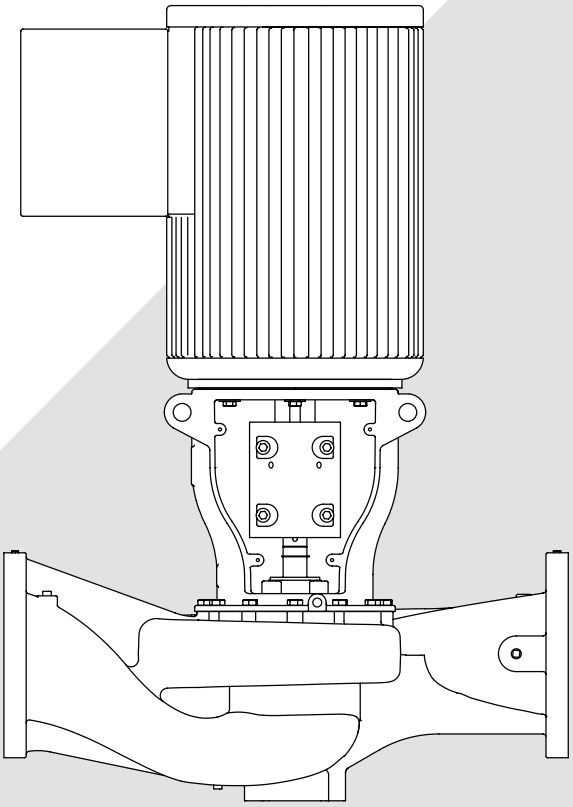
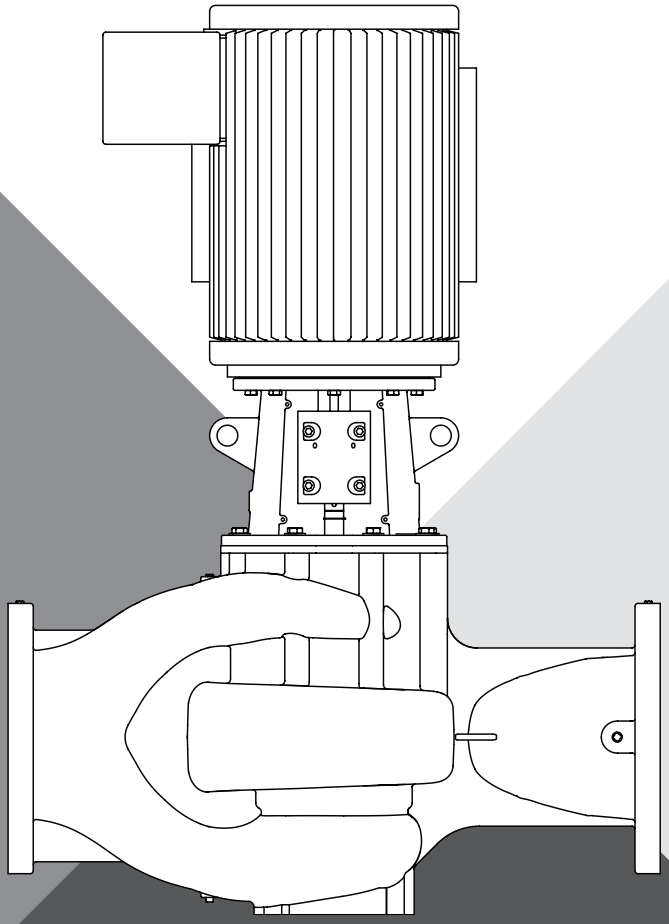
PENTAIR FAIRBANKS NIJHUIS

# VERTICAL IN-LINE SPLIT COUPLED PUMPS

1590-SC SERIES



Single Suction Pump



Double Suction Pump

# INSTALLATION AND OPERATION MANUAL

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# GENERAL INFORMATION

***NOTICE to the installer:*** Please make sure you provide this manual to the owner of the equipment or to the responsible party who maintains the system.

This manual contains important information for the safe use of Pentair Fairbanks Nijhuis® 1590 Vertical In-line Split Coupled Pumps. Read this manual completely before using this product. DO NOT DISCARD OR LOSE THIS MANUAL.

Pentair Fairbanks Nijhuis 1590 split coupled (SC) series pumps are superior commercial in-line pumps which have been manufactured and field tested under the severest demands. Pumping applications for the Pentair Fairbanks Nijhuis 1590-SC include: hot or chilled water circulation, pressure booster systems and cooling towers for office buildings, hotels, hospitals, universities and warehouses.

## SAFETY

### Explanation of Designations

**⚠ DANGER** warns about hazards that will cause serious personal injury, death or major property damage if ignored.

**⚠ WARNING** warns about hazards that can cause serious personal injury, death or major property damage if ignored.

**⚠ CAUTION** warns about hazards that will or can cause minor personal injury or property damage if ignored.

***NOTICE:*** indicates special instructions which are important but not related to hazards.

### General Guidelines

- These instructions must always be kept close to the product's operating location or directly with the product.
- These instructions should be read prior to installing, operating, using and maintaining the equipment in any region worldwide. The equipment must not be put into service until all the conditions relating to safety, noted in the instructions, have been met.
- The product must not be operated beyond the parameters specified for the application. If there is any doubt as to the suitability of the product for the application intended, contact Pentair Fairbanks Nijhuis Customer Service for advice, quoting the serial number.

### Personnel Qualification and Training

All personnel involved in the operation, installation, inspection and maintenance of the unit must be qualified to carry out the work involved. If the personnel in question do not already possess the necessary knowledge and skill, appropriate training and instruction must be provided.

It is recommended that proper documentation of personnel should be maintained by the responsible part(ies).

### Personnel Safety Actions

**CALIFORNIA PROPOSITION 65 WARNING:**

**⚠ WARNING** This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

**⚠ DANGER** Never do maintenance work when the unit is connected to power. Always follow lock out – tag out procedures when working on equipment that may turn on.

**⚠ WARNING** Guards must not be removed while the pump is operational. Always follow lock out – tag out procedures when working on equipment that may turn on.

**⚠ WARNING** Drain the pump and isolate pipe work before dismantling the pump. The appropriate safety precautions should be taken where the pumped liquids are hazardous.

**⚠ WARNING** **Handling components:** Many precision parts have sharp corners, thus wearing of appropriate safety gloves and equipment is required when handling these components. To lift heavy pieces above 25 kg (55 lb.) use a crane appropriate for the mass and in accordance with current local regulations.

**⚠ WARNING** **Thermal shock:** Rapid changes in the temperature of the liquid within the pump can cause thermal shock, which can result in damage or breakage of components and should be avoided.

**⚠ WARNING** Never apply heat to remove impeller.

**⚠ WARNING** **Noise & vibration levels:** Pentair Fairbanks Nijhuis 1590 SC pumps have been designed to meet the noise and vibration levels as per the Hydraulic Institute (HI) standard 9.6.4.

### Electrical Safety

**⚠ WARNING** **Sudden start-up hazard:** Disconnect and lock out power source before servicing. Failure to follow these instructions could result in serious personal injury, death or property damage.

**⚠ WARNING** **Electrical shock hazard:** All electrical connections are to be made by a qualified electrician in accordance with all codes and ordinances. Failure to follow these instructions could result in serious personal injury, death or property damage.

**⚠ WARNING** **Electrical overload hazard:** Ensure all motors have properly sized overload protection. Failure to follow these instructions could result in serious personal injury, death or property damage.

### High Temperature Safety

**⚠ WARNING** **Hot surface hazard:** If pumping hot water, ensure guards or proper insulation is installed to protect against skin contact with hot piping or pump components. Failure to follow these instructions could result in serious personal injury, death or property damage.

**⚠ WARNING** **Spraying water hazard:** When servicing pump, replace all gaskets and seals. Do not reuse old gaskets or seals. Failure to follow these instructions could result in serious personal injury, death or property damage.

### High Pressure Safety

**⚠ WARNING** **High pressure hazard:** All pumps are designed for specific maximum working pressure. Do not exceed this pressure. Install properly sized pressure relief valves in system. Failure to follow these instructions could result in serious personal injury, death or property damage.

**⚠ WARNING** **Expansion hazard:** Water expands when heated. Install properly sized thermal expansion tanks and relief valves. Failure to follow these instructions could result in serious personal injury, death or property damage.

**⚠ CAUTION**

- Ensure correct lubrication. See "Lubrication" on Page 8 for lubrication instruction.
- Start the pump at reduced speed or with the discharge valve partly opened. This is recommended to minimize the risk of overloading and damaging the pump motor at full or zero flow. Pumps may be started with the valve further open only on installations where this situation cannot occur. The pump discharge control valve may need to be adjusted to comply with the duty following the run-up process. See "Pump Operation" on Page 8.
- Suction valves to be fully open when pump is running.
- Do not run the pump continuously outside the allowable operating region.
- Operating at a flow rate higher than normal or at a flow rate with no backpressure on the pump may overload the motor and cause cavitation. Low flow rates may cause a reduction in pump/bearing life, overheating of the pump, instability, and cavitation/vibration. Running the pump at a flow rate below the manufacturer's recommended minimum flow rate will cause damage.
- Handling, transportation and installation of this equipment should only be undertaken by trained personnel with proper use of lifting equipment. See "Uncrating and Lifting" Figure 1 shown below for reference.
- Only water or other suitable HVAC media may be circulated through the use of these pumps. Circulation of hazardous, corrosive or flammable liquids by using these pumps is strictly prohibited.
- DO NOT turn on the electrical supply to the pump until all the plumbing connections and commissioning procedure have been accomplished.
- The pump must not be operated dry without fluid.
- Pipe systems must be installed in such a manner so that no load is transferred to pump flanges.
- Ensure that the motor installation instruction manual has been followed for determining the proper terminal connections so that correct pump rotation is obtained.

## TRANSPORT AND STORAGE

**Transport and Handling Requirements**

The pump has been prepared for shipment at the factory in such a way as to minimize potential damage due to handling and transport. The equipment should not be subjected to excessive G-forces during the handling or transport. For large, heavy, rotating components, the manufacturer should consider and adapt a means to restrict the movement of the rotating assembly to prevent damage to the bearings during transport. All such means should be removed before installation.

**Uncrating and Lifting**

Pump is fastened securely to the crate before shipment. The pump should be removed from the crate carefully by using proper tools and equipment. After removing from crate make sure that all the components are in good condition and have been received as mentioned in the packing list. Report immediately to the concerned person/department if any component is missing or received in a damaged condition. Extreme care must be taken while handling the pump set. Slings and hooks should be used in such a manner, so that while lifting the pump is not exposed to stresses.

While lifting the pump or pump set (with or without driver) suitable lifting equipment of adequate capacity should be used. The unit should be unloaded and handled by lifting equally. Entire pump should be lifted at four or more points provided in base frame. Attach nylon slings, chains, or wire rope to the hooks or clevises for lifting. Ensure that the lift angle of the slings, chains or wire rope is less than 45° from vertical.

**Methodology to Orient Pumps Vertically While Unpacking the Unit**

Since the pumps are shipped horizontally laid on crate, it is necessary to orient pumps vertically before shifting to their installation location. Once the unit is uncovered, lift the unit by placing straps around the motor while making a pivot point of casing. Human effort will also be required to orient the unit to vertical position. Now let the unit to rest on crate and follow the procedure mentioned below to place the unit to its desired location.

***NOTICE:*** For typical installation, suitable overhead lifting equipment of adequate capacity to lift the driver, the entire pump (without driver), or the heaviest sub assembly of the pump should be available at the jobsite when installing or removing the pump.

**Use following procedure for lifting the pump set.**

1. Remove the coupling guard.
2. Place lifting straps/slings on each side of the coupling through motor bracket as shown in the Figure 1 below.

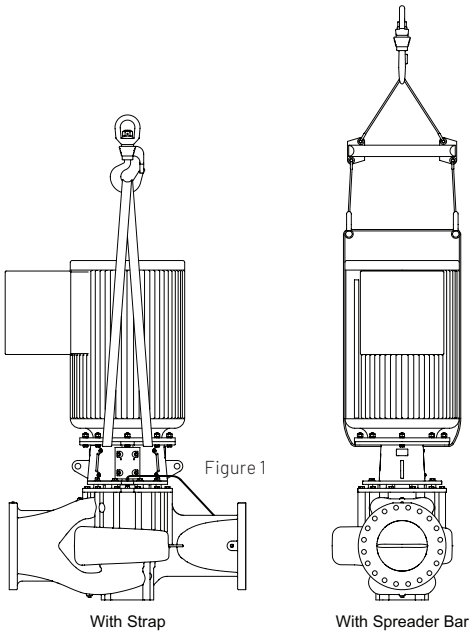



Figure 1

3. Use spreader bar in between the slings if necessary. This could be helpful for protecting the motor fan cover while lifting.
4. DO NOT use eyebolt or lifting lugs on motor and/or motor bracket for lifting the entire unit.
5. DO NOT place cable slings around the motor shaft.

**Receipt, Inspection, and Damage Reporting**

Upon receipt of the pump, immediately check for shortages of parts and damages. Prompt reporting to the carrier's agent, with notations made on the freight bill, may expedite satisfactory adjustment by the carrier.

This should be done at once. Do not unpack any more than required to verify that the equipment is complete and undamaged unless installation is to be done immediately. Do not leave the pump unit or any accessories exposed to weather or construction hazards, which may cause damage to the equipment.

**Unpacking**

As stated above, do not unpack any more than required to verify that the equipment is complete and undamaged unless installation is to be done immediately. Check all packing material that is to be discarded to verify that no parts or instructions are being accidentally discarded as well. It is recommended to leave small parts in their shipping container until installation so parts do not get misplaced. Make certain that accessories with a pump unit are clearly marked showing which pump unit they are to be used with. Clean all parts of all dirt, packing materials, and other foreign matter. Clean all non-coated machined surfaces. If the pump is to be installed immediately, then clean all coated machined surfaces too. Remove any rust spots found on the machined surfaces with a fine emery cloth. Clean all threaded connections and any accessory equipment.

**Storage**

The standard packaging is suitable for protection during shipment and during covered storage at the jobsite for a short period between installation and start-up. The preservatives applied at the factory have an effective life of two to three months from date of shipment, depending on the severity of the environment in which the equipment is stored.

**Short-Term Storage**

The pump and equipment, as shipped, have adequate protection for short-term (up to three months) storage in a covered, dry, and ventilated location at the jobsite prior to installation.

- Dry pump internals and spray the liquid end with a water-displacement rust inhibitor.
- Apply a film of compatible lube oil over the water-displacement rust preventative.
- After the pump has been thoroughly drained, cover the pump suction and discharge flanges with full gasket material and blank off these openings with metal blank flanges and a minimum of four bolts. Cover the pump stuffing box opening with a non-hygroscopic tape. If mechanical seals have been used, then the annular opening between gland plate and shaft should be closed by a removable sealing ring supplied by the original equipment manufacturer to exclude airborne dust. Additionally, all connections in the seal cartridge must be plugged or sealed.
- All exposed painted surfaces should be dry, clean, and free of grease and other contaminants.
- The pump should be covered with a weather-resistant cover of waterproof paper or plastic to prohibit the build up of dirt and dust accumulations.

**Long-Term Storage**

All pumps are factory serviced and delivered in a ready to operate condition. If after being delivered the pump is not put into immediate operation then proper care should be taken so that it operates without failure when put into service. The pump should be kept in a clean and dry area in a vertical position. Ensure that the following precautions are taken for pumps being stored for more than three months:

- Pump surfaces which are machined and unpainted (e.g. flange ends, feet mounting etc.) and are easily subjected to corrosion must be protected by corrosion resistant coating.
- The pump shaft should be rotated once per month to avoid locking of rotating assembly. This would also be helpful in uniform distribution of lubrication on bearings.

**Disposal of packaging materials**

Most of the materials supplied in the pump unit are suitable for recycling. Please conserve our natural resources and recycle these materials.

## PRODUCT DESCRIPTION

**Configuration**

Pumps are offered with various mechanical seal listed below:

- Type 1
- Type 21
- Type 8B2

Along with above, pumps are also offered with the following options required and mentioned by customer at the time of placing order:

- With flush line
- With or without abrasive separator
- Base options

**Parts**

Refer to "Assembly Exploded View" Figures 33, 34 and 35 on Pages 19-21 for listing various parts.

## INSTALLATION

**Installation Configuration**

The pump has been designed to be installed in various configurations as shown in the images below.

***NOTICE:*** The installation conditions shown in below images are for representation purpose only. The parts, accessories and supporting arrangements are not supplied with the pump unit unless otherwise specified.

**1. Hanger Supported Pipe Mounted**

Where floor space is a restriction, Pentair Fairbanks Nijhuis® 1590-SC Vertical In-line pumps can be installed in the system piping without any additional support from base, as illustrated in Figure 2 shown below. For such an installation, care must be taken to ensure that pipe hangers are designed to bear additional weight of pump set.

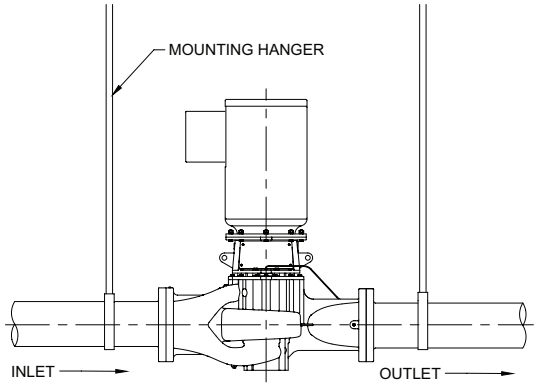



Figure 2

**2. Pipe Mounted Supported at Ceiling**

In tight rooms pump can be installed directly into the system piping with no base support and piping can be supported close to ceiling. With this arrangement the pump may be installed with a multi-purpose valve on the discharge side and suction diffuser on the suction side of the pump, as illustrated in Figure 3 shown below.

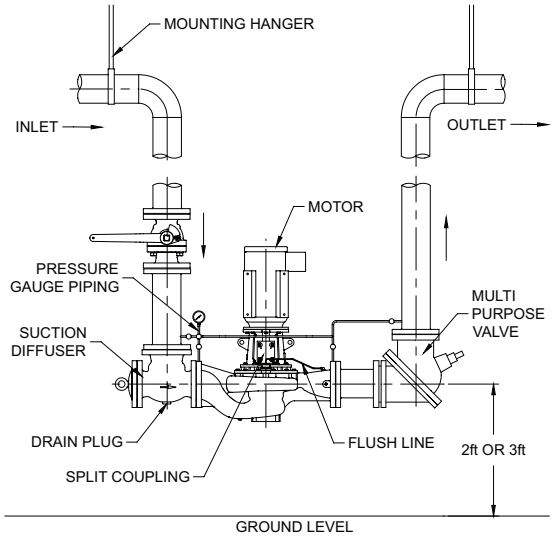



Figure 3

**3. Floor Saddle Support**

In many of the installation locations where support to pump from above is not possible, floor mounted saddle support can be provided beneathsuction and discharge piping. The pump case may be mounted on a base in such an installation but is not necessary. The installation is illustrated in Figure 4.

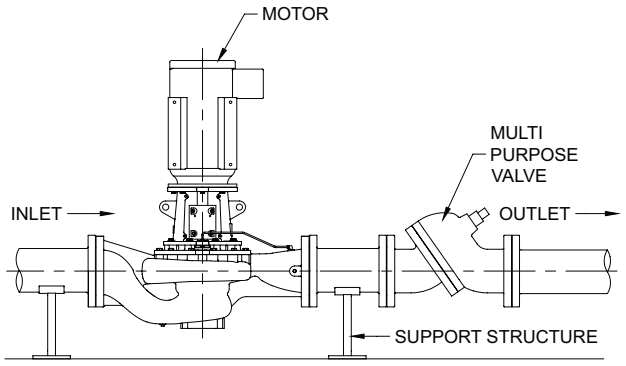



Figure 4

**4. Pipe Supports**

For ease of installation and increasing rigidity of the unit, a structural support may be provided at the pump suction and discharge ports with isolation pads beneath the support, as illustrated in Figure 5 shown below. Ensure that pipe hangers are adjusted so the pump flanges do not support the piping.

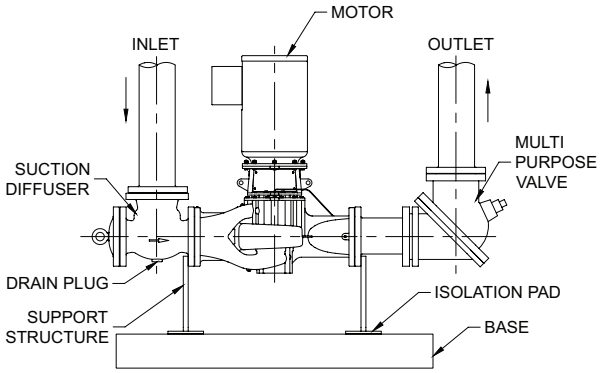



Figure 5

**5. Floor Mounted**

It is recommended that larger double suction vertical in-line pumps be floor mounted. This recommendation is based on the account of weight of pump and motor assembly. A mounting base is to be used for floor mounting which can be fastened to the integral cast in feet on the bottom of casing, as illustrated in Figures 6A shown below and 6B on next page. Make sure that pump is firmly bolted to the mounting base which in turn is also rigidly secured and mounted on the floor. During floor mounting it is recommended that flexible connectors are used to eliminate the potential for pipe load to be transferred to the pump. If flexible connectors are not used, it is very important to closely monitor the height of the pump support. If the height of support is more than required then the entire pipe load will be transferred to the pump which will start acting like a pipe support.

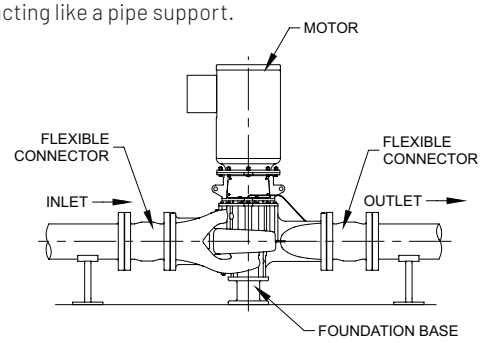



Figure 6A

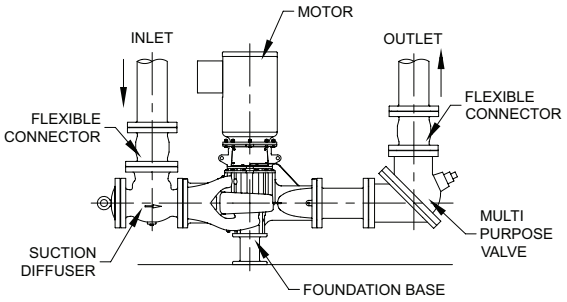



Figure 6B

When the pump is floor mounted, the piping will still need to be supported on both the suction and discharge sides to eliminate pipe stress at the pump. For supporting the pump from the bottom, case feet have been drilled and tapped to use commonly available pipe flanges to create the pump support.

**Table 1**

Pipe flange sizes for Pentair Fairbanks Nijhuis® 1590-SC pumps

| Pentair Fairbanks Nijhuis 1590-SC | |
|---|---|
| **Pump size** | **Feet drilling as per Class 125 flange** |
| 1-1/2" 1591, 1-1/2" 1592 | 1.5" |
| 2-1/2" 1591A, 2" 1593, 2" 1592A, 3" 1596A | 2" |
| 3" 1594A | 2.5" |
| 2-1/2" 1592,3" 1595, 4" 1595A, 4" 1596 | 3" |
| 3" 1597, 4" 1597, 4" 1598, 5" 1593A, 5" 1594, 5" 1591A, 5" 1592, 6" 1594A, 6" 1591A, 6" 1592 | 4" |
| 10" 1591A, 6" 1593A, 8" 1592A, 8" 1594A, 8" 1591A | 6" |
| 10" 1594 and 10" 1592 ONLY | 8" |
| 12" 1591, 12" 1593, 14" 1591, and 14" 1593 | 10" |

**Pump Location**

The pump should be located as close to the liquid source as possible so that the suction line can be short and direct. Location should require a minimum of elbows and fittings in the discharge line to minimize friction losses. The pump must be protected against flooding and located in a clean, open area, where it is easily accessible for inspection, disassembly and repair.

To minimize friction losses pump should be located such that the use of elbows and fittings in the discharge line is reduced. Pumps installed in dark, dirty areas or in cramped locations are often neglected, which can result in premature failure of both the pump and the driver. Open area would also be helpful with better air flow into the motor and/or motor fan.

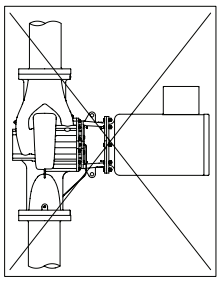


Figure 7

Pentair Fairbanks Nijhuis 1590-SC pump must be installed vertically. For horizontal installation refer to factory. Install isolating valves on each side of pump so that pump maintenance can be performed without draining the system. Special mounting requirements may be required if the pump is to be mounted near a noise or vibration sensitive area. The installation must be evaluated to ensure that the net positive suction head available (NPSHA) meets or exceeds the limits as stated below:

- 2 ft for building services
- 5 ft for municipal application

**Seismic analysis**

Please consult factory if the pump is to be installed in seismic zones.

**Piping and connections**

A minimum length of straight pipe is required on the suction side of the pump. Five times the pipe diameter is sufficient to allow a smooth entry of liquid into the pump.

Avoid using short elbows as they tend to give higher friction losses and interruption in streamline flow. Suction and discharge piping must be in line. To avoid undue stresses on pump and pipe flanges, never force align the pipes and provide a rigid support near the pump casing. Pump flanges must be tightened evenly to avoid flange cocking and liquid leakage.

Air leak/trapped in suction piping is one of the major causes of erratic pump performance. To avoid any such kind of trouble, suction piping should be arranged in such a manner that there are no high spots. This is to ensure that air is not trapped in the suction line which will cause faulty pump operation. Wherever suction line is larger than the pump suction nozzle, it is mandatory to use an eccentric reducer. For sumps below center line the straight side of the reducer must be located upwards so that any air cavity if present in the suction line passes through the line to outlet and there is no pressure drop at pump suction due to presence of air pockets.

The check valve must be installed in the discharge line which prevents backward flow of liquid into the pump, thereby protecting the pump from liquid back pressure.

***NOTICE:*** The suction valve should be fully open and should not be used for flow regulation. The discharge valve is to be used for flow regulation.

**Pipe Supports/Anchors/Joints**

- Suction and discharge piping should be anchored, supported, and restrained near the pump to avoid application of forces and moments to the pump in excess of those permitted.
- Expansion joints or flexible connections provided at the pump suction and discharge may need to be restrained to prevent transmitting excessive loads to the pump.
- If it is necessary to use an expansion joint or non-rigid coupling, then it is recommended that a pipe anchor be located between it and the pump.

***NOTICE:*** PRESTARTING INSTRUCTION, The coupling halves should be connected. Prior to connection, however, the drive motor should be started to make sure the direction of rotation is the same as the direction indicated by the arrow on the pump casing.

# PUMP OPERATION

## COMMISSIONING

### Lubrication

The pump does not contain any bearings that require lubrication; however motor bearings must be lubricated periodically.

**⚠ CAUTION** Before running the driver, either separately or connected to the pump, check lubrication and cooling requirements.

### Split Coupling

Power is transmitted from motor shaft to the pump shaft through a split coupling. The pump shaft does not contain bearings that need lubrication.

### Rotation

Before starting, check the direction of rotation. The direction is indicated by a direction arrow on the pump casing. The proper rotation can be easily determined by observing the direction of the casing scroll and the position of the discharge nozzle. The rotation should be checked with the coupling disconnected from the driven equipment.

**⚠ CAUTION** It is essential that the rotation of the motor be checked before connecting the shaft coupling. Incorrect rotation of the pump, for even a short time, may dislodge and damage the impeller, casing, shaft, and shaft seal.

### Guarding

All guards must be in place and secure per the instructions prior to start-up.

**⚠ CAUTION** Guards must not be removed while the pump is operational. Always follow lock out – tag out procedures when working on equipment that may turn on.

## START-UP CONSIDERATIONS

### System Flushing

When the pump is installed in the completed piping system, it is recommended that the system be flushed to remove debris such as stubs of welding rod, welding slag, and loose scale.

### Priming and Filling

A pump is considered to be primed when the casing and the suction piping are completely filled with liquid. Open discharge valves a slight amount. This will allow any entrapped air to escape and will normally allow the pump to prime, if the suction source is above the pump. When a condition exists where the suction pressure may drop below the pump's capability, it is recommended to add a low-pressure control device to shut down the pump when the pressure drops below a predetermined minimum.

## SHAFT SEALING SETTINGS AND ADJUSTMENTS

### Mechanical Seals

A mechanical seal consists of a rotating element and a stationary element. The sealing faces are highly lapped surfaces of materials selected for their low coefficient of friction and their resistance to corrosion by the liquid being pumped. The faces run with a very thin film of liquid between them. In addition, there must be a means of loading the seal. This is accomplished either with a spring (or springs) or with an elastomeric or metallic flexible member. Mechanical seals are made in a wide variety of designs; therefore the instructions for the specific seal must be carefully studied and followed. A mechanical seal is a precision device and must be treated accordingly. Mechanical seals normally require no adjustment during operation. Except for slight initial leakage, the seal should operate with negligible leakage.

**⚠ CAUTION** Mechanical seals should not run dry unless allowed by the manufacturer. Seals require a continuous supply of flush and/or cooling fluid.

## OPERATION, START-UP, AND SHUTDOWN

### Pump Operation

The following points must be ensured before starting the pump:

1. The current supply agrees with the voltage and frequency on the motor nameplate.
2. The motor is wired for correct voltage.
3. The thermal overload relays are correct size and set for operation.
4. The pump is fully primed. Flood the casing and seal area with liquid to release the air out of pump through flush line and air vent valve near discharge flange. Priming must be continued until air is completely removed. This may be indicated by continuous flow of liquid through flush line and air vent.
   ***NOTICE:*** Failure to flood the seal area with water may cause seal failure due to lack of lubrication.
5. Jog the motor with the coupling not in place to check that the motor rotates clockwise, as indicated by the arrow on the pump casing.
6. Coupling guard must be in its appropriate position on account of human safety.

### Starting Up

***NOTICE:*** MAKE SURE SUCTION LINE VALVE IS IN OPEN POSITION AND DISCHARGE LINE VALVE IS CLOSED

1. Check that the pump is operating smoothly and is not rubbing.
2. Start opening the discharge valve gradually.
   (***NOTICE:*** Do not run the pump for extended period with discharge valve closed, so as to avoid overheating and potential damaging loads.)
3. Stop the pump immediately if any of the following situations arise:
   a. No/insufficient liquid.
   b. Inadequate discharge pressure.
   c. Loss of suction pressure.
   d. High power consumption.
   e. Noisy operation and/or high vibration.
   Check Troubleshooting Guide on Page 17 for the cause.

### Shutdown

It is recommended to close the discharge valve before stopping the pump to avoid any water hammer effect. However, this practice is not mandatory and pump may be stopped with discharge valve open in case of an emergency.

Preferred shutdown sequence is as follows:

1. Preferably close the discharge valve first.
2. Then turn off the motor.
3. Now, close the suction line valve.
4. Drain the pump liquid completely, if pump to be kept nonoperational for longer period or if there is danger of freezing.

## MAINTENANCE AND SERVICE

**Schedule**

Preventive maintenance and routine check-ups may prevent the pump from major failures. An inspection & maintenance log should be kept and the inspector should immediately report any problems. Pump should be checked on regular basis for any unusual noise, vibrations and abnormal rise of temperature. If so equipped, check the sight flow indicator from time to time for fluid flow and if no flow is observed, replace the filter or check the separator. A suggested guide for preventive maintenance for normal application is given below in Table 2.

**Table 2**

**GUIDE FOR PREVENTIVE MAINTENANCE**

| ITEMS | ACTION REQUIRED | FREQUENCY |
|---|---|---|
| Vibration | Check for change in vibration levels | Refer to ANSI/HI 9.6.5 Condition Monitoring |
| Bolting | Check for proper bolt torque | Annually |
| Mechanical seals | Monitor seal leakage | Refer to ANSI/HI 9.6.5 Condition Monitoring |
| Pump/Motor alignment | Check for change in alignment | Annually |
| Surface inspection | Check for coating integrity or signs of corrosion | Exterior components: Quarterly<br>Interior components: Annually |
| Wear and running clearance | Inspect and measure | Annually or as determined by service condition when performance decreases are noted or as recommended |
| No flow in sight flow indicator (if installed) | Replace filter, Inspect separator | Daily |
| Controls and accessories | Inspect for damage, proper function and condition | Annually |
| General site conditions | Inspect for damage, proper function and condition | 150 hours of operation as necessary |

**Cold Weather Maintenance**

When handling water, care should be taken to prevent the pump from freezing during cold weather when the pump is not in operation. It may be necessary to drain the pump casing during shutdown periods by removing the bottom drain plug.

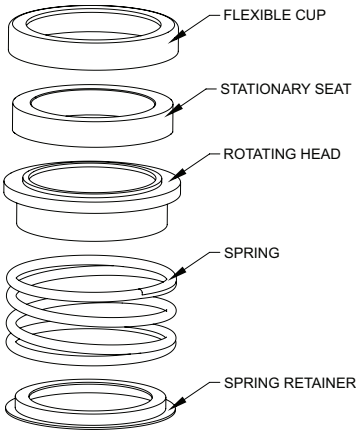
**Mechanical Seal Maintenance**

The mechanical seal require flushing which is flushed from discharge of the pump through a flush line. A throttle bushing isolates the mechanical seal from the liquid in the pump. Since mechanical seals need a film of liquid between the sealing faces, pump must not be run unless properly filled with liquid for intended operation.

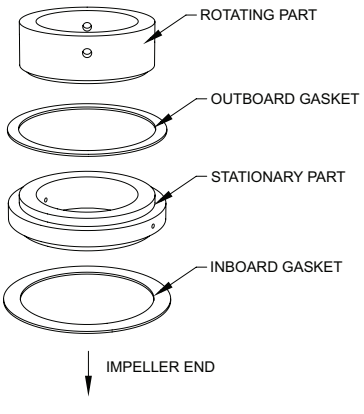
A 'weep' sound may be heard from mechanical seals at start-up. The pump should run for approximately 8-10 hours, which is the break-in period for seal. During this operation the mechanical seal would 'seat' properly.

Pentair Fairbanks Nijhuis® 1590-SC pumps are supplied with three basic types of seals:

1. Seal type 1
2. Seal type 21
3. Seal type 8B2




Mechanical Seal (Type 1 & 21)
Figure 8A




Mechanical Seal (Type 8B2)
Figure 8B

**Recommended Spare Part List**

Although all the components could be procured by the customer at short interval, to reduce downtime the below mentioned components should be kept handy in case the pump is to be shut down for maintenance. The components are:

- Mechanical seal
- Wear rings (If applicable)
- Gaskets, O-rings, seals

**Consumables**

Following items are of regular use during preventive & accidental maintenance and must be kept in stock by the customer:

- Lubricants
- Cleaning materials
- Touch up coating

**Required Tools and Fixtures**

Pump assembly and disassembly can be performed by using standard hand tools available in market. For quick reference, tools required for disassembly of various pump components are mentioned below and on next page:

**Table 3**

**QUICK REFERENCE FOR TOOLS AND FIXTURES**

**FOR PUMPS**
**(10" 1592, 10" 1594, 12" 1591, 12" 1593)**

| Hardware | Location | Wrench Size &Type (in inches) |
|---|---|---|
| Hex bolt | Motor bracket - motor mounting flange side | 15/16 open end wrench |
| Heavy hex nut, hex bolt | Motor bracket -motor mounting flange side, motor bracket register flange | 1-1/8 open end wrench |
| Hex bolt | Coupling guard & motor bracket | 1/2 open end wrench |
| Allen bolt | Coupling & gland jacking (in 10"1592 only) | 1/2 Allen key |
| Heavy hex nut | Coupling | 7/8 open end wrench & 3/8 socket head wrench |
| Hex screw /bolt | Gland & gland jacking, gland for external mechanical seal | 3/4 open end wrench |
| NPSF plug | Suction & discharge pressure gauge, air vent & drain, recirculation relief | 9/16 open end wrench |
| Set screw | Coupling | 1/4 Allen key |
| Retainer ring | Pump shaft | External retainer ring pliers |

**FOR PUMPS**
**(14" 1591, 14" 1593)**

| Hardware | Location | Wrench Size & Type (in inches) |
|---|---|---|
| Hex bolt | Motor bracket - motor mounting flange side | 1-1/8 open end wrench |
| Heavy hex nut, hex bolt | Motor bracket -motor mounting flange side, motor bracket register flange | 1-1/4 open end wrench |
| Hex bolt | Coupling guard & motor bracket | 1/2 open end wrench |
| Allen bolt | Coupling | 1/2 Allen key |
| Heavy hex nut | Coupling | 1-1/16 socket head wrench |
| Hex screw /bolt | Gland & gland jacking, gland for external mechanical seal | 3/4 open end wrench |
| NPSF plug | Suction & discharge pressure gauge, air vent & drain, recirculation relief | 9/16 open end wrench |
| Set screw | Coupling | 3/8 Allen key |
| Retainer ring | Pump shaft | External retainer ring pliers |

**FOR ALL OTHER PUMPS**

Refer to "Assembly Exploded View" Figure 35 on Page 21 for item numbers.

| Item No. | Motor Frame | Impeller Size[1] | Wrench Size and Type (in inches) |
|---|---|---|---|
| #32 | 143-145 | All pumps | 9/16 wrench |
| | 182-286 | | 3/4 wrench |
| | 324-445 | | 15/16 wrench |
| #5 | All motor frames | 11" & 9.5" | 3/4 wrench |
| | | 13.5" | 1-1/8 wrench |
| | | 7" | 9/16 wrench |
| #18 | All motor frames | All pumps | 1/2 wrench |
| #48 | 143-365 | All pumps | 5/16 Allen key |
| | 404-445 | | 3/8 Allen key |
| #55 | All motor frames | All pumps | 3/4 wrench |
| #4 | All motor frames | All pumps | 9/16 wrench |
| #4A | All motor frames | All pumps | 9/16 wrench |
| #20 | 143-215 | All pumps | 3/16 Allen key |
| | 254-445 | All pumps | 1/4 Allen key |
| #41 | All motor frames | All pumps | External retainer ring pliers |
| #9 | 143-215 | All pumps | 9/16 socket wrench |
| | 254-445 | | 3/4 socket wrench |
| #1 | All motor frames | All pumps | 19/32 wrench |
| #2 | All motor frames | All pumps | 19/32 wrench |

[1] 7", 9.5", 11" and 13.5" denote maximum impeller diameter of the pump. Refer to the Table for Pump - Impeller Size Relation on page 23 to identify the pump model.

In addition to the above mentioned tools some additional equipment & fixtures may be required which are mentioned below:

- Lifting devices (crane, hoist, lifting chains or straps)
- Impeller puller (to remove pressed-on impeller from shaft)
- Torch (to heat parts to aid in removal)
- Die grinder (to cut out wear rings or sleeves, if needed)
- Work table or fixture (for holding the pump)
- Measuring equipment (feeler gauges, dial indicator, etc.)

**Fastener Torque and Sequence**

Proper tightening of bolting is very important. Torque values will vary depending on the size and grade of bolting used. Torque values for coupling bolts and grub screws and sequence of their tightening are mentioned in the following section for replacement procedure of mechanical seals.

## REPAIRS

***NOTICE:*** READ AND UNDERSTAND ALL SAFETY WARNINGS AT THE BEGINNING OF THE MANUAL BEFORE BEGINNING INSTALLATION OR ANY REPAIR WORK

This repairs section is broken into two parts. The first part covers the replacement of the mechanical seal. The second part covers complete pump disassembly. Refer to the exploded pump diagrams (Figures 33, 34 and 35 on Pages 19 - 21) for item numbers.

**Mechanical Seal Replacement**

Refer to tools mentioned in the tables under "Required Tools and Fixtures" on Pages 10 - 11.

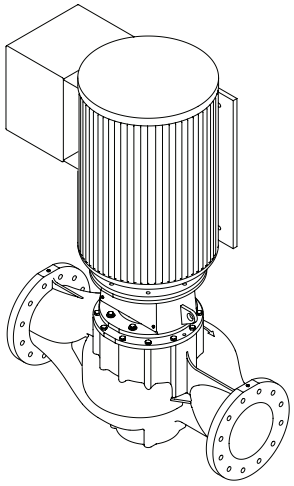


Figure 9

**⚠WARNING Sudden start-up hazard:** Disconnect and lock out power source before servicing. Failure to follow these instructions could result in serious personal injury, death or property damage.

1. Ensure the electrical power is locked out, the system pressure has been lowered and temperature of the unit is at a safe level.
2. Isolate the pump from the system by closing the valves that should be located on the suction and discharge side of the pump. Loosen one of the pipe plugs (#4) and drain the pump.

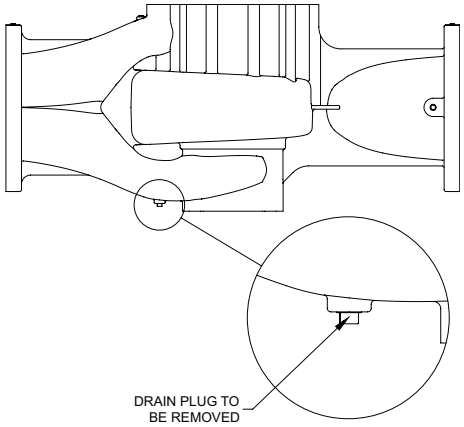



Figure 10

**⚠WARNING Hot surface hazard:** If pumping hot water, ensure guards or proper insulation is installed to protect against skin contact with hot piping or pump components. Failure to follow these instructions could result in serious personal injury, death or property damage.

**⚠WARNING Spraying water hazard:** When servicing pump, replace all gaskets and seals. Do not reuse old gaskets or seals. Failure to follow these instructions could result in serious personal injury, death or property damage.

3. Remove the coupling guards (#17) by removing the four (per side) cap screws (#18). Loosen the ferrule nuts on the tubing connectors (#1) and remove the gland flushing tubing (#3).

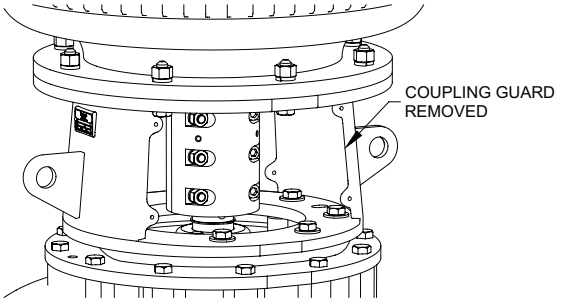



Figure 11

**If 8b2 mechanical seal has to be replaced, stop at this point and proceed to step 28 on Page 13. Otherwise continue for Type 21 mechanical seal replacement.**

**FOR TYPE 21 MECHANICAL SEAL**

4. **For Size 10" 1592** - Loosen the four gland bolts (#55) so that there is at least ½" gap between their head and the gland. Tighten the two set screws (#20) pre-installed into the gland keeping all the loosened gland bolts engaged in case of 10" 1592 pump, they will keep the gland from rotating as it is lifted.

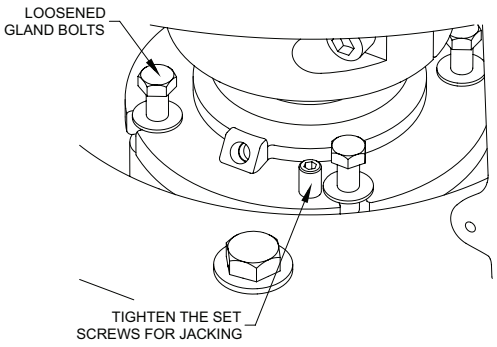



Figure 12A

**For All Other Sizes** - Loosen the four gland bolts (#55). Two should be loosened so that there is at least ½" gap between their head and the gland, and other two removed and transferred to the provided jacking holes.

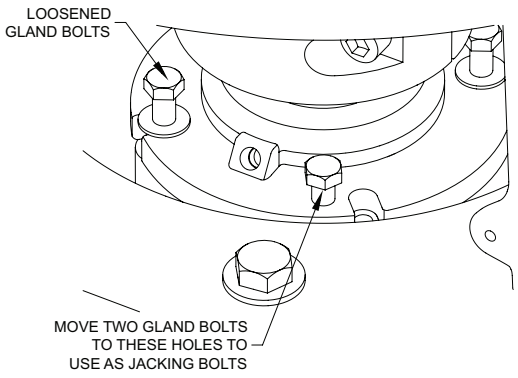



Figure 12B

5. Start tightening the jacking bolts/set screws to jack the seal gland (#44) upward until the top surface of the seal gland makes a firm contact with the bottom of the retaining ring (#41A). Make sure to alternate tightening of the bolts so the gland is raised evenly.
6. With the bolts (#55) tightened against the gland, the weight of the shaft (#40) and impeller (#11) can now be supported by the gland and the split coupling (#45) can be removed without the shaft dropping.
7. Remove the four coupling set screws (#20) followed by six/four socket head coupling bolts (#48) along with the nuts (#50) and spring washers (#49). The two coupling halves (#45) can now be pulled away from the shaft.

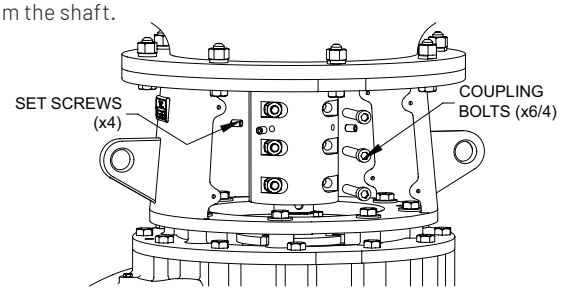



Figure 13

8. Remove the two linear (square) keys (#53, #54).

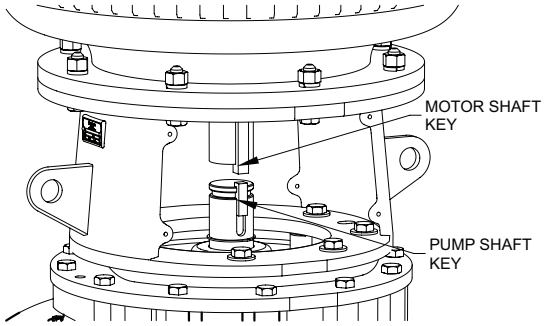



Figure 14

9. Carefully lower the shaft impeller assembly by backing off on the two gland supporting bolts (the two set screws in case of 10" 1592) until the face of the impeller rests inside the casing.
10. Remove the retaining ring (#41A) from the shaft.
11. Remove two remaining gland bolts (#55) which are engaged with seal plate (#35A).
12. The gland (#44) (with the stationary seat of the mechanical seal pressed internally) can now be removed through the gap present between the pump shaft and the motor shaft.

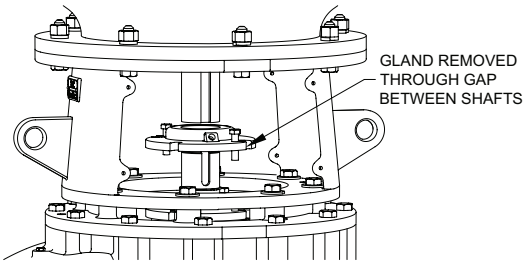



Figure 15

13. Pry the old mechanical seal (#27) rotating head, spring & spring retainer up and off the pump shaft.
14. Remove the stationary part of the mechanical seal from the gland. Remove the O-ring gasket (#43) from the groove on the bottom of the gland.

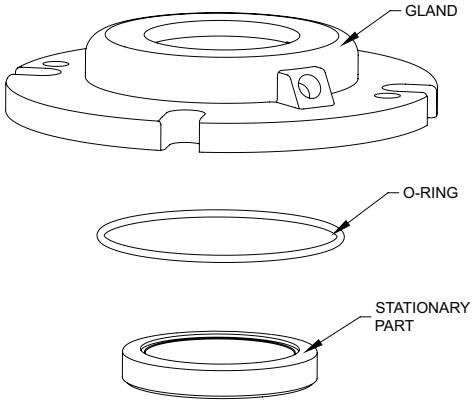



Figure 16

**If the pump is to be fully disassembled stop at this point and proceed to Step 1 under "Complete Pump Disassembly" on Page 15. Otherwise continue for installation of the mechanical seal.**

15. Clean all surfaces of the gland, checking for nicks and sharp edges that may damage the elastomers on the mechanical seal or the gland.
16. To replace the mechanical seal, lubricate the stationary seat bore in the gland with soapy water mixture and press in the seat ensuring it is flat in the bore.
17. Replace the gland O-ring, holding in the groove with a small amount of non-hardening silicon or grease.

    **⚠ CAUTION** The mechanical seal (#27) is a precision product and must be treated as such. During installation, great care must be taken to avoid dropping any part of the seal. Take particular care not to scratch the lapped faces on the washer or the sealing seat.
18. Lubricate the pump shaft with soapy water. Place the spring retainer over the shaft, followed by the spring and finally the rotating head of the seal until it rests over lower retaining ring.

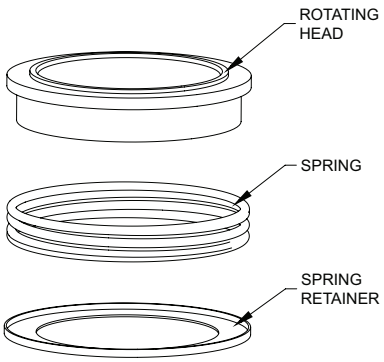



Figure 17

19. Place the gland down on the seal plate and ensure the two jacking bolts/set screws are engaged.
20. Engage the remaining two gland bolts loosely with the gland and seal plate (all the four bolts in case of 10" 1592 pump) to restrict the motion of the gland about shaft axis.
21. Replace the external retaining ring making sure it is in the groove of the shaft.
22. Using one half of the split coupling as a guide, (the tapping for set screws identifies the motor side of the coupling) utilize the jacking bolts to raise the shaft (with impeller) upward until the step inside the coupling touches motor shaft end face so that pre-specified distance between pump shaft and motor shaft is maintained.

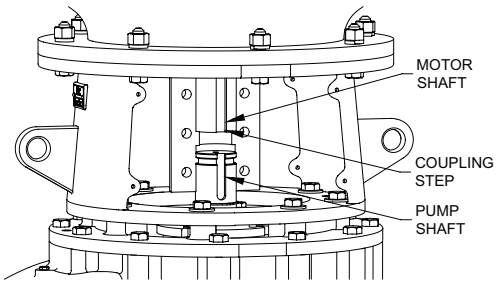



Figure 18

23. Place the linear motor key in the motor shaft. Place the linear pump key in the pump shaft and align the two linear keys so that the other coupling half fits over both motor and pump shaft.
24. Place the other half of the split coupling onto the shafts. Replace the six/four socket head cap screws (three/two sockets facing in on one side and three/two facing out on the other side requiring rotating the shaft 180 degrees to tighten the cap screws) and add spring washers and nuts. Adjust the socket head cap screws to maintain even gap between coupling halves. Tighten the socket head cap screws in a crosswise pattern. The minimum tightening torque to be maintained is 120 lbf-ft but should not exceed 130 lbf-ft. Make sure that all the bolts are tightened to same torque.

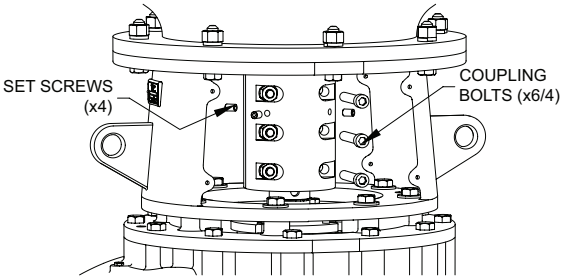



Figure 19

- **Tighten to the required torque in three steps as follows:**
  a) First time – Tighten to 50% of the specified torque
  b) Second time – Tighten to 75% of the specified torque
  c) Third time – Tighten to 100% of the specified torque

25. Tighten grub screws to fix the axial location of coupling (in a crossing pattern). The minimum tightening torque to be maintained is 30 lbf-ft but should not exceed 65 lbf-ft. Make sure that all the bolts are tightened to same torque.
    - **Tighten to the required torque in three steps as follows**
      a) First time – Tighten to 50% of the specified torque
      b) Second time – Tighten to 75% of the specified torque
      c) Third time – Tighten to 100% of the specified torque
26. Lower the gland by disengaging the jacking bolts/set screws and tighten the gland to the seal plate using the four gland bolts.
27. Reinstall the flush tubing. Ensure that impeller and motor rotate freely with no dragging or binding. Replace the coupling guards and refer to "Starting Up" on Page 8 for start-up instructions.

**FOR TYPE 8B2 MECHANICAL SEAL**

28. Loosen the four gland bolts (#55). Keeping the two bolts engaged with the gland to restrict the motion of the gland about shaft axis, engage the other two bolts into the threaded holes in jacking plate (#10)(supplied separately with pump). Place the jacking plate sub-assembly beneath the retaining ring, aligning the bolts with two clear blind holes in the gland (#44). Tighten the engaged bolts simultaneously such that the jacking plate makes firm contact with the bottom of the retaining ring (41A).

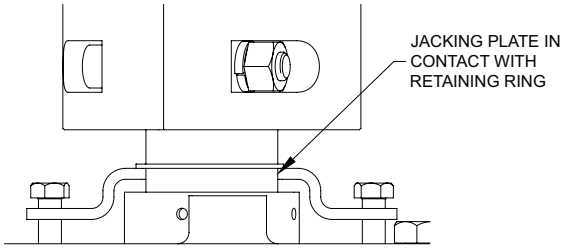



Figure 20

29. Remove set screws (#21) from rotating part of the seal and move the rotating part slightly upwards so that it does not hinder shaft (#40) axial movement when the jacking plate (#10) is backed off. Failure to do so could cause damage to the stationary seat when the impeller (#11) is lowered.

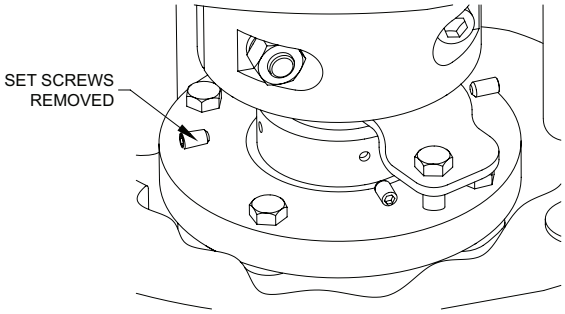



Figure 21

30. With the jacking bolts tight against the jacking plate, the weight of the shaft (#40) and impeller(#11) can now be supported by the gland (#44) and the split coupling (#45) can be removed without the shaft dropping.
31. Remove the four coupling set screws (#20) followed by six/four socket head coupling bolts (#48) along with the nuts (#50) and spring washer (#49). The two coupling halves (#45) can now be pulled away from the shaft.
32. Remove the two linear (square) keys (#53, #54).
33. Carefully lower the shaft impeller assembly by backing off the two gland plate supporting bolts until the face of the impeller rests inside the casing.
34. Remove the retaining ring (#41A) from the shaft.
35. Pry the old mechanical seal (#27) rotating part off the pump shaft.
36. Remove the jacking plate (#10) and bolts sub-assembly.
37. Inspect the surface of the stationary seat. If damaged, remove gland bolts (#55), and remove gland (#44) through the gap present between the pump shaft and the motor shaft.

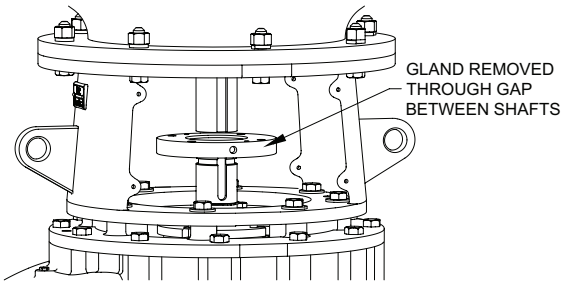



Figure 22

38. Remove the stationary part along with the inboard and outboard stationary gasket off the pump shaft.

    **If the pump is to be fully disassembled proceed to Step 1 under "Complete Pump Disassembly" on Page 15. Otherwise continue for installation of the 8B2 Seal.**

39. Clean all surfaces of the gland, checking for nicks and sharp edges that may damage the elastomers on the mechanical seal or the gland.
40. Remove the mechanical seal from its packaging, inspect for any damage, and keep seal faces clean and free from contaminants during installation.

    ***NOTICE:*** DO NOT GREASE OR TOUCH OR LUBRICATE SEAL FACES

41. Use soap, Petrol-Gel®, glycerin, etc. for lubrication for ease of assembly.
42. If removed, install the inboard stationary gasket and the stationary part of seal onto the shaft. Then place the outboard stationary gasket over the stationary part.
43. Next place the seal gland over the stationary part and gaskets, making sure that all the gaskets have been installed properly before securing the gland bolts.
44. Now install the rotating part of the seal over the shaft. Do not tighten seal set screws at this time.

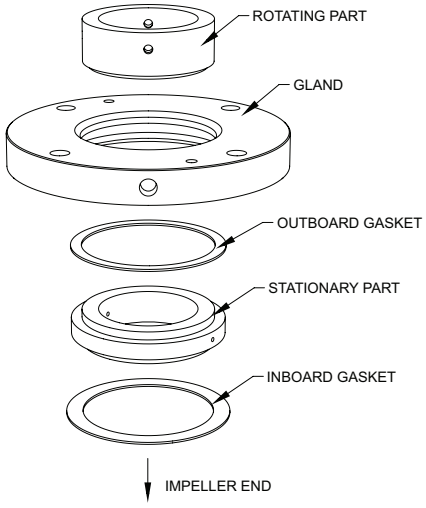



Figure 23

45. Replace the external retaining ring making sure it is in the groove of the shaft.
46. Engage the jacking plate and bolt sub-assembly so that it touches the lower face of the retaining ring.
47. Using half of the split coupling as a guide, (the tapping for setscrews identifies the motor side of the coupling) utilize the jacking plate and bolts sub-assembly to raise the shaft (with impeller) upward until the step inside the coupling touches motor shaft end face so

that pre-specified distance between pump shaft and motor shaft is maintained.

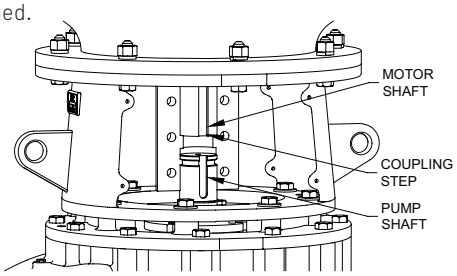



Figure 24

48. Place the linear motor key in the motor shaft. Place the linear pump key in the pump shaft and align the two linear keys so that the other coupling half fits over motor and pump shaft.
49. Place the other half of the split coupling onto the shafts. Replace the six/four socket head cap screws (three/two sockets facing in on one side and three/two facing out on the other side requiring rotating the shaft 180 degrees to tighten the cap screws) and add spring washers and nuts. Adjust the socket head cap screws to maintain even gap between the coupling halves.

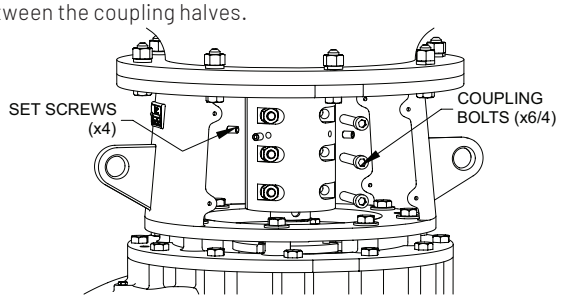



Figure 25

50. Tighten the socket head cap screws in a crosswise pattern. The minimum tightening torque to be maintained is 120 lbf-ft but should not exceed 130 lbf-ft. Make sure that all the bolts are tightened to same torque.
    - **Tighten to the required torque in three steps as follows:**
        a) First time – Tighten to 50% of the specified torque
        b) Second time – Tighten to 75% of the specified torque
        c) Third time – Tighten to 100% of the specified torque
51. Tighten set screws to fix the location of coupling (in a crossing pattern). The minimum tightening torque to be maintained is 30 lbf-ft but should not exceed 65 lbf-ft. Make sure that all the bolts are tightened to same torque.
    - **Tighten to the required torque in three steps as follows:**
        a) First time – Tighten to 50% of the specified torque
        b) Second time – Tighten to 75% of the specified torque
        c) Third time – Tighten to 100% of the specified torque
52. Fasten the set screws of rotating part of the seal. After maintaining the compression recommended by the seal manufacturer, tighten the set screws to a torque as recommended by the seal manufacturer.
53. Lower the jacking plate by utilizing bolts, replace the four gland bolts and tighten the gland to the seal plate.
54. Reinstall the flush tubing. Ensure that the coupling rotates freely with no dragging or binding. Replace the coupling guards and refer to "Starting Up" on Page 8 for start-up instructions.

**Complete Pump Disassembly**

**FOR PUMPS**
**(10" 1592, 10" 1594, 12" 1591, 12" 1593, 14" 1591 and 14" 1593 only)**

1. With the coupling (#45), gland (#44) and mechanical seal (#27) removed, remove the bolts (#32), nuts (#31) and washers (#32A) holding the motor to the bracket.
2. Pull the motor up and away utilizing suitable lifting equipment.
3. Remove the lower snap ring (#41B) from the pump shaft.
4. Remove the cap screws (#5) and washers (#5A) holding the bracket (#35) to the seal plate (#35A). Utilizing suitable lifting equipment lift the bracket straight up.
5. Remove the cap screws (#5) holding the seal plate to the casing (#6) and by utilizing two bolts jack the seal plate upwards. Utilizing suitable lifting equipment lift the seal plate straight up. Take care when lifting to ensure a straight lift.

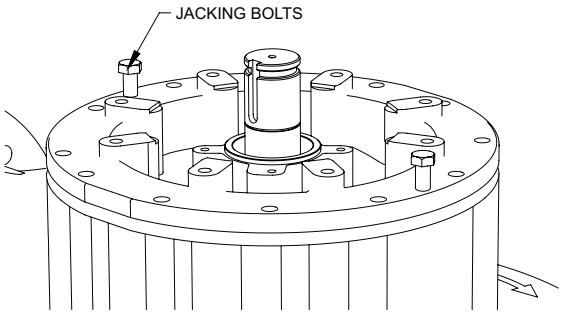



Figure 26

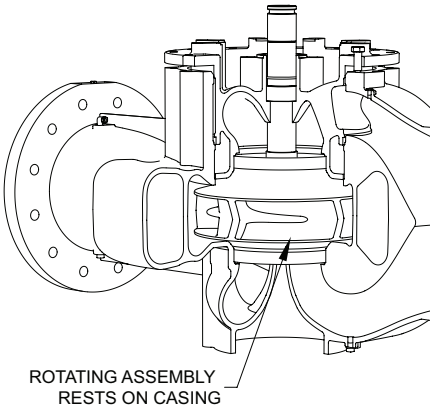



Figure 27

6. Remove carbon bushing (#42) from the bore inside the seal plate. During reassembly the new bushing must be pressed in evenly or it can crack.
7. Remove O-rings/gaskets (#8 and #8A) from the seal plate.

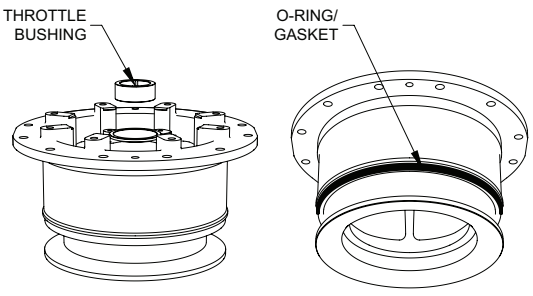



Figure 28

8. Unscrew impeller screw (#9), remove impeller washer (#9A) and impeller seal (#9C).
9. Slide impeller (#11) and impeller key (#12) from shaft.
10. Remove spire bush (#13) from the impeller bore using a small puller. During reassembly the new bushing must be pressed evenly or it can crack.
11. Remove wear rings (#7) & (#16) from the casing and seal plate with the help of a puller.

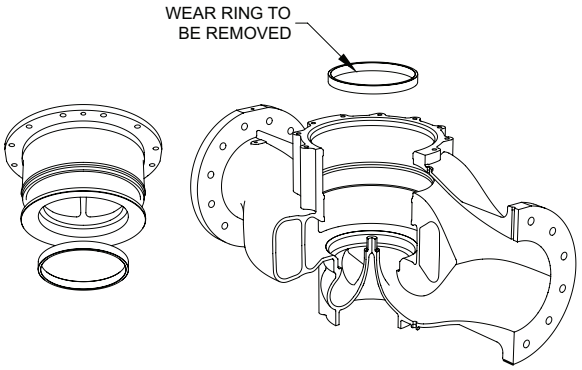



Figure 29

12. Remove sleeve (#25A) from casing spire with the help of a puller.
13. Remove nameplate (#34) and screws (#33) only if replacement is needed.

**Complete Pump Disassembly**

**FOR ALL OTHER PUMPS**

1. With the coupling, gland and mechanical seal removed, remove the bolts (#32) and nuts (#31) holding the motor to the bracket (#35). Pull the motor up and away utilizing suitable lifting equipment.

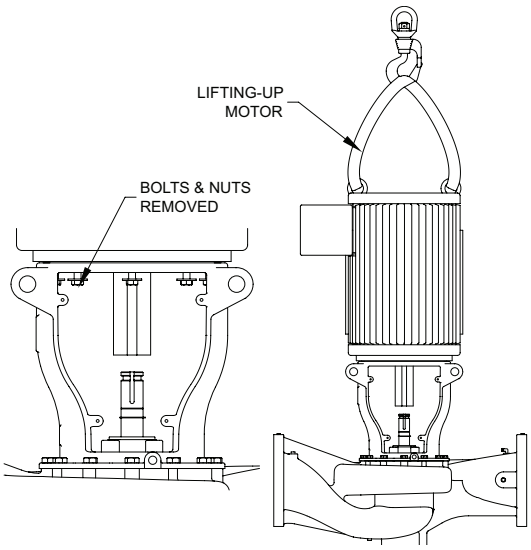



Figure 30

2. Remove the snap ring (#41B) from the shaft (#40).
3. Remove the cap screws (#5) holding the bracket (#35) to the casing (#6) and by utilizing two bolts, jack the seal plate upwards. Utilizing suitable lifting equipment lift the bracket straight up and off the casing and over the shaft. Take care when lifting to ensure a straight lift, the carbon bushing (#42) may be damaged by uneven lifting.

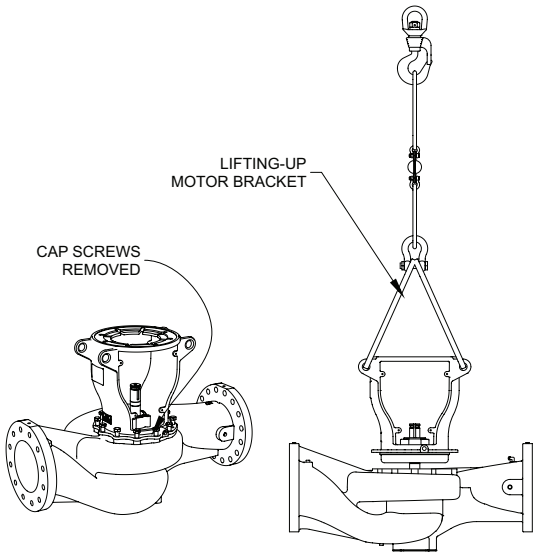



Figure 31

4. Remove the casing gasket (#8) from the casing and bracket.
5. Lift the rotating assembly from the casing.

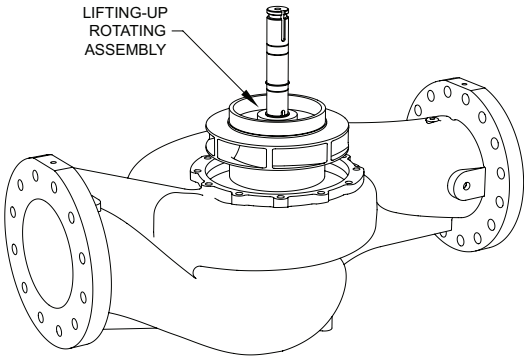



Figure 32

6. Unscrew impeller screw (#9) and remove impeller seal (#9C).
7. Slide impeller (#11) and impeller key (#12) from shaft.
8. Now remove the impeller washer (#9A).
9. Remove wear rings (#7, #16) from the casing and bracket.
10. Press out the carbon bushing (#42) from the bore inside the bracket (at the base of the packing box). During reassembly the new bushing must be pressed in evenly or it can crack.
11. Pump reassembly is performed in the reverse order of disassembly procedure.

**Inspection**

Once the pumping unit is disassembled, component parts should be inspected to determine their condition. Worn parts should be reconditioned to like-new condition or replaced.

**Assembly**

Pump reassembly is performed in the reverse order. During the assembly procedure, take care not to damage any of the component parts and avoid contamination (dirt, debris, moisture, etc.) to the unit.

# TROUBLESHOOTING GUIDE

**THE FOLLOWING IS A LIST OF COMMON PROBLEMS AND THEIR PROBABLE CAUSES.**

| Symptoms | Possible causes | Possible remedies |
|---|---|---|
| Insufficient pressure or Insufficient/no flow | Speed too low | Check and ensure correct voltage at motor terminals |
| | | Check if rotating elements freely rotate |
| | Wrong direction of rotation | Check motor rotation with direction arrow on casing |
| | | Ensure correct motor wiring |
| | Entrained air in pump | Ensure all air is vented, and pump is adequately primed |
| | | Ensure eccentric reducer, if correctly installed |
| | Air leaks into suction line | Tighten the suction piping flange bolts as required |
| | Leaking joints | Check for any external leakage and arrest |
| | Excessive leakage from seal | Inspect and replace mechanical seal, as required |
| | Insufficient submergence of suction pipe | Check and ensure sufficient pipe length, submerged well below the water surface |
| | Insufficient pressure at pump inlet | Ensure correct suction pipe sizing |
| | | Raise fluid level or move pump closer to the water level |
| | Clogged impeller | Clean impeller as required |
| | Damaged impeller | Check and replace impeller as required |
| | Worn wear rings | Check and replace wear rings, if equipped |
| | System head not as anticipated | Contact manufacturer for correct pump sizing |
| | Smaller impeller diameter | Contact manufacturer for correct impeller sizing |
| Excessive power consumption | Speed too high | Check and ensure correct voltage at motor terminals |
| | Rubbing or binding of rotating elements | Check if rotating elements are not rubbing against stationary components |
| | Shaft bent | Inspect shaft for any deformation and replace |
| | Worn wear rings | Check and replace wear rings, if equipped |
| | Head lower than rating, pumps too much liquid | Contact manufacturer for correct pump/impeller sizing |
| Abnormal noise and vibration | Coupling misalignment | Check and ensure alignment between pump and driver shaft |
| | Foundation/grouting not rigid | Ensure foundation is adequately sized and rigid to absorb the vibrations |
| | | Ensure foundation bolts are tightened to adequate torque |
| | Defective bearings | Check motor and/or pump for worn bearings, and replace as required |
| | Rubbing or binding of rotating elements | Check if rotating elements are not rubbing against stationary components |
| | Pump operating outside Allowable Operating Region (AOR) | Ensure the pump is being operated within its Allowable Operating region. Contact manufacturer for correct pump sizing. |
| | Entrained air in pump | Ensure all air is vented, and pump is adequately primed |
| | | Ensure eccentric reducer, if correctly installed |
| | Insufficient pressure at pump inlet | Ensure correct suction pipe sizing |
| | | Raise fluid level or move pump closer to the water level |

# TROUBLESHOOTING GUIDE

| Symptoms | Possible causes | Possible remedies |
|---|---|---|
| Motor fails to start | Incorrect wiring | Check motor wiring against motor wiring diagram (on motor) |
| | Wrong voltage | Check and ensure correct voltage at motor terminals |
| | Switches not set | Set switches ON |
| | Tripped thermal overload relay | Set relays ON |
| | Blown fuses | Replace fuses |
| | Loose or broken wiring | Check and tighten connections. Replace broken wiring |
| | Binding of rotating elements | Check if rotating elements freely rotate |
| | Defective motor | Check and replace motor |
| Motor runs hot | Speed too high | Check and ensure correct voltage at motor terminals |
| | Voltage lower than rated | Check and ensure correct voltage at motor terminals |
| | Rubbing or binding of rotating elements | Check if rotating elements are not rubbing against stationary components |

**Note: The pump delivered may not be fitted with all the components mentioned in the troubleshooting guide.**

For further troubleshooting assistance, contact Pentair Fairbanks Nijhuis Customer Service or your nearest Pentair Fairbanks Nijhuis authorized distributor.

# PENTAIR FAIRBANKS NIJHUIS® MODEL 1590-SC

## TC-Motor

**(Model 10" 1594)**

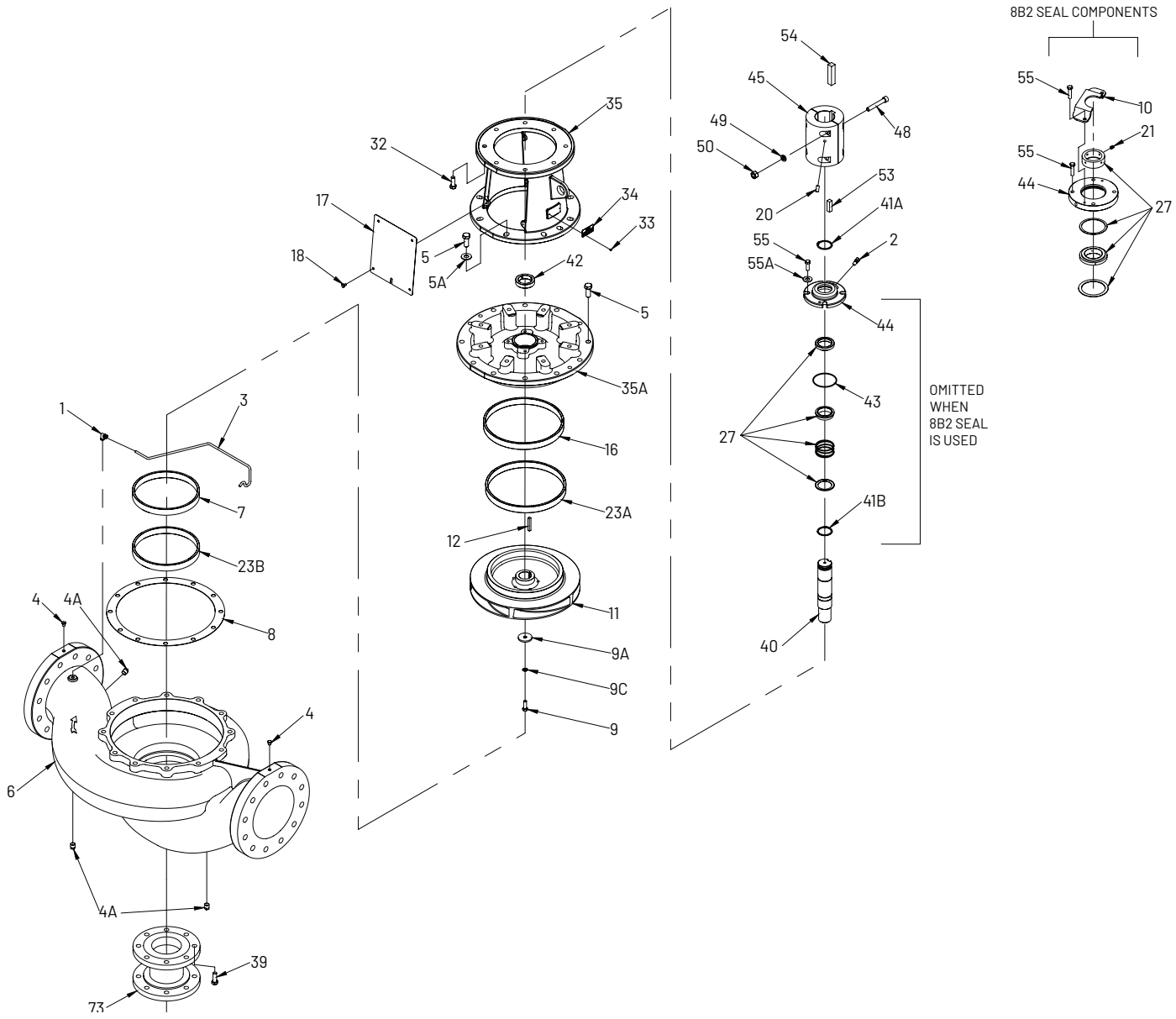



Figure 33

# PENTAIR FAIRBANKS NIJHUIS® MODEL 1590-SC

## TC-Motor

**(Models 10" 1592, 12" 1591, 12" 1593, 14" 1591 and 14" 1593)**

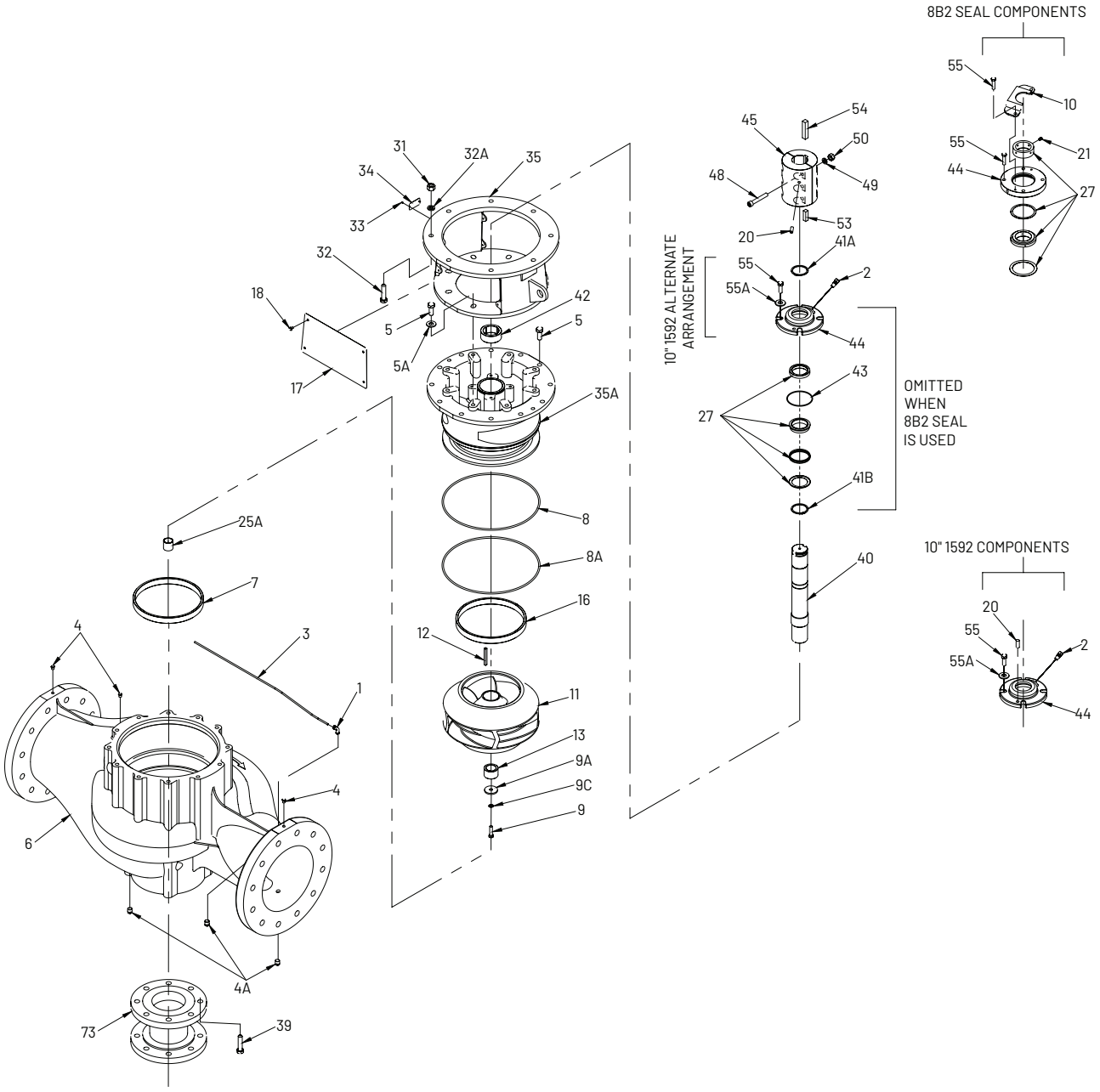



Figure 34

# PENTAIR FAIRBANKS NIJHUIS® MODEL 1590-SC

## TC/TSC-MOTOR

### ALL OTHER PUMP MODELS

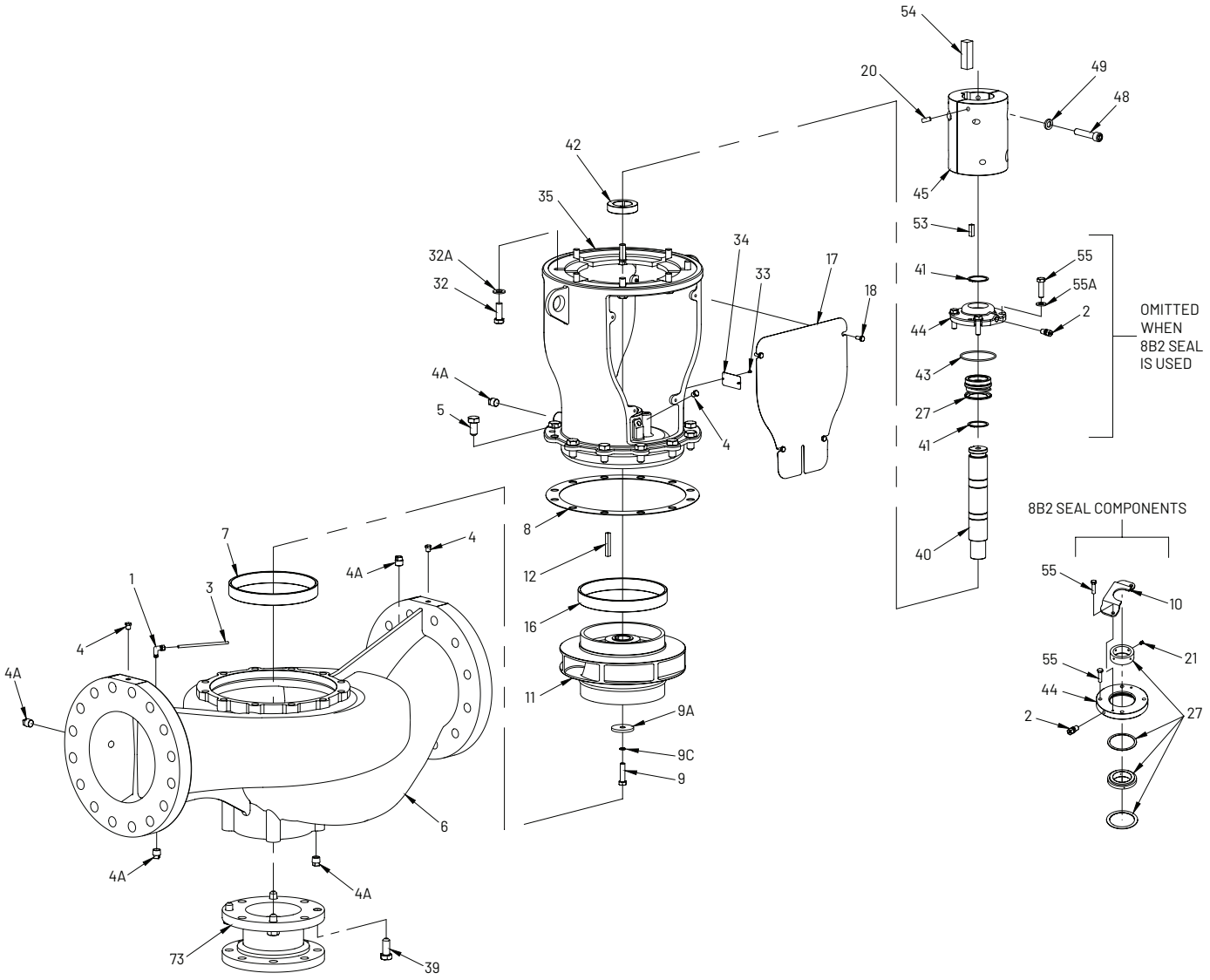



Figure 35

# PART LIST FOR PENTAIR FAIRBANKS NIJHUIS® 1590-SC VERTICAL IN-LINE PUMPS

**Reference "Exploded Views" Figures 33, 34 and 35 on Pages 19-21**

| ITEM NO. | DESCRIPTION |
|---|---|
| 1 | COMPRESSION ELBOW |
| 2 | COMPRESSION CONNECTOR |
| 3 | TUBING |
| 4 | PIPE PLUG |
| 4A | PIPE PLUG |
| 5 | CAP SCREW |
| 5A | WASHER |
| 6 | CASING |
| 7 | WEAR RING |
| 8 | GASKET |
| 9 | IMPELLER SCREW |
| 9A | IMPELLER WASHER |
| 9C | IMPELLER SEAL |
| 10 | JACKING PLATE |
| 11 | IMPELLER |
| 12 | IMPELLER KEY |
| 13 | SPIRE BUSH |
| 16 | WEAR RING |
| 17 | COUPLING GUARD |
| 18 | GUARD MOUNTING SCREW |
| 20 | SET SCREW |
| 23A | WEAR RING |
| 23B | WEAR RING |
| 25A | SPIRE SLEEVE |
| 27 | MECHANICAL SEAL |
| 31 | HEX NUT (MOTOR SIDE) |
| 32 | CAP SCREW |
| 32A | LOCK WASHER (MOTOR SIDE) |
| 33 | SCREW |
| 34 | NAME PLATE |
| 35 | BRACKET |
| 35A | SEAL PLATE |
| 39 | CAP SCREW |
| 40 | SHAFT |
| 41 (A, B) | RETAINING RING |
| 42 | THROTTLE BUSHING |
| 43 | GLAND O-RING |
| 44 | GLAND |
| 45 | SPLIT COUPLING |
| 48 | CAP SCREW |
| 49 | LOCK WASHER |
| 50 | HEX NUT |
| 53 | PUMP COUPLING KEY |
| 54 | MOTOR COUPLING KEY |
| 55 | GLAND CAP SCREW |
| 55A | GLAND WASHER |
| 73 | SPOOL BASE |

# PUMP – IMPELLER SIZE RELATION

| PUMP MODEL | MAX IMPELLER DIAMETER |
|---|---|
| 1-1/2" 1591 | 7" |
| 2" 1592A | |
| 2-1/2" 1591A | |
| 3" 1594A | |
| 4" 1595A | |
| 5" 1591A | |
| 6" 1591A | |
| 1-1/2" 1592 | 9.5" |
| 2-1/2" 1592 | |
| 3" 1595 | |
| 4" 1596 | |
| 5" 1592 | |
| 6" 1592A | |
| 8" 1591A | |
| 2" 1593 | 11" |
| 3" 1596A | |
| 4" 1597 | |
| 5" 1593A | |
| 6" 1593A | |
| 8" 1592A | |
| 3" 1597 | 13.5" |
| 4" 1598 | |
| 5" 1594 | |
| 6" 1594A | |
| 8" 1594A | |
| 10" 1591A | |

# STANDARD LIMITED WARRANTY

## WARRANTY

Seller warrants equipment (and its component parts) of its own manufacture against defects in materials and workmanship under normal use and service for one (1) year from the date of installation or start-up, or for eighteen (18) months after the date of shipment, whichever occurs first. Seller does not warrant accessories or components that are not manufactured by Seller; however, to the extent possible, Seller agrees to assign to Buyer its rights under the original manufacturer's warranty, without recourse to Seller. Buyer must give Seller notice in writing of any alleged defect covered by this warranty (together with all identifying details, including the serial number, the type of equipment, and the date of purchase) within thirty (30) days of the discovery of such defect during the warranty period. No claim made more than 30 days after the expiration of the warranty period shall be valid. Guarantees of performance and warranties are based on the use of original equipment manufactured (OEM) replacement parts. Seller assumes no responsibility or liability if alterations, non-authorized design modifications and/or non-OEM replacement parts are incorporated If requested by Seller, any equipment (or its component parts) must be promptly returned to Seller prior to any attempted repair, or sent to an authorized service station designated by Seller, and Buyer shall prepay all shipping expenses. Seller shall not be liable for any loss or damage to goods in transit, nor will any warranty claim be valid unless the returned goods are received intact and undamaged as a result of shipment. Repaired or replaced material returned to customer will be shipped F.O.B., Seller's factory. Seller will not give Buyer credit for parts or equipment returned to Seller, and will not accept delivery of any such parts or equipment, unless Buyer has obtained Seller's approval in writing. The warranty extends to repaired or replaced parts of Seller's manufacture for ninety (90) days or for the remainder of the original warranty period applicable to the equipment or parts being repaired or replaced, whichever is greater. This warranty applies to the repaired or replaced part and is not extended to the product or any other component of the product being repaired. Repair parts of its own manufacture sold after the original warranty period are warranted for a period of one (1) year from shipment against defects in materials and workmanship under normal use and service. This warranty applies to the replacement part only and is not extended to the product or any other component of the product being repaired. Seller may substitute new equipment or improve part(s) of any equipment judged defective without further liability. All repairs or services performed by Seller, which are not covered by this warranty, will be charged in accordance with Seller's standard prices then in effect.

THIS WARRANTY IS THE SOLE WARRANTY OF SELLER AND SELLER HEREBY EXPRESSLY DISCLAIMS AND BUYER WAIVES ALL OTHER WARRANTIES EXPRESSED, IMPLIED IN LAW OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Seller's sole obligation under this warranty shall be, at its option, to repair or replace any equipment (or its component parts) which has a defect covered by this warranty, or to refund the purchase price of such equipment or part. Under the terms of this warranty, Seller shall not be liable for (a) consequential, collateral, special or liquidated losses or damages; (b) equipment conditions caused by normal wear and tear, abnormal conditions of use, accident, neglect, or misuse of said equipment; (c) the expense of, and loss or damage caused by, repairs or alterations made by anyone other than the Seller; (d) damage caused by abrasive materials, chemicals, scale deposits, corrosion, lightning, improper voltage, mishandling, or other similar conditions; (e) any loss, damage, or expense relating to or resulting from installation, removal or reinstallation of equipment; (f) any labor costs or charges incurred in repairing or replacing defective equipment or parts, including the cost of reinstalling parts that are repaired or replaced by Seller; (g) any expense of shipment of equipment or repaired or replacement parts; or (h) any other loss, damage or expense of any nature.

The above warranty shall not apply to any equipment which may be separately covered by any alternate or special warranties.

PERFORMANCE: In the absence of Certified Pump Performance Tests, equipment performance is not warranted or guaranteed. Performance curves and other information submitted to Buyer are approximate and no warranty or guarantee shall be deemed to arise as a result of such submittal. All testing shall be done in accordance with Seller's standard policy under Hydraulic Institute procedures.

LIABILITY LIMITATIONS: Under no circumstances shall the Seller have any liability under the Order or otherwise for liquidated damages or for collateral, consequential or special damages or for loss of profits, or for actual losses or for loss of production or progress of construction, regardless of the cause of such damages or losses. In any event, Seller's aggregate total liability under the Order or otherwise shall not exceed the contract price.

ACTS OF GOD: Seller shall in no event be liable for delays in delivery of the equipment or other failures to perform caused by fires, acts of God, strikes, labor difficulties, acts of governmental or military authorities, delays in transportation or procuring materials, or causes of any kind beyond Seller's control.

COMPLIANCE WITH LAW: Seller agrees to comply with all United States laws and regulations applicable to the manufacturing of the subject equipment. Such compliance shall include: The Fair Labor Standards Acts of 1938, as amended; Equal Employment Opportunity clauses of Executive Order 11246, as amended; Occupational Safety and Health Act of 1970 and the standards promulgated thereunder, if applicable. Since compliance with the various Federal, State, and Local laws and regulations concerning occupational health and safety, pollution or local codes are affected by the use, installation and operation of the equipment and other matters over which Seller has no control, Seller assumes no responsibility for compliance with those laws and regulations, whether by way of indemnity, warranty, or otherwise. It is incumbent upon the Buyer to specify equipment which complies with local codes and ordinances.

PENTAIR

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