemble low speed shaft assembly, seal cage, and end cover with shims on both seal cage and end cover. Torque capscrews to torques listed in Table 1. Rotate the input shaft to seat output bearings.
   - C. Moving the shaft back and forth by hand, check axial float with dial indicator as shown in Figure 5. Axial float must be .0005 - .003" with .0005 being the absolute minimum. Do not preload bearings. If the axial float is not as specified, add or subtract required shims under end cover or behind bearing outer race, inside the cover, depending on the unit.
   - D. Remove output shaft with seal cage and apply bluing to several teeth on the gear. Worm thread and gear teeth must be clean of oil. Reassemble output shaft and seal cage with output key facing up.
   - E. Use a rag to apply hand pressure to the output shaft and rotate the high speed shaft both directions until the gear teeth with bluing have gone through gear mesh several times. Return output shaft to original position. Remove output shaft and seal cage to inspect contact. Compare with Figure 6. If contact is not correct, move assembly in the direction shown in Figure 6 by adjusting the shims. Maintain the same total shim thickness so the bearing end play is not affected. Repeat Steps D a E until contact pattern is acceptable.
   - F. Recheck axial float with dial indicator.
   - G. When contact pattern is correct, tighten seal cage and end cover capscrews to torques listed in Table 1.

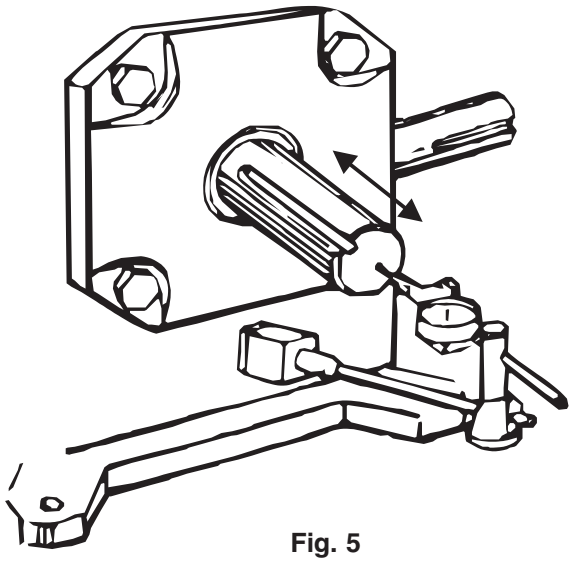


Fig. 5

⚠WARNING Disconnect all power before adjusting units

4. **Seals** - To reassemble seals to unit, see Parts Service Steps on Page 3.

5. **Motorized Coupling Adapter**

   Reassemble using the original dimensions determined under "General Instructions" on Page 2.

6. **Final Inspection**

   A. Turn the gear train by hand as a final check.

   B. Re-install reducer and accessories.

   C. Fill reducer with the recommended oil to the appropriate level. See the installation instructions supplied with the reducer.

   D. Spin test for three minutes and check for noise, leakage or rapid temperature rise.

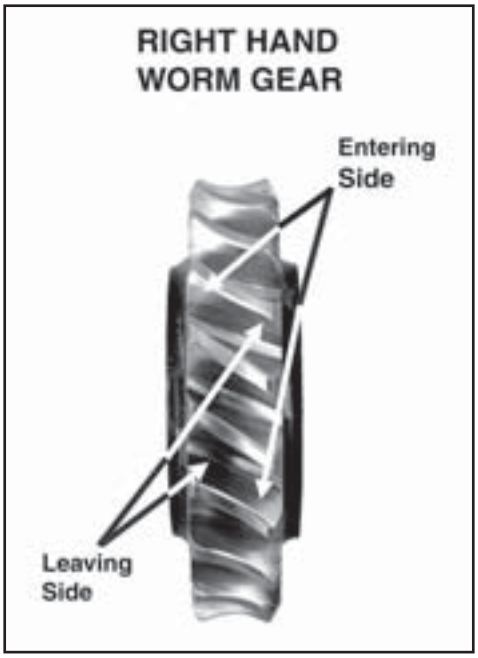


Fig. 6a: Entering and Leaving Sides

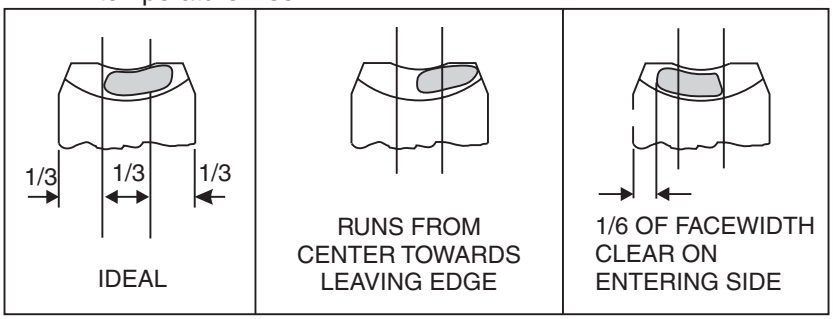


Fig. 6b: ACCEPTABLE

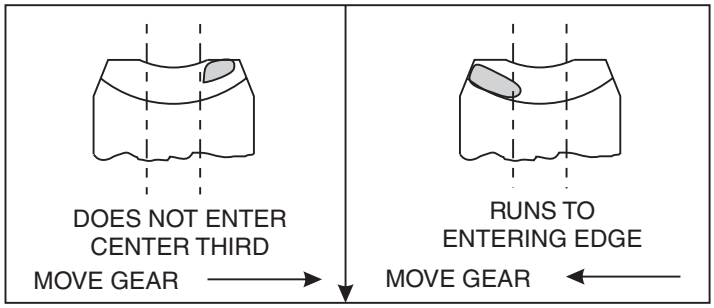


Fig. 6c: UNACCEPTABLE

PREVENTATIVE MAINTENANCE

1. After first week, check all external capscrews and plugs for tightness.

2. Periodically, check oil level when gears are at rest. Add oil if needed. Do not fill above the recommended level because leakage and overheating may result.

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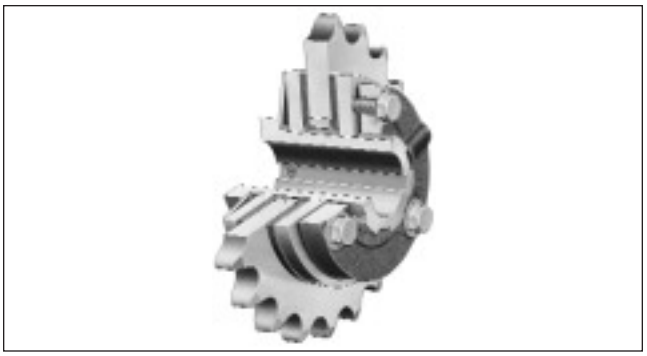
clutch offers thrifty overload protection that's easy to adjust.



Here is low cost protection for your machinery . . . a torque limiting clutch that is easy to install.

Torque-Limiter clutches feature an exclusive "Easy-Set Adjustment." With "Easy-Set," torque adjustment is accomplished quickly! The need for hammer and block, brute strength and spanner wrenches is eliminated.

These simple steps and the job is done:

1. Snug up the adjusting nut, finger tight, locate set screw over nearest spline notch and tighten. See table at right.
2. Tighten three cap screws until heads bottom — with a small wrench; this gives maximum torque.
3. For less torque — back off the cap screws, loosen the set screw, back off adjusting nut to one of the six spline notches as required, and retighten set screw and cap screws.

"Easy-Set Adjustment" not only simplifies installation, it provides solid support for pressure plates by compression at their peripheries.

The Torque-Limiter clutch gives machinery permanent protection against overloads during starting, reversing or driving — by slipping at any desired load. It resumes driving without resetting when the overload is relieved. It is simple in design, compact, efficient and built for long life. It provides low cost torque limiting service for a wide variety of applications. No lubrication . . . minimum maintenance.

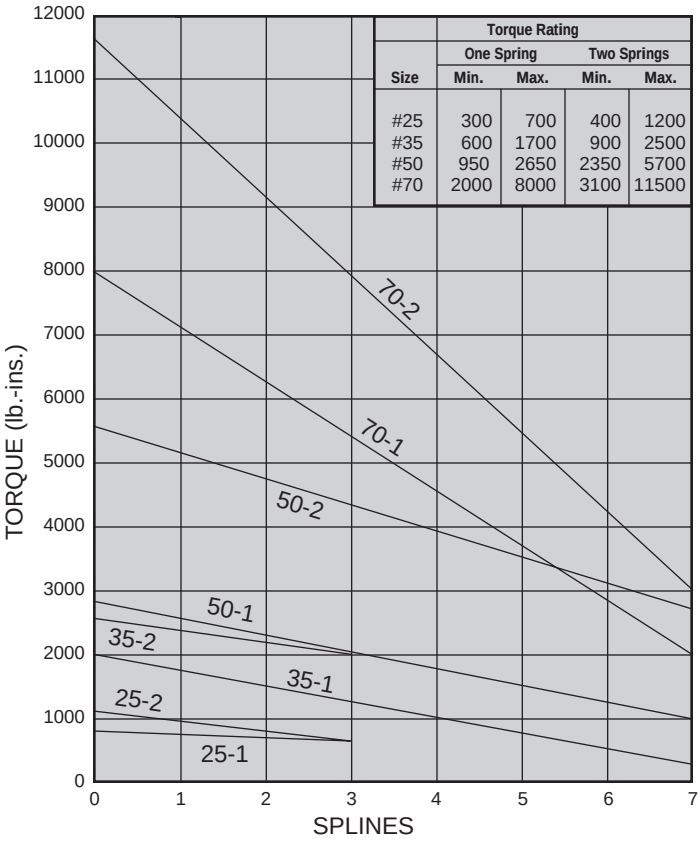
Starting shock from electric motors is a major cause of maintenance of moving parts. Torque-Limiter clutches provide a cushion by slipping until the torque drops to a pre-set level. They can be set to reduce shock loads on motors and driven equipment during reversing or inching. They provide mechanical protection against breakage due to sudden overload — by slipping when the pre-set torque limit is reached.

Torque-Limiter clutches may be used with a sprocket, gear, sheave, flange or other driven member. It is recommended that the rubbing sides of the driven member be ground to provide a smooth rubbing surface of 65 to 125 micro-inches. See torque rating table on following page.

The driven member is mounted on an oil-impregnated bushing and clamped between two, high quality friction discs by spring pressure. Each Torque-Limiter unit, completely assembled, contains one spring. Higher torque ratings can be obtained by the use of a second spring nested within the original spring. See rating table on following page.

When an overload occurs, the driven member slips between long-life, clutch-type friction discs. After slipping has started, it will continue at approximately 90% of the torque setting, due to the lower coefficient of friction when slipping, until the overload condition has been corrected.

TORQUE-LIMITER CLUTCH CALIBRATION



Size	Torque Rating			
	One Spring		Two Springs	
	Min.	Max.	Min.	Max.
#25	300	700	400	1200
#35	600	1700	900	2500
#50	950	2650	2350	5700
#70	2000	8000	3100	11500

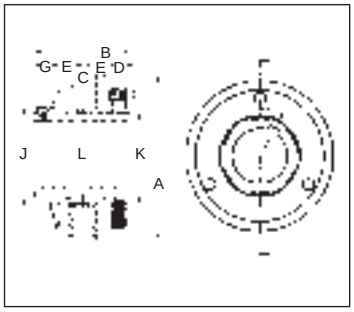
Note:
Graph indicates approximate rated torque vs number of splines adjusting nut is backed off from finger tight.

Torque-Limiter Clutches

TORQUE-LIMITER CLUTCHES

Each assembled unit contains one spring. Higher ratings can be obtained by ordering a second spring to nest in the original one. Bushings need to be ordered separately if required.

The rubbing sides of the center member should be ground parallel — 65 to 125 micro-inches.



Torque-Limiter Clutch Ratings

Size No.	Avg. Wt.	Torque Rating ▲ (Pound-Inches) With One Spring Min.	With One Spring Max.	With Two Springs** Min.	With Two Springs** Max	A	B	C Min.	C Max.	D	E	G ♦	H	J	K +.000 −.002 Spline O. D.	L +.003 −.000 Spkt. Bore
TT25	1	300	700	400	1200	2½	1¾	⅛	11/32	3/64	19/64	19/64	2½	1½	1.368	1.631/1.628
TT35	2.5	600	1700	900	2500	3½	2 1/16	⅛	⅝	5/64	23/64	3/64	3 3/16	1 15/16	1.675	2.006/2.003
TT50	6	950	2650	2350	5700	5	2⅞	⅛	⅝	5/64	29/64	2/32	4 5/16	2 13/16	2.625	3.008/3.005
TT70	18	2100	8000	3100	11500	7	3⅜	¼	1¼	5/64	31/64	29/32	6	4	3.811	4.197/4.194

▲ Using a center member with rubbing sides ground parallel — 65 to 125 micro-inches. Center member must be clean and free from oil, rust, etc.

** Second spring may be nested in one originally furnished. Order if required.

♦ Nominal for maximum torque setting. For minimum torque setting, add 3/64 for No. 25; 5/64 for No. 35; 3/32 for Nos. 50 and 70. When two springs are used this dimension is increased approximately 1/16″ on Nos. 25, 35 and 50 — 3/32″ on No. 70.

Stock Bores — Torque Limiters (No KW I-SS†)

Size No.	Stock Bore	Max. Bore Std. KW*	Max. Bore Shallow KW*
TT25	½	⅞	1
TT35	¾	1 3/16	1¼
TT50	1	1¾	2
TT70	1⅜	2¾	3

† Additional SS See List Price Alterations

* KW To Be Cut Central w/Threaded Spline

Standard Keyways

Torque-Limiter Bore	Keyway	Torque-Limiter Bore	Keyway
½-9/16	⅛ × 1/16	1 1/16-1¾	⅜ × 3/16
⅝-⅞	3/16 × 3/32	1 13/16-2¼	½ × ¼
15/16-1¼	¼ × ⅛	2 5/16-2¾	⅝ × 5/16
1 5/16-1⅜	5/16 × 5/32	3 13/16-3	¾ × ⅜

Bored to Size Torque Limiters w/Std. KW & I-SS†

Size No.	Finished Bores															
TT25	½	⅝	¾	⅞												
TT35			¾	⅞	1											
TT50					1	1⅛	1 3/16	1¼	1⅜	1 1/16	1½	1⅝				
TT70										1 1/16	1½		1¾	1 15/16	2	2 1/16

† KW Same as Std. Listed in Tables Above. Additional S.S. See List Price

Unit Size	Sprocket Pitch		Min. Allowable Sprocket Teeth and Length of Bushing Req'd for Chain Number 35	41	40	50	60	80	100	120	140	160
TT25	Min. Teeth	STK. >	25	19	19	16	..	..	..	..	..	..
		MTO ψ	25	19	19	16	..	..	..	..	..	..
	Bush. Lght. Req'd.		⅛	⅛	¼	¼	..	..	..	..	..	..
TT35	Min. Teeth	STK. >	35	25	26	21	18	15	..	..	..	..
		MTO ψ	33	25	26	21	18	15	..	..	..	..
	Bush. Lght. Req'd.		⅛	⅛	¼	¼	⅜	⅜	..	..	..	..
TT50	Min. Teeth	STK. >	48	35	35	29	25	19	..	..	..	..
		MTO ψ	46	35	35	29	25	19	..	..	..	..
	Bush. Lght. Req'd.		⅛	⅛	¼	¼	⅜	⅜	..	..	..	..
TT70	Min. Teeth	STK. >	..	..	48	38	33	26	21	18	16	14
		MTO ψ	..	..	48	38	33	26	21	18	16	14
	Bush. Lght. Req'd.		..	..	¼	¼	⅜	⅜	½	⅛>	⅛>	1λ

★ Min. number of teeth on sprocket stocked by factory which can be used w/Torque-Limiter clutch.

ψ Min. number of teeth on made-to-order sprocket which will permit chain to clear friction disc.

* Use one ⅜″ long bushing and one ½″ long.

♦ Use two ½″ long bushings.

Stock Plate Sprockets with Ground Face and Bored to Fit the Martin Torque Limiter

UNIT TT25

Sprocket Size
35TTA25-25
35TTA26-25
40TTA20-25
40TTA22-25
40TTA24-25
40TTA28-25
40TTA30-25
50TTA17-25
50TTA21-25
50TTA22-25

UNIT TT35

Sprocket Size
35TTA35-35
35TTA40-35
40TTA28-35
40TTA30-35
40TTA32-35
50TTA22-35
50TTA24-35
50TTA25-35
50TTA26-35
60TTA18-35
60TTA20-35

UNIT TT50

Sprocket Size
40TTA35-50
50TTA30-50
50TTA32-50
60TTA25-50
60TTA26-50
60TTA28-50
60TTA30-50
80TTA20-50
80TTA22-50
80TTA24-50

UNIT TT70

Sprocket Size
60TTA36-70
80TTA26-70
80TTA28-70
80TTA30-70
80TTA36-70
100TTA22-70
100TTA24-70

SPARE PARTS

TT25 TT50 TT35 TT70	QTY. REG.*
PRESSURE PLATE	2
FRICTION DISC	2
ADJ. NUT ASSY. & S.S.	1
ADJ. TENSION NUT	3
HUB	1

* PER UNIT

WARNING & SAFETY REMINDER

Safety must be considered a basic factor in machinery operation at all times. Most accidents are the result of carelessness or negligence. All rotating power transmission products are potentially dangerous and must be guarded by the contractor, installer, purchaser, owner, and user as required by applicable laws, regulations, standards, and good safety practice. Additional specific information must be obtained from other sources including the latest editions of American Society of Mechanical Engineers; Standard A.N.S.I. B15.1. A copy of this standard may be obtained from the American Society of Mechanical Engineers at 345 East 47th Street, New York, NY 10017 (212-705-7722).

It is the responsibility of the contractor, installer, purchaser, owner, and user to install, maintain, and operate the parts or components manufactured and supplied by [redacted] Sprocket & Gear, Inc., in such a manner as to comply with the Williams-Steiger Occupational Safety Act and with all state and local laws, ordinances, regulations, and the American National Standard Institute Safety Code.

CAUTION

Guards, access doors, and covers must be securely fastened before operating any equipment.

If parts are to be inspected, cleaned, observed, or general maintenance performed, **the motor driving the part or components is to be locked out electrically in such a manner that it cannot be started by anyone,** however remote from the area. Failure to follow these instructions may result in personal injury or property damage.

WARNING

NOTE: CATALOG DIMENSIONS

Every effort is made to keep all catalog dimensions and styles current in the catalog, however from time to time, it is necessary because of manufacturing changes to alter stock products dimensionally.

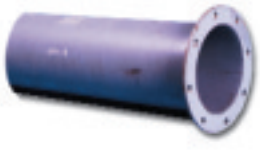
If any stock product dimension or style shown in this catalog is critical to your application please consult factory for certification.

Made-to-Order and Stock Products

Screw Conveyor Components and Accessories

ANGLE FLANGED "U" TROUGH
MILD STEEL AND GALVANIZED

FORM FLANGED "U" TROUGH
MILD STEEL AND GALVANIZED



TUBULAR HOUSING
MILD STEEL AND GALVANIZED

TROUGH ENDS
DISCHARGE GATE
FLAT RACK AND PINION

WITH AND WITHOUT FEET
MILD STEEL AND GALVANIZED

THRUST ASSEMBLY
TYPE E
WITH DRIVE SHAFT

INLETS AND DISCHARGE SPOUTS
MILD STEEL AND GALVANIZED

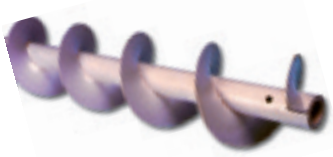
SHAFT SEAL
SPLIT GLAND

SHAFT SEAL
COMPRESSION TYPE
PACKING GLAND

SHAFT SEAL
WASTE PACK

SHAFT SEAL
PLATE

SHAFT SEAL
FLANGED PRODUCT
DROP-OUT



HELICOID SCREWS
RIGHT HAND AND LEFT HAND
MILD STEEL AND GALVANIZED

HELICOID FLIGHTING
RIGHT HAND AND LEFT HAND
MILD STEEL AND GALVANIZED.

SCREWS
HOT DIPPED GALVANIZED

SPECIALS

SECTIONAL FLIGHTS
MILD STEEL

TAIL COUPLING
AND DRIVE SHAFTS

ELEVATOR BUCKETS

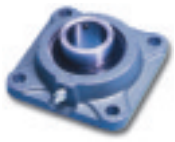
HANGER STYLE 220
HANGER STYLE 226
MILD STEEL AND
GALVANIZED

HANGER
MILD STEEL AND
GALVANIZED

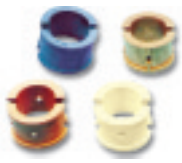
STYLE 216

HANGER
STYLE 70

HANGER
STYLE 19B



TROUGH END BEARINGS
BALL AND ROLLER

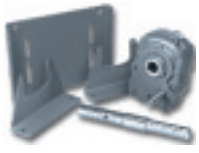


HANGER BEARINGS
STYLE 220/226
Martin HARD IRON
Martin BRONZE
NYLATRON
WOOD - GATKE

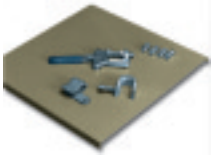
HANGER BEARINGS
HARD IRON
UHMW
WOOD
GATKE

SADDLES AND FEET

SCREW CONVEYOR DRIVE
WITH ACCESSORIES



SPEED REDUCER
SHAFT MOUNTED
WITH ACCESSORIES.



FLANGED COVER
WITH ACCESSORIES

For more information about

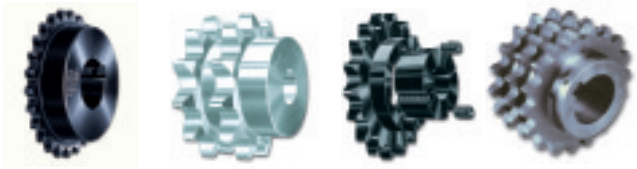
Martin

and our other quality products, join us at our web site

www.martinsprocket.com

Made-to-Order and Stock Products

All Steel Stock Sprockets



BORED TO SIZE HARDENED TEETH | DOUBLE SINGLE HARDEND TEETH | SABER TOOTH® HARDENED TEETH | QD TRIPLE

Stock Bushings/Hubs

BUSHINGS TYPE QD STEEL WITH KEYSEAT SIZE SF-N | TAPERED BUSHING | QD IDLER BUDSHING

Stock Gears/Steel and Cast

Spur Gears - Stocked in both 14-1/2º & 20º Pressure Angles

SPUR TYPE B | SPUR 3 DP | GEAR RACK

BEVEL | MITER | WORM GEAR | WORM

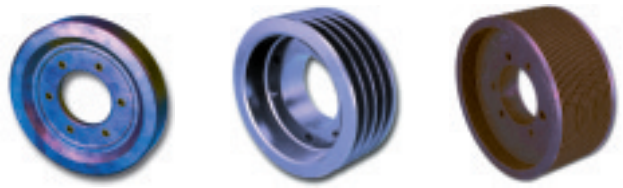
Stock Timing Pulleys

TIMING PULLEY TAPERED BUSHING | TIMING PULLEY QD | TIMING PULLEY STOCK BORE

STOCK BORE | QD | MTO

Martin'S NEW HTS (HIGH TORQUE SPROCKETS)

Stock QD V-Belt Sheaves



"3V" HI-CAP® | "5V" HI-CAP® | "8V" HI-CAP

Stock Tapered Bushed V-Belt Sheaves

CONVENTIONAL C SECTION TAPER BUSHED | "3V" HI-CAP® TAPER BUSHED | CONVENTIONAL B SECTION TAPER BUSHED

Stock Couplings/Covers

RUBBER ELEMENT Martin-FLEX® STOCK BORE | ROLLER CHAIN STOCK BORE | JAW | COUPLING COVERS

FINISHED BORE | "QD" | SC SPACER | TPR ELEMENT

Martin'S NEW QUADRA-FLEX® COUPLING

Stock Sintered Metal and Sinteed Steel Products.

HANGER BEARINGS.

Extensive stockyards of screws are available for quick shipment.

A broad inventory of equipment ensures prompt worldwide delivery.

Quality material and an experienced staff means a rapid turnaround for you, our customer.

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P.O. Box 13856 • Sacramento, CA 95853-3856
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P.O. Box 886 • Scottdale, GA 30079-0886
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Box 19447 • Charlotte, NC 28219-0447
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905-670-1991 (FAX 905-670-2110)

Martin **Sprocket & Gear Canada Inc. (Conveyor Division)**
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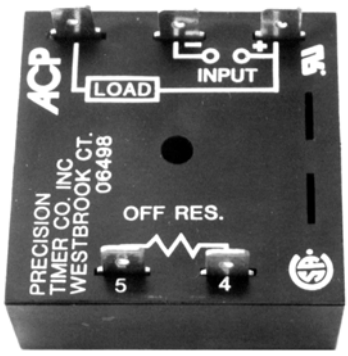
Martin Products are made in North America. For more information, contact your nearest Martin Distributor or Service Center.



TIMING MODULE

FULLY SOLID STATE ENCAPSULATED E75633 LR46938

ONE AMPERE LOAD RATING

Series 606 - PROGRAMMABLE RECYCLE

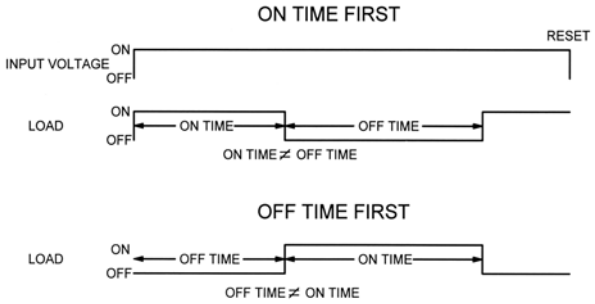
CMOS DIGITAL CIRCUITRY

- **Life Expectancy –unlimited**
- **Environment Protected**
- **Tamper Proof**
- **No False Operate**
- **Small Size – 2"x 2" x 53/64"**
- **Lightweight – approximately 2.5 oz.**
- **Rugged**

Application of power simultaneously initiates timing and turns the load ON. The load remains ON for the preset ON time period after which it turns OFF for the preset OFF time period. The ON/OFF cycling continues until power is removed. Removal of power at any point in the cycle will cause reset to T = To. The unit is available with the OFF time first, see the TIMING DIAGRAM and the table below.

Control the timing of valves, SFHP motors, lamps, relays, magnetic line starters, and actuators rated less than 1 ampere (10 amps inrush). CMOS digital circuitry, with solid state output switching. P/C boards and internal components are encapsulated in a flame retardant molded housing, fitted with quick connect wiring terminals. Available in all standard voltages and frequencies. Fixed or adjustable timing from .1 seconds to 24 hours.

TIMING DIAGRAM



SPECIFICATIONS

1. Repeat Accuracy: ± 0.1% or 16 ms. Whichever is greater
2. Combined Effect of Temperature and Voltage upon Repeat Accuracy: 1%
3. Reset Time: 150 ms.
4. Operating Voltage Tolerance: ± 20%
5. Load Current: Steady State – 8 ma. Min., 1 Ampere Max., 10 A Inrush
6 Voltage Drop: 1.5V Typical at 1 Ampere
7. Leakage Current: 5 ma.
8. Dielectric Strength: 1500 VRMS
9. Insulation Resistance: 100 Megohms Min.
10. Input Transient Protection: 3000V 120V UNITS, 6000V 240V units
11. Temperature Ambients: Operating -40°C to +70°C, Storage -55°C to +70°C
12. Humidity-Operating: 95% Relative
13. Linearity(Option A or D): ±5% Minimum from 10% to 90% of range
14. Timing Tolerance: ±9% + Tolerance of Rt Std., ±5% Special (Fixed)

HOW TO ORDER

606 – (T1) (T2) (V) (P1) (P2)

606R (T1) (T2) (V) (P1) (P2)

SERIES	(T1) = ON TIME	(T2) = OFF TIME	(V)=VOLTAGE	OPTIONS (P1) = ON TIME, (P2) = OFF TIME
606 ON FIRST **606R** OFF FIRST	P = 0.1 - 5 SEC. 1 = 0.1 - 10 SEC. L = 0.2 - 20 SEC. J = 0.3 - 30 SEC. M = 0.6 - 60 SEC. 2 = 1 - 100 SEC. K = 1.2 - 120 SEC. F = 2 - 180 SEC. E = 3 - 300 SEC. 3 = 10 - 1000 SEC. 4 = O.1 - 10 MIN. G = 0.3 - 30 MIN. H = 0.6 - 60 MIN. 5 = 1 - 100 MIN. V = 3 - 300 MIN. 6 = 10 - 1000 MIN. D = 1 - 24 HRS.	P = 0.1 - 5 SEC. 1 = 0.1 - 10 SEC. L = 0.2 - 20 SEC. J = 0.3 - 30 SEC. M = 0.6 - 60 SEC. 2 = 1 - 100 SEC. K = 1.2 - 120 SEC. F = 2 - 180 SEC. E = 3 - 300 SEC. 3 = 10 - 1000 SEC. 4 = O.1 - 10 MIN. G = 0.3 - 30 MIN. H = 0.6 - 60 MIN. 5 = 1 - 100 MIN. V = 3 - 300 MIN. 6 = 10 - 1000 MIN. D = 1 - 24 HRS.	1 = 12VDC 2 = 24VDC 3 = 48VDC 4 = 24VAC 5 = 120VAC 6 = 240VAC	O - CUSTOMER SUPPLIES OWN POTENTIOMETER OR RESISTOR A - POTENTIOMETER SUPPLIED AS LOOSE PART *B - EXTERNALLY INSTALLED RESISTOR *C - FACTORY FIXED INTERNAL D - TRIMMER POTENTIOMETER INSTALLED ON TERMINALS R - INTERNAL POTENTIOMETER WITH THRU SHAFT S – INTERNAL POTENTIOMETER WITH SCREWDRIVER SLOT **** For Fixed Time Specify The Value In Seconds, Minutes, Or Hours*** **MADE IN USA**

EXAMPLE P/N: 606-325OC/240S This is an PROGRAMMABLE RECYCLE 1A Rated Solid State Timer with a 10-1000 second ADJUSTABLE ON TIME and a fixed 240 second OFF TIME. The INPUT VOLTAGE of 120 VAC. The OFF TIME is FACTORY FIXED INTERNAL calibration. The customer will supply the ON TIME adjust potentiometer or resistor

AMERICAN CONTROL PRODUCTS
A DIV. OF PRECISION TIMER CO., INC.
47 WESTBROOK INDUSTRIAL PARK ROAD
WESTBROOK, CT. 06498
PHONE: (860)399-6253 **FAX:(860)399-5619**
EMAIL:info@precisiontimer.com **Web Site: precisiontimer.com**

TECHNICAL BULLETIN

SOLID STATE TIMING MODULE

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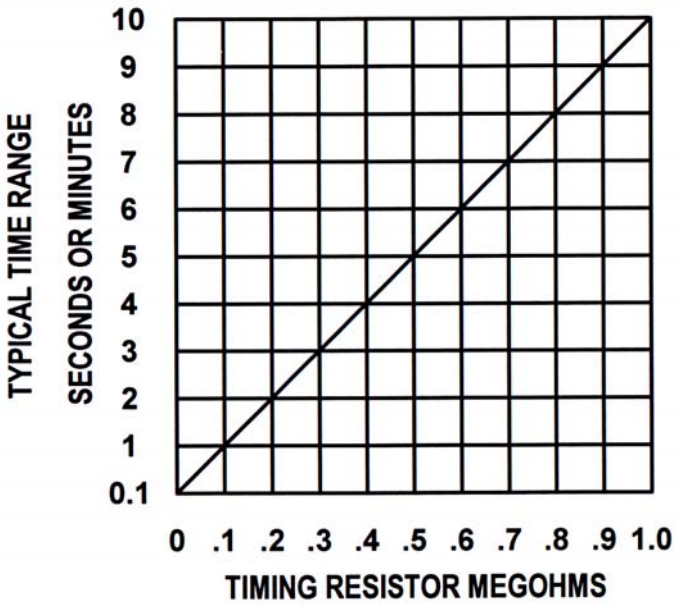
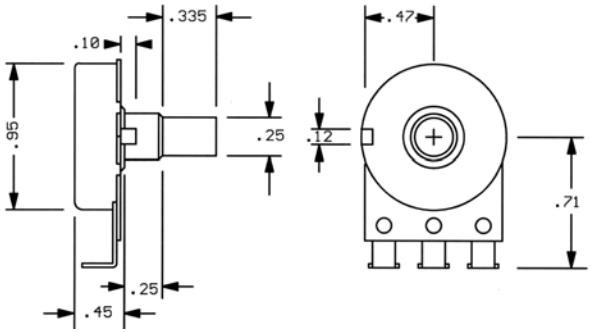
CALIBRATION RESISTANCE VS TIME

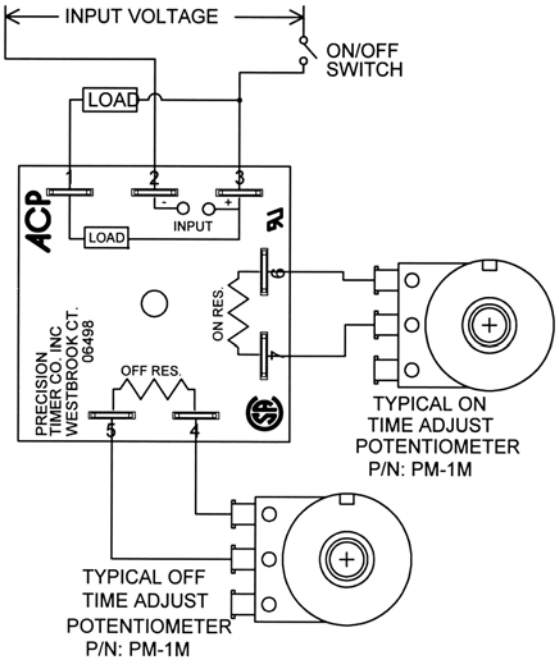


ACCESSORIES – AVAILABLE FROM STOCK

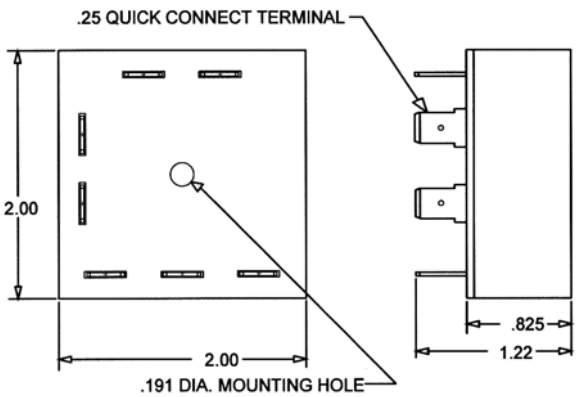
ORDER P/N: **PM – 1M 1 MEGOHM ± 20%**
PM – 100K 100 KOHM ± 20%

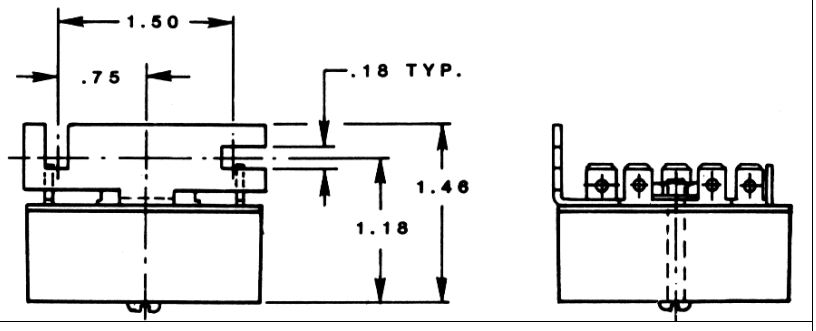


TYPICAL WIRING



OUTLINE DRAWING





Order bracket mount model as: 606BM – (T1) (T2) (V) (P1) (P2)
606RBM (T1) (T2) (V) (P1) (P2)

MADE IN USA

AMERICAN CONTROL PRODUCTS
A DIV. OF PRECISION TIMER CO., INC.
47 WESTBROOK INDUSTRIAL PARK ROAD
WESTBROOK, CT. 06498
PHONE: (860)399-6253 **FAX:(860)399-5619**
EMAIL:info@precisiontimer.com **Web Site: precisiontimer.com**

TECHNICAL BULLETIN

SOLID STATE TIMING MODULE

PAGE 2 OF 2	DATE 6-4-01	606	REV B

BLOWERS EXHAUSTERS COMPRESSORS

ROOTS™

US $3.00, Canada $4.50

Universal RAI®, URAI-DSL, URAI-G and Metric Series

Contents

Do These Things To Get The Most From Your ROOTS® blower

- ❑ Check shipment for damage. If found, file claim with carrier and notify ROOTS.
- ❑ Unpack shipment carefully, and check contents against Packing List. Notify ROOTS if a shortage appears.
- ❑ Store in a clean, dry location until ready for installation. Lift by methods discussed under INSTALLATION to avoid straining or distorting the equipment. Keep covers on all openings. Protect against weather and corrosion if outdoor storage is necessary.
- ❑ Read OPERATING LIMITATIONS and INSTALLATION sections in this manual and plan the complete installation.
- ❑ Provide for adequate safeguards against accidents to persons working on or near the equipment during both installation and operation. See SAFETY PRECAUTIONS.
- ❑ Install all equipment correctly. Foundation design must be adequate and piping carefully done. Use recommended accessories for operating protection.
- ❑ **Make sure both driving and driven equipment is correctly lubricated before start-up. See LUBRICATION.**
- ❑ Read starting check points under OPERATION. Run equipment briefly to check for installation errors and make corrections. Follow with a trial run under normal operating conditions.
- ❑ In event of trouble during installation or operation, do not attempt repairs of ROOTS furnished equipment. Notify ROOTS, giving all nameplate information plus an outline of operating conditions and a description of the trouble. Unauthorized attempts at equipment repair may void ROOTS warranty.
- ❑ Units out of warranty may be repaired or adjusted by the owner. Good inspection and maintenance practices should reduce the need for repairs.

NOTE: Information in this manual is correct as of the date of publication. ROOTS reserves the right to make design or material changes without notice, and without obligation to make similar changes on equipment of prior manufacture.

For your nearest ROOTS Office, dial our Customer Service Hot Line toll free; 1 877 363 ROOT(S) (7668) or direct 281-966-4700.

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DRESSER®
Roots

ROOTS® products are sold subject to the current General Terms of Sale, GTS-5001 and Warranty Policy WP-5020. Copies are available upon request.
Contact your local ROOTS Office or ROOTS Customer Service Hot Line 1-877-363-ROOT(S) (7668) or direct 281-966-4700.

Safety Precautions

It is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should be particularly noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Protect external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong coarse screen over the inlet and avoid standing in the discharge air stream. **CAUTION: Never cover the blower inlet with your hand or other part of body.**
- Stay clear of the blast from pressure relief valves and the suction area of vacuum relief valves.
- Use proper care and good procedures in handling, lifting, installing, operating and maintaining the equipment.
- Casing pressure must not exceed 25 PSI (1725 mbar) gauge. Do not pressurize vented cavities from an external source, nor restrict the vents without first consulting ROOTS.
- Do not use air blowers on explosive or hazardous gases.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be trained to exercise adequate general safety precautions.

Operating Limitations

A ROOTS blower or exhauster must be operated within certain approved limiting conditions to enable continued satisfactory performance. Warranty is contingent on such operation.

Maximum limits for pressure, temperature and speed are specified in TABLE 1 for various models & sizes of blowers & exhausters. These limits apply to all units of normal construction, when operated under standard atmospheric conditions. Be sure to arrange connections or taps for instruments, thermometers and pressure or vacuum gauges at or near the inlet and discharge connections of the unit. These, along with a tachometer, will enable periodic checks of operating conditions.

PRESSURE – The pressure rise, between inlet and discharge, must not exceed the figure listed for the specific unit frame size concerned. Also, in any system where the unit inlet is at a positive pressure above atmosphere a maximum case rating of 25 PSI gauge (1725 mbar) should not be exceeded without first consulting the ROOTS. Never should the maximum allowable differential pressure be exceeded.

On vacuum service, with the discharge to atmospheric pressure, the inlet suction or vacuum must not be greater than values listed for the specific frame size.

TEMPERATURE – Blower & exhauster frame sizes are approved only for installations where the following temperature limitations can be maintained in service:

- Measured temperature rise must not exceed listed values when the inlet is at ambient temperature. Ambient is considered as the general temperature of the space around the unit. This is not outdoor temperature unless the unit is installed outdoors.
- If inlet temperature is higher than ambient, the listed allowable temperature rise values must be reduced by 2/3 of the difference between the actual measured inlet temperature and the ambient temperature.
- The average of the inlet and discharge temperature must not exceed 250°F. (121°C).
- The ambient temperature of the space the blower/motor is installed in should not be highter than 120°F (48.8°C).

SPEED – These blowers & exhausters may be operated at speeds up to the maximum listed for the various frame sizes. They may be direct coupled to suitable constant speed drivers if pressure/temperature conditions are also within limits. At low speeds, excessive temperature rise may be a limiting factor.

Special Note: The listed maximum allowable temperature rise for any particular blower & exhauster may occur well before its maximum pressure or vacuum rating is reached. This may occur at high altitude, low vacuum or at very low speed. The units' operating limit is always determined by the maximum rating reached first. It can be any one of the three: Pressure, Temperature or Speed.

Installation

ROOTS blowers & exhausters are treated after factory assembly to protect against normal atmospheric corrosion. The maximum period of internal protection is considered to be one year under average conditions, if shipping plugs & seals are not removed. Protection against chemical or salt water atmosphere is not provided. Avoid opening the unit until ready to start installation, as corrosion protection will be quickly lost due to evaporation.

If there is to be an extended period between installation and start up, the following steps should be taken to ensure corrosion protection.

- ❑ Coat internals of cylinder, gearbox and drive end bearing reservoir with Nox-Rust VCI-10 or equivalent. Repeat once a year or as conditions may require. Nox-Rust VCI-10 is petroleum soluble and does not have to be removed before lubricating. It may be obtained from Daubert Chemical Co., 2000 Spring Rd., Oak Brook, Ill. 60521.

- ❑ Paint shaft extension, inlet and discharge flanges, and all other exposed surfaces with Nox-Rust X-110 or equivalent.

- ❑ Seal inlet, discharge, and vent openings. It is not recommended that the unit be set in place, piped to the system, and allowed to remain idle for extended periods. If any part is left open to the atmosphere, the Nox-Rust VCI-10 vapor will escape and lose its effectiveness.

- ❑ Protect units from excessive vibration during storage.

- ❑ Rotate shaft three or four revolutions every two weeks.

- ❑ Prior to start up, remove flange covers on both inlet and discharge and inspect internals to insure absence of rust. Check all internal clearances. Also, at this time, remove gearbox and drive end bearing cover and inspect gear teeth and bearings for rust.

Because of the completely enclosed unit design, location of the installation is generally not a critical matter. A clean, dry and protected indoor location is preferred. However, an outdoor location will normally give satisfactory service. Important requirements are that the correct grade of lubricating oil be provided for expected operating temperatures, and that the unit be located so that routine checking and servicing can be performed conveniently. Proper care in locating driver and accessory equipment must also be considered.

Supervision of the installation by a ROOTS Service Engineer is not usually required for these units. Workmen with experience in installing light to medium weight machinery should be able to produce satisfactory results. Handling of the equipment needs to be accomplished with care, and in compliance with safe practices. Unit mounting must be solid, without strain or twist, and air piping must be clean, accurately aligned and properly connected.

Bare-shaft Units: Two methods are used to handle a unit without base. One is to use lifting lugs bolted into the top of the unit headplates. Test them first for tightness and fractures by tapping with a hammer. In lifting, keep the direction of cable pull on these bolts as nearly vertical as possible. If lifting lugs are not available, lifting slings may be passed under the cylinder adjacent to the headplates. Either method prevents strain on the extended drive shaft.

Packaged Units: When the unit is furnished mounted on a baseplate, with or without a driver, use of lifting slings passing under the base flanges is required. Arrange these slings so that no strains are placed on the unit casing or mounting feet, or on any mounted accessory equipment. **DO NOT** use the lifting lugs in the top of the unit headplates.

Before starting the installation, remove plugs, covers or seals from unit inlet and discharge connections and inspect the interior completely for foreign material. If cleaning is required, finish by washing the cylinder, headplates and impeller thoroughly with an appropriate solvent. Turn the drive shaft by hand to make sure that the impellers turn freely at all points. Anti-rust compound on the connection flanges and drive shaft extension may also be removed at this time with the same solvent. Cover the flanges until ready to connect piping.

Mounting

Care will pay dividends when arranging the unit mounting. This is especially true when the unit is a “bare-shaft” unit furnished without a baseplate. The convenient procedure may be to mount such a unit directly on a floor or small concrete pad, but this generally produces the least satisfactory results. It definitely causes the most problems in leveling and alignment and may result in a “Soft Foot” condition. Correct soft foot before operation to avoid unnecessary loading on the casing and bearings. Direct use of building structural framing members is not recommended.

For blowers without a base, it is recommended that a well anchored and carefully leveled steel or cast iron mounting plate be provided. The plate should be at least 1 inch (25 mm) thick, with its top surface machined flat, and large enough to provide leveling areas at one side and one end after the unit is mounted. It should have properly sized studs or tapped holes located to match the unit foot drilling. Proper use of a high quality machinist’s level is necessary for adequate installation.

With the mounting plate in place and leveled, set the unit on it without bolting and check for rocking. If it is not solid, determine the total thickness of shims required under one foot to stop rocking. Place half of this under each of the diagonally-opposite short feet, and tighten the mounting studs or screws. Rotate the drive shaft to make sure the impellers turn freely. If the unit is to be direct coupled to a driving motor, consider the height of the motor shaft and the necessity for it to be aligned very accurately with the unit shaft. Best unit arrangement is directly bolted to the mounting plate while the driver is on shims of at least 1/8 inch (3mm) thickness. This allows adjustment of motor position in final shaft alignment by varying the shim thickness.

Aligning

When unit and driver are factory mounted on a common baseplate, the assembly will have been properly aligned and is to be treated as a unit for leveling purposes. Satisfactory

installation can be obtained by setting the baseplate on a concrete slab that is rigid and free of vibration, and leveling the top of the base carefully in two directions so that it is free of twist. The slab must be provided with suitable anchor bolts. The use of grouting under and partly inside the leveled and shimmed base is recommended.

It is possible for a base-mounted assembly to become twisted during shipment, thus disturbing the original alignment. For this reason, make the following checks after the base has been leveled and bolted down. Disconnect the drive and rotate the unit shaft by hand. It should turn freely at all points. Loosen the unit foot hold-down screws and determine whether all feet are evenly in contact with the base. If not, insert shims as required and again check for free impeller rotation. Finally, if unit is direct coupled to the driver, check shaft and coupling alignment carefully and make any necessary corrections.

In planning the installation, and before setting the unit, consider how piping arrangements are dictated by the unit design and assembly. Drive shaft rotation must be established accordingly and is indicated by an arrow near the shaft.

Typical arrangement on vertical units has the drive shaft at the top with counterclockwise rotation and discharge to the left. Horizontal units are typically arranged with the drive shaft at the left with counterclockwise rotation and discharge down. See Figure 4 for other various unit arrangements and possible conversions.

When a unit is DIRECT COUPLED to its driver, the driver RPM must be selected or governed so as not to exceed the maximum speed rating of the unit. Refer to Table 1 for allowable speeds of various unit sizes.

A flexible type coupling should always be used to connect the driver and unit shafts.

When direct coupling a motor or engine to a blower you must insure there is sufficient gap between the coupling halves and the element to prevent thrust loading the blower bearings. When a motor, engine or blower is operated the shafts may expand axially. If the coupling is installed in such a manner that there is not enough room for expansion the blower shaft can be forced back into the blower and cause the impeller to contact the gear end headplate resulting in damage to the blower. The two shafts must be in as near perfect alignment in all directions as possible, and the gap must be established with the motor armature on its electrical center if end-play exists. Coupling manufacturer's recommendations for maximum misalignment, although acceptable for the coupling, are normally too large to achieve smooth operation and maximum life of the blower.

The following requirements of a good installation are recommended. When selecting a coupling to be fitted to the blower shaft ROOTS recommends a taper lock style coupling to insure proper contact with the blower shaft. If the coupling must have a straight bore the coupling halves must be fitted to the two shafts with a line to line thru .001" interference fit. Coupling halves must be warmed up per coupling manufacturer's recommendations. Maximum deviation in offset alignment of the shafts should not exceed .005" (.13 mm) total indicator reading, taken on the two coupling hubs. Maximum deviation from parallel of the inside coupling faces should not exceed .001" (.03 mm) when checked at six points around the coupling.

When a unit is BELT DRIVEN, the proper selection of sheave diameters will result in the required unit speed. When selecting a sheave to be fitted to the blower shaft ROOTS recommends a taper lock style sheave to insure proper contact with the blower shaft. This flexibility can lead to operating temperature problems caused by unit speed being too low. Make sure the drive speed selected is within the allowable range for the specific unit size, as specified under Table 1.

Belt drive arrangements usually employ two or more V-belts running in grooved sheaves. Installation of the driver is less critical than for direct coupling, but its shaft must be level and parallel with the unit shaft. **The driver should be mounted on the inlet side of a vertical unit (horizontal piping) and on the side nearest to the shaft on a horizontal unit. SEE PAGE 6 - Acceptable Blower Drive Arrangement Options.** The driver must also be mounted on an adjustable base to permit installing, adjusting and removing the V-belts. To position the driver correctly, both sheaves need to be mounted on their shafts and the nominal shaft center distance known for the belt lengths to be used.

CAUTION: Drive couplings and sheaves (pulleys) should have an interference fit to the shaft of the blower (set screw types of attachment generally do not provide reliable service.) It is recommended that the drive coupling or sheave used have a taper lock style bushing which is properly sized to provide the correct interference fit required. Drive couplings, that require heating to fit on the blower shaft, should be installed per coupling manufacturer recommendations. A drive coupling or sheave should not be forced on to the shaft of the blower as this could affect internal clearances resulting in damage to the blower.

Engine drive applications often require special consideration to drive coupling selection to avoid harmful torsional vibrations. These vibrations may lead to blower damage if not dampened adequately. It is often necessary to install a flywheel and/or a torsionally soft elastic element coupling based on the engine manufacturer recommendations.

The driver sheave should also be mounted as close to its bearing as possible, and again should fit the shaft correctly. Position the driver on its adjustable base so that 2/3 of the total movement is available in the direction away from the unit, and mount the assembly so that the face of the sheave is accurately in line with the unit sheave. This position minimizes belt wear, and allows sufficient adjustment for both installing and tightening the belts. After belts are installed, adjust their tension in accordance with the manufacturer's instructions. However, only enough tension should be applied to prevent slippage when the unit is operating under load. Excessive tightening can lead to early bearing concerns or shaft breakage.

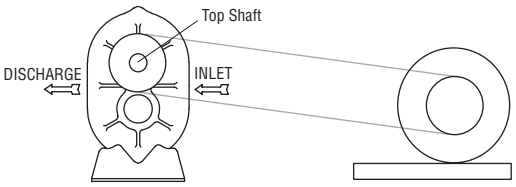
Before operating the drive under power to check initial belt tension, first remove covers from the unit connections. Make sure the interior is still clean, then rotate the shaft by hand. Place a coarse screen over the inlet connection to prevent anything being drawn into the unit while it is operating, and avoid standing in line with the discharge opening. Put oil in the sumps per instructions under **LUBRICATION.**

Piping

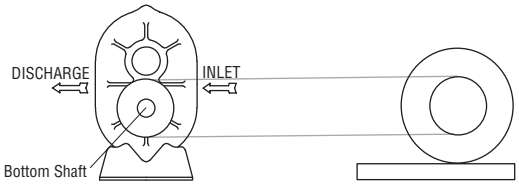
Before connecting piping, remove any remaining anti-rust compound from unit connections. Clean pipe should be no

Acceptable Blower Drive Arrangement Options

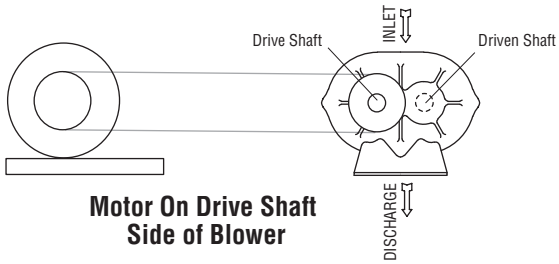
ACCEPTABLE



Motor On Inlet Side of Blower (Top Shaft)

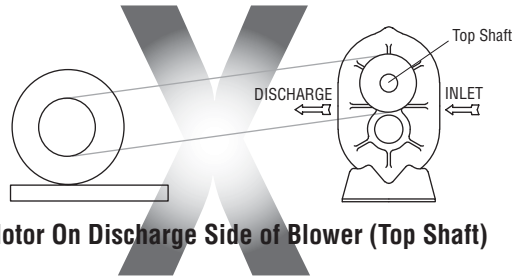


Motor On Inlet Side of Blower (Bottom Shaft)

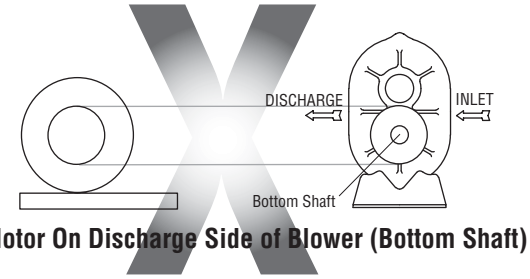


Motor On Drive Shaft Side of Blower

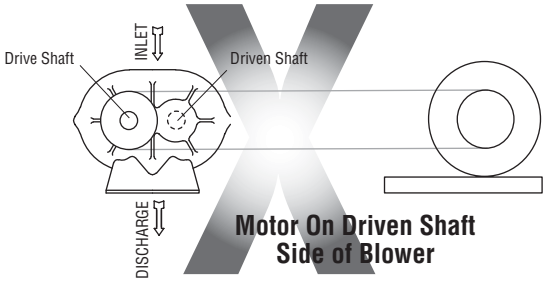
UNACCEPTABLE



Motor On Discharge Side of Blower (Top Shaft)



Motor On Discharge Side of Blower (Bottom Shaft)



Motor On Driven Shaft Side of Blower

smaller than unit connections. In addition, make sure it is free of scale, cuttings, weld beads, or foreign material of any kind. To further guard against damage to the unit, especially when an inlet filter is not used, install a substantial screen of 16 mesh backed with hardware cloth at or near the inlet connections. Make provisions to clean this screen of collected debris after a few hours of operation. It should be removed when its usefulness has ended, as the wire will eventually deteriorate and small pieces going into the unit may cause serious damage.

Pipe flanges or male threads must meet the unit connections accurately and squarely. DO NOT attempt to correct misalignment by springing or cramping the pipe. In most cases this will distort the unit casing and cause impeller rubbing. In severe cases it can prevent operation or result in a broken drive shaft. For similar reasons, piping should be supported near the unit to eliminate dead weight strains. Also, if pipe expansion is likely to occur from temperature change, installation of flexible connectors or expansion joints is advisable.

Figure 3 represents an installation with all accessory items that might be required under various operating conditions. Inlet piping should be completely free of valves or other restrictions. When a shut-off valve can not be avoided, make sure a full size vacuum relief is installed nearest the unit inlet. This will protect against unit overload caused by accidental closing of the shut-off valve.

Need for an inlet silencer will depend on unit speed and pressure, as well as sound-level requirements in the general surroundings. An inlet filter is recommended, especially in dusty or sandy locations. A discharge silencer is also normally suggested, even though Whispair units operate at generally lower noise levels than conventional rotary blowers. Specific recommendations on silencing can be obtained from your local ROOTS distributor.

Discharge piping requires a pressure relief valve, and should include a manual unloading valve to permit starting the unit under no-load conditions. Reliable pressure/vacuum gauges and good thermometers at both inlet and discharge are recommended to allow making the important checks on unit operating conditions. The back-pressure regulator shown in Figure 3 is useful mainly when volume demands vary while the unit operates at constant output. If demand is constant, but somewhat lower than the unit output, excess may be blown off through the manual unloading valve.

In multiple unit installations where two or more units operate with a common header, use of check valves is mandatory. These should be of a direct acting or free swinging type, with one valve located in each line between the unit and header. Properly installed, they will protect against damage from reverse rotation caused by air and material back-flow through an idle unit.

After piping is completed, and before applying power, rotate the drive shaft by hand again. If it does not move with uniform freedom, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment.

DO NOT operate the unit at this time unless it has been lubricated per instructions.

Technical Supplement for 32, 33, 36, 42, 45, 47, 53, 56, 59, 65, 68, 615 Universal RAI-G blowers

ROOTS Universal RAI-G rotary positive gas blowers are a design extension of the basic Universal RAI blower model. URAI-G blower uses (4) mechanical seals in place of the standard inboard lip seals to minimize gas leakage into the atmosphere. The seal vent chambers are plugged. These units are intended for gases which are compatible with cast iron case material, steel shafts, 300/400 series stainless steel and carbon seal components, viton o-rings and the oil/grease lubricants. If there are any questions regarding application or operation of this gas blower, please contact factory.

Precaution: URAI-G blowers: Care must be used when opening the head plate seal vent chamber plugs (43) as some gas will escape–if it is a pressure system, or the atmospheric air will leak in-if the system is under vacuum. There is a possibility of some gas leakage through the mechanical seals. This leakage on the gear end will escape through the gear box vent, and on the drive end, through the grease release fittings. If the gas leakage is undesirable, each seal chamber must be purged with an inert gas through one purge gas hole (43) per seal . There are two plugged purge gas holes(1/8 NPT) provided per seal. The purge gas pressure must be maintained one psi above the discharge gas pressure. Also, there exists a possibility of gear end oil and drive end grease leakage into the gas stream.

The lubricants selected must be compatible with the gas.

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

When servicing drive end bearings of a Gas blower, use the specified NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001, with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

*ROOTS Synthetic Oil & Grease is superior in performance to petroleum based products. It has high oxidation stability, excellent corrosion protection, extremely high film strength and low coefficient of friction. Typical oil change intervals are increased 2-3 times over petroleum based lubricants. Also, ROOTS Synthetic Oil is 100% compatible with petroleum based oils. Simply drain the oil in the blower and refill the reservoirs with ROOTS Synthetic Oil to maintain optimum performance of your ROOTS blower.

For Units with a Grease Lubricated Drive End

A simple but very effective lubrication system is employed on the drive shaft end bearings. Hydraulic pressure relief fittings are provided to vent any excess grease, preventing pressure build-up on the seals. A restriction plug and metering orifice prevent loss of lubricant from initial surges in lubricant pressure but permit venting excess lubricant under steadily rising pressures.

When servicing drive end bearings of Non Gas blower, use the specified NLGI #2 premium grade microgel grease with 250°F (121°C) service temperature and moisture resistance and good mechanical stability. ROOTS specifies Shell Darina EP NLGI Grade 2. Product Code 71522.

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

When servicing drive end bearings of a Gas blower, use the specified NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001, with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

NOTE: Lithium based greases are not compatible with the ROOTS Synthetic grease used when assembling a Gas blower or the non-soap base grease used when assembling a standard URAI blower. Lithium based grease is not approved for any ROOTS blowers.

Using a pressure gun, slowly force new lubricant into each drive end bearing housing until traces of clean grease comes out of the relief fitting. The use of an electric or pneumatic grease gun could force the grease in too rapidly and thus invert the seals and should not be used.

After a long shutdown, it is recommended that the grease fittings be removed, the old grease flushed out with kerosene or #10 lubricating oil, drained thoroughly, and bearings refilled with new grease. Be sure grease relief fittings are reinstalled. Grease should be added using a hand operated grease gun to the drive end bearings at varying time intervals depending on duty cycle and RPM. Table 4 has been prepared as a general greasing schedule guide based on average operating conditions. More frequent intervals may be necessary depending on the grease operating temperature and unusual circumstances.

For Units with Splash Lubrication on Both Ends

Bearings and oil seals are lubricated by the action of the timing gears or oil slingers which dip into the main oil sumps causing oil to splash directly on gears and into bearings and seals. A drain port is provided below each bearing to prevent an excessive amount of oil in the bearings. Seals located inboard of the bearings in each headplate effectively retain oil within the sumps. Any small leakage that may occur should the seals wear passes into a cavity in each vented headplate and is drained downward.

Oil sumps on each end of the blower are filled by removing top vent plugs, Item (25), and filling until oil reaches the middle of the oil level sight gauge, Item (45 or 53), or the overflow plug (see pages 14 and 15).

Initial filling of the sumps should be accomplished with the blower not operating, in order to obtain the correct oil level. Approximate oil quantities required for blowers of the various models and configurations are listed in Table 3. Use a good grade of industrial type non-detergent, rust inhibiting, antifoaming oil and of correct viscosity per Table 2. *ROOTS synthetic oil (ROOTS P/N 813-106-) is highly recommended. ROOTS does not recommend automotive type lubricants, as they are not formulated with the properties mentioned above.

The oil level should not fall below the middle of the site gauge or overflow plug on URAI (ref. pages 14 & 15) when the blower is idle. It may rise or fall on the gauge during operation, to an extent depending somewhat on oil temperature and blower speed.

Proper lubrication is usually the most important single consideration in obtaining maximum service life and satisfactory operation from the unit. Unless operating conditions are quite severe, a weekly check of oil level and necessary addition of lubricant should be sufficient. During the first week of operation, check the oil levels in the oil sumps about once a day, and watch for leaks. Replenish as necessary. Thereafter, an occasional check should be sufficient. It is recommended that the oil be changed after initial 100 hours of operation. Frequent oil changing is not necessary unless the blower is operated in a very dusty location.

Normal life expectancy of petroleum based oils is about 2000 hours with an oil temperature of about 180°F (82°C). As the oil temperature increases by increments of 15-18°F (8°C - 10°C), the life is reduced by half. Example: Oil temperatures of 210-216°F (99°C - 102°C) will produce life expectancy of 1/4 or 500 hours. Therefore, it is considered normal to have oil change periods of 500 hours with petroleum based oils.

Normal life expectancy of ROOTS™ Synthetic Oil is about 4000 to 8000 hours with an oil temperature of about 180°F (82°C). As the oil temperature increases by increments of 15-18°F (8°C - 10°C), the life is reduced by half. Example: Oil temperatures of 210-216°F (99°C - 102°C) will produce life expectancy of 1/4 or 1000 to 2000 hours.

NOTE: To estimate oil temperature, multiply the discharge temperature of the blower by 0.80. Example: if the discharge air temperature of the blower is 200° F, it is estimated that the oil temperature is 160° F.

*ROOTS™ Synthetic Oil & Grease is superior in performance to petroleum based products. It has high oxidation stability, excellent corrosion protection, extremely high film strength and low coefficient of friction. Typical oil change intervals are increased 2-3 times over petroleum based lubricants. Also, ROOTS™ Synthetic Oil is 100% compatible with petroleum based oils. Simply drain the oil in the blower and refill the reservoirs with ROOTS™ Synthetic Oil to maintain optimum performance of your ROOTS™ blower.

Operation

Before operating a blower under power for the first time, recheck the unit and the installation thoroughly to reduce the likelihood of avoidable troubles. Use the following procedure check list as a guide, but consider any other special conditions in the installation.

- ❑ Be certain that no bolts, tools, rags, or debris have been left in the blower air chamber or piping.
- ❑ If an outdoor intake without filter is used, be sure the opening is located so it cannot pick up dirt and is protected by a strong screen or grille. Use of the temporary protective screen as described under INSTALLATION is strongly recommended.
- ❑ Recheck blower leveling, drive alignment and tightness of all mounting bolts if installation is not recent. If belt drive is used, adjust belt tension correctly.
- ❑ Turn drive shaft by hand to make sure impellers still rotate without bumping or rubbing at any point.
- ❑ Ensure oil levels in the main oil sumps are correct.
- ❑ Check lubrication of driver. If it is an electric motor, be sure that power is available and that electrical overload devices are installed and workable.
- ❑ Open the manual unloading valve in the discharge air line. If a valve is in the inlet piping, be sure it is open.
- ❑ Bump blower a few revolutions with driver to check that direction of rotation agrees with arrow near blower shaft, and that both coast freely to a stop.

After the preceding points are cleared, blower is ready for trial operation under “no-load” conditions. The following procedure is suggested to cover this initial operation test period.

a. Start blower, let it accelerate to full speed, then shut off. Listen for knocking sounds, both with power on and as speed slows down.

b. After blower comes to a complete stop, repeat above, but let blower run 2 or 3 minutes. Check for noises, such as knocking sounds.

c. After blower comes to a complete stop, operate blower for about 10 minutes unloaded. Check oil levels. Observe cylinder and headplate surfaces for development of hot spots such as burned paint, indicating impeller rubs. Be aware of any noticeable increase in vibration.

Assuming that all trials have been satisfactory, or that necessary corrections have been made, the blower should now have a final check run of at least one hour under normal operating conditions. After blower is restarted, gradually close the discharge unloading valve to apply working pressure. At this point it is recommended that a pressure gauge or manometer be connected into the discharge line if not already provided, and that thermometers be in both inlet and discharge lines. Readings from these instruments will show whether pressure or temperature ratings of the blower are being exceeded.

During the final run, check operating conditions frequently and observe the oil levels at reasonable intervals. If excessive noise or local heating develops, shut down immediately and determine the cause. If either pressure rise or temperature rise across the blower exceeds the limit specified in this manual, shut down and investigate conditions in the piping system. Refer to the TROUBLESHOOTING CHECKLIST for suggestions on various problems that may appear.

The blower should now be ready for continuous duty operation at full load. During the first few days make periodic checks to determine whether all conditions remain steady, or at least acceptable. This may be particularly important if the blower is supplying air to a process system where conditions can vary. At the first opportunity, stop the blower and clean the temporary inlet protective screen. If no appreciable amount of debris has collected, the screen may be removed. See comments under INSTALLATION. At this same time, verify leveling, coupling alignment or belt tension, and mounting bolt tightness.

Should operating experience prove that blower capacity is a little too high for the actual air requirements, a small excess may be blown off continuously through the manual unloading or vent valve. Never rely on the pressure relief valve as an automatic vent. Such use may cause the discharge pressure to become excessive, and can also result in failure of the valve itself. If blower capacity appears to be too low, refer to the TROUBLESHOOTING CHECKLIST.

Vibration Assessment Criteria

With measurements taken at the bearing locations on the housings, see chart below for an appropriate assessment guide for rotary lobe blowers rigidly mounted on stiff foundations.

In general, blower vibration levels should be monitored on a regular basis and the vibration trend observed for progressive or sudden change in level. If such a change occurs, the cause should be determined through spectral analysis.

As shown on the chart below, the level of all pass vibration will determine the need to measure discrete frequency vibration levels and the action required.

All Pass Vibration (in/sec)	Discrete Frequency Vibration (in/sec)	Action
0.45 or less	N/R	Acceptable
Greater than 0.45 but 1.0 or less	0.45 or less @ any frequency	Acceptable
	Greater than 0.45 @ any frequency	Investigate
Greater than 1.0	Less than 1.0	Investigate
	Greater than 1.0	Investigate

Troubleshooting Checklist

Trouble	Item	Possible Cause	Remedy
No flow	1	Speed too low	Check by tachometer and compare with published performance
	2	Wrong rotation	Compare actual rotation with Figure 1 Change driver if wrong
	3	Obstruction in piping	Check piping, valves, silencer to assure open flow path
Low capacity	4	Speed too low	See item 1, If belt drive, check for slippage and readjust tension
	5	Excessive pressure rise	Check inlet vacuum and discharge pressure and compare with Published performance
	6	Obstruction in piping	See item 3
	7	Excessive slip	Check inside of casing for worn or eroded surfaces causing excessive clearances
Excessive power	8	Speed too high	Check speed and compare with published performance
	9	Excessive pressure rise	See Item 5
	10	Impeller rubbing	Inspect outside of cylinder for high temperature areas, then check for impeller contact at these points. Correct blower mounting, drive alignment
	11	Scale, sludge, rust or product build up	Clean blower appropriately
Damage to bearings	12	Inadequate lubrication	Check oil sump levels in gear and drive end headplates
or gears	13	Excessive lubrication	Check oil levels. If correct, drain and refill with clean oil of recommended grade
	14	Excessive pressure rise	See Item 5
	15	Coupling misalignment	Check carefully. Realign if questionable
	16	Excessive belt tension	Readjust for correct tension
Vibration	17	Misalignment	See Item 15
	18	Impellers rubbing	See Item 10
	19	Worn bearings/gears	Check gear backlash and condition of bearings, and replace as indicated
	20	Unbalanced or rubbing impeller	Scale or process material may build up on casing and impellers, or inside impellers. Remove build-up to restore original clearances and impeller balance
	21	Driver or blower loose	Tighten mounting bolts securely
	22	Piping resonances	Determine whether standing wave pressure pulsations are present in the piping
	23	Scale/sludge build-ups	Clean out interior of impeller lobes to restore dynamic balance
	24	Casing strain	Re-work piping alignment to remove excess strain
Driver stops, or will not start	25	Impeller stuck	Check for excessive hot spot on headplate or cylinder. See item 10. Look for defective shaft bearing and/or gear teeth
	26	Scale, sludge, rust or product build-up	Clean blower appropriately
Excessive breather	27	Broken seal	Replace seals
Blow-by or excessive oil leakage to vent area	28	Defective O-ring	Replace seals and O-ring
Excessive oil leakage in vent area	29	Defective/plugged breather	Replace breather and monitor oil leakage
	30	Oil level too high	Check sump levels in gear and drive headplates.
	31	Oil type or viscosity incorrect	Check oil to insure it meets recommendations. Drain then fill with clean oil of recommended grade.
	32	Blower running hot	Recommended oil temperature can be found on page 6 of this manual. The blower must be operated within the conditions of this manual

Inspection & Maintenance: Universal RAI® series blowers

A good program of consistent inspection and maintenance is the most reliable method of minimizing repairs to a blower. A simple record of services and dates will help keep this work on a regular schedule. Basic service needs are:

- Lubrication
- Checking for hot spots
- Checking for increases or changes in vibration and noise
- Recording of operating pressures and temperatures

Above all, a blower must be operated within its specified rating limits, to obtain satisfactory service life.

A newly installed blower should be checked often during the first month of full-time operation. Attention there after may be less frequent assuming satisfactory performance. Lubrication is normally the most important consideration and weekly checks of lubricant levels in the gearbox and bearing reservoirs should be customary. Complete oil change schedules are discussed under **LUBRICATION.**

Driver lubrication practices should be in accordance with the manufacturer's instructions. If direct connected to the blower through a lubricated type coupling, the coupling should be checked and greased each time blower oil is changed. This will help reduce wear and prevent unnecessary vibration. In a belted drive system, check belt tension periodically and inspect for frayed or cracked belts.

In a new, and properly installed, unit there is no contact between the two impellers, or between the impellers and cylinder or headplates. Wear is confined to the bearings (which support and locate the shafts) the oil seals, and the timing gears. All are lubricated and wear should be minimal if clean oil of the correct grade is always used. Seals are subject to deterioration as well as wear, and may require replacement at varying periods.

Shaft bearings are designed for optimum life under average conditions with proper lubrication and are critical to the service life of the blower. Gradual bearing wear may allow a shaft position to change slightly, until rubbing develops between impeller and casing. This will cause spot heating, which can be detected by observing these surfaces. Sudden bearing failure is usually more serious. Since the shaft and impeller are no longer supported and properly located, extensive general damage to the blower casing and gears is likely to occur.

Oil seals should be considered expendable items, to be replaced whenever drainage from the headplate vent cavity becomes excessive or when the blower is disassembled for any reason. Some oil seal leakage may occur since an oil film under the lip is required for proper operation. Periodically leaked oil should be wiped off from surfaces. Minor seal leakage should not be considered as indicating seal replacement.

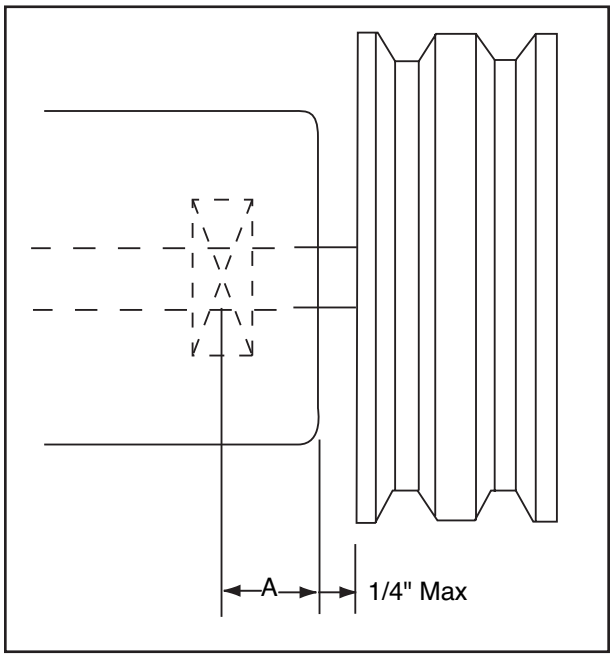
Timing gear wear, when correct lubrication is maintained, should be negligible. Gear teeth are cut to provide the correct amount of backlash, and gears correctly mounted on the shafts will accommodate a normal amount of tooth wear without permitting contact between lobes of the two impellers. However, too high an oil level will cause churning and excessive heating. This is indicated by unusually high temperature at the bottom of the gear housing. Consequent heating of the gears will result in loss of tooth-clearance , backlash and rapid wear of the gear teeth usually will develop. Continuation of this tooth wear will eventually produce impeller contacts (knocking), and from this point serious damage will be unavoidable if blower operation is continued. A similar situation can be produced suddenly by gear tooth fracture, which is usually brought on by sustained overloading or momentary shock loads.

Problems may also develop from causes other than internal parts failure. Operating clearances within a blower are only a few thousandths of an inch. This makes it possible for impeller interference or casing rubs to result from shifts in the blower mounting, or from changes in piping support. If this type of trouble is experienced, and the blower is found to be clean, try removing mounting strains. Loosen blower mounting bolts and reset the leveling and drive alignment. Then tighten mounting again, and make sure that all piping meets blower connections accurately and squarely Foreign materials in the blower will also cause trouble, which can only be cured by disconnecting the piping and thoroughly cleaning the blower interior.

A wide range of causes & solutions for operating troubles are covered in the **TROUBLE SHOOTING CHECKLIST.** The remedies suggested should be performed by qualified mechanics with a good background. Major repairs generally are to be considered beyond the scope of maintenance, and should be referred to an authorized ROOTS distributor.

Warranty failures should not be repaired at all, unless specific approval has been obtained through ROOTS before starting work. Unauthorized disassembly within the warranty period may void the warranty.

Figure 2 - Allowable Overhung Loads for V-Belt Drives Universal RAI®/URAI®-J Units



$$\text{Belt Pull lbs} = \frac{252100 \bullet \text{Motor HP}}{\text{Blower RPM} \bullet \text{Sheave Diameter}}$$

$$\text{Shaft Load (lb.in)} = \text{Belt Pull} \bullet \left(A + 1/4\text{"} + \frac{\text{Sheave Width}}{2}\right)$$

Frame Size	Dimension "A"	Max Allowable Shaft Load (lb-in.)	Min Sheave Diameter
22, 24	0.61	150	4.00
32, 33, 36	0.80	400	5.00
42, 45, 47	1.02	650	5.00
53, 56, 59	1.13	1,325	6.00
65, 68, 615	1.36	2,250	8.00
76, 711, 718	1.16	2,300	9.50

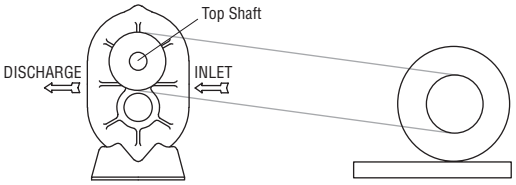
NOTE:
Arc of sheave belt contact on the smaller sheave not to be less than 170°

Driver to be installed on the inlet side for vertical units, and on the drive shaft side for horizontal units.

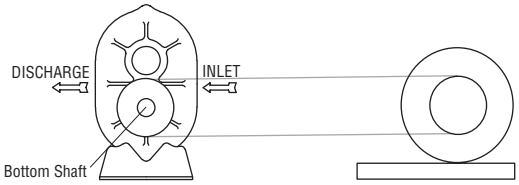
ROOTS recommends the use of two or more 3V, 5V or 8V belts and sheaves.

Acceptable Blower Drive Arrangement Options

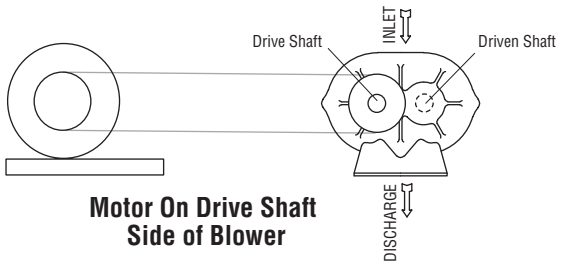
ACCEPTABLE



Motor On Inlet Side of Blower (Top Shaft)

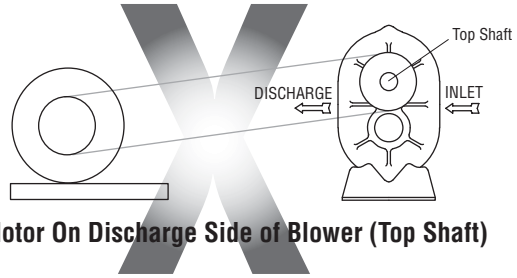


Motor On Inlet Side of Blower (Bottom Shaft)

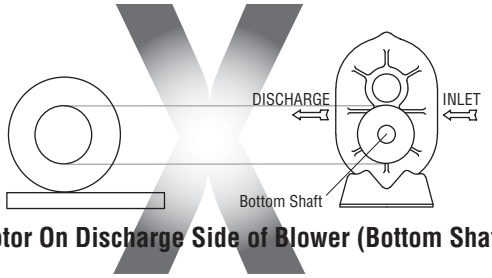


Motor On Drive Shaft Side of Blower

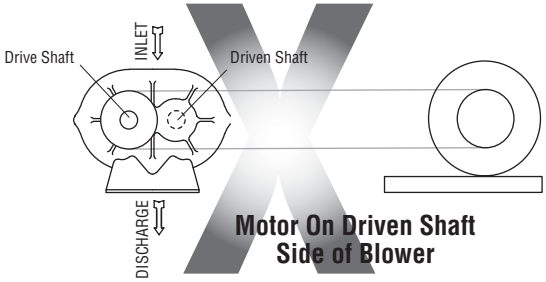
UNACCEPTABLE



Motor On Discharge Side of Blower (Top Shaft)

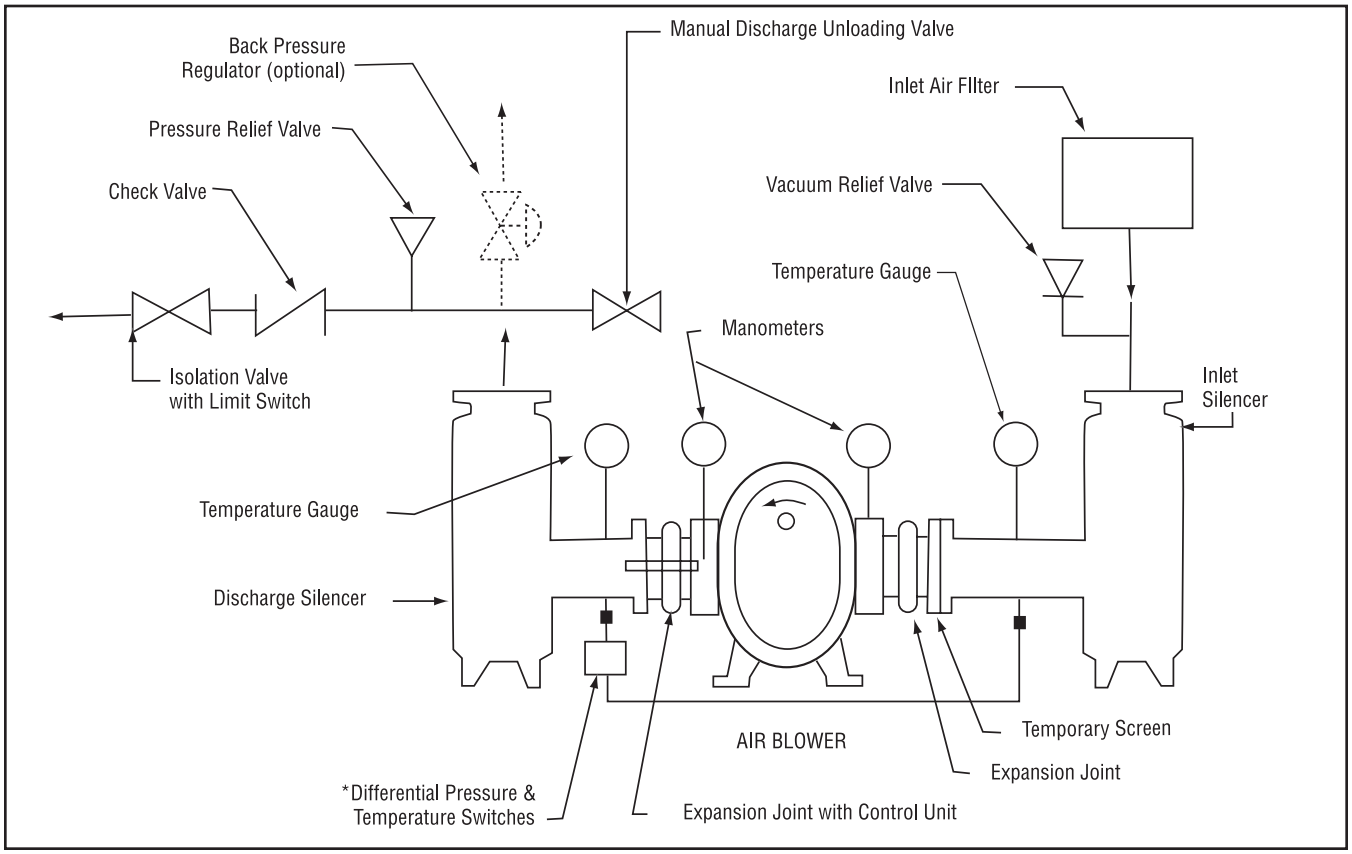


Motor On Discharge Side of Blower (Bottom Shaft)



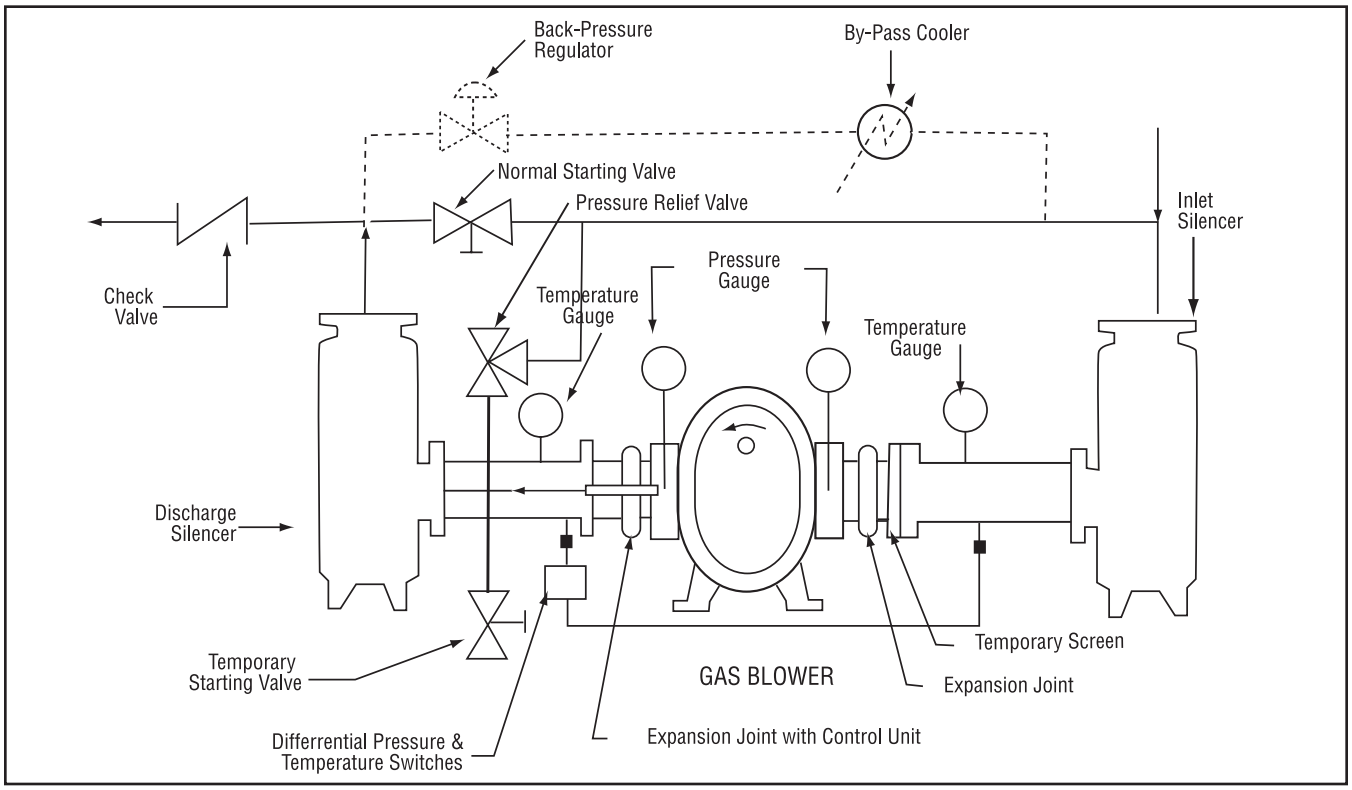
Motor On Driven Shaft Side of Blower

Figure 3a - Air Blower Installation with Accessories



Above are suggested locations for available accessories.

Figure 3b -Gas Blower Installation with Accessories



Above are suggested locations for available accessories.

Figure 4

Blower Orientation Conversion

Model	Reversible Rotation	Whispair™ Design
Universal RAI	yes	no
URAI-J Whispair™	no	yes
URAI-G	yes	no

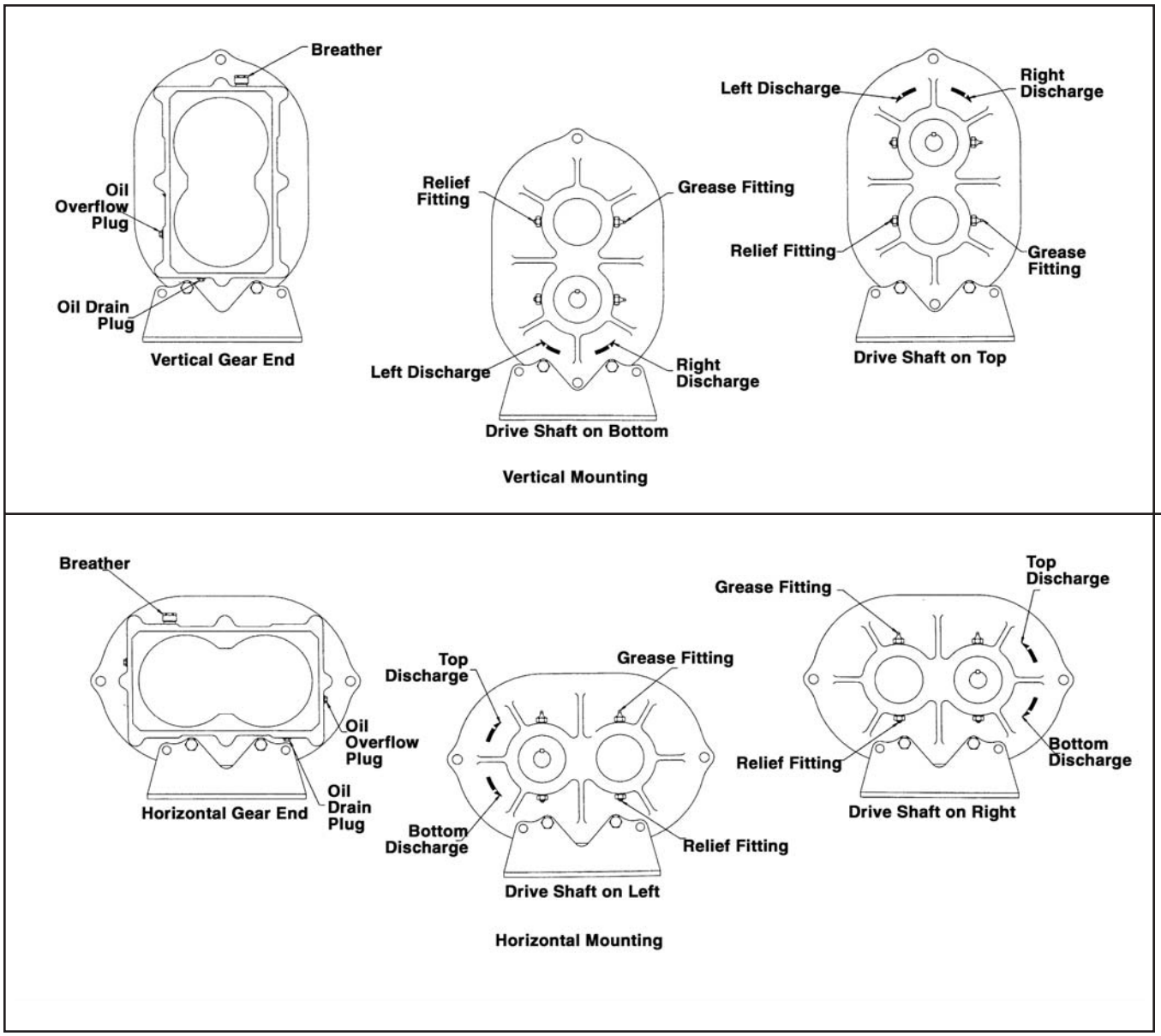
Special Note: WHISPAIR™ models are designed to operate with only one shaft rotation direction to take full advantage of the Whispair feature. Therefore, a WHISPAIR™ blower may be operated in the following combinations.

- CCW Rotation: Bottom Shaft; Right side discharge or a Left Shaft; Bottom discharge
- CCW Rotation: Top Shaft; Left side discharge or a Right Shaft; Top discharge

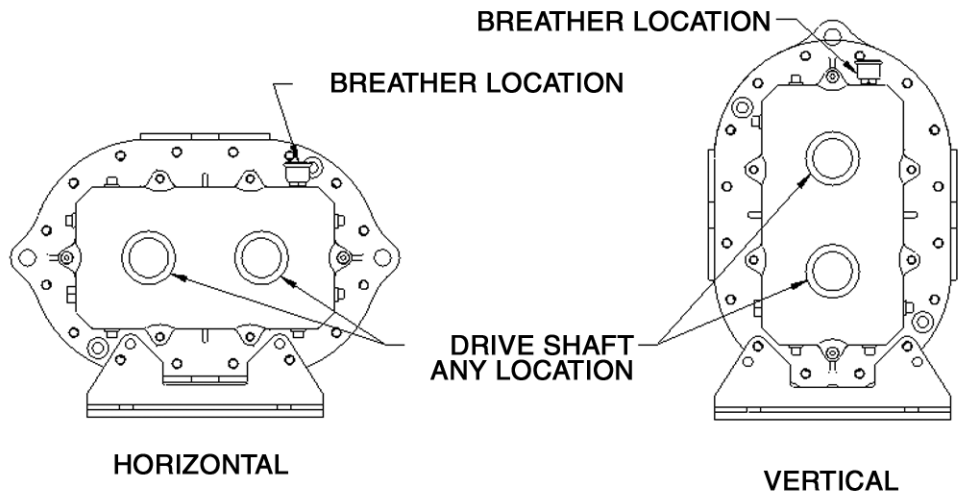
or

- CW Rotation: Bottom Shaft; Left side discharge or a Right Shaft Bottom discharge
- CW Rotation: Top Shaft; Right side discharge or a Left Shaft Top discharge

Blower Orientation and Lubrication Points: Grease Lubricated Drive End
Universal RAI series & URAI-G gas blowers



Drive End Breather Orientation for U-RAI series - DSL with Oil Lube



U-RAI DLS BREATHER ORIENTATION

REVISED DATE: 1/11/05

Table 1 - Universal RAI series, Universal URAI-DSI & URAI-G gas blower, Maximum Allowable Operating Conditions

Frame Size	Gear Diameter (Inch)	Speed RPM	Temp. Rise F°	(C°)	Delta Pressure PSI	(mbar)	Inlet Vacuum INHG	(mbar)
22	2.5	5275	225	(125)	12	(827)	15	(500)
24	2.5	5275	210	(117)	7	(483)	15	(500)
32	3.5	3600	240	(133)	15	1034	16	(539)
33	3.5	3600	225	(125)	12	(827)	15	(500)
36	3.5	3600	225	(125)	7	(483)	15	(500)
42	4.0	3600	240	(133)	15	(1034)	16	(539)
45	4.0	3600	225	(125)	10	(690)	16	(539)
47	4.0	3600	225	(125)	7	(483)	15	(500)
53	5.0	2850	225	(125)	15	(1034)	16	(539)
56	5.0	2850	225	(125)	13	(896)	16	(539)
59	5.0	2850	225	(125)	7	(483)	15	(500)
65	6.0	2350	250	(130)	15	(1034)	16	(539)
68	6.0	2350	240	(133)	14	(965)	16	(539)
615	6.0	2350	130	(72)	7	(483)	14	(472)
76	7.0	2050	250	(139)	15	(1034)	16	(539)
711	7.0	2050	225	(125)	10	(690)	16	(539)
718	7.0	2050	130	(72)	6	(414)	12	(405)

Table 2 - Recommended Oil Grades

Ambient Temperature °F (°C)	ISO Viscosity No.
Above 90° (32°)	320
32° to 90° (0° to 32°)	220
0° to 32° (-18° to 0°)	150
Below 0° (-18°)	100

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

Table 3 - Approximate Oil Sump Capacities

These capacities are provided to assist in stocking the correct amount of oil. Exact sump capacities may differ slightly. See "Lubrication" section for proper filling instructions.

UNIVERSAL RAI, URAI-J, URAI-G

Frame Size	Gear End Capacity Fl. Oz. (Liters)	
	Vertical	Horizontal
22	3.4 (.1)	6.1 (.18)
24	3.4 (.1)	6.1 (.18)
32	8.5 (.25)	16.0 (.47)
33	8.5 (.25)	16.0 (.47)
36	8.5 (.25)	16.0 (.47)
42	12.7 (.37)	22.8 (.67)
45	12.7 (.37)	22.8 (.67)
47	12.7 (.37)	22.8 (.67)
53	16.0 (.47)	27.6 (.82)
56	16.0 (.47)	27.6 (.82)
59	16.0 (.47)	27.6 (.82)
65	28.3 (.84)	52.1 (1.54)
68	28.3 (.84)	52.1 (1.54)
615	28.3 (.84)	52.1 (1.54)
76	32.3 (.96)	59.5 (1.76)
711	32.3 (.96)	59.5 (1.76)
718	32.3 (.96)	59.5 (1.76)

See page 14 and 15 for illustration of vertical and horizontal configurations.

UNIVERSAL URAI series-DSL Splash Lubricated Drive End

Note that the gear end sump capacity is provided on the adjacent table.

Frame Size	Drive End Capacity Fl. Oz. (Liters)	
	Vertical	Horizontal
32	4.0 (.12)	6.5 (.19)
33	4.0 (.12)	6.5 (.19)
36	4.0 (.12)	6.5 (.19)
42	5.5 (.16)	10.8 (.32)
45	5.5 (.16)	10.8 (.32)
47	5.5 (.16)	10.8 (.32)
53	7.5 (.22)	14.8 (.44)
56	7.5 (.22)	14.8 (.44))
59	7.5 (.22)	14.8 (.44)
65	16 (0.47)	31 (0.91)
68	16 (0.47)	31 (0.91)
615	16 (0.47)	31 (0.91)

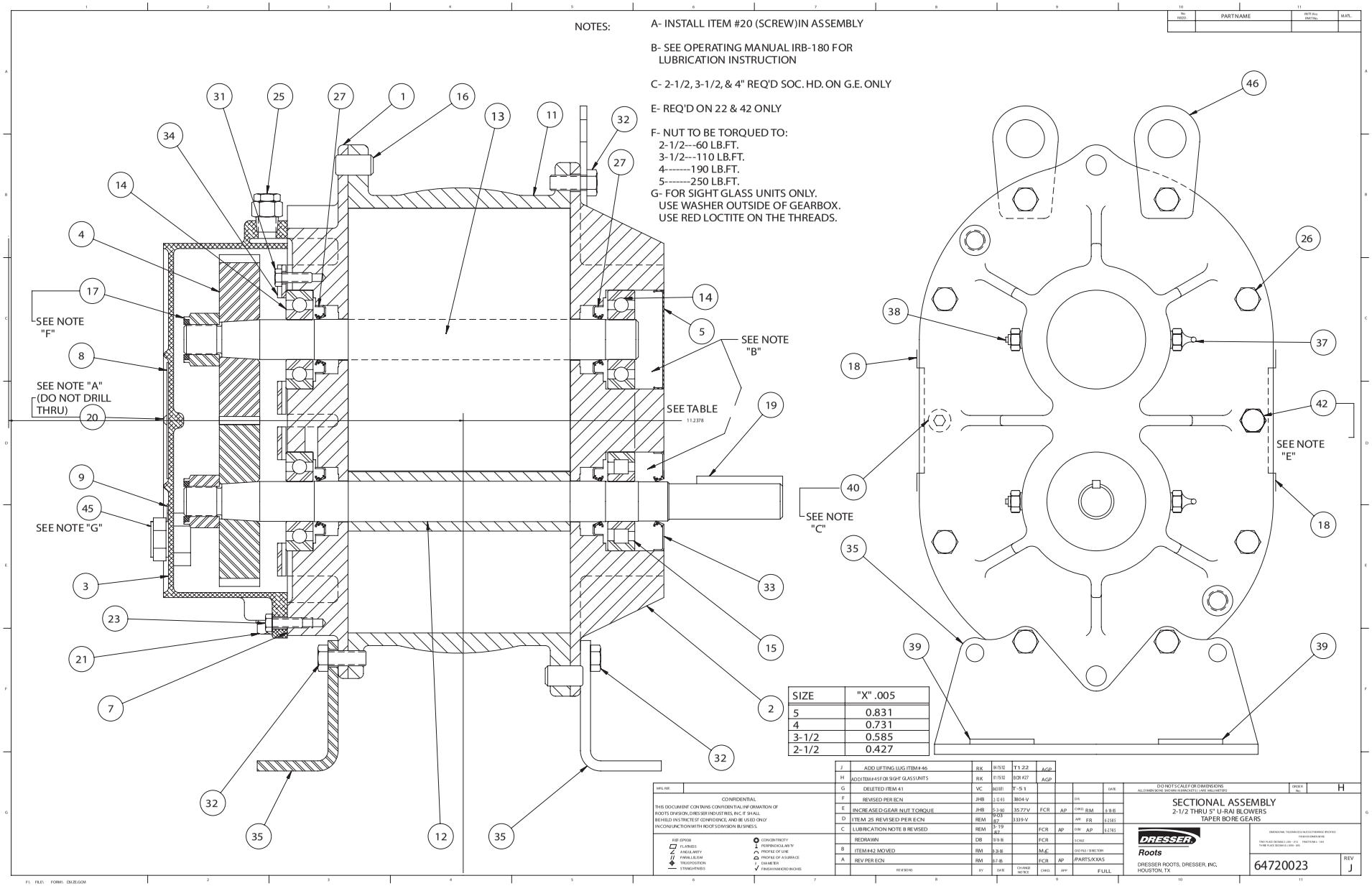
Table 4 - Universal URAI series with Grease Lubricated Drive End: Specified Bearing Greasing Intervals

Speed In RPM	Operating Hours Per Day		
	8	16	24
	Greasing Intervals in Weeks		
750-1000	7	4	2
1000-1500	5	2	1
1500-2000	4	2	1
2000-2500	3	1	1
2500-3000	2	1	1
3000 and up	1	1	1

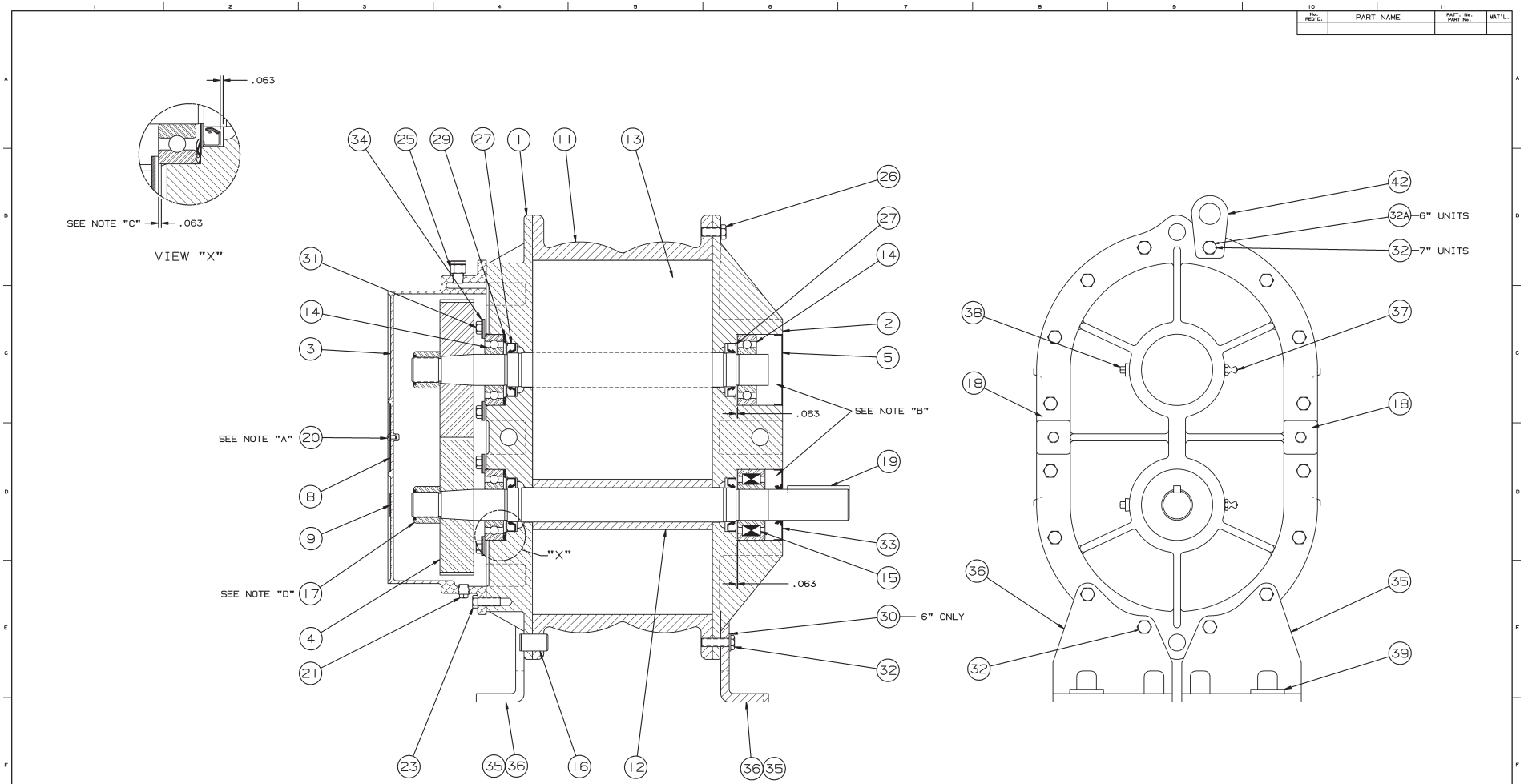
The specified grease for servicing drive end bearings of a Gas blower, use a NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001 with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

When servicing drive end bearings of Non Gas blower, use a NLGI #2 premium grade microgel grease with 250°F (121°C) service temperature and moisture resistance and good mechanical stability. ROOTS specifies Shell Darina EP NLGI Grade 2. Product Code 71522.

NOTE: Lithium based greases are not compatible with the ROOTS Synthetic grease used when assembling a Gas blower or the non-soap base grease used when assembling a standard URAI blower. Lithium based grease is not approved for any ROOTS blowers.



Assembly of UNIVERSAL RAI Series, Air Blowers, 2-1/2” Through 5” Gear Diameter



NOTES

A INSTALL ITEM #20 (SCREW) IN ASSEMBLY

B SEE OPERATING MANUAL IRB-103 FOR LUBRICATION INSTRUCTION

C INSTALL BEARINGS AS SHOWN BEFORE SETTING END CLEARANCE

D NUT TO BE TORQUED TO:
6"---400 LB. FT.
7"---550 LB. FT.

No. REQ'D.	PART NAME	PATT. No. PART No.	MAT'L.

MFG. REF. 62600023

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REF: ANSI Y14.5M-1982
FLATNESS — CONCENTRICITY ◎
ANGULARITY ∠ — PERPENDICULARITY ⊥
PARALLELISM // — PROFILE OF LINE ⌒
TRUE POSITION ⌖ — PROFILE OF A SURFACE ⌓
STRAIGHTNESS — DIAMETER ⌀
FINISH IN MICRO INCHES √

	REVISIONS	BY	DATE	CHANGE NOTICE	CHKD.	APP
H	ADDED ITEM 32A	AKP	12/12/05	76311V		
G	REMOVED ITEM 44	AJK	8/21/05	75271V	AGP	
F	ADDED ITEM 44	RDR	3/4/05	74191V		

DATE
DR. REM 12/8/95
CHKD. FCR 3/12/96
APP. AP 8/8/96
DEV
SCALE 6"=1'-0"
CAD FILE / DIRECTORY 64792A23
XASR

DO NOT SCALE FOR DIMENSIONS
ALL DIMENSIONS SHOWN IN BRACKETS [ ] ARE MILLIMETERS
ORDER No. 55-1242-2

SECTIONAL ASSEMBLY
FOR 6" & 7" U-RAI BLOWER
WITH TAPER GEAR FIT

DRESSER ROOTS
ROOTS DIVISION
DRESSER EQUIPMENT GROUP
A HALLIBURTON COMPANY
HOUSTON, TX USA

COMMERCIAL TOLERANCES UNLESS OTHERWISE SPECIFIED
FINISHED DIMENSIONS
TWO PLACE DECIMALS [.XX]---±.010
THREE PLACE DECIMALS [.XXX]---±.005
FRACTIONAL---±1/64

64792023 REV H

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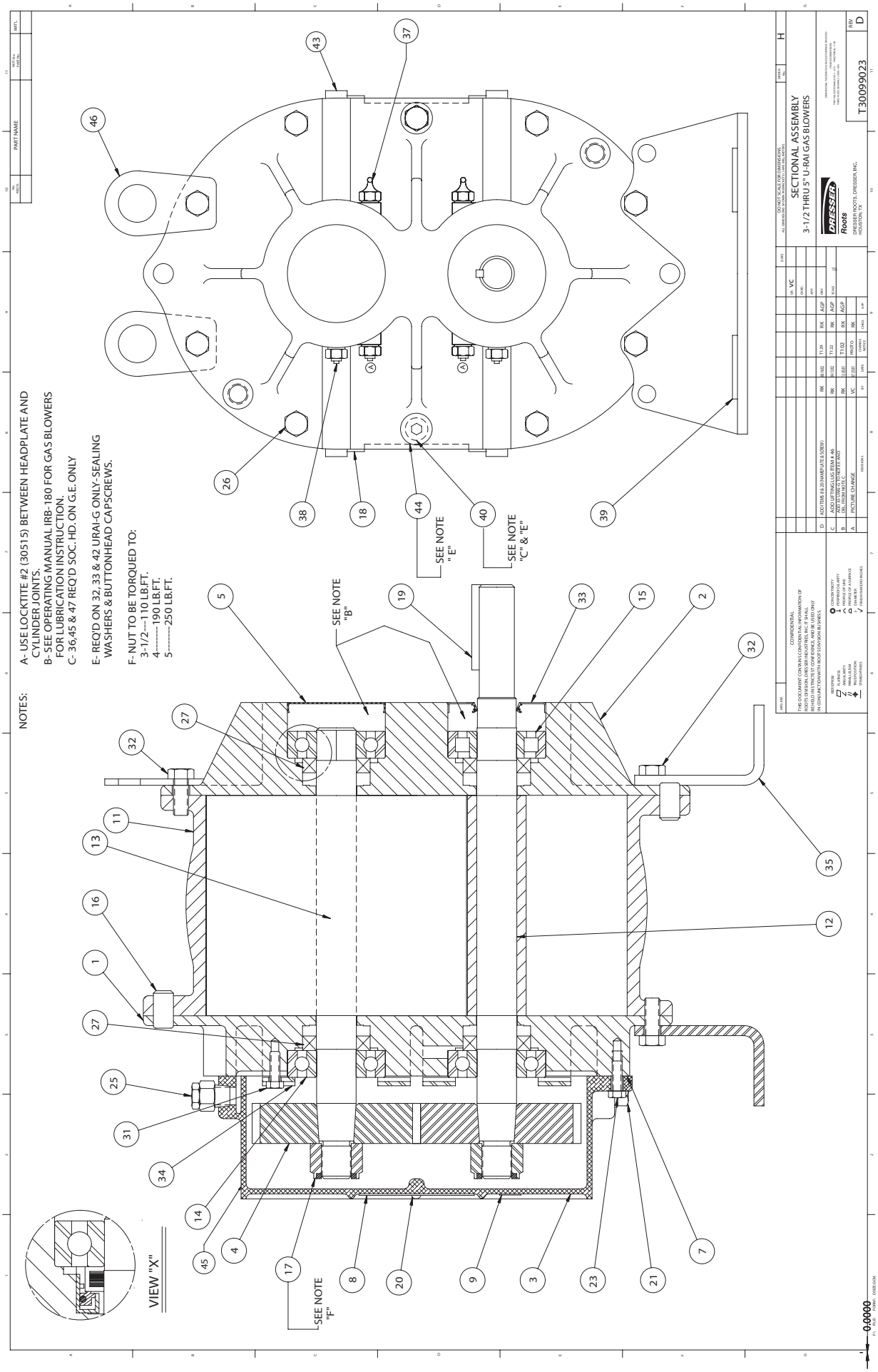
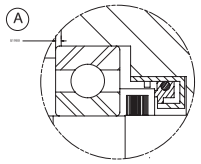
Assembly of UNIVERSAL RAI Blowers, 6” and 7” Diameter



Assembly of UNIVERSAL RAI-G Series Gas Blowers, 3-1/2"Through 5" Gear Diameter



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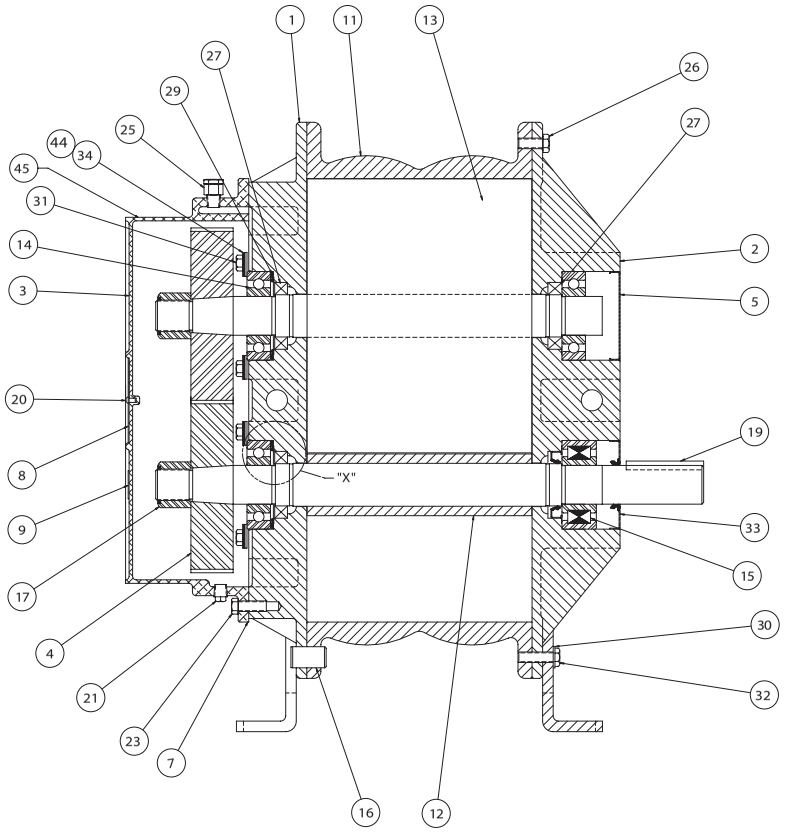
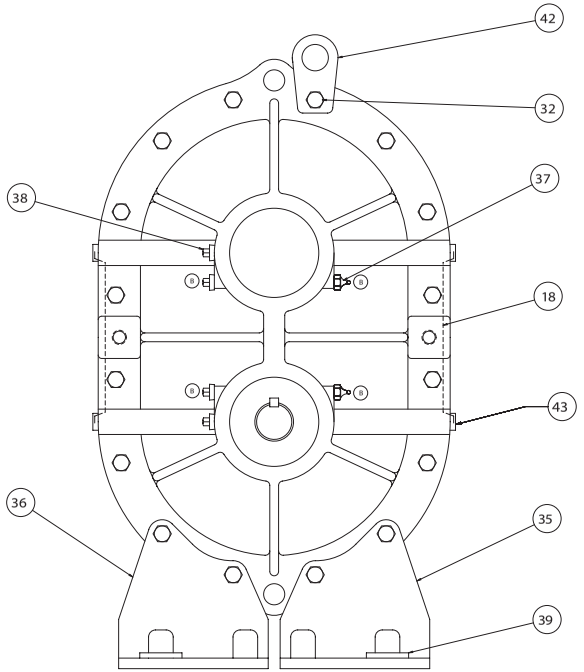


SEE NOTE "C"



NOTES

A USE LOCKTITE #2 (30515) BETWEEN HEADPLATE AND CYLINDER JOINTS.

B SEE OPERATING MANUAL IRB-180 FOR LUBRICATION INSTRUCTION

C NUT TO BE TORQUED TO: 6"—400 LB.FT.

MFG. REF.	REF.6479 2023										DATE	DO NOT SCALE OR DIMENSIONS ALL DIMENSIONS SHOWN IN INCHES (UNLESS OTHERWISE NOTED)	ORDER No.
CONFIDENTIAL THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION OF ROOTS DIVISION, DRESSER INDUSTRIES, INC. IT SHALL BE HELD IN STRICTEST CONFIDENCE, AND BE USED ONLY IN CONJUNCTION WITH ROOTS DIVISION BUSINESS.										DR. VC	11/13/11	SECTIONAL ASSEMBLY FOR 6" U-RAI GAS BLOWERS	
										CHKD.			
										APP.			
										DW			
REF: EP938 FLATNESS ANGULARITY PARALLELISM TRUE POSITION STRAIGHTNESS CONCENTRICITY PERPENDICULARITY PROFILE OF LINE PROFILE OF A SURFACE DIAMETER FINISH IN MICRO INCHES										SCALE	NTS	DRESSER Roots DRESSER ROOTS, DRESSER, INC. HOUSTON, TX	
	C	ADD ITEMS # 8 & 20 (NAMEPLATE & SCREW)	RK	08/16/12	T129	RK						DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ± DECIMALS ± ANGLES ±	
	B	PICTURE CHANGE	VC	07/2011	PROTO	RK							
	A	ADDED DIMENSION .066	VC	06/26/11	P PROTO	RK						T30110023	REV B
		REVISIONS	BY	DATE	CHANGE NOTICE	CHKD.	APP.						

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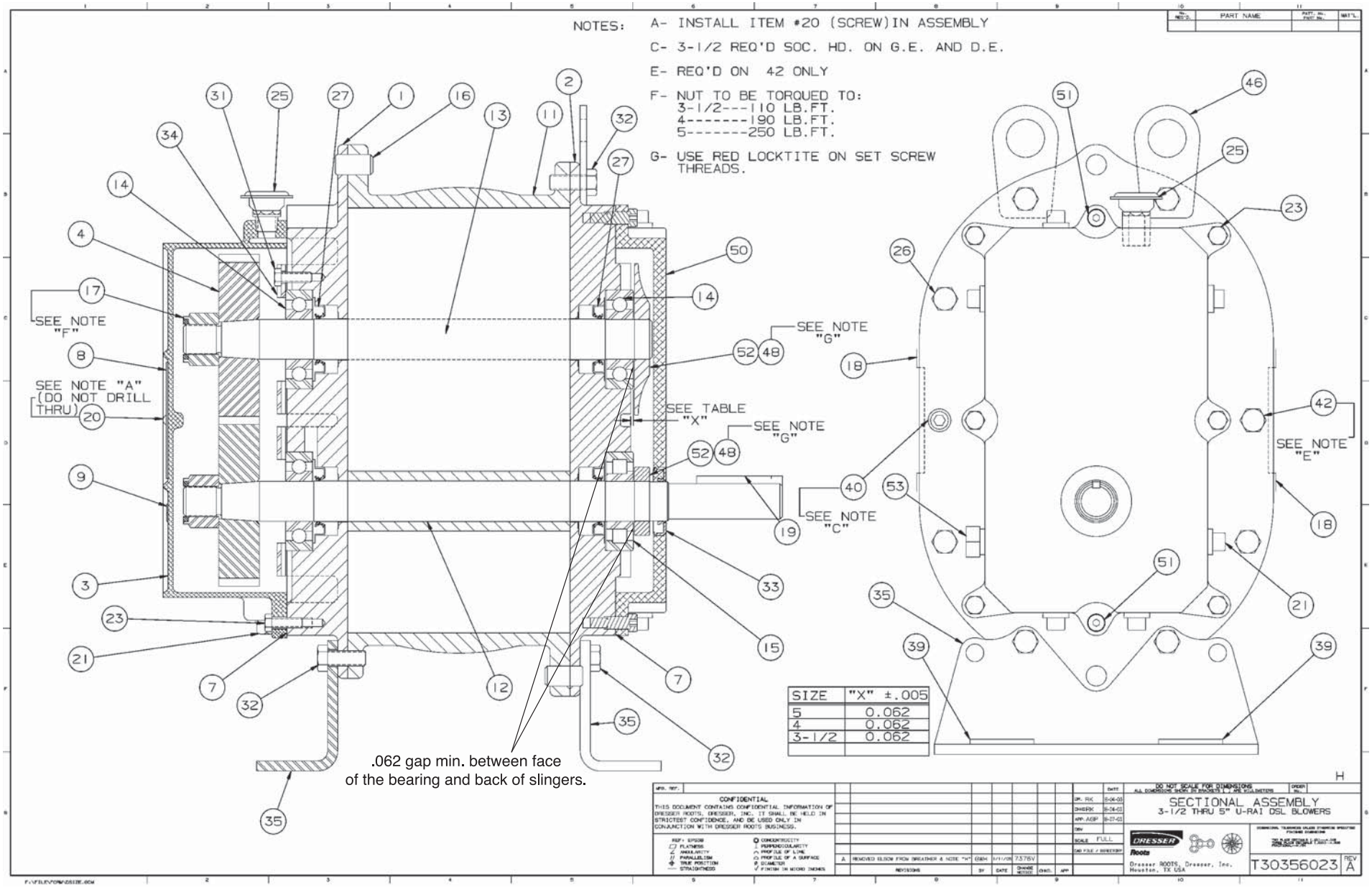
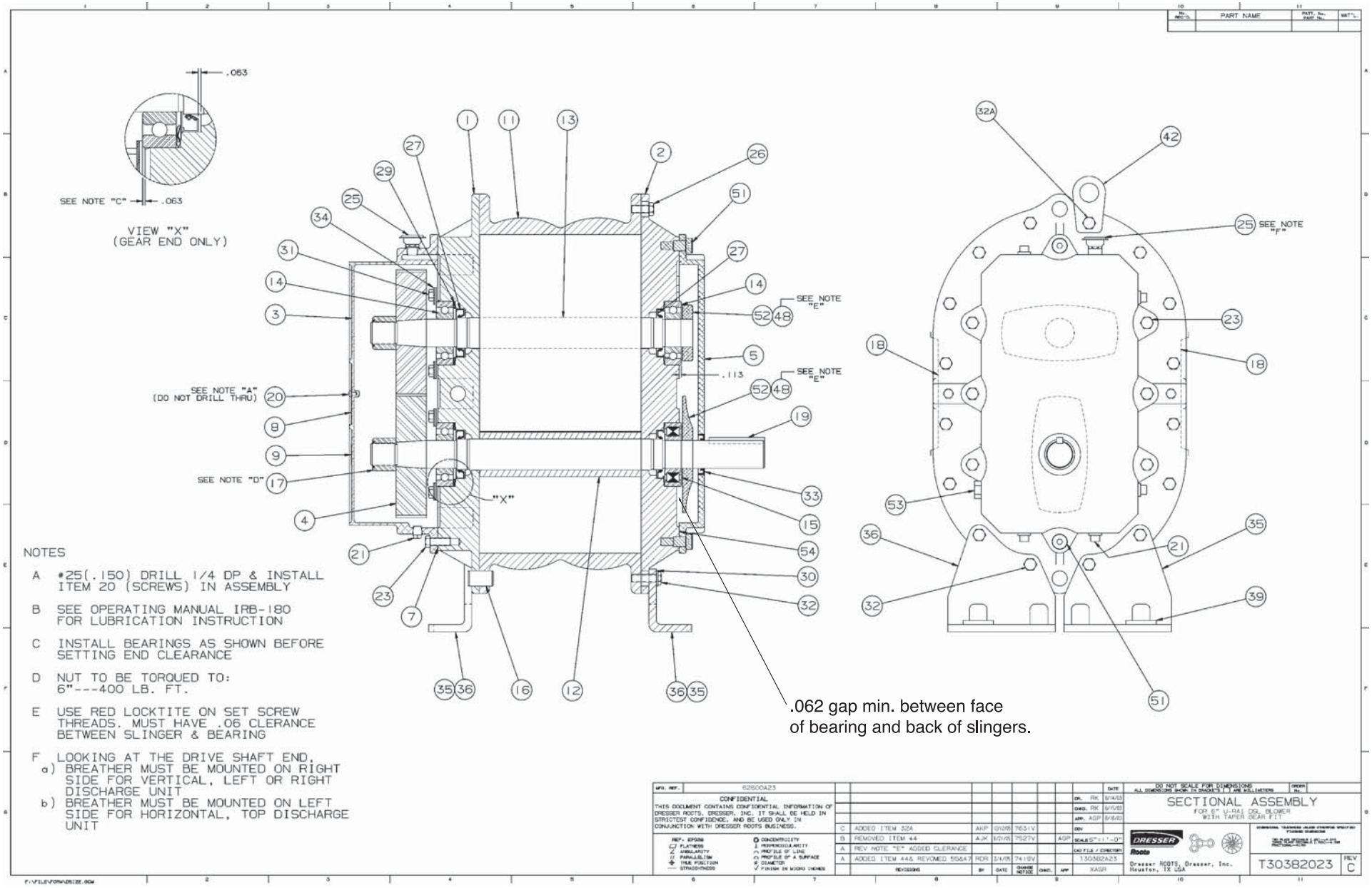
Assembly of UNIVERSAL RAI Series Gas Blowers, 6” Gear Diameter



Assembly of UNIVERSAL RAI Series - DSL with Splash Lubricated Drive End 3-5" Gear Diameter



Assembly of UNIVERSAL RAI Series - DSL with Splash Lubricated Drive End 6” Gear Diameter

Universal RAI Series Blowers Parts List 2-1/2" – 5" Gear Diameter

(Refer to drawing #64720023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex	6
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
31	Screw, Hex, Nylock	4
32	Screw, Hex	6
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2

*Quantities vary by blower.

Universal RAI Series Blowers Parts List 6" & 7" Gear Diameter

(Refer to drawing #64792023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex Nylock	8
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
29	Washer, Spring Wavy	2
31	Screw, Hex, Nylock	4
32	Screw, Hex	10
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4

*Quantities vary by blower.

Universal RAI-DSL Series Blowers Parts List 3-1/2" – 5" Gear Diameter

(Refer to drawing #T30356023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
7	Gasket, Gear Box, DE Cover	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex	6
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
31	Screw, Hex, Nylock	4
32	Screw, Hex	6
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2
48	DE Oil Slinger Set Screw	4
50	Drive End Cover	1
52	Drive End Oil Slinger	2
53	Oil Sight Glass	2

*Quantities vary by blower.

Universal RAI®-DSL Series Blowers Parts List 6" Gear Diameter

(Refer to drawing #T30382023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1

Item #	Part Name	Qty.
21	Plug, Pipe	3
23	Screw Hex Nylock	8
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
31	Screw, Hex, Nylock	4
32	Screw, Hex	10
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
39	Washer Mounting	4
48	DE Oil Slinger Set Screw	4
50	Drive End Cover	1
52	Drive End Oil Slinger	2

*Quantities vary by blower.

Universal RAI Series Gas Blowers Parts List
3-1/2" & 5" Gear Diameter

(Refer to drawing #T30099023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex	8
25	Breather (Plug Vent)	1
26	Screw, Hex	14*
27	Seal, Bearing	4
31	Screw, Hex	4
32	Screw, Hex	4
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2

*Quantities vary by blower.

Universal RAI Series Gas Blowers Parts List
6" Gear Diameter

(Refer to drawing #T3011023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
7*	Gasket DE Cover	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex Nylock	8
25	Breather (Plug Vent)	1
26	Screw, Hex	14**
27	Seal, Bearing	4
31	Screw, Hex	4
32	Screw, Hex	10
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2
43	Plug	8
53	Oil Sight Glass	2

*DE cover gasket is not the same as the gasket used on the GE. You must specify the gasket required when ordering.
**Quantities vary by blower.

Specified Lubricants

ROOTS Synthetic Oil: ISO-VG-220 Grade

	Part Number
Quart	813-106-001
Gallon	813-106-002
Case (12 qts)	813-106-008

ROOTS Synthetic Oil: ISO-VG-320 Grade

	Part Number
Quart	813-106-004
Gallon	813-106-005
Case (12 qts)	813-106-007

ROOTS Synthetic Grease: NLGI #2

	Part Number
14.5 oz. Tube	T200019-001
5 Gallon Pail	T200019-003
Case (30 tubes)	T200019-002

UNIVERSAL RAI (URAI) AIR BLOWERS

URAI AIR BLOWERS (with Grease Lubricated Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
65102020	22	1" NPT	0.625"	32
65103020	24	2" NPT	0.625"	43
71048020	32	1.25" NPT	0.750"	69
65105020	33	2" NPT	0.750"	74
65106020	36	2.5" NPT	0.750"	102
65108020	42	1.5" NPT	0.875"	88
65109020	45	2.5" NPT	0.875"	109
65110020	47	3" NPT	0.875"	128
65112020	53	2.5" NPT	1.125"	143
65113020	56	4" NPT	1.125"	170
65114020	59	4" NPT	1.125"	204
65116020	65	3" NPT	1.375"	245
65117020	68	5" NPT	1.375"	285
65118020	615	6" Flange	1.375"	425
65120020	76	4" NPT	1.562"	400
65121020	711	6" Flange	1.562"	530
65122020	718	8" Flange	1.562"	650

Refer to Specification Sheet S-12K84

URAI-DSL AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
T30378020	32	1.25" NPT	0.750"	72
T30379020	33	2" NPT	0.750"	77
T30380020	36	2.5" NPT	0.750"	105
T30352020	42	1.5" NPT	0.875"	92
T30353020	45	2.5" NPT	0.875"	113
T30354020	47	3" NPT	0.875"	132
T30359020	53	2.5" NPT	1.125"	148
T30360020	56	4" NPT	1.125"	175
T30361020	59	4" NPT	1.125"	209
T30384020	65	3" NPT	1.375"	250
T30385020	68	5" NPT	1.375"	290
T30386020	615	6" Flange	1.375"	430

Refer to Specification Sheet S-27S03

Universal RAI air blowers include detachable mounting feet which permit vertical or horizontal installation. The units are center timed for rotation in either direction. The bearings on the URAI are grease lubricated on the drive end and splash lubricated on the gear end. The URAI-DSL is splash lubricated on BOTH ends.

UNIVERSAL RAI (URAI) GAS BLOWERS

URAI-G™ GAS BLOWERS (with Grease Lubricated Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
710480G0	32	1.25" NPT	0.750"	69
651050G0	33	2" NPT	0.750	74
651060G0	36	2.5" NPT	0.750	102
651080G0	42	1.5" NPT	0.875"	88
651090G0	45	2.5" NPT	0.875	109
651100G0	47	3" NPT	0.875	128
651120G0	53	2.5" NPT	1.125"	143
651130G0	56	4" NPT	1.125	170
651140G0	59	4" NPT	1.125	204
651160G0	65	3" NPT	1.375"	245
651170G0	68	5" NPT	1.375	285
651180G0	615	6" NPT	1.375	425

Refer to Specification Sheet S-60A01

Universal RAI-G™ gas blowers include detachable mounting feet which permit vertical or horizontal installation. **Feet are different for vertical and horizontal mounting**.

The units are center timed for rotation in either direction. The bearings on the Universal RAI-GTM are grease lubricated on the drive end and splash lubricated on the gear end. ROOTS Synthetic lubricant is recommended.

UNIVERSAL RAI (URAI-J) WHISPAIR AIR BLOWERS

URAI-J WHISPAIR AIR BLOWERS (with Grease Lubed Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
74065020	33J	2" NPT	0.750"	84
74086020	36J	2.5" NPT	0.750	112
74066020	45J	2.5" NPT	0.875"	119
74087020	47J	3" NPT	0.875	138
74067020	56J	4" NPT	1.125"	180

Refer to Specification Sheet S-33A93

URAI-J-DSL WHISPAIR AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
T30417020	33J	2" NPT	0.750"	87
T30418020	36J	2.5" NPT	0.750	115
T30410020	45J	2.5" NPT	0.875"	122
T30412020	47J	3" NPT	0.875	141
T30415020	56J	4" NPT	1.125"	185

Refer to Specification Sheet S-30S03

URAI-J METRIC WHISPAIR AIR BLOWERS (with Grease Lubed Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
TBD	33J	2" BSP	19 mm	84
740860M0	36J	2.5" BSP	19 mm	112
TBD	45J	2.5" BSP	24 mm	119
TBD	47J	3" BSP	24 mm	138
TBD	56J	4" BSP	28 mm	180

URAI-J-DSL METRIC WHISPAIR AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
TBD	33J	2" BSP	19 mm	87
T304660M0	36J	2.5" BSP	19 mm	115
TBD	45J	2.5" BSP	24 mm	122
T304550M0	47J	3" BSP	24 mm	141
TBD	56J	4" BSP	28 mm	185

Universal RAI-J air blowers incorporate the patented WhispairTM design in addition to the same features as the original URAI blowers. The URAI-J's are center timed, however the WhispairTM benefits can only be realized when the jet is located in the discharge position.

UNIVERSAL RAI METRIC (URAI-M) AIR BLOWERS

NOTE: METRIC URAI product has metric shaft diameter and connection sizes

URAI-METRIC AIR BLOWERS (with Grease Lubricated Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
651020M0	22	1" BSP	16 mm	32
651030M0	24	2" BSP	16 mm	43
710480M0	32	1 1/4" BSP	19 mm	69
651050M0	33	2" BSP	19 mm	74
651060M0	36	2 1/2" BSP	19 mm	102
651080M0	42	1 1/2" BSP	24 mm	88
651090M0	45	2 1/2" BSP	24 mm	109
651100M0	47	3" BSP	24 mm	128
651120M0	53	2 1/2" BSP	28 mm	143
651130M0	56	4" BSP	28 mm	170
651140M0	59	4" BSP	28 mm	204
T30392060	65	3" BSP	32 mm	245
T30394060	68	5" BSP	32 mm	285
T30390060	615	150 NP10	32 mm	425
T30396060	76	4" BSP	38 mm	400
T30398060	711	150 NP10	38 mm	530
T30400060	718	200 NP10	38 mm	650

URAI-DSL-METRIC AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
T30463060	32	1 1/4" BSP	19 mm	72
T30464060	33	2" BSP	19 mm	77
T30465060	36	2 1/2" BSP	19 mm	105
T30451060	42	1 1/2" BSP	24 mm	92
T30452060	45	2 1/2" BSP	24 mm	113
T30453060	47	3" BSP	24 mm	132
T30459060	53	2 1/2" BSP	28 mm	148
T30460060	56	4" BSP	28 mm	175
T30461060	59	4" BSP	28 mm	209
T30472060	65	3" BSP	32 mm	250
T30473060	68	5" BSP	32 mm	290
T30474060	615	150 NP 10	32 mm	430

Universal RAI air blowers include detachable mounting feet which permit vertical or horizontal installation. The units are center timed for rotation in either direction. The bearings on the URAI are grease lubricated on the drive end and splash lubricated on the gear end. The URAI-DSL is splash lubricated on BOTH ends.

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ISRB-2002 rev.0106
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