TECHNICAL SERVICE MANUAL: INSTALLATION, OPERATION & MAINTENANCE

VIKING PUMP®

CIRCUMFERENTIAL PISTON PRODUCT LINE:
STAINLESS STEEL
TRA®20 SERIES
SIZES: ALL

TABLE OF CONTENTS

MODEL NUMBER CHART

Standard Models:

- 0060 • 0180 • 0450 • 1300 • 2100 • 3200
- 0150 • 0300 • 0600 • 1800 • 2200

Rectangular Flange Models:

- 0240 • 0340 • 0640 • 1340 • 2240

GENERAL INFORMATION

Each Viking Pump product is shipped completely assembled and ready for use. Normal maintenance – as outlined in this manual – will provide long, trouble free service when the pumps is incorporated in a properly designed system.

Inspection at receipt: ports are covered at the factory to prevent dirt and foreign objects from entering the pump head. If port covers are damaged or missing, remove the pump cover to ensure the pump is clean and free of foreign objects or materials before rotating the shaft. If the pump is damaged in transit, file a claim with the carrier right away. The carrier has a Bill of Lading showing that the shipment was received from us in good condition.

Returns: when necessary to return a product under warranty or for any other reason, first contact Viking Pump to receive a Return Goods Authorization number to facilitate getting the product back to you as soon as possible.

Replacement Labels:

⚠ WARNING !

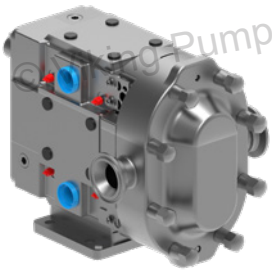
The following labels are installed on your equipment. If these labels are removed or become unreadable, contact your local Viking Pump Hygienic distributor and they will be supplied at no charge.

Application Instructions: Apply to a clean, dry surface. Remove the backing from the label, place it in proper position, protect it with a cover sheet and burnish it. (A soft rubber roller also may be used to press the label into place.) Apply all labels to be readable from the front of the pump

Important:

1. Pump and drive are factory aligned.
2. Recheck alignment after installation and before start-up
3. Recheck alignment periodically, to maximize service life.

FIGURE 1



SAFETY INFORMATION & INSTRUCTIONS

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH, AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. VIKING'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP, AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

⚠ **DANGER = FAILURE TO FOLLOW THE INDICATED INSTRUCTION MAY RESULT IN SERIOUS INJURY OR DEATH.**

⚠ **WARNING = IN ADDITION TO SERIOUS INJURY OR DEATH, FAILURE TO FOLLOW THE INDICATED INSTRUCTION MAY CAUSE DAMAGE TO PUMP AND/OR OTHER EQUIPMENT**

⚠ DANGER

DO NOT OPERATE PUMP IF:

- The front cover is not installed correctly.
- Any guards are missing or incorrectly installed.
- The suction or discharge piping is not connected.

⚠ DANGER

DO NOT place fingers, etc. into the pumping chamber or its connection ports or into any part of the gearbox if there is ANY possibility of the pump shafts being rotated. Severe injury will occur.

⚠ DANGER

DO NOT exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those for which the pump was originally supplied, without confirming its suitability for the new duty. Running the pump outside of its operating envelope can cause mechanical contact in the pump head, excessive heat and can represent a serious risk to health and safety.

⚠ DANGER

Installation and operation of the pump must always comply with health and safety regulations.

⚠ WARNING

A device must be incorporated into the pump, system, or drive to prevent the pump exceeding its stated duty pressure. It must be suitable for both directions of pump rotation where applicable. Do not allow pump to operate with a closed/blocked discharge unless a pressure relief device is incorporated. If an integral relief valve is incorporated into the pump, do not allow re-circulation through the relief valve for extended periods.

⚠ DANGER

The mounting of the pump or pump unit should be solid and stable. Pump orientation must be considered in relation to drainage requirements. Once mounted, shaft drive elements must be checked for correct alignment. Rotate pump shaft by at least one full revolution to ensure smoothness of operation. Incorrect alignment will produce excessive loading and will create high temperatures and increased noise emissions. It may also be necessary to earth the pump to avoid the build up of a potential charge difference that could cause a spark.

⚠ DANGER

The installation must allow safe routine maintenance and inspection (to check for leakage, monitor pressures, etc) and provide adequate ventilation necessary to prevent overheating.

⚠ WARNING

Before operating the pump, be sure that it and all parts of the system to which it is connected are clean and free from debris and that all valves in the suction and discharge pipelines are fully opened. Ensure that all piping connecting to the pump is fully supported and correctly aligned with its relevant connections. Misalignment and/or excess loads will cause severe pump damage. This could result in unexpected mechanical contact in the pump head and has the potential to be a source of ignition.

⚠ WARNING

Be sure that pump rotation is correct for the desired direction of flow (refer to ***"Startup Checklist" on page 6***).

⚠ WARNING

Do not install the pump into a system where it will run dry (i.e. without a supply of pumped media).

⚠ WARNING

Pressure gauges/sensors are recommended, next to the pump suction and discharge connections to monitor pressures.

⚠ DANGER

Caution must be taken when lifting the pump. Suitable lifting devices should be used as appropriate. Lifting eyes installed on the pump must only be used to lift the pump, not pump with drive and/or base plate. If pump is base plate mounted, the base plate must be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached.

⚠ DANGER

DO NOT attempt to dismantle a pressure relief valve, which has not had the spring pressure relieved, is still connected to a pressurised gas/air supply or is mounted on a pump that is operating. Serious personal injury or death and/or pump damage may occur.

⚠ DANGER

DO NOT attempt any maintenance or disassembly of the pump or pump unit without first ensuring that:

- The pump is fully isolated from the power source (electric, hydraulic, pneumatic).
- The pumping chamber, pneumatic relief valve and any shaft seal support system are depressurised and purged.
- Any temperature control devices (jackets, heat-tracing, etc) are fully isolated, that they are depressurised and purged, and components are allowed to reach a safe handling temperature.

⚠ DANGER

DO NOT loosen or undo the front cover, any connections to the pump, shaft seal housings, temperature control devices, or other components, until sure that such action will not allow the unsafe escape of any pressurised media.

⚠ DANGER

Pumps and/or drives can produce sound power levels exceeding 85dB (A) under certain operating conditions. When necessary, personal protection against noise must be taken.

⚠ DANGER

Avoid any contact with hot parts of pumps and/or drives that may cause injury. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc.), bad installation, or poor maintenance can all promote high temperatures on pumps and/or drives.

⚠ WARNING

When cleaning, either manually or by CIP (cleaning in place) method, the operator must ensure that a suitable procedure is used in accordance with the system requirements. During a CIP cleaning cycle, a pump differential pressure of between 2 and 3 bar (30 and 45 psi) is recommended to ensure suitable velocities are reached within the pump head. The exterior of the pump should be cleaned periodically.

TOOLS REQUIRED FOR DISASSEMBLY / ASSEMBLY

1. O-ring removal tool—supplied with pump
2. Soft-faced hammer
3. Suitable gear puller
4. Allen wrenches
5. Hydraulic press
6. Suitable V blocks
7. Torque wrench
8. Measuring tools
9. Spanner wrenches for gear end lock nuts—available from Viking Pump
   - » WT0150SPWRENCH
   - » WT0300SPWRENCH
   - » WT0600SPWRENCH
   - » WT2200SPWRENCH

NORMAL OPERATION

Normal operation of most Viking Pump TRA®20 Series pumps is within a range of 0 to 600 rpm, with a pressure range of 0 to 450 psi. Standard rotors operate within a temperature range of –40°F to 200°F. Hot clearance rotors operate at 200°F to 300°F. Consult factory for operation at other values. Refer to ***"Table 1" on page 8***.

PUMP CHARACTERISTICS

Viking Pump TRA®20 pumps are positive-displacement, low-slip, stainless steel pumps designed with larger diameter shafts for greater strength and stiffness, mounted on a heavy-duty bearing frame (stainless steel option available) with double tapered roller bearings.

- Up to 200 psi (13.8 bar) pressure capability.
- No bearings in the product zone.
- Heavy-duty bearing frame with large diameter shafts.
- Greased lubed bearings for positive lubrication to all bearings over entire speed, temperature and pressure range.
- Non-galling ASTM A-494 rotors are standard; permits running at tighter clearances and pumping a wide range of viscosities.

GENERAL

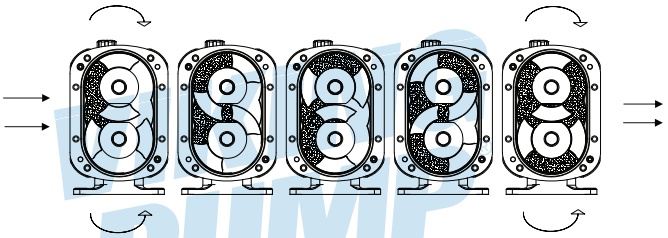
TRA®20 PUMPING PRINCIPAL

The pumping action is generated by the counter-clockwise rotation of two pumping elements (rotors) within a chamber (rotorcase) - see ***"Figure 2" on page 8***. The rotors are located on shafts, which in turn are mounted within an external gearbox and supported by the bearings; the timing gears are also located on the shafts. The timing gears transfer the energy from the drive shaft to the driven shaft, synchronising the rotors such that they rotate without contact with each other.

As the rotors pass the inlet port, see ***"Figure 2" on page 8***, the cavity generated increases creating a pressure decrease, which induces the pumped medium to flow into the rotorcase.

The pumped medium is carried around the rotorcase by the rotors to the discharge side of the pump, here the cavity decreases and the pumped medium is discharged from the rotorcase.

FIGURE 2



TRA®20 RANGE OPERATING PARAMETERS

In practice, maximum pressure and speed operating parameters may be limited due to the nature of the product to be pumped and/or design of the system in which the pump is to be installed. Consult Viking Pump or your Viking Pump Hygienic authorised distributor for assistance.

The operating temperature limit of the pump is determined by the rotor clearance.

For the circumferential piston pumps (CPP):

- TRA®20 Series - four rotor clearance bands:
  - a) Standard
  - b) FF (Front Face)
  - c) Hot
  - d) Extra (Hot Chocolate)

The pump should not be subjected to sudden temperature changes to avoid the risk of damage from sudden expansion/ contraction of components. Care should be taken when selecting pumps for handling liquids containing abrasive particles as these may cause wear of pump head components.

TABLE 1

TRA®20 Series	Liquid Operating Temperature Limit °C (°F)			
	Standard	FF	Hot	Extra
Circumferential Piston	93°C (200°F)	105°C (221°F)	150°C (302°F)	*See Note*

NOTE: *"Extra" clearance rotors are another available option from Viking Pump. "Extra" clearance rotors are recommended for use with products such as peanut butter or chocolate. These products tend to ""plate out"" and build up on rotor surfaces. Extra clearance rotors require special selection procedures. Contact Viking Pump Application Engineering for assistance.*

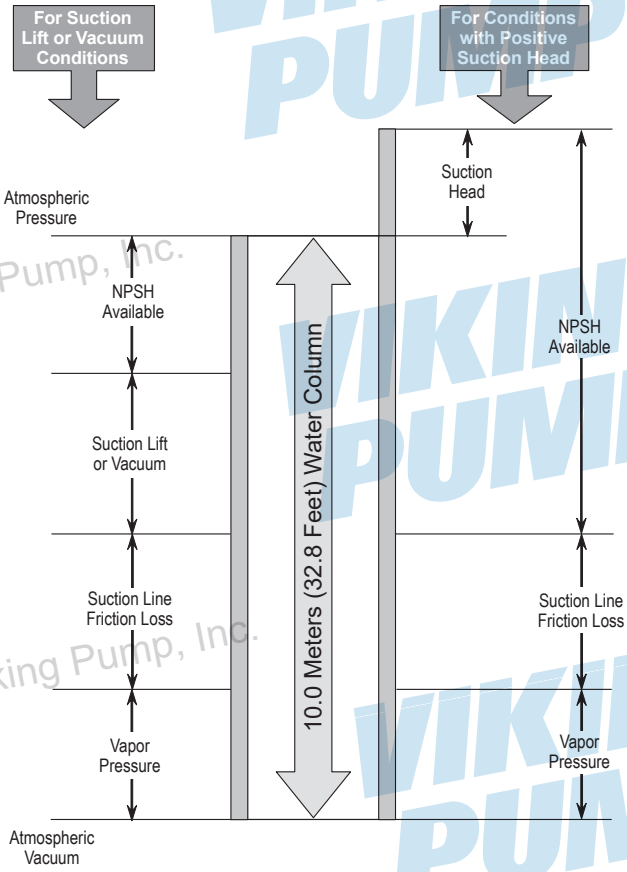
⚠ WARNING !

The Net Positive Suction Head available (NPSHa) from the system must always exceed the Net Positive Suction Head required (NPSHr) by the pump.

Observing the following general guidelines should ensure the best possible suction condition is created.

- Suction piping is at least the same diameter as the pump connections.
- The length of suction piping is kept to the absolute minimum.
- The minimum number of bends, tees and pipework restrictions are used.
- Calculations to determine system NPSHa are carried out for the worst condition, see below.

Should advice on pump or system NPSH characteristics be required contact the factory or their authorised Viking Pump Hygienic distributor.



EQUIPMENT SERIAL NUMBER

All Viking Pump pumps are identified by a serial number on the gear case nameplate, which is stamped on the pump body and cover.

⚠ DANGER

The gear case, body, and cover must be kept together as a unit due to backface, rotor, and cover clearances. Failure to do so will damage the pump.

INSTALLATION

Installation should follow good practice to provide the best performance and must meet local code requirements. All system components must be correctly sized to provide satisfactory operation of your Viking Pump product.

Consideration must be given to the following in order to achieve proper installation:

1. Pumps of this type are usually mounted on a base plate common with the drive unit. Bases may be permanently mounted, be self-leveling with vibration isolation pads, have adjustable legs or be portable. Bases should be level during pump operation.
2. Provide power as required by the motor and controls as needed for system operation.

⚠ WARNING !

Electrical connections must be made by a registered electrician in accordance with local codes and standards.

⚠ WARNING !

To avoid serious injury or death, do not install or service pump unless power is off and locked out.

3. Piping should be supported independently of the pump to prevent mis-alignment of pump parts that will cause excessive wear to rotors, bearings and shafts. Use of thermal expansion (flexible) joints will also minimize forces exerted on the pump. Inlet and outlet valves permit servicing of the pump without emptying the entire system. Inlet piping must not slope toward the pump in such a way as to cause formation of an air pocket ahead of the pump. An inlet valve will serve to keep the inlet line full. This is particularly important with low viscosity fluids and with frequent starts and stops. With low absolute inlet pressure, a check on the outlet side of the pump prevents backflow and minimizes start-up differential pressure.

⚠ DANGER

Operation of the pump with inlet and/or outlet valves in the closed position can cause damage to the pump.

4. Welding of fittings is not recommended since warpage can occur which may effect pump operation and performance.
5. Overpressure protection must be provided for this pump. A pump mounted pressure relief valve, a torque limiting device on the drive or a rupture disc in the discharge piping are examples. If pump rotation is to be reversed, pressure protection must be provided on both sides of the pump.

⚠ WARNING !

Do not operate pump unless overpressure protection is installed in discharge piping.

6. Inlet side strainers or traps can be used to prevent foreign objects from entering and damaging the pump. Selection should be made based on viscosity to prevent clogging and restricting the inlet thus causing cavitation and reduction of flow from the pump.
7. Installation of pressure and/or vacuum gauges at inlet and/or outlet provide a convenient way to assess pump operation. Such gauges can indicate if pressure is normal or not, show changes in pump or system conditions, and provide indications of flow and changes in viscosity.
8. Pumps and drives ordered from the factory on a common base plate have been supplied with a flexible coupling and aligned before shipping. This alignment should be rechecked after the pump is installed and piping is complete.

   Using feeler gages check angular alignment in four places around the coupling. The alignment and space between the couplings should be set to the manufacturer's recommended distance. Shim as needed - see ***"Figure 3" on page 5***. Using a straight edge check parallel alignment as shown in ***"Figure 4" on page 5***. Shim height as needed.

FIGURE 3

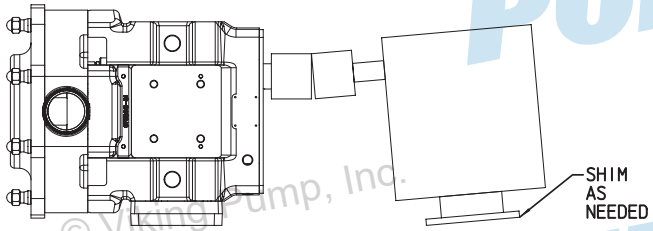
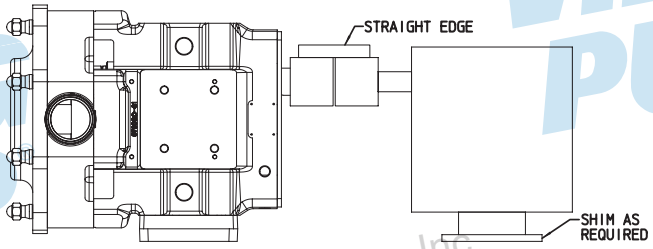


FIGURE 4



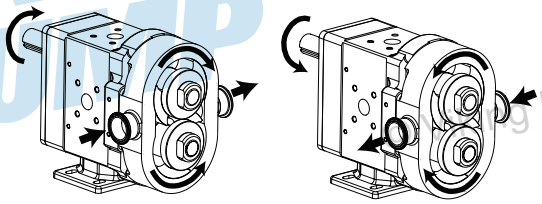
9. Turn pump shaft manually to make sure that the pump turns freely.

⚠ WARNING !

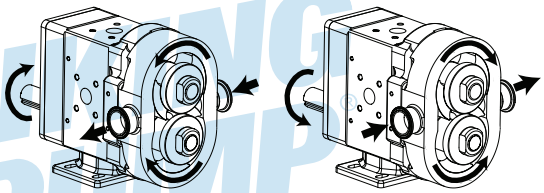
Do not put fingers in ports or near rotating members.

10. Jog motor and observe motor coupling to make sure pump will turn in the right direction. See ***"Figure 5" on page 6***.

FIGURE 5



Top Shaft Drive



Bottom Shaft Drive

⚠ WARNING !

Stay clear of motor shaft and coupling when jogging motor.

11. Lock out power to pump.

⚠ WARNING !

To avoid serious injury or death, do not install or service pump unless power is off and locked out.

12. Connect coupling halves and install coupling guard.

⚠ WARNING !

Do not operate pump without guards in place.

⚠ WARNING !

Do not put fingers in ports or near rotating members.

13. Make sure inlet and outlet connections are tightened. If pump has double seals connect seal flushing piping.

These connections are 1/8" NPT pipe threads standard, BSP optional. Liquid used for flushing can be connected to one of the seals and discharged to drain on the opposite side. Flow should be about 1/4 GPM, but may be increased for high temperature applications, but should be kept as near to 1/4 GPM as possible to avoid seal damage. Maximum flush pressure for mechanical seals is 30 PSI (2 bar).

14. Lubrication (**Refer to *"Table 2" on page 6* and *"Table 3" on page 6***)

Gears are lubricated with oil conforming to ISO 460, SAE 140, AGMA grade 7 or FDA 21 CFR 178.3570 for top or bottom shaft mounting position and oil is added at the factory.

TABLE 2 - LUBRICATING OIL AND GREASE AMOUNT

Model	Oil Amount (gears)		Grease Amount (per bearing)	
	Top/ Bottom Mount	Side Mount	Front	Rear
0060, 0150, 0180	1.3 oz (40 mL)	3.3 oz (100 mL)	0.37 oz (11 cc)	0.13 oz (4 cc)
0300	2.0 oz (60 mL)	4.0 oz (120 mL)	0.60 oz (18 cc)	0.21 oz (6 cc)
0450, 0600, 1300	6.0 oz (170 mL)	9.5 oz (280 mL)	0.84 oz (25 cc)	0.76 oz (22 cc)
1800, 2200	11.0 oz (320 mL)	20.0 oz (600 mL)	1.33 oz (39 cc)	1.03 oz (30 cc)
2100, 3200	17.0 oz (500 mL)	44.0 oz (1300 mL)	1.96 oz (58 cc)	1.16 oz (34 cc)

TABLE 3 - SUGGESTED LUBRICATING OIL AND GREASE BRAND

	Lubricating Oil	Grease
Governing Standard	Conforming to ISO 460 or SAE 140 or AGMA grade 7, and FDA 21 CFR 178.3570.	Conforming to ISO 220 or NLGI grade 2, and NSF USDA-H1
Suggested Brand Names	Chevron Lubricating Oil FM ISO 460 or equivalent to Governing Standard	Chevron FM Grease ALC 2 EP or equivalent to Governing Standard

Bearings are greased with grease conforming to ISO 220, NLGI grade 2 or NSF USDA-H1. Grease bearings after every 250 hours of operation; change oil every 500 hours. Where moisture and/or condensation are heavy change oil and grease more frequently. If temperature is 5°F or below, bearings should be greased with silicon grease.

STARTUP CHECKLIST

- ☐ Has protection from high pressure been considered? ***See "Installation", step 5.***
- ☐ Are pump and all piping clean and free of foreign material, gaskets, weld slag, bolts etc.?

  DO NOT USE PUMP TO CLEAN SYSTEM.
- ☐ Are connections tightened and leak free?
- ☐ Is gear drive properly lubricated? ***See "Installation", step 14.***
- ☐ Are all guards in place and secure?
- ☐ Have seals requiring flushing been supplied with an adequate supply of clean flushing fluid?
- ☐ Are all valves open on the discharge side of the pump?
- ☐ Are all valves open on the inlet side of the pump, and is the material to be pumped reaching the pump?
- ☐ Is direction of rotation correct? See ***"Installation", step 10***.
- ☐ Jog or start pump at low speed when possible.

Check to see that pump is performing properly within several minutes. If problems are detected, see ***"Troubleshooting Guide" on page 21***.

CLEANING & WET-END MAINTENANCE

Viking Pump products are designed for easy removal of the cover, rotors and seals for cleaning when necessary. See instructions under ***"Disassembly & Assembly: Pump Head & Seal" on page 9***.

⚠ WARNING !

To avoid serious injury or death, do not install or service pump unless power is off and locked out.

⚠ WARNING !

Relieve system pressure before removing cover or port connections.

⚠ DANGER

Handle all parts with care to avoid nicks and scratches which may affect pump operation.

CLEANING

Clean per established procedures. Be aware of the cleaning solution used (see MSDS), and of cleaning solution temperature. Make sure no residual cleaning solution stays in the pump.

Note that acidic cleaners have a high metal corrosion rate, so pump parts should be exposed to these cleaners no longer than necessary and be completely rinsed.

CIP

The TRA®20 pump range has optional features to allow the pump to be effectively cleaned by the CIP procedures recommended for in place cleaning of process plants. Flat body profile allows complete draining of the side-mounted pump and provides the CIP solution access to the entire cover o-ring groove. CIP holes in the rotor hubs provide additional CIP solution access to the cover hub/shaft seal areas for difficult cleaning applications

It is recommended that a differential pressure of 2 to 3 Bar (30 to 45 psi) be developed across the pump head during cleaning in order to develop the necessary fluid velocities required for thorough cleaning. To assist in maximizing the effectiveness of cleaning within the pump head, it is recommended that during the cleaning cycle a flow rate equivalent to a velocity of 1.5 meters per second in a pipe of equal diameter to the rotor case connections is achieved.

Rotor Retainer Seal Replacement Interval

It is recommended that the Rotor Retainer o-ring seal be replaced every 12 months. O-rings can be obtained by Viking Pump as a service part. Please contact your sales representative for details and provide the pump serial number.

Rotor Retainer Seal Inspection

Periodically inspect the Rotor Retainer o-ring seal for any discoloration, nicks, or cracks. If any of the defects above are noticed, the o-ring seal must be replaced. Inspection and replacement refer to ***"Rotor Retainer Seal Replacement Procedure" on page 7***.

Rotor Retainer Seal Replacement Procedure

1. Remove rotor case cover.
2. Remove rotor retainers and ensure components are dry before servicing.
3. With a penlight, inspect shaft blind tapped hole for contamination. If soiled, refer to cleaning procedure below.
4. If applicable inspect socket head cap screw heads and rotor retainer plate for contamination. If soiled refer to cleaning procedure below.
5. Remove and discard rotor retainer O-ring seal/s.
6. Install the Belleville washer (41) into the rotor nut, with the cone of the washer pointing toward the nut.
7. Install the retainer o-ring (40) into the rotor nut, to retain the washer.
8. Install the new rotor nut o-rings (39) onto the rotor nut. Screw the rotor nuts onto the shafts, and use a torque wrench to tighten to specified setting in Table 8 of this manual.
9. Install the rotor case cover and use a torque wrench to tighten cover nuts to torque setting specified in this manual.

Cleaning Procedure for Circumferential Rotor Screw Tapped Hole

1. Remove rotor retainer devices from the shaft.
2. Submerge and soak retainer part/s for 5 minutes in clean out of place (COP) tank with 2% caustic solution.
3. While wearing the appropriate personal protective equipment (PPE) scrub the part/s vigorously with a sanitary bristle brush for two minutes while submerged.
4. Procure a clean sanitary pipe brush of a size that engages the threaded hole with enough interference to remove contaminants. While wearing the appropriate PPE. Scrub the shaft hole with internal thread vigorously by plunging the sanitary pipe brush in and out of the hole for two minutes while consistently flushing the hole with a 2% caustic solution using a spray bottle.
5. Soak all above parts in acid sanitizer for 5 minutes, and then scrub again.
6. Flush shaft threaded hole with acid sanitizer for 5 minutes using spray bottle, and then scrub the hole again with the pipe brush for two minutes.
7. Rinse well with clean water and blow-dry blind tapped hole with clean air.
8. Swab test the inside of the tapped hole to determine cleanliness.
9. Should the swab test fail, repeat steps 2 thru 8 above until swab test is passed.

PREVENTIVE MAINTENANCE

Simple inspection during cleaning will often detect signs of a problem before it becomes serious so that it can be corrected at minimal cost and down-time.

- Remove rotors as described in Step 1 of ***"Disassembly & Assembly: Pump Head & Seal" on page 9***. Visually inspect rotor wing tips for signs of metal-to-metal contact. If present the pump should be repaired or replaced.

  Possible causes:

  » Worn shaft keyway — replace shaft.

  » Worn rotor keyway — replace rotor (usually both parts wear, often due to running a loose rotor).

  » Loose or worn gears, key, keyway shaft — inspect and replace as needed.

- Visually inspect the rotor hub where it contacts the shoulder on the shaft for wear.

  Possible cause:

  » Running loose rotor — replace rotor and correctly tighten or re-shim shaft to maintain backface clearance.

- Inspect shoulder on shaft for wear.

  Possible cause:

  » Running loose rotor — replace or re-shim shaft.

- Check gear backlash. There should be no free movement of either shaft.

  Possible causes:

  » Worn gear teeth — replace gear

  » Gear loose on shaft — remove gear, inspect key, keyways and shaft. Replace worn parts and retighten.

- Check condition of bearings. Hand load (about 30 lbs.) each shaft. There should be no detectable movement.

  Cause of movement:

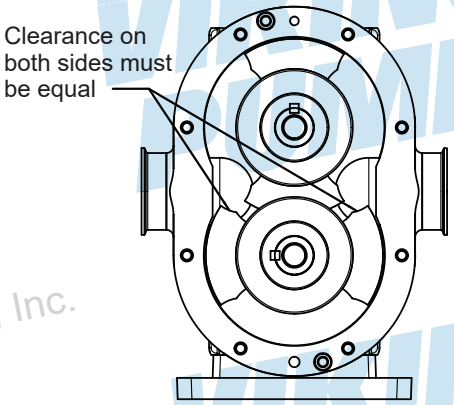
  » Bearings worn due to lack of lubrication or overload — replace bearings and ensure adequate lubrication, reduce hydraulic load.

If gear box disassembly is required, refer to ***"Disassembly & Assembly: Gear Box" on page 12***.

Refer to Step 4 of ***"Disassembly & Assembly: Pump Head & Seal" on page 9*** for rotor installation. When pump is assembled there must be equal clearance where shown. See ***"Figure 6" on page 8***.

Follow lubrication intervals as shown in ***"Table 2" on page 6*** and ***"Table 3" on page 6***.

FIGURE 6

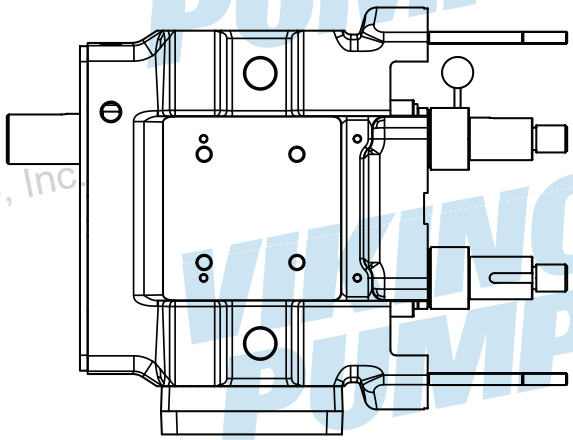


ANNUAL MAINTENANCE

Conduct the same checks as above, and in addition do the following:

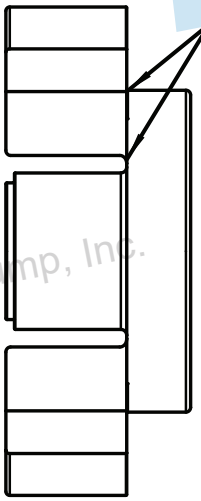
1. Check bearings for radial play using a dial indicator as shown. If indicator reading is equal to or greater than the rotor to body clearance in **Standard Clearances**, replace bearings. See ***"Figure 7" on page 8***.

FIGURE 7



2. Drain oil, remove gear box cover and inspect gears for wear, backlash, and looseness. Retighten as needed.
3. Carefully inspect rotors visually for worn splines, bearing shoulder wear, and for stress cracks. Replace worn or cracked rotors. See ***"Figure 8" on page 8***.

FIGURE 8



4. See ***"Standard Clearances" on page 14*** and check radial and back face clearance to determine wear.

See ***"Disassembly & Assembly: Pump Head & Seal" on page 9*** for disassembly and assembly. When replacing bearings or shafts in the field care must be taken to properly shim the shaft to provide the correct clearances between the rotors, body and cover.

Operating speed adjustment can compensate for wear in some applications. When performance is no longer acceptable, you may take advantage of the Viking Pump remanufacturing plan, as follows:

Remanufacturing Program

Viking Pump TRA®20 Pumps may be remanufactured up to three times depending on use and wear. Remanufactured pumps are backed with the same warranty as a new pump. Factory remanufacturing involves body and cover remachining, new rotors, and replacement of all worn parts such as shafts, bearings, gears etc.

To facilitate the remanufacturing process contact the factory to discuss the particular pump(s) to be remanufactured and obtain return goods authorization. It may be possible to supply a remanufactured pump in advance of returning a pump to the factory although not all sizes may be available at any one time. Be sure to clean and flush pump before returning it to the factory.

DISASSEMBLY & ASSEMBLY: PUMP HEAD & SEAL

Before disassembly, lock out power and release pressure from pump.

⚠ WARNING !

To avoid serious injury or death, do not install or service pump unless power is off and locked out.

⚠ WARNING !

Relieve system pressure before removing cover or port connections.

⚠ DANGER

Handle all parts with care to avoid nicks and scratches which may affect pump operation.

PUMP HEAD DISASSEMBLY

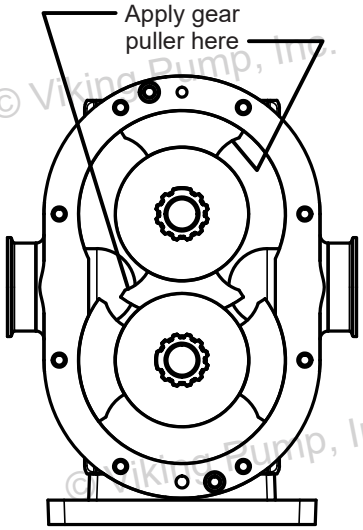
Remove cover nuts and cover. If necessary, tap cover with soft hammer to loosen. Remove and discard cover “O” ring.

Insert a plastic or other soft dowel to block rotor against pump body when loosening rotor nuts. Loosen and remove nuts. Remove rotor nut “O” rings, Belleville washers and retaining “O” rings. Discard “O” rings.

Orient rotors perpendicular to each other, then remove rotor with both wings exposed first. If necessary, use gear puller or hardwood lever to remove rotor from shaft. Remove and discard rotor hub “O” rings. See ***"Figure 9" on page 9***.

Remove body by pulling it straight off studs. Note that the pump body must be assembled to the same bearing housing from which it was removed.

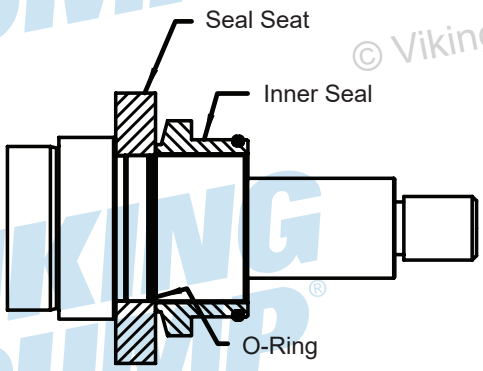
FIGURE 9



If fitted with Allen head hold down bolts in the body remove them, then remove pump body by pulling it straight off studs. Note that the pump body must be assembled to the same bearing housing from which it was removed.

SEAL DISASSEMBLY

FIGURE 10



Single Mechanical Seal

(See ***"Figure 10" on page 5***)

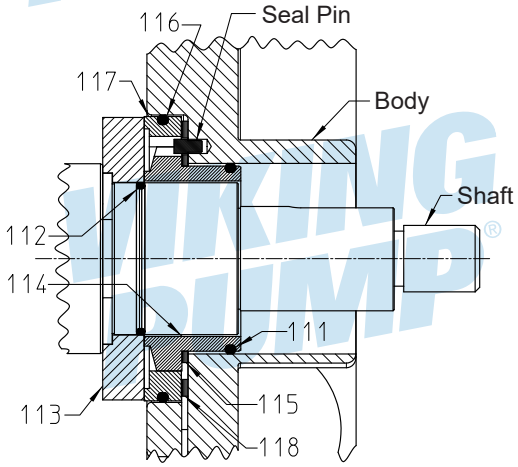
Inner Seal:

Remove seal from body. If chipped, scratched or evidence of cracks, discard seal. Make sure shoulder is clean; remove burrs if present; remove and discard O-rings.

Seal Seat:

Remove seal seat from shaft. If chipped, scratched or evidence of cracks, discard seal. Make sure shoulder is clean; remove burrs if present; remove and discard O-rings.

FIGURE 11



Double Mechanical Seal

(See ***"Figure 11" on page 10***)

Inner Seal:

Remove seal from body. If chipped, scratched or evidence of cracks, discard seal. Make sure shoulder is clean; remove burrs if present; remove and discard O-rings.

Outer Seal:

Remove seal from body. If chipped, scratched or evidence of cracks, discard seal. Remove and discard O-rings.

Seal Seat:

Remove seal seat from shaft. If chipped, scratched or evidence of cracks, discard seal. Make sure shoulder is clean; remove burrs if present; remove and discard O-rings.

SEAL ASSEMBLY

(For 3200 model pump, consult factory)

Prior to reassembling the pump head, inspect all parts to make sure they are free from damage. Nicks, scratches and cracks in mechanical seal components may cause seal leakage. Nicks, scratches and burrs on any pump part may cause leakage or performance problems.

Refer to sketches with disassembly instructions.

Single Mechanical Seal

(See ***"Figure 10" on page 5***)

Seal Seat:

Apply a suitable O-ring lubricant to new O-rings and insert them into shaft grooves.

Install seal seats, lining up the parallel flat surfaces on rear face with the shaft parallel surfaces.

Inner Seal:

Assemble wave spring on seal and install into body in alignment with seal pins.

Apply a suitable O-ring lubricant to new O-rings and insert them into the inner seal O-ring grooves.

Lubricate seal faces.

Double Mechanical Seal

(See ***"Figure 11" on page 10***)

Seal Seat:

Apply a suitable O-ring lubricant to new O-ring and insert into shaft groove furthest from spline.

Install seal seat lining up the parallel flat surfaces with the shaft parallel surfaces.

Inner Seal:

Apply a suitable O-ring lubricant to new O-ring and insert into body groove.

Assemble wave spring on seal and install into body with notches engaging pins in body.

Outer Seal:

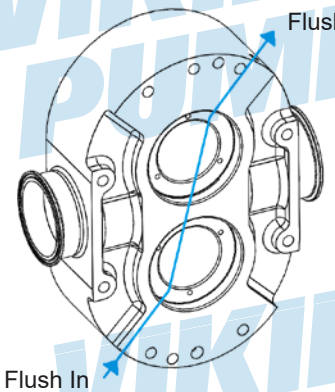
Apply a suitable O-ring lubricant to new O-rings and install on outer diameter of seal.

Insert seal assembly into body engaging notches with pins and pushing from opposite side, over and in, to seat O-ring.

Assemble wave spring on seal.

Apply lubricant to seal faces.

FIGURE 12



Seal Flush Installation

(See ***"Figure 12" on page 11***)

Flush holes, threaded for 1/8 NPT, are required on the TRA®20 pump for a double o-ring or mechanical seal. Flush media enters the bottom side of the pump and discharges from the top side. Check to ensure flush water is flowing out of the discharge line, before running the pump. Most applications require only a low pressure flush, at a flow rate of approximately 0.25 US GPM.

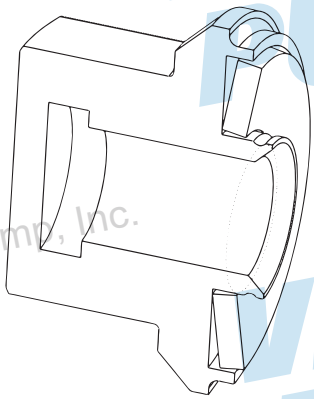
PUMP HEAD ASSEMBLY

Slide body over shafts and studs taking care not to damage seal parts. Press body firmly against gear case engaging dowels. Install Allen head body hold down bolts.

Apply a suitable lubricant to new rotor hub O-rings and install in grooves in rotor hubs. Slide rotors on to shafts. Align keyways and install keys.

Assemble Belleville washers into rotor nuts with cone of the washer pointing to the nut. See ***"Figure 13" on page 11***. Apply a suitable lubricant to washer new retaining O-rings and insert into the rotor nuts to retain the washers. Make sure washer is not tight against the O-ring.

FIGURE 13



Apply a suitable lubricant to the rotor nut O-rings and install in each nut. Apply a suitable food grade anti-seize compound to the threads on each shaft and thread the nuts onto each shaft.

Insert a plastic or other soft dowel to block rotor against pump body, then tighten each nut to the torque listed in ***"Fasteners & Torque Settings" on page 18***.

If rotor nuts are not tightened to the specified torque (as listed in ***"Fasteners & Torque Settings" on page 18***), they could come loose, causing damage to the pump.

Install a new cover O-ring into cover groove, then install cover onto pump body. Apply a suitable anti-seize compound to the threads of the body studs and thread cover nuts on studs.

Tighten each nut to the torque in ***"Fasteners & Torque Settings" on page 18***. If cover nuts are not tightened to the specified torque (listed in Table 5), body studs may break under high pressure.

Place cover O-ring in groove, push cover over studs making sure O-ring remains in groove.

Attach wing nuts and tighten by striking with a soft hammer.

Sterilize pump in accordance with accepted sterilization procedures. Make sure no residual solution remains in the pump.

DISASSEMBLY & ASSEMBLY: GEAR BOX

⚠ WARNING !

To avoid serious injury or death, do not install or service pump unless power is off and locked out.

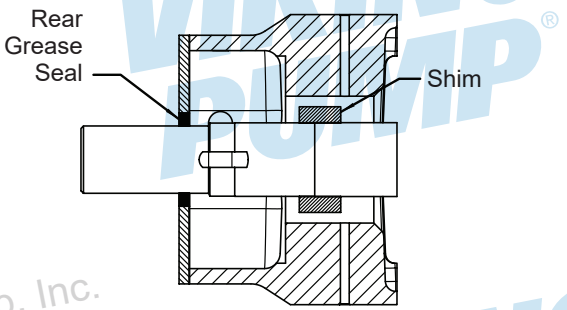
⚠ WARNING !

Relieve system pressure before removing cover or port connections.

GEAR BOX DISASSEMBLY

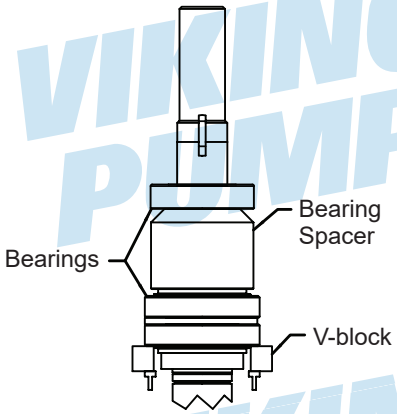
1. Remove pump head as described in step 1 of ***"Disassembly & Assembly: Pump Head & Seal" on page 9*** and drain oil from gear box.
2. Remove cap screws. Remove cover using soft hammer to loosen.
3. Scrape sealant from gear box and cover.
4. Remove oil seal from cover using an arbor press. Discard seal.
5. Using hammer and drift pin straighten locking tab on lock washers.
6. Prevent shafts from turning by wedging a wooden block between the gears.
7. Use a spanner wrench or drift pin to remove the gear lock nuts.
8. When removing shafts, make sure shaft ends are protected.
9. Remove front bearing retainer bolts. Remove sealant from retainers and gearbox, press out and discard grease seals. (If retainers are stuck they will press out when shaft is removed. Refer to cleaning process described above once removed.)
10. Place gear box on arbor press with pump head end down. Protect shaft ends with a wooden block and press shafts out of gear box.
11. Remove sealant from bearing retainers, press out and discard grease seals.
12. Remove shims. If they will be reused identify the shaft on which they were used. Press out and discard rear grease seals. See ***"Figure 14" on page 12***.

FIGURE 14



13. Use hydraulic press and V blocks to remove bearings and spacer. See ***"Figure 15" on page 12***.

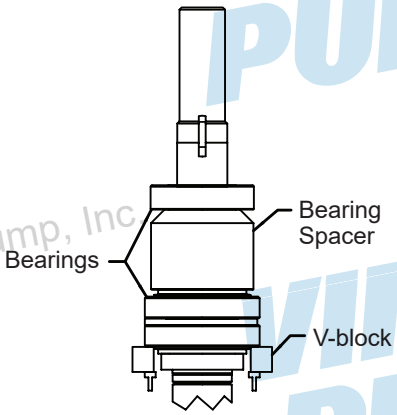
FIGURE 15



GEAR BOX ASSEMBLY

1. Coat front bearing area of shaft with grease conforming to ISO 220, NLGI grade 2 or NSF USDA-H1 and position shaft in hydraulic press with spline down.
2. Place front bearing over shaft with shield side down.Press onto shaft until bearing is seated against shoulder. Place bearing spacer over shaft to seat on front bearing.
3. Coat rear bearing area on shaft with grease conforming to ISO 220, NLGI grade 2 or NSF USDA-H1. Slide rear bearing over shaft with shield side down. Press bearing onto shaft until it seats against spacer. See ***"Figure 16" on page 12***.

FIGURE 16



NOTE: For both front and rear bearing as described in 2 and 3 above, shields must face bearing spacer.

4. Viking Pump pumps have close running tolerances to provide efficient operation. The position of the rotors is controlled by the use of shims behind the front bearing in the gear box. These shims control both the backface clearance between the rotors and the bottom of the rotor pocket in the housing and the clearance between the rotors and the cover. See ***"Standard Clearances" on page 14*** for these dimensions. Clearance for both rotors should be equal to avoid rotor-to-rotor contact. To establish the correct shim thickness, make the following measurements in 0.001 inches:
   a. Measure body width.

b. Measure depth of rotor bore.

c. Measure distance from gear box face to bottom of front bearing pocket in gear box.

d. Slide rotor onto shaft and measure from back of rotor to back of front bearing.

Do calculations for shim thickness:

» A – B = X

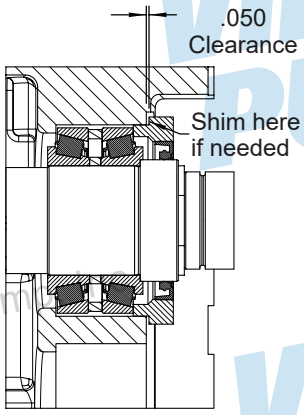
» C + X = Y

» (Y – D) + required backface clearance (from ***"Standard Clearances" on page 14***) = shim thickness.

Repeat measurements for second rotor.

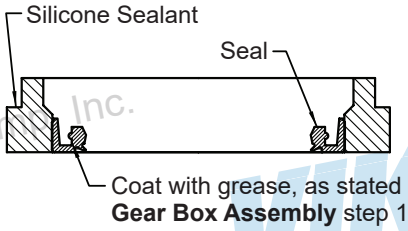
5. Place shim stock in the required thickness against shoulder in the bearing bore.
6. Place gearbox on arbor press with front (pump) end up. Place shaft assemblies in gear box with spline end up and with shafts in the correct location to provide top or bottom drive as required. Press shafts into housing until bearing is seated against shims.
7. Place body on gear box, making sure it is firmly seated. Install rotors on shafts. Secure with rotor retaining nuts: tighten first nut on shaft by striking nut wrench with soft faced hammer, then tighten second nut against first in the same way to jam nuts together. Check back face clearance against value in ***"Standard Clearances" on page 14***. If necessary remove rotors, then remove shafts to adjust shim thickness.
8. When back face clearance has been established in accordance with the value shown in ***"Standard Clearances" on page 14***, remove body and secure shaft assemblies in the gear box with bearing retainers. Do not apply sealant at this time. Retainers must seat firmly against the bearing and leave .050-.060" clearance between retainer and gear box. Use shims if needed to obtain this clearance. See ***"Figure 17" on page 13***.

FIGURE 17



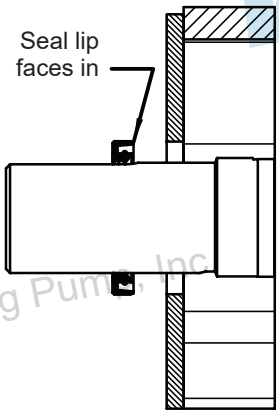
9. Make sure backface clearance is correct. Remove bearing retainers and grease both front and rear bearings through grease fittings until grease is visible around ball assemblies.
10. Install grease seals in bearing retainers. Coat seal lips with grease conforming to ISO 220, NLGI grade 2 or NSF USDA-H1. Coat retainer flanges with silicone sealant. Install retainers. See ***"Figure 18" on page 13***.

FIGURE 18



11. Please keys into shaft key slots. Slide gear with single punch mark onto drive shaft. Slide gear with two punch marks onto short shaft, with punch marks aligned on each side of single mark on drive gear.
12. Install lock washers and lock nuts onto shafts. Tighten locknut with spanner wrench. Bend locking tab on lockwasher to secure.
13. Press in rear seal with lip facing inward. Refer to ***"Figure 19" on page 13***.

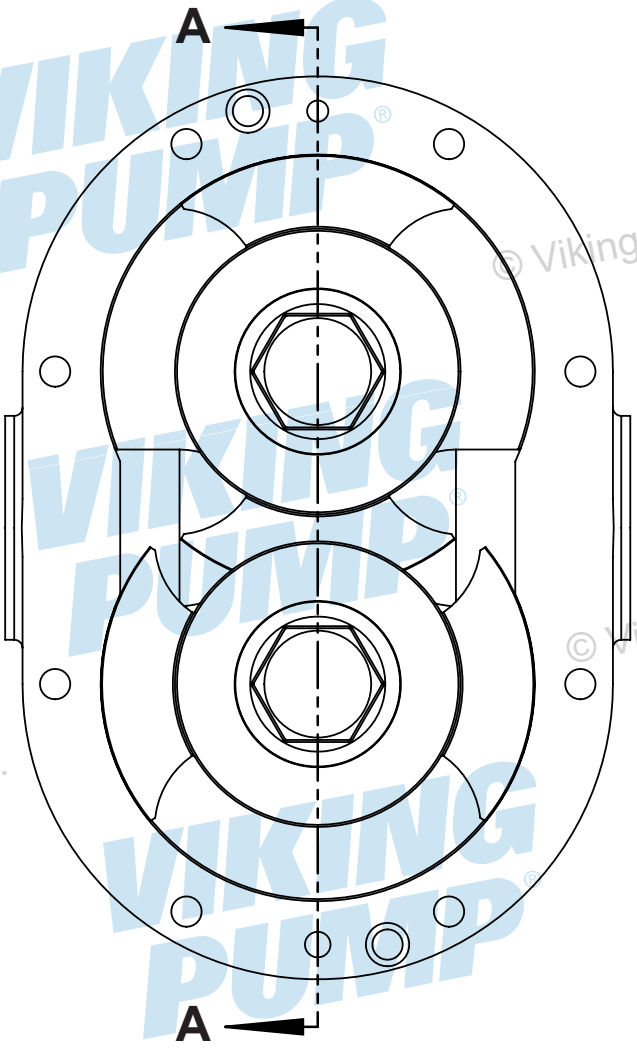
FIGURE 19

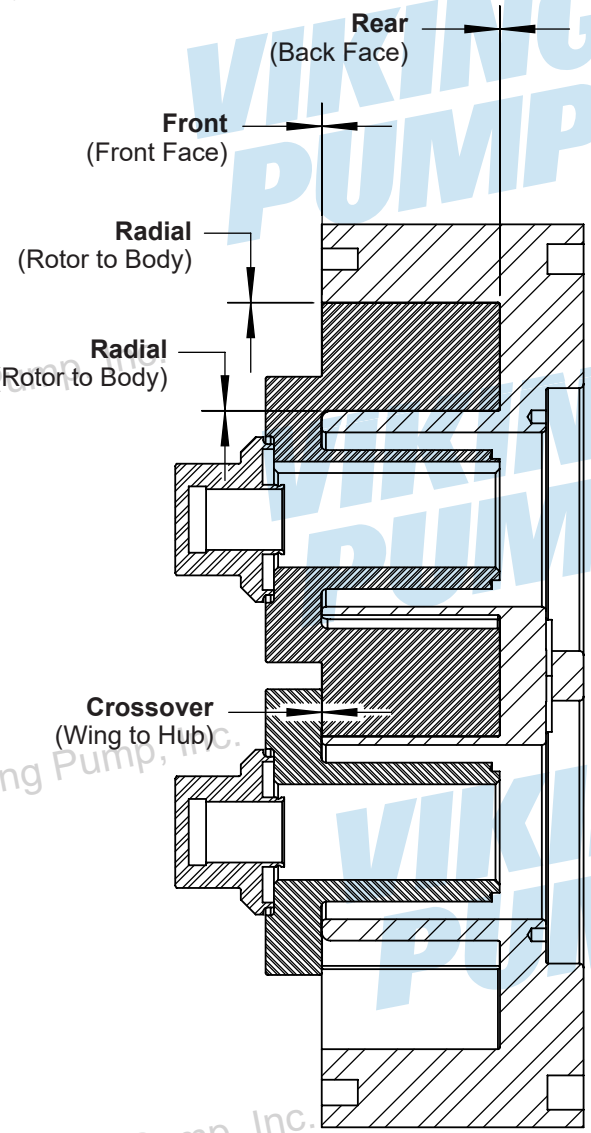


14. Place silicone sealant on back of gear case and mount cover assembly on case.
15. Fill gear case with oil as specified in ***"Table 3" on page 6***.

Assemble pump head as described in step 4 of ***"Disassembly & Assembly: Pump Head & Seal" on page 9***.

STANDARD CLEARANCES





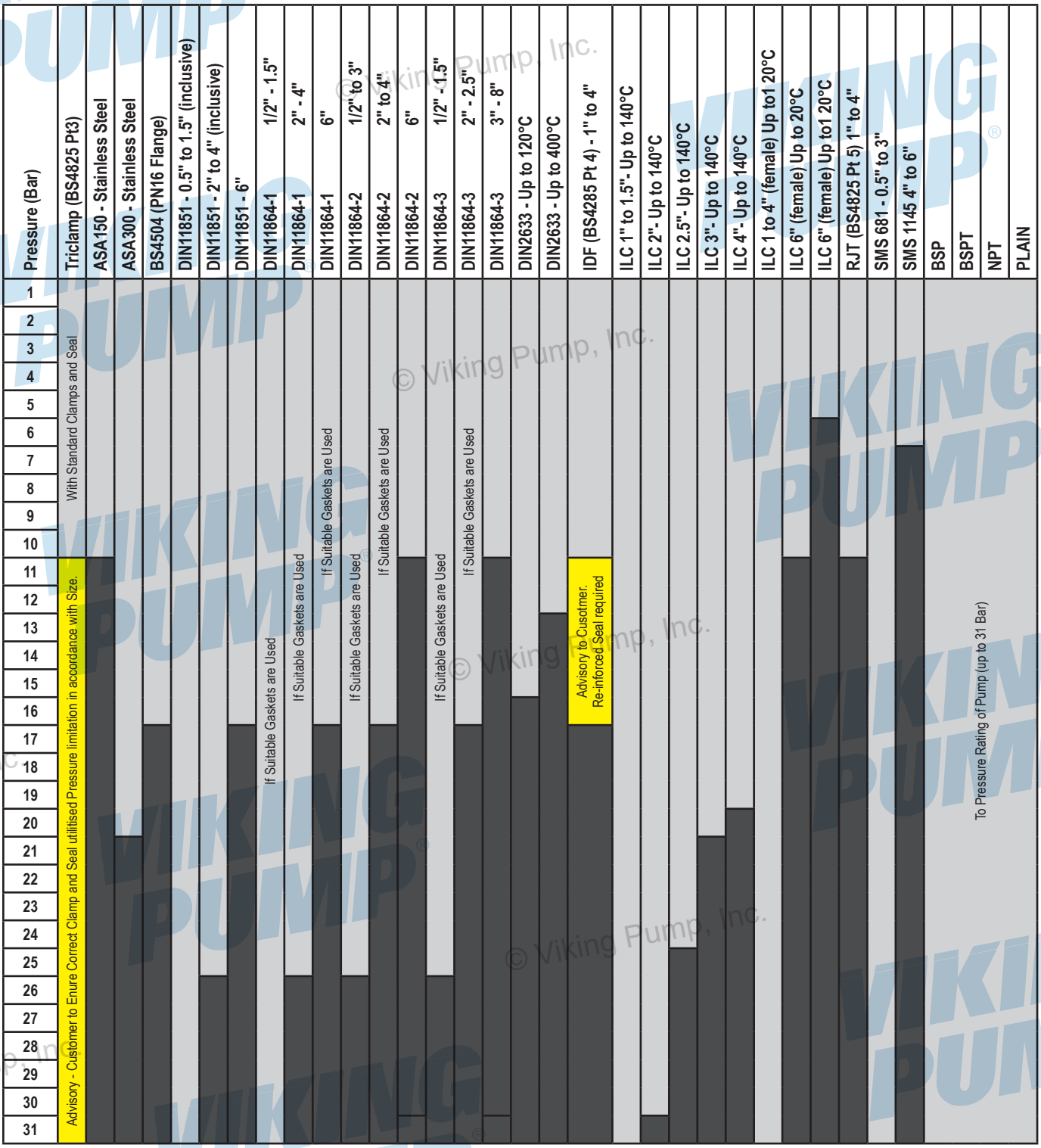
Section A-A

Model	Clearance Type	Limit	Rotor to Body	Front Face	Back Face	Wing to Hub
0060	Standard	Min	.0010	.0055	.0015	.0040
		Max	.0035	.0065	---	---
	Front Face	Min	.0010	.0080	.0015	.0065
		Max	.0035	.0090	---	---
	Hot	Min	.0040	.0080	.0015	.0065
		Max	.0050	.0090	---	---
	Extra (Hot Choc)	Min	.0055	.0085	.0035	.0070
		Max	.0065	.0095	---	---
	Stainless Steel	Min	.0055	.0085	.0035	.0070
		Max	.0065	.0095	---	---
0150	Standard	Min	.0010	.0055	.0015	.0065
		Max	.0035	.0065	---	---
	Front Face	Min	.0010	.0085	.0015	.0095
		Max	.0035	.0095	---	---
	Hot	Min	.0035	.0085	.0015	.0095
		Max	.0045	.0095	---	---
	Extra (Hot Choc)	Min	.0050	.0095	.0045	.0105
		Max	.0060	.0105	---	---
	Stainless Steel	Min	.0050	.0095	.0045	.0105
		Max	.0060	.0105	---	---
0180 & 0240	Standard	Min	.0010	.0040	.0015	.0050
		Max	.0035	.0050	---	---
	Front Face	Min	.0010	.0065	.0015	.0075
		Max	.0035	.0075	---	---
	Hot	Min	.0035	.0065	.0015	.0075
		Max	.0045	.0075	---	---
	Extra (Hot Choc)	Min	.0045	.0075	.0045	.0085
		Max	.0055	.0085	---	---
	Stainless Steel	Min	.0045	.0075	.0045	.0085
		Max	.0055	.0085	---	---

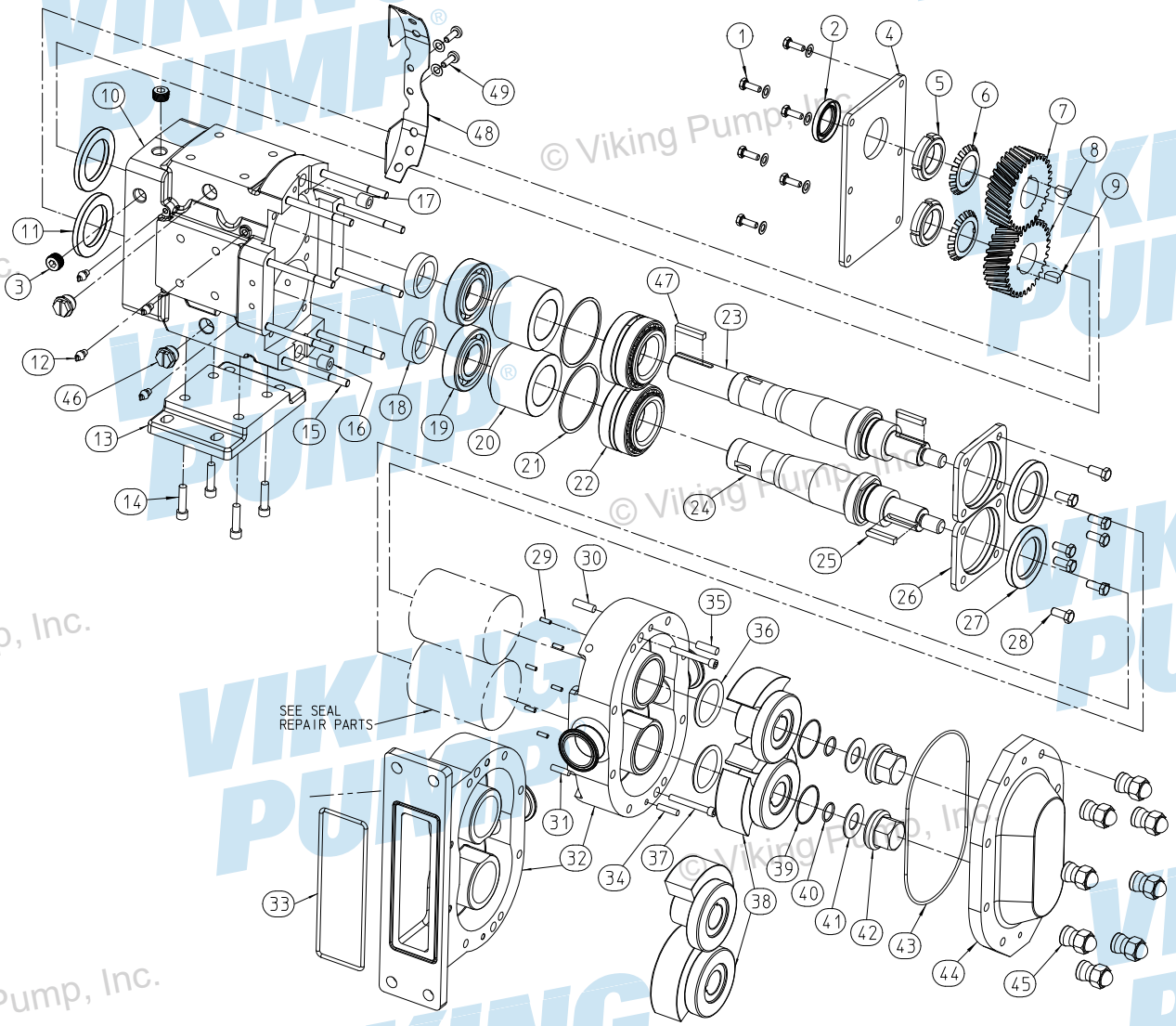
Model	Clearance Type	Limit	Rotor to Body	Front Face	Back Face	Wing to Hub
0300 & 0340	Standard	Min	.0010	.0045	.0020	.0055
		Max	.0040	.0055	---	---
	Front Face	Min	.0010	.0075	.0020	.0085
		Max	.0040	.0085	---	---
	Hot	Min	.0040	.0075	.0020	.0085
		Max	.0055	.0085	---	---
	Extra (Hot Choc)	Min	.0045	.0085	.0050	.0095
		Max	.0060	.0095	---	---
	Stainless Steel	Min	.0045	.0085	.0050	.0095
		Max	.0060	.0095	---	---
0450	Standard	Min	.0030	.0060	.0040	.0055
		Max	.0060	.0080	---	---
	Front Face	Min	.0030	.0100	.0040	.0095
		Max	.0060	.0120	---	---
	Hot	Min	.0065	.0100	.0040	.0095
		Max	.0085	.0120	---	---
	Extra (Hot Choc)	Min	.0075	.0110	.0070	.0105
		Max	.0095	.0130	---	---
	Stainless Steel	Min	.0075	.0110	.0070	.0105
		Max	.0095	.0130	---	---
0600 & 0640	Standard	Min	.0030	.0060	.0040	.0040
		Max	.0060	.0080	---	---
	Front Face	Min	.0030	.0100	.0040	.0080
		Max	.0060	.0120	---	---
	Hot	Min	.0065	.0100	.0040	.0080
		Max	.0085	.0120	---	---
	Extra (Hot Choc)	Min	.0075	.0110	.0070	.0090
		Max	.0095	.0130	---	---
	Stainless Steel	Min	.0075	.0110	.0070	.0090
		Max	.0095	.0130	---	---
1300 & 1340	Standard	Min	.0035	.0055	.0040	.0060
		Max	.0065	.0085	---	---
	Front Face	Min	.0035	.0105	.0040	.0110
		Max	.0065	.0135	---	---
	Hot	Min	.0070	.0105	.0040	.0110
		Max	.0090	.0135	---	---
	Extra (Hot Choc)	Min	.0075	.0125	.0070	.0120
		Max	.0095	.0155	---	---
	Stainless Steel	Min	.0075	.0125	.0070	.0120
		Max	.0095	.0155	---	---

Model	Clearance Type	Limit	Rotor to Body	Front Face	Back Face	Wing to Hub
1800	Standard	Min	.0055	.0060	.0050	.0075
		Max	.0080	.0100	---	---
	Front Face	Min	.0055	.0115	.0050	.0130
		Max	.0080	.0155	---	---
	Hot	Min	.0095	.0115	.0050	.0130
		Max	.0115	.0155	---	---
	Extra (Hot Choc)	Min	.0105	.0105	.0085	.0120
		Max	.0125	.0145	---	---
	Stainless Steel	Min	.0105	.0105	.0085	.0120
		Max	.0125	.0145	---	---
2200 & 2240	Standard	Min	.0055	.0065	.0050	.0080
		Max	.0080	.0095	---	---
	Front Face	Min	.0055	.0120	.0050	.0140
		Max	.0080	.0150	---	---
	Hot	Min	.0095	.0120	.0050	.0140
		Max	.0115	.0150	---	---
	Extra (Hot Choc)	Min	.0105	.0110	.0085	.0130
		Max	.0125	.0140	---	---
	Stainless Steel	Min	.0105	.0110	.0085	.0130
		Max	.0125	.0140	---	---
2100	Standard	Min	.0080	.0095	.0050	.0095
		Max	.0110	.0125	---	---
	Front Face	Min	.0080	.0150	.0050	.0150
		Max	.0110	.0180	---	---
	Hot	Min	.0125	.0145	.0050	.0150
		Max	.0145	.0175	---	---
	Extra (Hot Choc)	Min	.0125	.0175	.0110	.0175
		Max	.0145	.0205	---	---
	Stainless Steel	Min	.0125	.0175	.0110	.0175
		Max	.0145	.0205	---	---
3200	Standard	Min	.0080	.0085	.0050	.0085
		Max	.0110	.0115	---	---
	Front Face	Min	.0080	.0145	.0050	.0145
		Max	.0110	.0175	---	---
	Hot	Min	.0125	.0135	.0050	.0135
		Max	.0145	.0165	---	---
	Extra (Hot Choc)	Min	.0125	.0165	.0110	.0165
		Max	.0145	.0195	---	---
	Stainless Steel	Min	.0125	.0165	.0110	.0165
		Max	.0145	.0195	---	---

PRESSURE LIMITATION OF PORT TYPES



TRA®20 EXPLODED VIEW



Item	Description	Item	Description
1	Capscrew, Gear Case Cover, SS	25	Rotor Key
1a	Washer GC Cover Capscrew, SS	26	Bearing Retainer Front
2	Oil Seal - Gear Case Cover	27	Grease Seal Front Brg Ret
3	Oil Level, Drain Plug, SS	28	Button Head Capscrew, Brg Ret, SS
4	Gear Case Cover, Steel (Powder Coated, White) Gear Case Cover, Stainless Steel	29	Stop Pin, Seal
		30	Dowel (upper gear case)
5	Lock Nut - Gear	31	Dowel Pin,Lower Gear Case Side
6	Lock Washer - Gear	32	Pump Body
7	Gear Drive Shaft	33	Rectangular Flange O Ring
8	Gear Short Shaft	34	Dowel Pin,Lower Cover Side
9	Key, Gear	35	Dowel Pin, Upper Cover Side
10	Gear Case, Cast Iron (Powder Coated, White)	36	Rotor Hub O Ring
11	Oil Seal Rear	37	Body Retaining Screw
12	Grease Fitting ¼-28, SS	38	Twin Blade Rotor, Upper Single Wing Rotor, Lower
13	Gear Case Base, Cast Iron (Powder Coated, White)		
14	Socket Head Capscrew, Mounting Shim, SS	39	Rotor Nut O Ring
15	Stud for Cover	40	Retainer O Ring
16	Dowel Bushing, Lower	41	Washer, Belleville
17	Dowel Bushing, Upper	42	Rotor Nut
18	Spacer Gear to Rear Bearing	43	Cover O Ring
19	Rear Bearing	44	Pump Cover
20	Spacer Bearing	45	Hex Nut
21	Shim Kit	46	Large Cleanout Plug
22	Front Bearing	47	Drive Shaft Key
23	Drive Shaft	48	Seal Guards, SS
24	Short Shaft (17-4PH) Model 0450 TRA20	49	Fastener, Seal Guard

FASTENERS & TORQUE SETTINGS

Item	Description	Location		0060	0150	0180	0300	0450	0600	1300
45	Acorn Nut (Dome Nut)	Front Cover to Rotor Case	Qty / Pump	8	8	8	8	8	8	8
			Size (in)	1/4"-20	1/4"-20	1/4"-20	5/16"-18	3/8"-16	3/8"-16	3/8"-16
			Torque (N-m)	9	9	9	15	76	76	34
			Torque (lbf-ft)	7	7	7	11	56	56	25
42	Rotor Retainer*	Rotor to Shaft	Qty / Pump	4	4	4	4	4	4	4
			Size (in)	7/16"-14	7/16"-14	7/16"-14	5/8"-11	5/8"-11	5/8"-11	5/8"-11
			Torque (N-m)	68	68	68	163	339	339	339
			Torque (lbf-ft)	50	50	50	120	250	250	250
37	Socket Head Cap Screw	Rotor Case to Gearbox	Qty / Pump	2	2	2	2	2	2	2
			Size (in)	1/4"-20	1/4"-20	1/4"-20	1/4"-20	3/8"16	3/8"16	3/8"16
			Torque (N-m)	8.1-9.5	8.1-9.5	8.1-9.5	8.1-9.5	27.1-29.8	27.1-29.8	27.1-29.8
			Torque (lbf-ft)	6-7	6-7	6-7	6-7	20-22	20-22	20-22
28	Cap Screw	Bearing Retainer to Gearbox	Qty / Pump	8	8	8	8	8	8	8
			Size (in)	1/4"-20	1/4"-20	1/4"-20	5/16"-18	3/8"-16	3/8"-16	3/8"-16
			Torque (N-m)	8.1-9.5	8.1-9.5	8.1-9.5	14.9-16.3	27.1-29.8	27.1-29.8	27.1-29.8
			Torque (lbf-ft)	6-7	6-7	6-7	11-12	20-22	20-22	20-22
15	Stud	Front Cover to Gearbox	Qty / Pump	8	8	8	8	8	8	8
			Size (in)	1/4"-20	1/4"-20	1/4"-20	5/16"-18	3/8"-16	3/8"-16	3/8"-16
			Torque (N-m)	8.1-9.5	8.1-9.5	8.1-9.5	14.9-16.3	27.1-29.8	27.1-29.8	27.1-29.8
			Torque (lbf-ft)	6-7	6-7	6-7	11-12	20-22	20-22	20-22
5	Locknut	Drive / Lay Shaft	Qty / Pump	2	2	2	2	2	2	2
			Size (in)	N-05	N-05	N-05	N-07	N-09	N-09	N-09
			Torque (N-m)	102	102	102	136	190	190	190
			Torque (lbf-ft)	75	75	75	100	140	140	140
1	Cap Screw	Gearbox Cover	Qty / Pump	6	6	6	6	6	6	6
			Size (in)	1/4"-20	1/4"-20	1/4"-20	1/4"-20	3/8"-16	3/8"-16	3/8"-16
			Torque (N-m)	8.1-9.5	8.1-9.5	8.1-9.5	8.1-9.5	27.1-29.8	27.1-29.8	27.1-29.8
			Torque (lbf-ft)	6-7	6-7	6-7	6-7	20-22	20-22	20-22
14	Socket Head Cap Screw	Mounting Foot	Qty / Pump	4	4	4	4	4	4	4
			Size (in)	5/16"-18	5/16"-18	5/16"-18	3/8"16	1/2"-13	1/2"-13	1/2"-13
			Torque (N-m)	14.9-16.3	14.9-16.3	14.9-16.3	27.1-29.8	58.3-63.7	58.3-63.7	58.3-63.7
			Torque (lbf-ft)	11-12	11-12	11-12	20-22	43-47	43-47	43-47
49	Socket Head Cap Screw	Finger Guard	Qty / Pump	8	8	8	8	8	8	8
			Size (in)	#8-32	#8-32	#8-32	#8-32	#8-32	#8-32	#8-32
			Torque (N-m)	13.56-27.12	13.56-27.12	13.56-27.12	13.56-27.12	13.56-27.12	13.56-27.12	13.56-27.12
			Torque (lbf-ft)	10-20	10-20	10-20	10-20	10-20	10-20	10-20

* Installation of this part requires the use of an FDA approved food-grade anti-seize compound.

Item	Description	Location		1800	2100	2200	3200
45	Acorn Nut (Dome Nut)	Front Cover to Rotor Case	Qty / Pump	8	8	8	8
			Size (in)	7/16"-14	5/8"-11	7/16"-14	5/8"-11
			Torque (N-m)	149	214	149	214
			Torque (lbf-ft)	110	158	110	158
42	Rotor Retainer*	Rotor to Shaft	Qty / Pump	4	4	4	4
			Size (in)	1"-8	1-1/8"-7	1"-8	1-1/8"-7
			Torque (N-m)	441	508	441	508
			Torque (lbf-ft)	325	375	325	375
37	Socket Head Cap Screw	Rotor Case to Gearbox	Qty / Pump	2	2	2	2
			Size (in)	3/8"-16	3/8"-16	3/8"-16	3/8"-16
			Torque (N-m)	27.1-29.8	27.1-29.8	27.1-29.8	27.1-29.8
			Torque (lbf-ft)	20-22	20-22	20-22	20-22
28	Cap Screw	Bearing Retainer to Gearbox	Qty / Pump	8	8	8	8
			Size (in)	3/8"-16	5/16"-18	3/8"-16	5/16"-18
			Torque (N-m)	27.1-29.8	14.9-16.3	27.1-29.8	14.9-16.3
			Torque (lbf-ft)	20-22	11-12	20-22	11-12
15	Stud	Front Cover to Gearbox	Qty / Pump	8	8	8	8
			Size (in)	7/16"-14	5/8"-11	7/16"-14	5/8"-11
			Torque (N-m)	42.0-46.1	124.7-136.9	42.0-46.1	124.7-136.9
			Torque (lbf-ft)	31-34	92-101	31-34	92-101
5	Locknut	Drive / Lay Shaft	Qty / Pump	2	2	2	2
			Size (in)	N-11	N-13	N-11	N-13
			Torque (N-m)	312	434	312	434
			Torque (lbf-ft)	230	320	230	320
1	Cap Screw	Gearbox Cover	Qty / Pump	6	6	6	6
			Size (in)	3/8"-16	3/8"-16	3/8"-16	3/8"-16
			Torque (N-m)	27.1-29.8	27.1-29.8	27.1-29.8	27.1-29.8
			Torque (lbf-ft)	20-22	20-22	20-22	20-22
14	Socket Head Cap Screw	Mounting Foot	Qty / Pump	4	4	4	4
			Size (in)	1/2"-13	1/2"-13	1/2"-13	1/2"-13
			Torque (N-m)	58.3-63.7	58.3-63.7	58.3-63.7	58.3-63.7
			Torque (lbf-ft)	43-47	43-47	43-47	43-47
49	Socket Head Cap Screw	Finger Guard	Qty / Pump	8	4	8	4
			Size (in)	#8-32	#8-32	#8-32	#8-32
			Torque (N-m)	13.56-27.12	13.56-27.12	13.56-27.12	13.56-27.12
			Torque (lbf-ft)	10-20	10-20	10-20	10-20

* Installation of this part requires the use of an FDA approved food-grade anti-seize compound.

CARE OF STAINLESS STEEL

Stainless steel components used in products made by Viking Pump are produced using methods that preserve the corrosion resistant property of stainless steel. The following precautions must be observed in use and cleaning to maintain corrosion resistance:

1. Hydrochloric acid, even with added inhibitors, is **NOT** recommended for cleaning due to its corrosion producing properties.
2. Pitting can occur when stray electrical currents contact wet stainless. Check electrical devices on a regular basis for improper grounding, damaged insulation or other defects that might cause stray currents.
3. Objects in contact with stainless steel prevent the air from drying and reforming the protective oxide film on the stainless, therefore don't leave tools, rubber mats etc. in contact with stainless pump components.
4. Utilize conditioned water where necessary to prevent foreign matter in the water from causing pitting or deposits that may prevent thorough cleaning.
5. Immediately rinse equipment with warm water after use, then clean as soon as possible. Pitting may occur under particles of product left on pump surfaces.
6. Use only recommended cleaning compounds from reputable suppliers, and use only as specified by the manufacturer, to prevent pitting, stress cracking and surface discoloring.
7. Scratches and metal particles embedded into stainless may cause corrosion over time. Use only non-metallic brushes and pads for hand cleaning.
8. Chemical bactericides must be used at the lowest permissible concentration, temperature and time. Follow directions supplied by the manufacturer and local health authority. Chlorine and other halogens may destroy the protective film while increased temperatures increase chemical activity which accelerates corrosion. Inspect joints for properly sealed gaskets in joints; crevices caused by improperly seated gaskets will promote crevice corrosion, particularly in the presence of chlorine.
9. Check all equipment for evidence of pitting and discolored surfaces and for stress cracks. Remove deposits and color from surfaces immediately using mild scouring powder and detergents. Rinse thoroughly and air dry to promote reformation of the protective oxide film.

ASTM A-494

ASTM A-494 is the standard rotor material for TRA®20 CPP pumps. This alloy was developed specifically for corrosion resistance and close operating clearance requirements of high performance rotary positive displacement pumps. ASTM A-494 is a nickel based, corrosion-resistant, non-galling or seizing material. The ASTM designation is A-494 Grade CY5SnBiM (UNS N26055), and the material is listed in the 3-A Sanitary Standards as acceptable for product contact surfaces.

The above properties make ASTM A-494 the ideal material for Viking Pump CPP pumps. The non-galling rotors permit close operating clearances in the liquid end. This provides low slip and minimum shear damage. The rotors will not gall or seize if they come in contact with the body or cover during operation.

The corrosion resistance of ASTM A-494 is approximately equal to AISI 300 Series Stainless Steel. However, ASTM A-494 has limited resistance to certain aggressive chemicals that may be commonly used in contact with AISI 300 Series Stainless Steel.

Do not use ASTM A-494 in contact with nitric acid. Nitric acid is commonly used to passivate new installations of stainless steel equipment. Do not allow nitric acid based passivation chemicals to contact ASTM A-494 rotors. Remove the rotors during passivation and use a separate pump to circulate the passivation chemicals. Also, if nitric acid-based CIP cleaning chemicals are used, remove the rotors prior to CIP cleaning and clean them separately by hand in a mild detergent.

If you have any questions regarding other aggressive chemicals, please contact Viking Pump Application Engineering for assistance..

ELASTOMER SEAL REPLACEMENT FOLLOWING PASSIVATION

Passivation chemicals can damage product contact areas of Viking Pump equipment. Elastomers (rubber components) are most likely to be affected. Always inspect all elastomer seals after passivation is completed. Replace any seals showing signs of chemical attack. Indications bay include swelling, cracks, loss of elasticity or any other noticeable changes when compared with new components.

TROUBLESHOOTING GUIDE

A properly sized and installed pump should provide trouble free operation, however problems in pumping systems may occur over time. The following information may help in identifying and resolving such problems:

PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Pump not turning	Drive motor not running	Check circuit breakers, fuses
	Keys sheared or missing	Replace keys
	Drive belts, etc. slipping or broken	Adjust or replace
	Shaft or gears sheared	Replace
No flow, pump turning	Rotation in wrong direction	Reverse rotation
No flow, pump not priming	Inlet valve closed	Open valve
	Inlet line clogged	Clean line and filters
	Air leaks because of bad seals and/or pipe connections	Replace seals, pressurize lines to check for leakage
	Speed of pump too slow	Increase speed, fill inlet lines, install foot valve
	Liquid drains or siphons	Install foot or check valves
	Air lock due to fluids that may vaporize or allow gas to come out of solution	Install air bleed in lines near pump
	Excess clearance between rotors and body and cover	Increase pump speed, install foot valve, have pump rebuilt
	Net inlet pressure too low	Check Net Inlet Pressure Available at Pump and Net Inlet Pressure Required by Pump. Calculate system and modify inlet system as needed.
	With vacuum inlet system, atmospheric "blow back" prevents pump from starting flow	Install check valve in discharge line
No flow	Relief valve not properly adjusted or held open by foreign material	Adjust or clear valve
Fluid vaporization (starved Pump inlet)	Filters, valves, inlet filters or lines clogged	Clean
	Inlet line too small or too long, too many valves or fittings, filter too small	Make necessary changes
	Net Inlet Pressure Available at Pump too low	Increase level in source tank or pressurize tank
		Select larger pump with less inlet pressure required
	Viscosity of pump fluid higher than anticipated	Reduce pump speed (lower flow will result) or modify system
	Temperature of fluid higher than anticipated	Provide cooling, reduce speed, modify system to increase available inlet pressure
Insufficient flow	Speed too low	Increase speed
	Air leaks because of bad seals and/or pipe connections	Replace seals, pressurize lines to check for leakage
Relief valve not adjusted or held	Adjust/clean	Open
	Flow diverted in system	Check system valves and controls
	Hot clearance rotors used with "cold" or low viscosity fluid	Replace with standard rotors
	Worn pump	Increase speed, recondition pump
	Pressure too high	Modify system
Noisy operation	Cavitation due to high fluid Viscosity, high vapor pressure or high temperature	Reduce speed and/or temperature, modify system
	Inlet Pressure Available less than Inlet Press Required	Modify System
	Air or gas in system due to system leaks	Fix leaks
	Dissolved gas or naturally aerated products	Reduce discharge pressure, reduce speed and/or temperature, modify system
	Rotor to body contact	Check back face and rotor to cover clearances and reshim as necessary
		Check for distortion of pump due to Installation of piping. Reassemble pump and/or re-install piping
	Pressure higher than pump is Rated	Reduce pressure
	Worn bearings or gears	Replace as needed, ensure regular lubrication
	Rotor to rotor contact noise due to twisted shaft, sheared keys, loose or mistimed gears, worn splines	Rebuild with new parts as needed
	Relief valve chattering	Readjust, repair or replace valve
	Drain train components	Lubricate, repair or replace as needed
Pump overheats, stalls, draws excessive current (trips breaker, blows fuses)	Higher viscous losses than anticipated	If pump is within rating, increase drive size
	Pressure higher than anticipated	Reduce speed, increase line size
	Fluid colder than anticipated, high viscosity	Heat fluid/insulate and heat lines, increase running clearances
	Fluid sets up during shutdown	Insulate or heat lines, install recirculating or "soft start" drive, Flush with different fluid
	Fluids such as chocolate, latex build up on internal pump surfaces	Increase running clearances
Pump service life not as long as expected	Misalignment of drive and piping, excessive pump overhang	Align piping and drive
	Abrasive fluid	Use larger pump at slower speed
	Bearings and gears lack lubrication	Establish and follow lubrication schedule
	Speeds and pressures higher than pump is rated	Reduce speed and pressures by system modification
	Pump corrodes	Upgrade material used in pump

FOR ATEX PUMPS ONLY

INCORRECT INSTALLATION, OPERATION, OR MAINTENANCE OF EQUIPMENT MAY CAUSE SEVERE PERSONAL INJURY OR DEATH AND/OR EQUIPMENT DAMAGE AND MAY INVALIDATE THE WARRANTY.

This information must be read fully before beginning installation, OPERATION, or maintenance and must be kept with the pump. SUITABLY TRAINED OR QUALIFIED PERSONS MUST UNDERTAKE ALL INSTALLATION AND MAINTENANCE only.

⚠ **DANGER = FAILURE TO FOLLOW THE INDICATED INSTRUCTION MAY RESULT IN SERIOUS INJURY OR DEATH.**

⚠ DANGER

Viking Pump ATEX pumps are sold to be coupled with a motor, and usually be mounted on a base plate. The motor, other electrical equipment, gear reducers, couplings, guards and base plates must comply with ATEX requirements. The motor, gear reducer, sensors, and other associated electrical equipment must bear CE and ATEX marking. Couplings must be ATEX marked, and be accompanied by a Certificate of Conformity. Failure to comply will void ATEX Certification and may result in an explosion causing death or serious injury.

⚠ DANGER

Insure that the pump is grounded (earthed) with the connection provided and that the motor, gear reducer, base plate and other components are adequately grounded. Failure to ground equipment may result in an explosion causing death or serious injury.

⚠ DANGER

Provide a means to monitor all sensing equipment. Failure to do so may cause unacceptable build up of temperature or pressure which could result in an explosion causing death or serious injury.

⚠ DANGER

Install ATEX conforming guards as required to meet EC Directives.

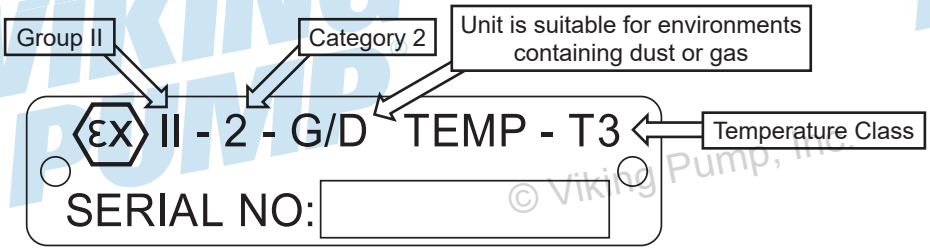
⚠ DANGER

Conduct all maintenance activities as detailed in the pump manual. Failure to do so may cause pump failure could result in an explosion causing death or serious injury.

ATEX EQUIPMENT GROUPS

Equipment - groups (Annex I of the EC-Directive 94/9/EC)							
Group I (mines, mine gas and dust)		**Group II** (other explosive atmospheres gas/dust)					
Category M		**Category 1**		**Category 2**		**Category 3**	
1	**2**	**G** (gas) **(Zone 0)**	**D** (dust) **(Zone 20)**	**G** (gas) **(Zone 1)**	**D** (dust) **(Zone 21)**	**G** (gas) **(Zone 2)**	**D** (dust) **(Zone 22)**
for equipment providing a very high level of protection when endangered by an explosive atmosphere	for equipment providing a high level of protection when likely to be endangered by an explosive atmosphere	for equipment providing a very high level of protection when used in areas where an explosive atmosphere is very likely to occur		for equipment providing a high level of protection when used in areas where an explosive atmosphere is likely to occur		for equipment providing a normal level of protection when used in areas where an explosive atmosphere is less likely to occur	

ATEX TAG USED ON VIKING PUMP ATEX CERTIFIED PUMPS



RISK ASSESSMENT

Risk assessment relating to the use Viking Pump TRA®20 pumps in potentially explosive atmospheres.

Note: For a product to be suitable for an application it must be fit for its designated purpose and also be suitable for the environment where it is installed.

Source of Hazards	Potential Hazards	Frequency of Hazards	Recommended Measures
Unvented cavities	Build up of explosive gas	**Very Rare**	Ensure that pump is totally filled. Consider mounting ports vertically.
Housing / Rotors / Impellers / Front Cover / Backplate	Unintended mechanical contact	**Rare**	Ensure that operating pressures are not exceeded. Ensure that sufficient NPSH to prevent cavitation. Service plan.
Pump external surfaces	Excess temperature. Electrostatic charging.	**Rare**	User must ensure temperature limits. Do not overfill gearboxes with lubricant. Provide a ground contact for pump. Service plan.
Housing / Cover O-ring	Pump liquid leakage. Build up of explosive gas.	**Very Rare**	Check selection of elastomers are suitable for application. Ensure cover retaining nuts are tight. Service plan.
Pump housing / cover / Impeller / Backplate	Pump liquid leakage. Build up of explosive gas.	**Very Rare**	Corrosion resistant materials.
Shaft seals	Excess temperature. Unintended mechanical contact. Leakage. Build up of explosive gas.	**Rare**	Selection of seal system must be suitable for application. Service as needed. Always provide seal flush when so equipped.
Rotation direction test	Excess temperature	**Very Rare**	Ensure liquid is in pump chamber before testing / Always provide seal flush when so equipped. Allow pump to run for minimum period - a few seconds / See Manual
Closed valve condition	Excess Temperature. Excess Pressure. Mechanical contact.	**Rare**	Provide over-pressure protection. See Manual.
Shaft	Random induced current	**Very Rare**	Provide a ground contact for pump.

TECHNICAL SERVICE MANUAL: INSTALLATION, OPERATION & MAINTENANCE

VIKING PUMP®

CIRCUMFERENTIAL PISTON PRODUCT LINE:
STAINLESS STEEL
TRA®20 SERIES
SIZES: ALL

VIKING PUMP®

WARRANTY

Viking pumps, strainers and reducers are warranted to be free of defects in material and workmanship under normal conditions of use and service. The warranty period varies by type of product. A Viking product that fails during its warranty period under normal conditions of use and service due to a defect in material or workmanship will be repaired or replaced by Viking. At Viking's sole option, Viking may refund (in cash or by credit) the purchase price paid to it for a Viking product (less a reasonable allowance for the period of use) in lieu of repair or replacement of such Viking product. Viking's warranty is subject to certain restrictions, limitations, exclusions and exceptions. A complete copy of Viking's warranty, including warranty periods and applicable restrictions, limitations, exclusions and exceptions, is posted on Viking's website (www.vikingpump.com/warranty#information). A complete copy of the warranty may also be obtained by contacting Viking through regular mail at Viking Pump, Inc., 406 State Street, Cedar Falls, Iowa 50613, USA.

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