Zenith® Pumps C-9000 Gear Pumps

Installation, Care and Maintenance

Zenith Corrosive Duty Gear Pumps

Zenith® Pumps

Note: Thoroughly read and understand this entire manual before installation and operation of the pump.

Zenith®

In 1926, Zenith Pumps was approached by the synthetic fiber industry to design a pump that would provide precise, pulseless and repeatable flow while ensuring ultimate product quality. The options then were the same as those in the chemical process industry today—diaphragm, lobe, coarse gear, piston, plunger and screw pumps. Each has problems with pulsation, flow inaccuracies, multiple seal areas and slip, which require constant calibration, high maintenance and extended downtimes.

Zenith Pumps met the challenge and designed a rotary external gear pump of unique precision and simplicity. Manufacturing techniques were developed to hold tolerances to ±.00005", minimizing internal clearances and assuring accurate and precise metering. The pump's simplistic design of only three moving parts – two metering gears and a drive shaft – provided long life and reduced maintenance.

For years, engineers have relied on Zenith to provide precision fluid handling solutions for their most difficult pumping applications. Zenith gear pumps can be found wherever *precise, pulseless,* and *repeatable metering* of fluids is required.

Benefits

High Accuracy — Stable, repeatable flows are assured even under varying conditions of temperature, viscosity and pressure.

Precision Construction — Ground and lapped components allow for operating clearances to .00015" and provide high volumetric efficiency.

Minimum Pulsation — Unique design offers virtually pulseless flow without valves or flexible elements to hinder performance.

Active Flowmeter Concept — Unparalleled mechanical precision, combined with the closed loop set point accuracy, ensures an exact volume per revolution without expensive flow meters.

Low Cost of Ownership — With only three moving parts and 316 stainless steel compatible construction, the pump provides excellent corrosion resistance for most chemical processes.

Experience — Zenith has over 74 years of application experience with engineers available 24 hours a day to support your precision fluid metering needs.

Specifications

Capacities (cc/rev):

0.3, 0.6, 1.2, 2.4, 4.5, 9.0

Recommended Speed:

up to 1000 rpm

Flow Range:

up to 9,000 cc/Minute
(2.4 GPM)

Inlet Pressure:

300 psi (20 Bar) Maximum

Outlet Pressure:

1000 psi (70 Bar) Maximum

Differential Pressure:

20 to 1000 psi. (viscosity dependent)

Temperature:

-40° F (- 40° C) Minimum

350° F (175° C) Maximum

Seals:

Single Mechanical, Double Lip, or Magnetic

Rotation:

Clockwise (CW) facing drive shaft

Port Connections:
Metric thread or SAE 61 Standard

Optional Port Adapters:
M12 X 1/4" NPT. . . . . 0.3 – 2.4 cc/rev
1/2" SAE X 1/2" NPT. . . . . 4.5 – 9.0 cc/rev

Optional Band heaters:
150 Watt, 115 VAC. . . . . 0.3 – 2.4 cc/rev
325 Watt, 115 VAC. . . . . 4.5 – 9.0 cc/rev

Quick Start:

1. **If you are familiar** with installation of Zenith pumps please read over the list of Do's and Don'ts on page 15.
2. **Special care must be taken:** The C-9000 pumps are easily damaged in handling due to the soft metal used in their construction.
3. **It is strongly recommended** that you thoroughly read through this entire manual before you begin installation or any servicing of the C-9000 pumps.

Introduction:

This manual was specifically written for the 0.3, 0.6, 1.2, 2.4, 4.5, and 9.0 cc/rev C-9000 pumps. It will guide you through the process of maintaining and caring for your pump.

C-9000 series pumps are similar in concept to other Zenith pumps, however several key physical aspects differ in ways which will affect the care and maintenance of the product. The following literature will discuss, in detail, how to care and maintain a well running and efficient pump in order to maximize the productivity and effectiveness of your Zenith product.

Below are a few key points which must be considered in order to prevent damage to the product during handling, installation and cleaning.

Most importantly

1. Use only brass or plastic tools to pry on the C-9000 pump components;
2. If you must hammer on the pump, use a clean plastic hammer (no imbedded metal chips, etc.) and tap lightly;
3. Do not perform maintenance on the silicon carbide sleeve bearings.
4. Use force, not impact, to move stubborn parts.

Again, the C-9000 pumps are not as hard as the tools found in most maintenance areas, and can be damaged by common steel tools. This is one feature of the pump that must be taken into consideration in the installation, disassembly and assembly procedures.

The specially designed bearings require an interference fit installed at the Zenith plant and should not be removed by the customer. These sleeve bearings are extremely brittle and fragile, and can be easily broken resulting in multiple part damage and high replacement cost. See *Figure 1.* The sleeve bearings should not need to be replaced during routine maintenance.

If you follow the above suggestions and the Do's and Don'ts list (page 15), you will be able to maintain a C-9000 pump with little chance of damage.

Figure 1

Installation:

The following is a general installation procedure for Zenith C-9000 Series metering pumps. The procedure may vary slightly depending on the pump model purchased. For special applications, considerations, or technical assistance, please contact your representative or our Applications Engineering Group.

Things to remember

1. The pump should be carefully unpacked and inspected. If any items are missing or damaged, the freight carrier and Zenith should be notified immediately.
2. **Take Care!** - The pump is a precision instrument. Dropping the pump on a hard surface or striking the pump with a hard object can cause serious damage to the components.
3. Treat the pump as a precision gauging instrument.
4. Always flush the piping system before connecting the pump.
5. Filters should be installed upstream of the pump. For C-9000 pumps, the fluid should be filtered to five (5) microns, absolute.
6. **Zenith C-9000 pumps must never be run without a fluid.** C-9000 pumps contain no lubricant when shipped from the factory. Prior to start-up, the pump must be wetted by priming the pump with the process fluid, or by pouring fluid into the inlet port and rotating the drive shaft until fluid appears at the discharge port. The product to be pumped can be used as this fluid, assuming it will not evaporate prior to the pump actually being started. Remove seal housing plug and fill with compatable fluid. This will ensure that the shaft seal is lubricated.
7. Turn pumps by hand before start-up to ensure free rotation before starting the drive.
8. For applications above ambient temperatures, if using heaters, heat the pump slowly and evenly (including the seal arrangement) prior to introducing hot fluid into the pump. This prevents thermal shock and material distortion.
9. Make sure that process fluid is in the pump before starting. Apply positive pressure to the pump inlet when metering high-viscosity fluids to prevent cavitation.
10. Install a pressure regulating valve downstream of the pump, if necessary, to ensure there is at least 20 psig differential pressure at all times.

Installing the pump

Install the selected fittings into the inlet and discharge ports, taking care not to over tighten the fittings. Mount the pump to the base plate using the two mounting screw holes on the bottom of the front plate. Align the pump shaft to the shaft on the gear reducer using a shaft alignment gauge, laser alignment mechanism, or by carefully using a straight edge to control the coupling alignment. Jaw-type couplings are not recommended as shaft misalignment must be controlled to within .008 inch parallel and to within 1° angular. For Zenith-supplied systems (pump, reducer, baseplate, coupling, etc.), the shaft misalignment should be controlled to within .035 inch parallel and to within 1° angular, but these values may need to be adjusted depending on the particular coupling chosen for your application. When installing the coupling end member onto the pump shaft, do not use excessive force. This connection should be a slip fit. If not, increase the inside diameter of the coupling accordingly.

If your pump was designed to use an outer drive gear, you must grease the outer drive gear and carefully mesh it with the drive pinion gear. A backlash of .005" is recommended.

Start-Up

1. Allow enough time for all components of the system to reach process temperature before starting the pump. Apply inlet pressure to the pump, allowing time to ensure that the process fluid has entered the pump to prevent the bearing areas from running dry.
2. Before starting, remove all flow restrictions downstream of the pump to provide initial operation with the slightest amounts of back pressure.
3. **Set the acceleration rate for the pump to be 0.3 seconds/rpm or more.** Prior to start-up, adjust the acceleration rate of the controller to ensure initial slow speed operation. This corresponds to 600 seconds to reach 2000 rpm, or .3 seconds/rpm.

Start-Up (cont.)

4. **Start the pump and accelerate to 30 rpm or to the lowest set point of speed for the application, whichever is less.** Watch the point of discharge for evidence of fluid. If no discharge is seen after 10 revolutions of the shaft shut down the pump and check for obstructions in the system and proper pump rotation. This is assuming a connection can be broken within a few inches of the pump outlet port, where the flow would be evident within several seconds. If the distance between the pump outlet and the point of discharge inspection were long, more time would be needed before flow is confirmed. This is more risky, and damage to the pump might result if it is run dry for more than 30 seconds.

Note: The pump will discharge a cloud of bubbles when it is started, but this will subside when the air is purged from the pump. This is a normal part of pump startup.

5. When smooth flow is seen at the discharge the pump and system can be gradually brought up to normal operating speeds and pressure. Listen for unusual sounds when first starting the pump and turn the pump off immediately if any are heard. Investigate for causes of distress.

6. If, at any time during operation, the pump does not appear to be running smoothly, stop the pump immediately to avoid serious internal damage.

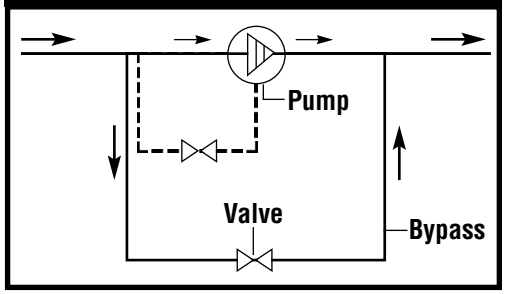
Flushing of the product piping

Take care when flushing the pump or downstream process equipment using the Zenith precision metering pump as the flushing pump. The pump must be able to withstand the solvent or flushing agent as well as the product, and the operating speed and pressure during flushing must still fall within the applicable range for the C-9000 product.

If it is necessary to flush the system, the following suggestions are recommended to prevent pump damage:

1. Minimize the differential pressure across the pump ports to less than 100 psi, but not less than 20 psi.
2. Reduce the pump speed to an acceptable level, approximately 50-100 rpm.
3. Flush the pump for the shortest allowable time, yielding effective cleansing of the system, and no longer than necessary.
4. Another alternative is to use a bypass around the pump, as illustrated in *Figure 2*, this will allow for high velocity flushing of the downstream system while minimizing risk to the metering pump. During the flush cycle, run the pump slowly. The fluid will pass through and around the pump. This will allow the system to be flushed quickly and effectively.
5. If it is necessary to also flush the seal housing, and the discharge pressure is higher than the suction pressure (during flushing cycle), connect the seal housing drain to the suction line (dotted line on *Figure 2*).

Figure 2



Care During Operation

How does the pump work?

Fluid enters the pump through the inlet port located in the front plate and fills the gear pocket. As the gears rotate, a precise amount of fluid is trapped between the side walls of the gear pockets and gear teeth.

The metered fluid is transported by the rotation of the gears to the discharge side of the pump where the gear teeth come into mesh. This action forces the fluid out of the gear teeth and through the outlet port located in the front plate. The pressure developed is determined by the pump size, the gear clearances, pump speed, fluid viscosity and impedance to flow.

How fast can I run the pump?

Pump speed is limited by practical considerations. If a high viscosity fluid is being metered and pump speed is increased beyond a certain point, the fluid may not be able to fill the gear teeth spaces, and the pump will not obtain enough fluid to maintain normal volumetric

Care During Operation (cont.)

efficiency. Lack of sufficient fluid is called starvation or cavitation. This can be remedied by increasing the inlet pressure or reducing pump speed.

Pumping thin fluids requires a different approach. Since the pump depends upon the **metered fluid for lubrication** of internal bearing surfaces, speeds are normally limited. These bearing surfaces include the bearing areas in the front and rear plates. Operating a Zenith pump above indicated speeds will accelerate wear and may cause seizure, especially if the fluid is a poor lubricant at operating temperatures. It is not recommended to pump abrasive fluids with C-9000 pump models. In certain applications, it is recommended to use a pump of larger capacity operated at a lower speed. Contact your representative or our Applications Engineering Department for assistance with this special case.

Inlet Pressure Requirement

Once the pump is installed the inlet port pressure must be found and adjusted to an acceptable level. It is highly recommended that the inlet port pressure be at least one atmosphere. It is, however, acceptable to have 0.5 atmosphere or even vacuum at the inlet assuming the port is flooded. It is also imperative that the pumping losses from the tank to the inlet port be considered in this procedure. A high viscosity fluid requires a high inlet pressure; a low viscosity fluid requires a low inlet pressure. Once the pump has started cavitation will occur if the inlet pressure is not high enough. Cavitation may damage the pump so if it occurs stop the pump immediately. Keep in mind that once the inlet is flooded and the pump is started there will be a head loss across the inlet port of the pump. ***Table 1*** on the next page has been included for reference.

De-rating the Pump Performance

Pump displacement depends on four basic variables: fluid viscosity, gear clearances, differential pressure and pump speed. The pump performance is de-rated, or reduced from the ideal value, due to slip of the product fluid around the gears from the discharge side back to the intake side.

The less viscous the fluid, the more likely it is to flow through a given orifice. For de-rating the pump, this orifice is the gear clearance. Differential pressure forces the fluid through this clearance at a steady rate, regardless of the pump speed. Thus, the slip flow is constant for a given amount of time. The actual delivery of fluid is the measured delivery minus the slip. This means the pump displacement is still linear. If we increase the pump speed we increase the measured delivery, while the slip remains constant. Slip flow is repeatable and predictable, and pump operation can be adjusted to compensate for this flow.

Graph 1 on the next page has been included for reference.

Operating at elevated temperatures

Zenith C-9000 Series pumps are designed for operating temperatures less than 176°C. When operating at temperatures above ambient, heaters should be used, and pumps should be heated slowly and uniformly to avoid distortion and internal component interference.

Magnetic Coupling Pumps

In normal operation, the magnetic poles of the outer drive magnet remain aligned with the magnetic poles of the inner pump magnet. The motion of the motor is smoothly transferred to the pump shaft. If the torque load on the pump exceeds the magnetic coupling strength, then the outer magnets will rotate past the inner magnets and the magnetic poles will misalign. The outer magnet will increase to a no-load motor speed while the inner magnet remains relatively motionless. Excessive noise and vibration can be observed as the poles of a decoupled magnet move past one another.

The pump should be stopped immediately if the magnets decouple. Continued operation of the motor with the magnets decoupled will reduce the future strength of the coupling. The magnets will not properly realign until the motor has been stopped. Before restarting the motor, one should determine the cause of the decoupling and remedy the problem. Decoupling does not necessarily indicate a pump failure. It indicates that an instantaneous torque requirement of the pump has exceeded the strength of the magnetic coupling supplied with the system.

Without disassembly of the pump it can be difficult to determine whether the magnetic coupling or the pump internals are operating incorrectly. The following is a list of examples that could result in magnet decoupling:

- Blockage or restriction in the discharge side of the system

Care During Operation
(cont.)

- Discharge pressure in excess of nominal conditions
- Too rapid acceleration or deceleration of the drive system
- An increase in fluid viscosity
- Foreign particles impinging upon pump internal components
- Increased friction due to a poorly lubricating process fluid

The decoupling characteristic of magnets can be a safety feature, preventing inadvertent pump/motor overloads. Magnets should be chosen so that their decoupling torque is greater than the pump input torque. This should include any transient, starting, and stopping conditions in addition to steady state values.

The decoupling torque can vary with different fluids, temperatures, operating pressures, and magnet sizes. Accurate sizing of magnets for a specific application requires precise knowledge of several operating conditions. Check with your Zenith representative to see which 9000-MD system is appropriate.

WARNING General Magnetic Coupling Precautions

Both the inner and outer magnetic rotors are very powerful. **Handle them with caution.**

Danger! Persons with cardiac pacemakers should stay at least 8 feet from the magnetic product at all times.

Do not position hands or fingers so that they may become trapped between the two magnetic rotors, or between one magnet and a metal object.

Do not position the magnets near one another unless assembling the pump to the system. Both rotors should be fastened to their respective shafts before bringing them into proximity.

Do not place the magnets near any electronic equipment or media that is sensitive to magnetic fields (computers, diskettes, credit cards, etc.)

When storing and assembling the magnetic coupling, make sure that no small metallic fasteners, pieces or other foreign objects adhere to the rotors or barrier cap.

If the magnets de-couple, stop the drive system for the pump immediately. Determine the cause of the excessive torque requirement and remedy the problem prior to re-starting the system.

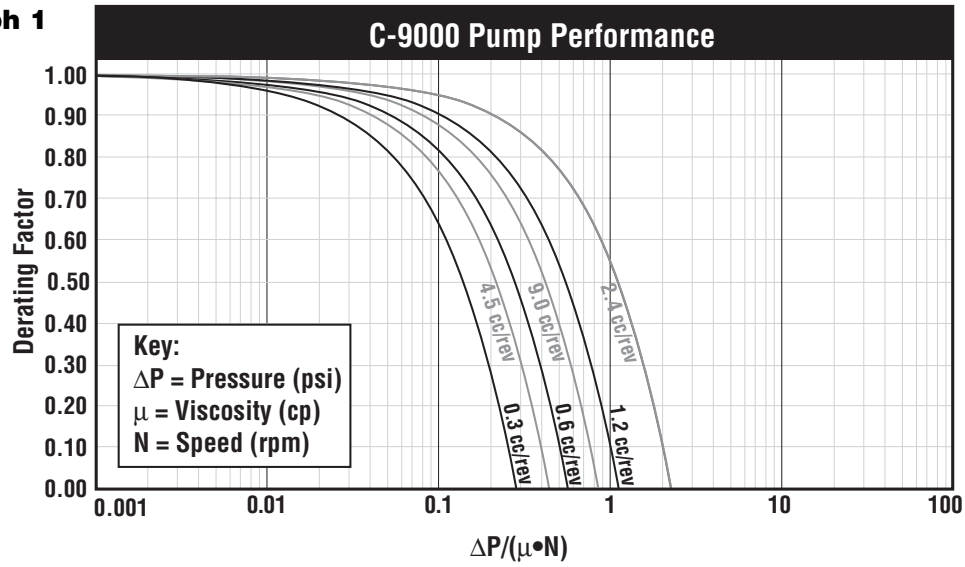
Inlet Pressure Loss (psi) = Viscosity(cps) • Displacement(cc/rev) • Shaft Speed(rpm) • [(Specific Gravity • W1)+W2]

Table 1

cc/rev	W1	W2
0.3	4.29E-06	2.32E-06
0.6	1.93E-06	2.47E-06
1.2	1.21E-06	2.77E-06
2.4	9.34E-07	3.38E-06
4.5	3.00E-07	3.46E-07
9.0	2.24E-07	4.19E-07

Note: This sizing procedure should be used as a guideline for estimating pump type, pump size and system requirements. Please consult Zenith to confirm pump and system selection prior to placing a purchase order.

Graph 1



Flowrate = pump capacity (cc/rev) x rpm x performance factor

Cleaning, Inspection and Repair

REMEMBER: Zenith metering pumps are made for exacting duty. In order to develop high pressure and minimize slip flow, the clearance between the metering gears and the housing must be as small as possible, yet large enough to allow adequate lubrication. All parts are machined to extreme accuracy. Critical dimensions are held between one and two ten-thousandths of an inch (2 to 5µ). Consistent performance is dependent upon proper handling.

Please handle the pumps with extreme care and set aside a separate clean area for pump maintenance and repair.

It is recommended that pump users institute a program for dimensional inspection of critical parts in order to keep maintenance and operating costs to a minimum. By noting the performance of a pump immediately before removing it from service and correlating the performance to measured component wear, the maximum wear limits for the pump's critical components can be established. Additionally, the service life of the pump can be predicted and downtime can be scheduled accordingly.

If necessary, any Zenith precision metering pump requiring maintenance can be returned to the factory for complete repair and overhaul. For a large number of pumps, Zenith offers a contract repair service, which helps to reduce repair costs and delivery time. Zenith Pumps also offers pump maintenance seminars. For more information concerning Zenith pump repair services, please contact our Customer Service Department.

C-9000 Series Disassembly

Instructions below assume the pump has been removed from the system, for example magnetically driven pumps with adapter plates have been disengaged from the housings.

Note: As parts are disassembled, place them carefully on a clean surface such as a soft cloth. See Figure 3. Do not allow them to touch each other. Pay close attention to the order in which parts are removed. This will aid in the reassembly of the pump. The numbers in parentheses refer to the part numbers on the bill of materials.

Caution: Please review the precautions listed on Page 7 for Magnetically Coupled Pumps.

1. If the pump came with an outer drive gear, remove it from the drive shaft before starting disassembly.

2. Remove the square key (17) from the shaft end.

3. If applicable, remove the socket head screws (18) from the seal housing (11). See *Figure 4.*

4. Lift off the seal housing (11). Take care to also remove the o-ring (33) which seals the housing to the front plate. The ring may be attached to the front plate.

5. Remove the seal (51) [item 13 on 4.5 & 9 cc/rev pumps] from the seal housing (11).

a) Mechanical Face Seal Pumps; The ceramic seat of the mechanical face seal may be removed from the seal housing by pushing it out with finger pressure. If it is stuck, use two small Allen keys or other small pins to press the seat from the housing using the two access holes in the housing face. Set screws will have to be loosened to allow removal of the mechanical seal (13) from the drive shaft. Some materials of the seal (face) are brittle in nature, use extreme caution so as not to damage the seal or its components. Remove the retaining ring (16) from drive shaft with a brass or plastic tool.

b) Double Lip Seal Pumps; Press the lip seal (51) [item 13 on 4.5 & 9 cc/rev pumps] from the housing using finger pressure, or by pressing on the seal using a plastic tool.

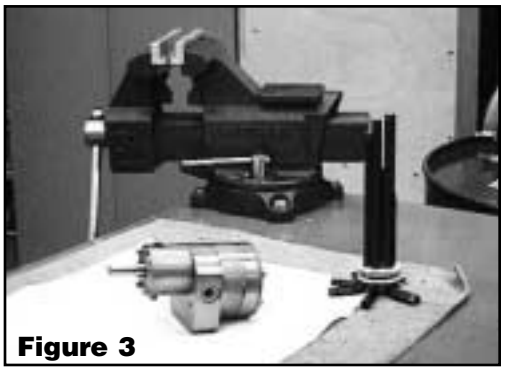


Figure 3

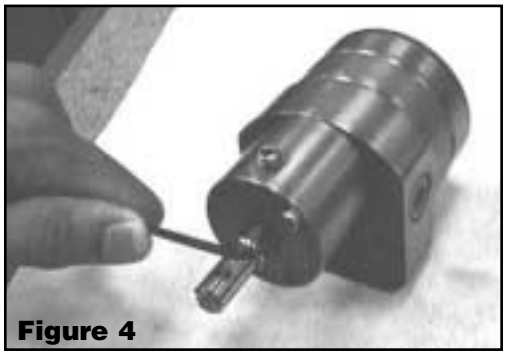


Figure 4

C-9000 Series Disassembly

(cont.)

C) Magnetically Coupled Pumps

If applicable, remove the screws that secure the barrier cap to the adapter plate. Remove the barrier cap and its O-Ring. **NOTE:** There could be process fluid contained in the barrier cap. Loosen setscrew at the bottom of the inner rotor with appropriate Allen wrench. **NOTE:** Beware of strong magnetic forces. Slide the inner rotor off the shaft.

Remove the square key from the pump shaft. Remove the four socket head screws/washers securing the adapter plate to the pump body. Lift the adapter plate off the pump body and retrieve the O-Ring.

6. Now set the pump in a vice that has soft, **protective jaws made of brass, aluminum, plastic or any material softer that 316ss**. Orient the pump with the drive shaft pointed down. Allow the vice to grip the pump on the port sides of the front plate.

7. Loosen and remove the socket head screws (19) [and 15 if applicable], from the back of the rear plate (7).

8. Remove the rear plate (7). Always use the pry slots to prevent scratching the precision lapped surfaces. **Use brass or plastic tools to pry, if necessary.** Take care not to press on the gears or the edges of the gear pocket.

Caution: Do not allow the gears to be lifted out of the gear plate. They may drop, causing damage to the gear teeth. See *Figure 5.*

9. Remove the drive shaft (2) and the driving gear (5). The round key (4) will fall from between the gear and the drive shaft.

10. Remove the retaining ring (16) from the drive shaft with a brass or plastic tool.

11. Remove the arbor (9) and the driven gear (5) from the gear plate (3). **Note:** The driven and driving gears are identical in most models.See *Figure 6.*

12. Remove both retaining rings (16) from the arbor (9) using brass or plastic tools. Remove the driven gear (5) from the arbor (9). See *Figure 7.*

13. Remove the round key (4) from the arbor (9).

14. Remove the gear plate (3). Always use the pry slots to prevent scratching the plates!

Caution: The slip-fit dowels (10) may come off with the gear plate.

15. Remove both slip-fit dowels (10) by turning and pulling simultaneously. It is acceptable to lightly press the dowels out using an arbor press. Use a brass or plastic pin to press against the dowel.

16. Remove the o-rings (34) from the front and rear plates with a brass or plastic tool.

17. Do not attempt to remove the special bearings located in the front and rear plates. See *Figure 8.*

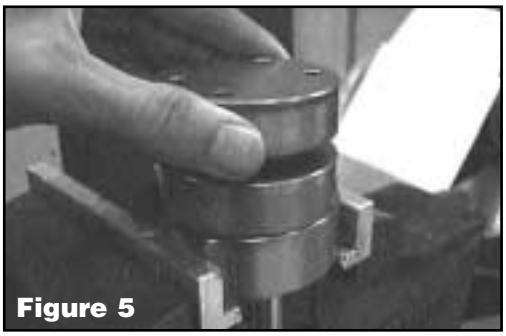


Figure 5

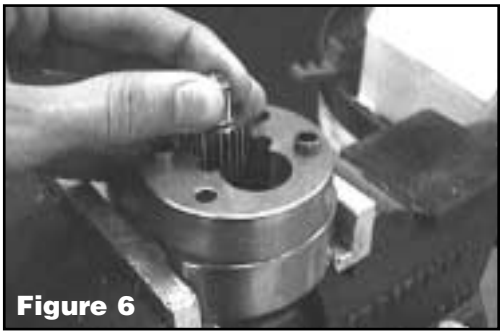


Figure 6

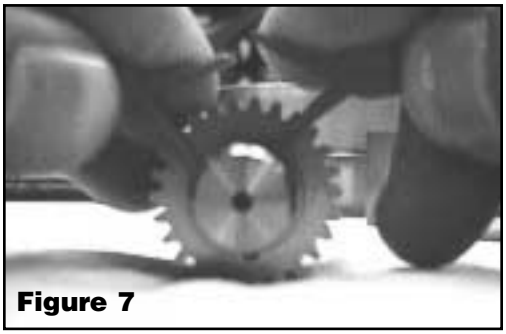


Figure 7

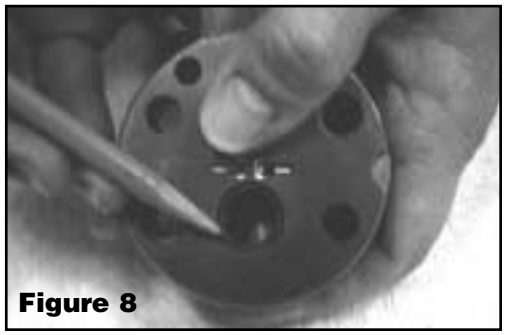
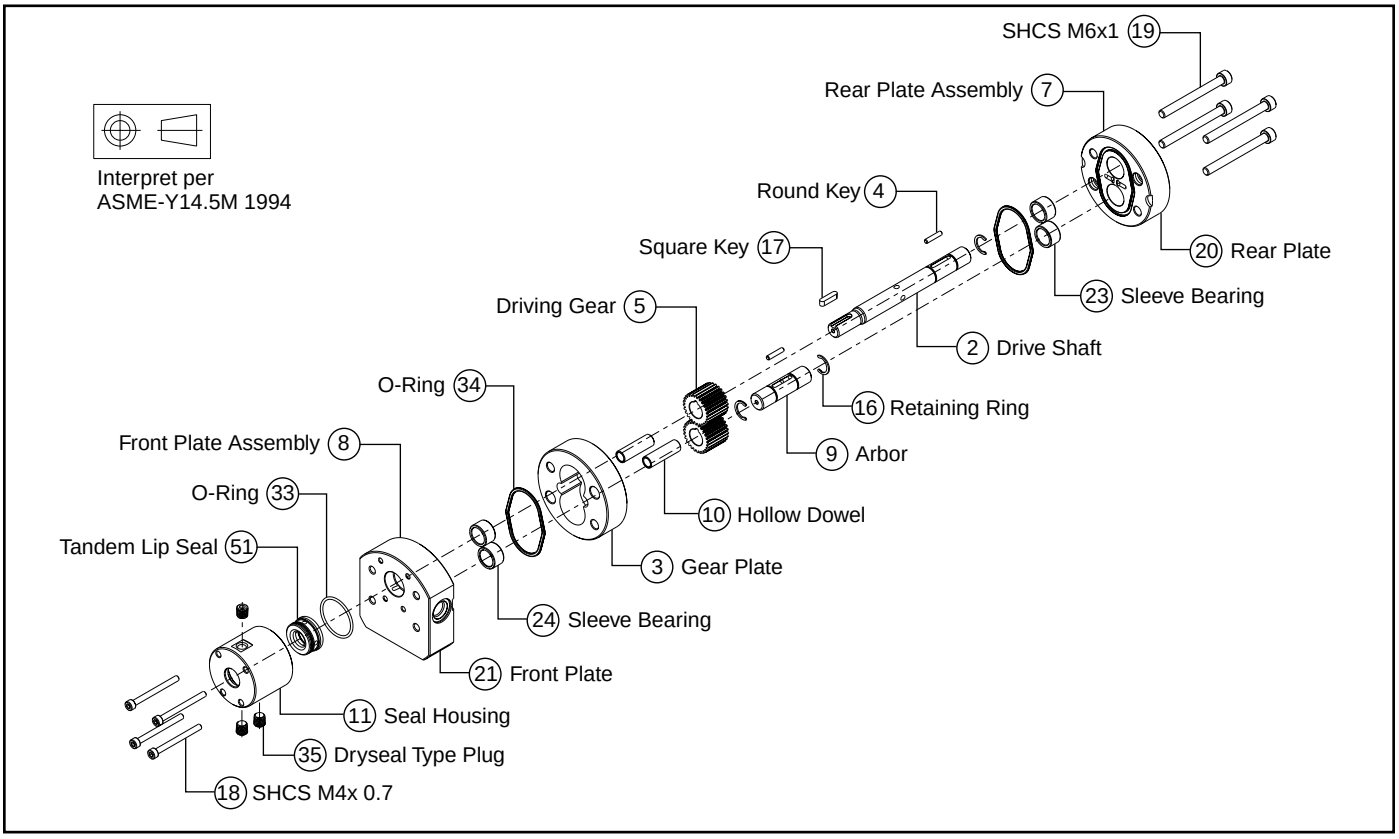
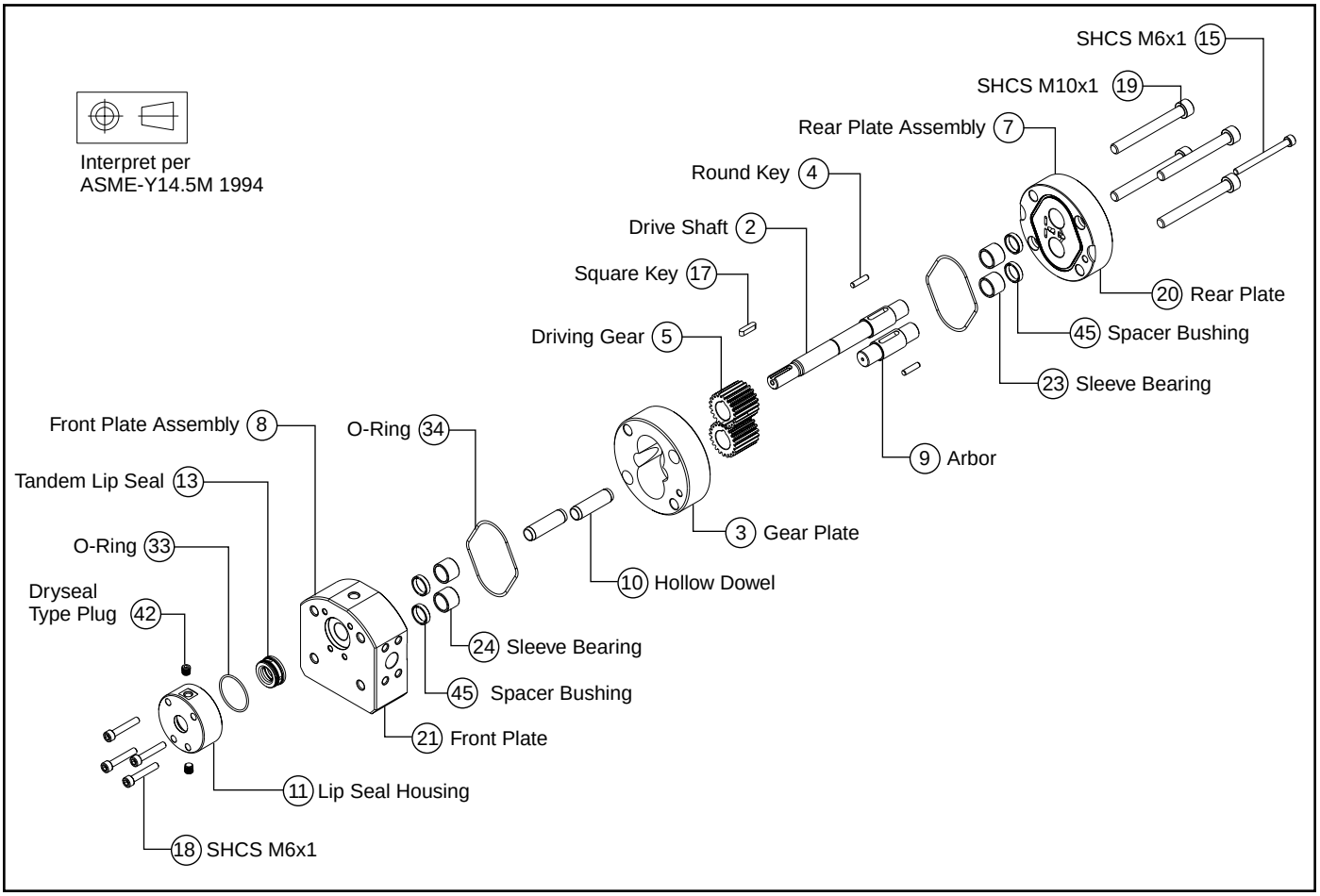


Figure 8

0.3 - 2.4 cc/rev C-9000



4.5 & 9.0 cc/rev C-9000



Inspection and Part Preparation

After the parts have been cleaned, they should be inspected for nicks, burrs and stubborn residue. The gears and the edges of the gear plate pockets are the most likely areas to be damaged because of the sharp edges on these parts. An illuminated magnifier helps during the examination.

Components should be cleaned with a soft brush and a mild detergent solution, or a safe, industrial solvent. Do not use abrasives to clean the pump.

Carefully inspect for any tool marks, nicks or scratches on the surfaces of the plates and gears. See *Figure 9.* Watch for shiny areas around nicks or scratches on the plates. These indicate a raised area that is present. This damaged area needs further attention. It is acceptable to carefully stone a "cratered" nick with a new, hard Arkansas or X-Fine water stone (6000 grit or higher), but this should be done with extreme care.

Deep marks or galling cannot be removed by stoning. These surfaces must be ground. Return the parts to the factory for repair or replacement.

Any nicks in the gear teeth should be removed by carefully stoning the parts with a fine India oilstone or an Arkansas stone. After all preparation has been completed, remove the abrasive dust and loose residue in an ultrasonic cleaner or other suitable cleaning method. Abrasive dust is larger in size than the pump clearances.

Always use clean, lint-free rags or disposable towels and compressed air to clean components. Common paper towels are not acceptable because they can leave small pieces of paper and dust on the pump parts. Use chemical brushes to clean between gear teeth, bores and other pump features. After all components are clean, the pump can be reassembled. See *Figure 10.*

If cleaned parts are not to be reassembled for a period of time, they should be carefully packed in soft paper to prevent damage during storage. Never allow C-9000 parts to touch each other in storage or during cleaning. These components can easily damage each other if they collide by shifting around in a pan or bin.

New and replacement parts should always be deburred and cleaned using the above procedures. In addition to the above methods, new gears must be deburred on the teeth tips and edges using 600 grit paper, as well. Roll the gear for two revolutions like a wheel against the abrasive paper. Press down gently on the gear during this process. Simulate a motion as if you were trying to sand the teeth off of the gear; perform only two complete turns. Now, hold the gear and sweep the edges of the teeth against the paper for two revolutions of the gear. Finally, lay the gear flat on its side and block as discussed above. Repeat this blocking on the other side of the gear. Sharp edges on the gear bores must also be broken.

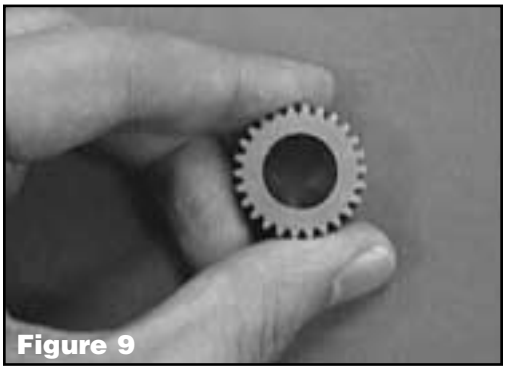


Figure 9

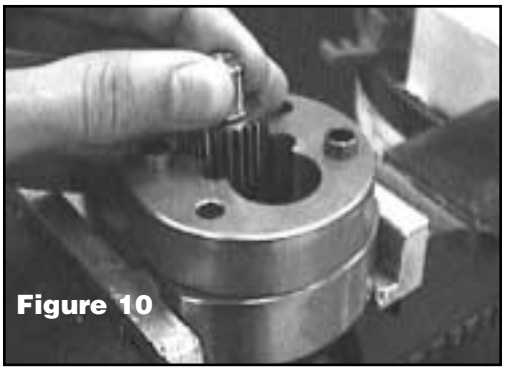


Figure 10

C-9000 Series Reassembly

Use all pages of the assembly drawing during the reassembly process to assure correct orientation of the parts

Note: If the pump will not turn freely after a component is installed, then the pump needs to be inspected further to determine where the unwanted contact is occurring.

Caution: Please review the precautions listed on Page 7 for Magnetically Coupled Pumps.

Provide a can of compatible lubricant, preferably a mineral oil or process-acceptable synthetic lubricant such as glycerin. If none of these materials are available it is acceptable to use rubbing alcohol as a substitute lubricant. Shaft, arbor, dowels, and gears should be lubricated prior to assembly. Take care to remove excess fluid from between the plate surfaces using a clean, lint-free towel. Threads on bolts should be lubricated with an anti-seize compound or a molydisulfide based grease See *Figure 11*. During assembly, considerable care should be taken to prevent wedging or jamming of close-fitting components. Never force the parts together. They will drop or press into place with finger pressure if properly aligned.

1. Insert the o-rings (34) into the grooves on the front and rear plates (8,7). Replace these o-rings if they have been damaged.
2. Place the front plate (8) in a **vise that has soft protective jaws.** Grip the pump on the port sides of the front plate with the inner surface of the plate facing up.
3. Push both slip-fit dowels (10) into the dowel holes in the gear plate (3).
4. Place the gear plate (3) on the front plate (8) and align the dowels so they slip into the corresponding holes on the front plate. Make sure that the bolt holes also line up when fitting the gear plate on the front plate. See *Figure 12.*
5. Place the round key (4) on the arbor (9) and fit the driven gear (5) on to the arbor. **Note:** The driven and driving gears are identical in most models.
6. Snap the retaining rings (16) onto the arbor and slip the arbor into the front plate (8).
7. Install the round key (4) into the keyway on the drive shaft.
8. Slide the driving gear (5) onto the drive shaft and against the retaining ring. Take care to align the keyway in the gear with the key (4). The key may need to be held down to prevent it from being damaged by the gear
9. Insert the drive shaft (2) into the front plate (8) and insert the gear into the gear pocket of the gear plate (3). See *Figure 13.*
10. Install the rear plate (7).

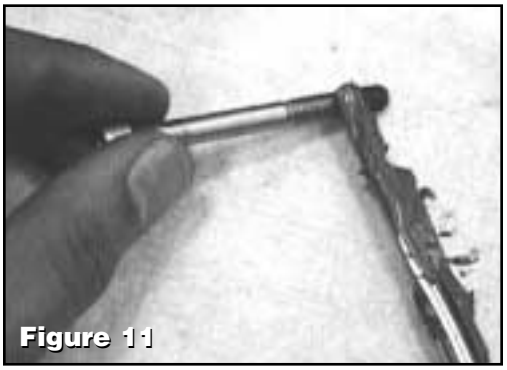


Figure 11


Figure 12


Figure 13

C-9000 Series Reassembly

(cont.)

11. Lubricate the threads and install the socket head screws (19) through the rear plate (7). Torque the screws to 50% of recommended torque (see table page 14) using a crossing pattern. Check for free rotation of the gears. If acceptable, continue to torque to total recommended torque. Again, check for free rotation of the gears. See *Figure 14.*

12. Place a seal installation tool (lip seal version only) (52) [item 41 on .05-2.4 cc/rev pumps] over the end of the shaft.

Note: For Magnetically Coupled Pumps no seal installation tool is required.
Insert the smaller O-Ring into the groove on the adapter plate, using compatible grease to retain the O-Ring into the groove. Install the plate with the O-Ring facing the pump body using the four socket head screws and sealing washers. Insert the square key onto the pump shaft, then slide the inner magnet onto the shaft. Refer to certified pump assembly drawing to determine the correct height/placement of the magnet. **Note:** This is critical to the pumps proper operation. Secure the inner magnet by tightening the setscrew upon the square key. Place the larger O-Ring into the exposed face of the adapter plate. Lower the barrier cap into position over the inner magnet. If applicable mount the barrier cap by installing/tightening the eight socket head screws.

Assembly is now complete.

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13. Mechanical Seal Installation

a) Snap the retaining ring (16) onto the drive shaft. Install the mechanical seal (13) onto the drive shaft with the carbon end away from the front plate. Take care when pressing the seal onto the shaft. **The elastomer can be damaged by the keyway or shaft edge.**

b) Align the set screws with the grooves machined in the drive shaft and tighten the set screws.

c) Install the ceramic seat in the seal housing (11) with the 0-ring of the seat away from the mechanical seal.

14. If your pump contains a double lip seal (51) [item 13 on 4.5 & 9 cc/rev pumps] push the seal to the rear of the seal housing. Make sure there is no gap between the seal and the seal housing.

15. Install the o-ring (33) into the recess in the seal housing (11). If necessary, use compatible grease to keep the o-ring in place. **Note:** This ring may already be in place if the pump was previously assembled.

16. Install the seal housing (11) over the drive shaft (2). See *Figure 15.*

17. Lubricate the socket head screws and install them (18) into the seal housing (11). Tighten to the recommended torque remembering to use a crossing pattern.

18. Install the square key (17) into the drive shaft keyway.

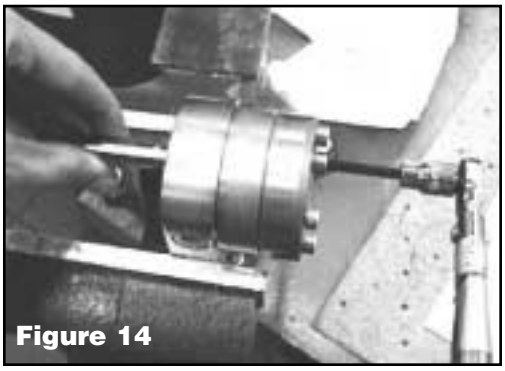

Figure 14

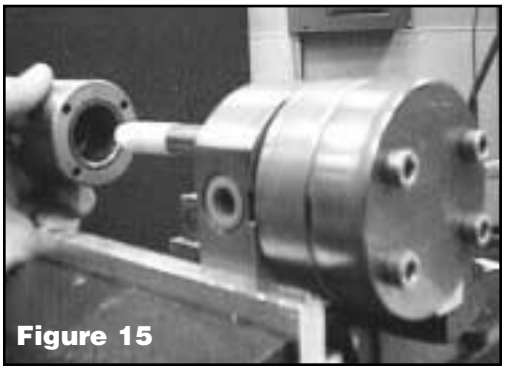

Figure 15

Screw Torque

Pump Bolt Size	Bolt Material	Recommended Torque (lb.-in)*
M4	316 SS	20
M6	316 SS	70
M8	316 SS	169
M10	316 SS	335
M12	316 SS	580
Mounting Bolt Size	**Bolt Material**	**Recommended Torque (lb.-in)***
M10	Alloy	519
M12	Alloy	910

***Lubricated values/if non-lubricated increase by 33%.**

Trouble-shooting

Examples of malfunctions of the pump with possible causes and remedies are listed in the following table:

Trouble	Probable Cause	Remedy
Pump will not turn	**1)** Drive malfunction	Verify that drive is powered. Assure that alarm circuits are clear. Check motor drive current and speed settings.
	2) Process conditions changed	Check process conditions for proper temperature, pressures, viscosities and materials.
	3) Entrained particle	Disassemble and clean pump; replace any damaged parts.
	4) Possible internal damage	Disassemble and clean pump; replace damaged parts. Consult factory.
Excessive seal assembly leakage	**1)** Worn seal face(s)	Replace seal.
	2) Improperly Positioned seal or faces	Check seal and faces for proper position.
Reduced pump efficiency	**1)** Excessive outlet pressure	Reduce outlet pressure.
	2) Worn gear(s)	Replace worn gear(s).
	3) Process conditions changed	Consult factory for gear clearance recommendations for new process conditions.

Do's	Don'ts
Handle with care - The pump can be damaged by common steel tools.	**Don't** pry, tap, scratch, scrape or otherwise work on the pump or its components with steel tools. **Don't** assume that because it is steel you can't damage the pump in handling.
Disassemble the pump in a clean area and keep the area clean during maintenance.	**Don't** work on the pump in a dirty area.
Cover the workbench with a clean cloth or with paper towels. Change the towels on the bench as necessary to ensure the area is clean during maintenance and assembly.	**Don't** work on a bench which is not covered. Hard particles imbedded in the bench can cause damage to the pump parts.
Keep prying and scraping tools and hammers used on C-9000 product separate from those used for other maintenance tasks	**Don't** use dirty or damaged tools, or those that might have hard particles imbedded in them.
Pry only with clean, new brass or plastic tools and pry in designated areas only.	**Don't** use steel prying tools. **Don't** pry with edges or corners of the tool. **Don't** pry with broken or damaged tools.
Tap lightly with clean plastic or rubber hammers.	**Don't** tap with steel tools or hammers. **Don't** use hammers with imbedded particles in the hammer faces. Use clean, new tools.
Lubricate the threads on screws and bolts with an anti-seize compound or with molybdenum disulfide grease.	**Don't** assemble the pump without lubricating the bolt threads.
Tighten the bolts with torque wrenches to the specified torque.	**Don't** tighten the bolts without using a torque wrench.
Tighten the bolts in a crossing pattern.	**Don't** tighten the bolts all the way in the first attempt, and don't tighten them in a circular order.
Avoid touching the bearings with any hard object.	**Don't** attempt to remove the bearings from the plates. The bearings can be easily broken and the plates damaged in the process.
Use the seal installation tool provided when reassembling the pump.	**Don't** attempt to install the seal without the seal installation tool and instructions.
Clean the pump with water and approved liquid solvents. "Soft" abrasive cleansers are acceptable (kitchen and bath cleansers that won't scratch.)	**Don't** clean the pump using abrasives or by bead or sand blasting. **Don't** burn the pump out in a furnace.

FAILURE, IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

WARNING

This document and other information from Zenith Pumps, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Zenith Pumps and its subsidiaries at any time without notice.

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