



**FAIRBANKS NIJHUIS™**

# MODELS 5410, 5420 AND 5440 **SOLIDS HANDLING PUMPS**

## **INSTALLATION, OPERATION AND MAINTENANCE MANUAL**

NOTE! 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.

**LOSS OR DAMAGE IN TRANSIT:**

Immediately upon receipt, a complete inspection and accounting against the packing list should be made of all major components, and accompanying boxes or pallets. All material is shipped F.O.B. our factory or our vendor's shipping point unless optional contractual arrangements are made. Under these terms, any claims for loss or damage in transit should be immediately directed to the delivering freight carrier. Fairbanks Nijhuis® will assist the customer in receiving fair compensation, but assumes no responsibility to mediate such claims. This policy includes shipments wherein Fairbanks Nijhuis pays freight costs as part of the sales terms.

If there is any indication of oil leakage from the motor oil chamber, advise the factory immediately and request instructions for proper handling.

**PUMP/MOTOR IDENTIFICATION:**

Carefully record all of the following data from your pump/motor nameplate. It will aid in obtaining the correct replacement parts for your pump. In addition to the nameplate, the pump serial number is also stamped on the discharge flange.

**Pump:**

Serial Number \_\_\_\_\_  
 Size \_\_\_\_\_ Model No. \_\_\_\_\_  
 GPM \_\_\_\_\_ Head \_\_\_\_\_ (feet)  
 BHP \_\_\_\_\_ RPM \_\_\_\_\_  
 Pump Weight \_\_\_\_\_ (lbs.) \_\_\_\_\_

**Motor:**

Horsepower \_\_\_\_\_  
 Serial Number \_\_\_\_\_  
 Motor Frame \_\_\_\_\_  
 Full Load Speed \_\_\_\_\_  
 Full Load Amps \_\_\_\_\_  
 ph/Hz/V \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ .  
 Motor Weight \_\_\_\_\_ -  
 Motor Identification Number \_\_\_\_\_  
 Date Placed in Service \_\_\_\_\_

## **INTRODUCTION:**

Congratulations! You are the new owner of the finest pump commercially available. If you give it the proper care as outlined and recommended by this manual, it will provide you with reliable service and long life.

## **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.**

### **IMPORTANT:**

**Read this complete manual and manuals for all component equipment before assembly or installation is started. It contains information that is the result of engineering and research efforts. It is designed to supply adequate instructions for the installation, operation and maintenance of your pump. Failure or neglect to properly install, operate or maintain your pump may result in personal injury, property damage or unnecessary damage to the pump.**

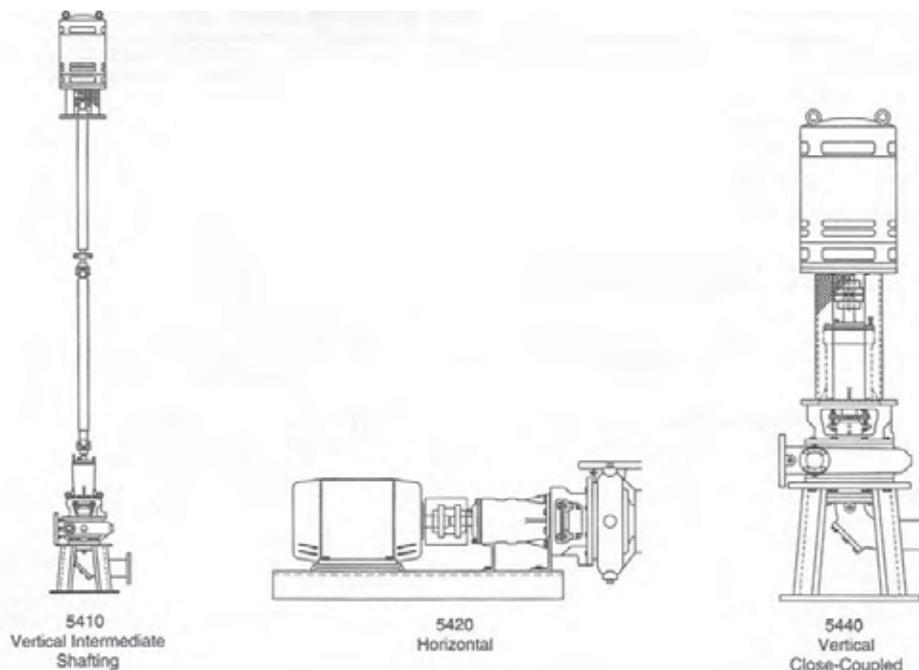
This manual applies to the pump installation, operation and maintenance. It is intended to be general and not specific. If your operating conditions ever change, always refer to the factory for reapplication. Always refer to the manuals provided by manufacturers of the accessory equipment for their separate instructions.

This manual contains installation, operation and maintenance instructions for Fairbanks Nijhuis series 5410, 5420 and 5440 solids handling pumps.

Variations exist in both the equipment used with these pumps and in the particular installation of the pump and driver. Therefore, specific operating instructions are not within the scope of this manual. The manual contains general rules for installation, operation and maintenance of the pump. If there are questions regarding the pump or its application that are not covered in this manual, please contact the factory as follows: Fairbanks Nijhuis, 3501 Fairbanks Avenue, Kansas City, Kansas 66106, Phone 913-371-5000, Fax 913-748-4025.

To obtain additional data on hydraulics and pump selection and operation, we suggest you purchase both of the following reference books:

1. The Fairbanks Nijhuis *Hydraulic Handbook* available from the Kansas City factory.
2. *Hydraulic Institute Standards* from the Hydraulic Institute, 9 Sylvan Way, Parsippany, NJ 07054-3802



**5400, 5700 and 2400 Solids Handling  
PRESTART-UP AND START-UP CHECKLIST**

Contractor \_\_\_\_\_

Pump Serial Number \_\_\_\_\_

Project Name \_\_\_\_\_

Pump Model Number \_\_\_\_\_

Procedure	Yes	No	N/A	Comments
<b>1. Shipment</b>				
Was there any damage in transit? (List)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Were all items received? (List)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>2. Storage</b>				
Has equipment been protected from the elements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Was equipment subject to flooding?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>Have storage instructions been followed?</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>3. Installation</b>				
Were retaining fasteners, used in shipping, removed prior to installation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Is grouting under base properly compacted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Is grouting of the nonshrink type?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Have proper anchor bolts been used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Have the bolts been properly tightened?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Have both the suction and discharge been checked for pipe strain?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Are lube lines and seal water lines properly installed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Are accessory items, RTD's, bearing temp detectors, vibration sensors, etc. mounted and properly installed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Are lube lines purged of air and lubricant added (pump and driver)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>Are all safety guards in place?</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>Have impellers been checked for proper clearance?</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>4. Alignment</b>				
<b>Has the alignment of driver to pump been checked?</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Have indicator readings been taken? (List)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>5. Rotation</b>				
Has the rotation of the drives been checked for correctness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Has the coupling been turned to assure free rotation of pump and motor?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>6. System</b>				
Has the system been checked to ensure that it is free of foreign matter and purged of air which could be damaging to the pump?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Is liquid available to the pump?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Has assurance been obtained from responsible parties that all piping is secure and that the routing of flow has been established and is correct?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>7. Start-Up</b>				
Has flow been established? Flow rate: _____ GPM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Have gauge readings been taken? Suction pressure: _____ psi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Discharge pressure: _____ psi				
Has packing been adjusted to ensure proper lubrication of packing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
If pumps are equipped with mechanical seals, is the lubricating seal water pressure a constant 10 to 15 psi, above the discharge of the pump?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Is excessive vibration present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Is bearing operating temperature excessive?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<b>8. Safety</b>				
Have all safety labels been read and understood?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Name \_\_\_\_\_ Date \_\_\_\_\_

## **SAFETY:**

Safety should be of utmost importance when in close proximity of this pumping equipment. Before attempting to operate this equipment, you should read this manual in its entirety, taking special notice of all CAUTIONS, WARNINGS and/or DANGER notifications. These warnings apply to pumps supplied by Fairbanks Nijhuis. Refer to the manuals supplied by the manufacturer of accessory items for additional warnings before operating this equipment.

**The words DANGER, WARNING and CAUTION have different connotations and are generally defined as follows:**

### **DANGER:**

**DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

### **WARNING:**

**WARNING indicates a potentially hazardous situation which, if not avoided, will result in a serious injury.**

### **CAUTION:**

**CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or may indicate that improper practices will result in equipment malfunction or failure. It may also be used to alert against unsafe practices.**

### **IMPORTANT:**

**Another notation will appear throughout this manual. IMPORTANT indicates the highlight or accent of specific information.**

The installation, use and operation of this type of equipment is affected by various federal, state and local laws, and the regulations concerning OSHA. Compliance with such laws relating to the proper installation and safe operation of this type of equipment is the responsibility of the equipment owner and all necessary steps should be taken by the owner to assure compliance with such laws before operating the equipment.

### **DANGER:**

**Do not attempt to service the pump until the electrical power has been disconnected and it has been verified that the pump cannot start. Because many installations use automatic starting equipment, the pump unit may start at any time without warning. Proper precautions should be taken to avoid injury as a result of automatic starting of the equipment.**

### **DANGER:**

**This product has been designed specifically for operation in water or sewage. Do not use with other liquids without first consulting the factory.**

### **WARNING:**

**Do not attempt to try to clean the pump with bare hands. The pumped material may contain items that may present health hazards such as needles and other sharp objects. Always wear heavy puncture-resistant gloves.**

### **WARNING:**

**Before attempting to service this pump:**

1. Familiarize yourself with this manual.
2. Disconnect or lock out the power source to ensure the pump will not start. Confirm power source disconnect with appropriate electrical test equipment.
3. Close the discharge valve, and if present, the suction valve.

**After the pump has been installed, make certain that the pump and all piping connections are tight and are properly supported prior to start-up and operation.**

### **WARNING:**

**Certain procedures in disassembly and assembly require parts be heated to high temperatures. Heat-resistant gloves must be worn when handling heated parts. Heated parts can cause severe personal injury.**

**After the pump has been set and grouted in place and is ready for operation, the following steps should be followed:**

1. Reinstall the packing, seal water ring and gland. Adjust in accordance with this manual. Flush the mineral oil out of the mechanical seal if unit is so equipped.

2. Remove bearing housing covers and remove one-half of the grease in bearing housings. Remove all grease relief fittings and grease relief nipples from upper and lower bearing housings.
3. Start the pump per start-up instructions and permit grease to be purged from each bearing housing. Do not install grease relief piping until purging has completely stopped after the pump has been operating for at least eight (8) hours. Observe bearing temperatures, and stop and start the pump or run it at reduced speed until temperatures stabilize within the specified limits.
4. Stop the pump, wipe any grease off the shaft and bearing frame and place the pump in service per instructions in this manual.

### **DANGER:**

Do not attempt to clean the pump until electrical power has been disconnected and it has been verified that the pump cannot start.

## **INTRODUCTION:**

### **GENERAL:**

The Model 5410, 5420 and 5440 pumps consist of several components. The following is a list of those major parts (or component assemblies) and a brief description of their design and function.

### **IMPELLER:**

The impeller is a solids handling type of one piece construction, single suction, enclosed radial flow design with well-rounded leading vanes and tapered toward the trailing edge for a circular flow pattern. Waterways through the impeller have extremely smooth contours, free of sharp corners, so as to minimize rags or stringy, fibrous material from catching or clogging. The impeller is balanced and secured to the shaft by means of a bolt, impeller washer and key. The arrangement is such that the impeller cannot be loosened from torque in either forward or reverse rotation.

### **VOLUTE:**

The volute is matched to the impeller and made of close-grained cast iron. The volute is of one-piece circular constant flow, equalizing pressure design with smooth fluid passages large enough to pass any size solid that can pass through the impeller and has a flange discharge.

### **FRONTHEAD:**

5411, 5421 and 5441 pump frontheads are cast integrally with the volute. Model 4" 541XC and 4" 544XC pumps have a fronthead cast integrally with a combination base elbow as standard. All other models have a separately cast fronthead which directs flow to the eye of the impeller.

### **BACKHEAD:**

Cast as a separate piece, the backhead houses the sealing box which is designed to accept conventional packing or standard mechanical seals without requiring remachining. Casting is tapped so that packing leakage can be piped directly to a drain.

### **FRAME/BEARING/SHAFT:**

Bearing frame is machined for accurate and permanent bearing alignment and houses the bearing/shaft assembly. The shaft is accurately machined along its entire length and precision ground at bearing locations. A renewable shaft sleeve protects the shaft where it passes through the sealing box area.

### **541X/544X BASE AND ELBOW :**

Pumps are mounted on rigid bases which are open to allow for access to the suction elbow. Bases bolt directly to the volute. Suction elbows include a cleanout opening and have flat-faced flanges conforming to ANSI drilling standards.

### **541XC/544XC COMBINATION BASE ELBOW :**

Base and elbow are integrally cast as one piece with a flat-faced suction flange conforming to ANSI drilling standards. A hand-hole cleanout is located 180° from the suction flange.

### **5420 BASE:**

Fabricated steel base supports the pump and driver and is designed with large access openings to facilitate grouting.

### **COUPLING GUARDS:**

All 5410, 5420 and 5440 pumps are furnished with coupling guards.

### **NET POSITIVE SUCTION HEAD (NPSH):**

NPSH can be defined as the head (energy that causes liquid to flow through the suction pipe and enter the eye of the impeller). NPSH is expressed in two values:

1. NPSH required (NPSHR)
2. NPSH available (NPSHA)

It is essential that NPSHA always be greater than NPSHR to prevent cavitation, vibration, wear and unstable operation.

NPSHR is a function of pump design and therefore varies with the make, size, capacity and speed of the pump. The value for your pump can be obtained from your pump performance curve. NPSHA is a function of your system and may be calculated as follows:

1. When the source of liquid is above the pump:  $NPSHA = \text{barometric pressure (feet)} + \text{static suction head (feet)} - \text{friction losses in suction piping (feet)} - \text{vapor pressure of liquid (feet)}$ .
2. When the source of liquid is below the pump:  $NPSHA = \text{barometric pressure (feet)} - \text{static suction lift (feet)} - \text{friction losses in suction piping (feet)} - \text{vapor pressure of liquid (feet)}$ .

Note: Suction head or suction lift on vertical pumps is measured from the datum elevation plane which is the horizontal plane that passes through the lowest point on the impeller suction vane.

### **LOCATION AND HANDLING:**

The pump should be installed as near to the fluid as possible so a short direct suction pipe can be used to keep suction losses to a minimum. If possible, locate the pump so fluid will flow to the suction opening by gravity. Discharge piping should be direct and with as few elbows and fittings as possible.

Pump and driver should be located in an area that will permit periodic inspection and maintenance. Head and access room should be provided, and all units should be installed in a dry location with adequate drainage.

### **FOUNDATION:**

Pump foundations should have a level surface and be of sufficient mass to prevent vibration and form a permanent rigid support. The most satisfactory foundations are concrete with anchor bolts of adequate size imbedded in the foundation in pipe sleeves with an inside diameter of 2-1/2 times larger than the bolt diameter, which will allow for final accurate positioning of the unit. Recommended anchor bolt design is available from the factory.

### **INSTALLATION:**

#### **GENERAL:**

Do not pick up the complete unit by the driver eye bolts or a pump shaft eyebolt.

#### **WARNING:**

#### **IMPORTANT:**

Pump and driver alignment should be checked throughout the piping and grouting procedures. Once piping connections have been made and grouting completed, alignment corrections are difficult.

#### **GROUTING:**

When alignment is correct, the unit should be grouted using a high grade nonshrinking grout. The base is designed to be completely filled with grout.

#### **CAUTION:**

Damaging vibration may result if the baseplate is not solidly in contact with the grout bed.

Do not fill the anchor bolt pipe sleeves with grout.

If leveling devices are used, make sure they are not imbedded in grout. Provide access in the grout to the leveling devices (if used) so that they can be backed off or removed after the grout has cured.

Allow the grout to fully cure. Back off leveling nuts (if used) and remove shims and/or wedges. Firmly tighten the foundation bolts so the base is solidly against the grout bed. All pockets and/or holes left by removal of leveling devices are to be filled with grout. Recheck alignment before connecting the piping.

**PIPING:****CAUTION:**

**All piping connections must be made with the pipe in a free supported state, and without the need to apply vertical or side pressure to obtain alignment of the piping with the pump flange.**

All piping should be independently supported near the pump so the pipe strain will not be transmitted to the pump casing. Weight of the pipe and contained liquid must be considered in support design. Suction and discharge piping should be one or two sizes larger than the pump suction and discharge sizes, especially where piping is of considerable length. Flexible joints installed in the piping must be equipped with tension rods to absorb piping axial thrust.

Suction pipe must be airtight and sloped upward to the pump flange to avoid air pockets which will impair satisfactory pump operation. Discharge pipe should be as direct as possible with a minimum of valves to reduce pipe friction losses.

A check valve and closing valve should be installed in the discharge line and a closing valve in the suction line. The check valve, between the pump and closing valve, protects the pump from water hammer and prevents reverse rotation in the event of power failure. Closing valves are used in priming, starting and when the pump is shut down. Pumps must never be throttled by use of a valve in the suction line.

**AUXILIARY PIPING CONNECTIONS:**

In addition to primary piping connections, your pump may require connections to the water seal ring, stuffing box drain, baseplate drain, discharge pressure gauges or mechanical seals (if provided). All these connections should now be installed. (Refer to Mechanical Seal section of this manual.)

NOTE: For satisfactory pump operation and life, auxiliary pipe lines must be kept clean.

**ROTATION:**

Before connecting the motor to the pump, bump start the driver and verify rotation is in the proper direction. Correct pump rotation is indicated by a directional arrow on the pump casing.

**VIBRATION AND NOISE LEVELS:**

After installation is complete and the pump is put into normal service, a baseline measurement of noise and vibration levels should be made for future reference. Periodic checks should be made, as changes in either of these could indicate problems. Early detection can save expensive repairs and downtime. Refer to Troubleshooting in the operation section of this manual for simple causes and remedies.

Vibration and noise level measurements should be made with the equipment in its normal operating mode, with no unusual background noise present.

**INSTALLATION 5410:****LEVELING OF THE PUMP:**

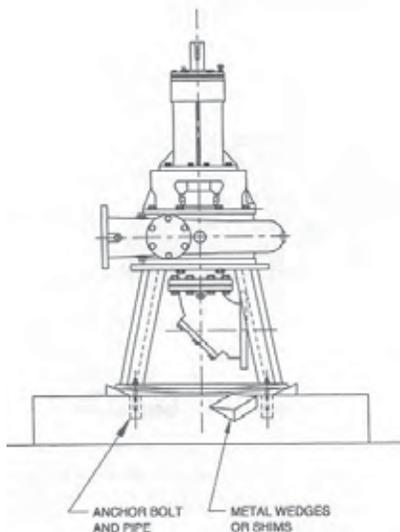
Lower the pump onto the foundation and position the base so the anchor bolts are aligned in the middle of the holes in the base.

Set the base on metal shims or metal wedges placed directly under the part of the base carrying the greatest weight, and spaced close enough to give uniform support and stability.

Adjust the metal shims or wedges until the shaft of the pump is vertical. Make sure that all shims or wedges fit firmly between the foundation and the base.

If leveling nuts are installed on the anchor bolts and are used for alignment, follow the same procedure as with shims or wedges. Support the base with additional shims or wedges if necessary. Make sure that all nuts and shim are in firm contact with the base.

Tighten the foundation bolts snugly, but not too firmly and with a good quality machinist's level check that the shaft is vertical in two vertical planes. Refer to the Grouting section.



## FLEXIBLE SHAFT AND DRIVER:

### CAUTION:

Carefully read the manufacturer's installation instructions supplied with the shafting and driver.

Refer to the unit setting plan supplied with your pump.

Install flexible shafting per installation instructions as provided by the shafting manufacturer.

The driver is normally mounted on a high ring base. This base should be mounted on a level foundation and grouted in place. Refer to the Grouting section of this manual.

The high ring base should be leveled prior to grouting. Check the level on the machined surface of the high ring base in two horizontal planes using a good quality machinist's level.

## INSTALLATION 5420:

### LEVELING OF THE PUMP:

Lower the unit onto the foundation and position the base so the anchor bolts are aligned in the middle of the holes in the base. Disconnect the coupling halves.

Set the base on metal shims or metal wedges placed directly under the part of the base carrying the greatest weight, and spaced close enough to give uniform support and stability.

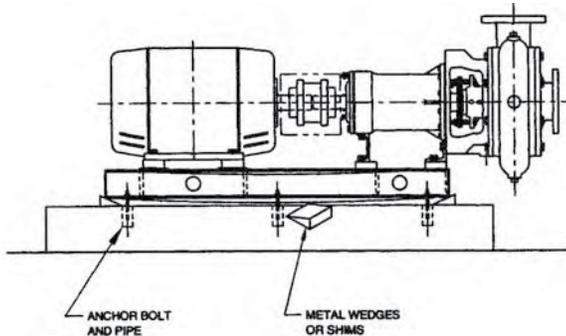
Adjust the metal shims or wedges until the shaft of the pump and driver are level. Make sure that all shims or wedges fit firmly between the foundation and the base.

If leveling nuts are installed on the anchor bolts and are used for alignment, follow the same procedure as with shims or wedges. Support the base with additional shims or wedges if necessary. Make sure that all nuts and shims are in firm contact with the base.

Tighten the foundation bolts snugly, but not too firmly, and recheck the shafts for being level before grouting. Motor and pump shafts should also be in close alignment prior to grouting. If not in close alignment, determine the cause for misalignment and correct. Refer to the Grouting section.

### IMPORTANT:

Pump and driver alignment should be checked throughout the piping and grouting procedures. Once piping connections have been made and grouting completed, alignment corrections are difficult.



### FINAL COUPLING ALIGNMENT:

#### CAUTION:

Check safety codes, and always install protective guard or shield as required by the various federal, state and local laws and the regulations concerning OSHA.

The final coupling alignment must be made after the piping has been connected. Realign as required. If sufficient adjustment is not achieved, piping may have to be disconnected to properly align the coupling. Reconnect the piping and recheck coupling alignment.

A flexible coupling must not be used to compensate for misalignment resulting from poor installation or temperature changes.

Fairbanks Nijhuis pumps may be supplied with one of several different types of commercial couplings. Refer to coupling drawings and alignment tables in this manual and/or the coupling manufacturer's installation and alignment instructions which may be supplied with the pump.

### PERIODIC ALIGNMENT CHECK:

Coupling misalignment can occur because of shifts in grouting and/or foundations, or because of large objects going through the pump causing shock loading conditions.

Coupling alignment should be checked periodically for changes. Coupling misalignment can lead to or cause bearing failure, coupling failure, shaft breakage and high power consumption.

Refer to the coupling alignment tolerances found in this manual or the coupling manufacturer's alignment instructions that may have been supplied with the pump.

#### **V-BELT DRIVE:**

Pumps coupled to its driver by means of V-belts and sheaves may have been shipped separately from the drive components. Refer to the driver manufacturer's literature for installation, operation and maintenance instructions.

### **INSTALLATION 5440:**

#### **LEVELING OF THE PUMP:**

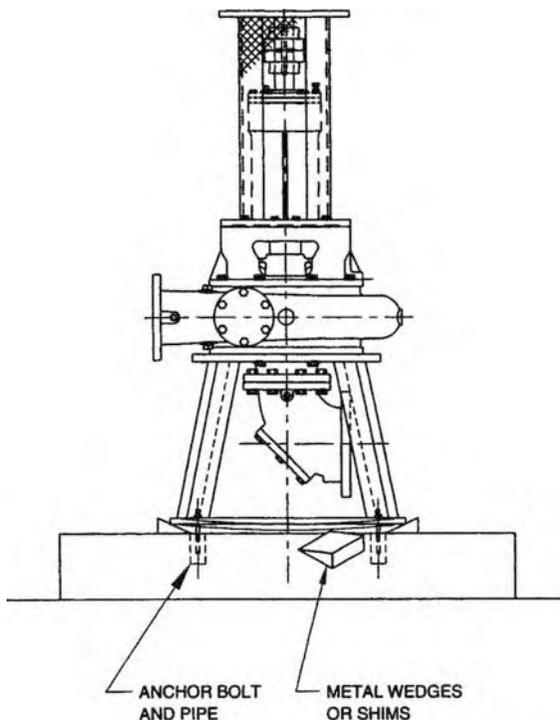
Lower the pump onto the foundation and position the base so the anchor bolts are aligned in the middle of the holes in the base. Disconnect the coupling halves.

Set the base on metal shim or metal wedges placed directly under the part of the base carrying the greatest weight, and spaced close enough to give uniform support and stability.

Adjust the metal shims or wedges until the shaft of the pump is vertical. Make sure that all shims or wedges fit firmly between the foundation and the base.

If leveling nuts are installed on the anchor bolts and are used for alignment, follow the same procedure as with shims or wedges. Support the base with additional shims or wedges if necessary. Make sure that all nuts and shims are in firm contact with the base.

Tighten the foundation bolts snugly, but not too firmly, and with a good quality machinist's level check that the shaft is vertical in two vertical planes. Refer to the Grouting section.



#### **DRIVER INSTALLATION:**

Mount the driver on the driver pedestal and secure with proper bolting. Units are self-aligning. If you experience difficulty with the coupling connection, contact the factory for assistance prior to starting the pump.

### **OPERATION:**

#### **GENERAL:**

This section contains applicable start-up and break-in procedures for operation. Because variations may exist in a particular installation between pumps, drivers and accessory equipment, specific operating instructions are not within the scope of this manual.

### **CAUTION:**

**Before starting or operating the pump, read this entire manual and especially comply with the following instructions:**

- A. Before starting the pump:
  1. Rotate the shaft by hand to assure all moving parts are free.
  2. Install guards around all exposed rotating parts.
  3. Fill the casing and suction line with liquid. The pump may be primed by using a priming system.
- B. Observe all caution or danger tags attached to the equipment.
- C. Never run the pump dry as the close running fits within the pump are lubricated by the liquid. Running dry may result in pump seizure.
- D. If excessive vibration or noise occurs during operation, shut the pump down and consult the Troubleshooting guide or a Fairbanks Nijhuis representative.

#### **WET WELL DESIGN:**

It is required that an evenly distributed flow of nonaerated water be supplied to the pump suction. Improper wet well or sump design, or insufficient suction pipe submergence can result in vortexing which reduces the pump's performance and can cause severe damage to the pump.

## **NORMAL OPERATING PROCEDURES:**

Monitor the following during running cycles:

- A. Unit vibration or noise.
- B. Driver lubrication.
- C. Pump lubrication.
- D. Packing box leakage.

Check the following before normal start-up:

- A. Driver lubrication (refer to driver operating manual)
- B. General condition of all equipment.

## **PRIMING:**

The priming procedure is different for positive and negative suction head systems and the following procedures should be followed:

- A. Positive suction head.
  - 1. Open the vent on the highest point of the pump casing.
  - 2. Open all suction valves.
  - 3. Allow liquid to flow from the vent hole until all air bubbles are vented, then close the vent.
  - 4. Pump is now primed.
- B. Negative suction head.
  - 1. Install the priming system on the vent at the highest point of the pump casing.
  - 2. Close the discharge valve.
  - 3. Open the suction valve.
  - 4. Start the priming system.
  - 5. Run the priming system until a continuous stream flows through the suction line, then close the vent valve.
  - 6. The pump is now primed.

## **STARTING THE PUMP:**

- A. After the pump is primed, the discharge valve closed, and the suction valve open, start the driver according to the driver manufacturer's instruction.
- B. Open the discharge valve slowly to prevent water hammer.
- C. Immediately after the pump has been started, check bearing temperature, stuffing box lubrication and operation, and pump noise level. Continue to monitor these values for the first several hours of operation.

## **BEARING OPERATING TEMPERATURE**

These pumps are designed to operate over a wide ambient temperature. The temperature, when measured on the outside surface of the bearing housing, should not exceed 190° F . Temperatures in excess of 190° F may indicate a lack of lubricant or bearing problems. If temperatures exceed this limit, the pump should be stopped and the cause investigated and corrected.

## **REGULATING/CONTROL PROCEDURE:**

Pump stations are usually designed to have the pumps started and stopped automatically using a controller. Since this is a function of station design, the operators should be thoroughly familiar with the system's operating parameters and the use of the controller.

## **STOPPING THE PUMP:**

- A. Disconnect the electrical power and lock out the power to the driver.

## **DANGER:**

- B. Check power source with appropriate electrical test equipment to ensure driver cannot accidentally start.

## **EMERGENCY PROCEDURES:**

Many installations are equipped with emergency shutoff switches near the pump location. These locations should be plainly marked and be readily accessible at all times.

The control panel (if used) may be equipped with an emergency stop button or switch.

**IMPORTANT:**

The operator or persons working around the equipment should be familiar with locations of emergency shutoff points.

- A. Emergency Start-up.
  1. Open the suction valve.
  2. Start the driver.
  3. Open the discharge valve.
- B. Emergency Shut-down.
  1. Shut off the power at the nearest switch.

**OPERATING AT REDUCED CAPACITY:**

Typical applications cover a wide range of flow rates, and a variable speed driver is often used to adjust the pump capacity, which is taken into consideration by Fairbanks Nijhuis when selecting the pump and impeller trim. Although these pumps are applicable over a wide range of operating conditions, care should be exercised when doing so, especially when actual conditions differ from sold conditions. Always contact your nearest Fairbanks Nijhuis distributor or factory before operating the pumps at any condition other than that for which they were sold.

**SEASONAL OPERATING INSTRUCTIONS:**

If the pump is located in an area that is subject to below freezing temperatures for extended periods of time and will not be operated enough to prevent freezing, it should be drained to prevent damage to the casing.

**TROUBLESHOOTING:**

If you have followed the installation and start-up procedures outlined in this manual, your pump should provide reliable service and long life. However, if operating problems occur, significant time and expense can be saved if you use the following checklist to eliminate the most common causes of those problems. Common problems are listed below with suggested remedies shown.

<b>INSUFFICIENT DISCHARGE</b>	
Symptom	Remedy
1. Pump not primed.	Prime pump. Evacuate all the air.
2. Speed too low.	Check drive speed and voltage.
3. System discharge head too high.	Change system. Raise wet well level. Install larger impeller and driver.
4. Suction lift too high.	Increase submergence. Lower pump. Change system.
5. Wrong direction of rotation.	Reverse any two motor lead connections. Check driver O&M.
6. Air leaks into suction piping, stuffing box or gaskets.	Check flange connections for proper seal. Tighten connections.
7. Impeller passage partially plugged.	Clean impeller passages.
8. Impeller damaged.	Check and repair or replace.
9. Impeller diameter too small.	Replace impeller with larger diameter. Check driver HP.
10. Insufficient suction line submergence.	Increase submergence.
11. Air in liquid.	Increase submergence to prevent vortexing.
12. Insufficient net positive suction head.	Increase submergence. Lower pump. Change system.

<b>LOSS OF SUCTION</b>	
Symptom	Remedy
1. Suction line leaks.	Tighten flange connections and check to be sure they are sealed.
2. Water seal line to packing box is plugged.	Unplug the line. Provide clear water source.
3. Suction lift too high.	Increase submergence. Lower pump. Reduce suction line losses.
4. Air or gases in liquid.	Increase submergence to prevent vortexing.
5. Air leaks into suction piping, stuffing box or gasket.	Check connections and tighten.
6. Wrong direction of rotation.	Reverse any two motor lead connections. Check driver O&M.

<b>EXCESSIVE POWER CONSUMPTION</b>	
Symptom	Remedy
1. Speed too high.	Check driver speed and voltage.
2. Head lower than rating—pumps too much liquid.	Change system. Reduce pump speed. Trim impeller.
3. Specific gravity or viscosity of liquid is too high.	Reduce pump capacity.
4. Mechanical defects. a. Shaft bent. b. Rotating element binds.	Replace shaft. Determine cause and correct.
5. Misalignment.	Check motor/pump to base connections. Realign coupling.
6. System head lower than design.	Change system. Reduce pump speed. Trim impeller.
7. Incorrect impeller diameter.	Determine correct impeller diameter and replace or trim impeller.
8. Packing gland too tight.	Adjust packing gland.

<b>VIBRATION OR NOISE</b>	
Symptom	Remedy
1. Misalignment between drive and pump.	Realign driver and pump.
2. Foundation bolts loose or defect in grouting.	Tighten foundation bolts and/or regrout.
3. Mechanical defects. a. Shaft bent. b. Rotating element binds.	Replace shaft. Determine cause and correct.
4. Head lower than rating—pumps too much liquid. 5. Pipe strain.	Increase system head. Reduce pump speed. Trim impeller. Improperly supported or aligned. Check pipe supports and adjust or realign.
6. Pump running at shut-off condition.	Open discharge valve. Check for obstructions.
7. Insufficient suction line submergence.	Increase submergence.
8. Air in liquid.	Increase submergence to prevent vortexing.
9. Impeller passages plugged.	Clean impeller passages.

<b>OVERHEATING</b>	
Symptom	Remedy
1. Bearing.	
a. Excessive lubricant.	Drain lubricant as necessary.
b. Shaft bent.	Replace shaft.
c. Rotating element binds.	Determine cause and correct.
d. Pipe strain.	Check pipe supports.
e. Insufficient bearing lubrication.	Add lubricant.
f. Incorrect type of lubricant.	Check the lubricant used. Refer to Maintenance section for recommended lubricants.
2. Packing box.	
a. Packing gland too tight.	Adjust packing gland.
b. Water seal line plugged.	Clean seal line. Provide source of clean liquid.

**MAINTENANCE, PREVENTIVE:**

**CAUTION:**

Carefully read this section before attempting any maintenance procedure. Refer to accessory equipment manuals that may have been included.

To assure satisfactory operation of the pumps, routine inspection and periodic maintenance are required. It is suggested that an inspection and maintenance log be kept and the inspector immediately report any problems. A guide for preventive maintenance for normal applications is shown below. Usual application with abnormal heat, moisture, dust, etc. may require more frequent inspection and service.

Item	Action Required
Seal Box	Check every 150 hours for proper operation. Adjust or replace packing as necessary; or replace mechanical seal if so equipped.
Bearings	Lubricate every 2000 hours or at least once a year.
Mechanical Seal Filter	Clean or replace at least once a year.
Pump Alignment	Check for changes on an annual basis.
Pump Vibration Level	Check for changes on an annual basis.
Pump Noise Level	Check for changes on an annual basis.

**STUFFING BOX:**

The stuffing box is equipped with either packing or a mechanical seal. Generally, pumps should be checked for leakage every 150 hours of operation.

**PACKING REPLACEMENT:**

Use Fairbanks Nijhuis replacement packing. The replacement procedure should be as follows:

- A. Stop the pump.

**DANGER:**

**Extreme care should be exercised and steps taken to ensure that the driver cannot be accidentally started. Keep hands, fingers, clothing and any tools away from the coupling. Failure to do so could result in serious personal injury.**

- B. Unbolt and remove the gland.
- C. Use a flexible Packing Tool\* with a hook attachment for removal of the packing and a wood screw attachment for removal of the water seal ring. The water seal ring contains several holes for the packing tool.

Note the location of the water seal ring relative to the number of packing rings on each side of the water seal ring.

\*The Packing Tool can be purchased from industrial supply or hardware stores. It is not considered a special tool.

- D. Clean the packing box and shaft sleeve.
- E. Inspect the shaft sleeve for wear or rough finish and replace the sleeve with a Fairbanks Nijhuis sleeve if necessary.
- F. Install the new packing and water seal ring.

**IMPORTANT:**

**Stagger the packing end joints 180 degrees and firmly seat each ring of packing as you install it.**

Refer to the technical data section (Table #2) in this manual for pertinent packing box dimensions.

- G. Slide the packing (212) and water seal ring (10) into the stuffing box on the backhead (34) and install the guard.
- H. Reinstall the gland and tighten the gland nuts.
- I. Loosen the gland nuts so they can be adjusted with finger pressure to obtain the correct leakage for lubrication after start-up.

**PACKING ADJUSTMENT:**

Adjustment is accomplished by lightly tightening the gland nuts and then loosening them so they can be adjusted with finger pressure to allow a small flow of liquid to lubricate the packing.

Adjust the packing according to the following procedure:

- A. Start the pump and observe the leakage from the stuffing box.
- B. The correct amount of flow from the gland should be a stream about 1/8" diameter.
- C. Tighten or loosen the gland nuts until the correct amount of leakage is obtained.
- D. After installing new packing, it may be necessary to readjust the gland several times before the packing is correctly adjusted.

**IMPORTANT:**

**Do not tighten the gland to stop all leakage. Leakage is necessary to ensure the cooling, flushing and lubrication of the packing and to prevent shaft sleeve damage.**

**Connect piping from the backhead taps to a suitable drain. Check periodically to ensure the drain is working properly.**

- E. The stuffing box should be inspected every 150 hours for excessive leakage. If the flow of liquid has increased and cannot be reduced by a slight tightening of the gland, replace the packing and/or shaft sleeve.

**EXTERNAL WATER FLUSH:**

If the pump is handling abrasive material, it is recommended that an external water line be connected to the stuffing box and water injected through the water seal ring.

A flow rate of 2–3 gpm at a pressure of 5–10 psi above the pump discharge pressure should be used.

**MECHANICAL SEAL REPLACEMENT:**

Refer to the Mechanical Seal section of this manual for general information, including removal and installation procedures.

**BEARING LUBRICATION:**

Under normal operating conditions, the bearings must be lubricated every 2000 hours of running time or at least once a year regardless of total operating hours.

**IMPORTANT:**

Any application with abnormal heat, moisture, dust, etc. may require a change in this schedule, and you should refer to a lubrication engineer or the factory for specific instructions.

**CAUTION:**

Grease recommendations in this manual will provide satisfactory lubrication over a wide temperature range. There is, however, a practical limit and operation of the pump that should be discontinued and the factory consulted if temperatures measured on the outside of the bearing housing exceed 190 degrees F.

**GREASE RECOMMENDATIONS:**

Recommended grease is a N.L.G.I., No. 2 lithium based multipurpose with a mineral oil viscosity of 950–1250 SUS at 100 degrees F, and 80–82 SUS at 210 degrees F. Suggested greases meeting this specification are listed below:

Manufacturer	Brand Name
Atlantic Richfield	ARCO M/P #2
Chevron	Dura-Lith
Exxon	Ronex or MP #2
Gulf	Gulf Crown #2
Sinclair	Litholine MP #2
Texaco	Marfak 958 or MP #2

Estimated quantities of grease for each bearing is 4–5 ounces. An experienced mechanic will be able to determine the correct amount of grease.

Proceed as follows during lubrication:

**DANGER:**

Extreme care should be exercised and steps taken to ensure the driver cannot be accidentally started. Keep hands, fingers, clothing and any tools away from the coupling. Failure to do so could result in serious personal injury.

- A. Stop the unit, remove the grease drain plug and connect a grease gun to the lubrication fitting.
- B. Start the unit and inject grease until the old grease is relieved through the drain opening.
  - 1. If the grease does not relieve at the drain, check for blockage with a mechanical probe.
  - 2. Immediately after lubrication, bearing temperatures may rise above normal level.
- C. Continue running the unit until bearing temperatures stabilize at the normal level and grease stops seeping at the grease drain opening.
- D. Stop the unit, remove the grease gun, wipe off the relieved grease and replace the plug.
- E. Resume normal operation.

**IMPELLER RUNNING CLEARANCE:**

As the impeller and fronthead wear, the clearance increases causing internal leakage, decreasing pump performance.

The clearance can be adjusted to compensate for wear. Refer to the data section of this manual for nominal impeller clearances. If the desired clearance cannot be obtained, it may be necessary to rebuild the pump.

The clearance may be checked by removing the suction hand-hole cover and placing a feeler (thickness) gauge between the impeller and the fronthead. (Refer to the impeller adjustment drawing illustrations.)

**WARNING:**

Pumped media may contain items that present health hazards, such as needles and other sharp objects. Always wear puncture-resistant gloves.

**T20, T30 AND T40 FRAME PUMPS:**

Back off the jackscrews and tighten the capscrews at the bearing housing until the impeller just contacts the fronthead.

NOTE: If the pump is equipped with other than packing or a double mechanical seal, it will be necessary to loosen the seal lock collar to allow movement in the shaft.

Measure the gap between the housing and frame.

Loosen the capscrews and tighten each jackscrew in a crisscross method, 1/8 of a turn at a time until the gap between bearing housing and frame is increased by the amount of required impeller distance.

**IMPORTANT:**

If the gap is not as specified, repeat this entire procedure until the proper clearance is achieved. Tighten the locknuts to ensure that the jackscrews will remain in the proper position.

**T60 and T80 Frame Pumps:**

Back off the stud locknuts and capscrews holding the thrust bearing cover (159) and thrust bearing housing (158) to the frame (90).

NOTE: If the pump is equipped with other than packing or a double mechanical seal, it will be necessary to loosen the seal lock collar to allow movement of the shaft.

Measure the gap between the thrust bearing housing (158) and the frame (90).

Adjust the shim pack (186A) thickness between the thrust bearing housing (158) and the frame (90) to achieve the correct impeller clearance.

Tighten the stud nuts and capscrews against the O-rings. Do not compress the O-rings by more than 50%. Recheck the impeller clearance.

**IMPORTANT:**

If the gap is not as specified, repeat this entire procedure until the proper clearance is achieved.

Tighten the locknuts to the stud nuts to ensure the housing will remain in proper position.

**CLEANING THE PUMP**

If the pump becomes clogged, it will be necessary to stop the pump and clean out the impeller and volute area. Proceed according to the following instruction:

- A. Stop the pump and lock out the controls so that the pump cannot accidentally start.

**DANGER:**

Lock out the power and ensure the pump cannot be accidentally started. Check with appropriate test equipment to verify the pump cannot start.

- B. Unbolt and remove the cleanout covers in the volute and elbow (if so equipped). Use a hose or long handle to loosen and remove debris. If the material cannot be loosened by a hose, use a scraper and loosen and then flush with a hose.

**WARNING:**

Do not attempt to clean the pump with bare hands. Pumped media may contain items that present health hazards, such as needles and other sharp objects. Always wear puncture-resistant gloves.

- C. Install new gaskets and replace the cleanout covers.
- D. Return to normal operating cycle.

## **MAINTENANCE, CORRECTIVE:**

Major corrective maintenance will require disassembly of the pump. The following are step-by-step instructions:

### **TIME REQUIREMENTS:**

Estimated time to replace packing is 1–2 man hours. Mechanical seal replacement time is approximately four (4) man hours. Complete disassembly and reassembly of the complete pump is estimated at 6–8 hours.

### **MAINTENANCE QUALIFICATIONS:**

The pump described by this manual is designed to be maintained by a mechanic experienced with rotating machinery, using normal mechanics tools.

### **PUMP DISASSEMBLY:**

## **CAUTION:**

**Read this entire disassembly procedure and refer to the sectional drawings in this manual before proceeding.**

- A. Prepare the pump for disassembly according to the following procedure:
1. Lock out the power to the driver.

## **DANGER:**

**Check power source with appropriate electrical test equipment to ensure driver cannot accidentally start.**

2. Close suction and discharge valves.
3. Drain the pump
4. **5410 Construction:**  
Remove the shaft guard and disconnect the shafting at the pump flange. Remove the pump half shaft connecting flange and the coupling key (272).  
**5420 and 5440 Construction:**  
Remove the coupling guard and coupling.
5. Disconnect and remove gauges and all other auxiliary piping. (Stuffing box lubrication lines, grease lines, etc.)
6. If the volute (30) or fronthead (33) must be removed for any reason, disconnect the suction and discharge piping.
7. **5410 and 5440 Construction:**  
Remove the capscrews securing the volute (30) to the base (15) and the capscrews securing the elbow (44) to the fronthead (33).  
**5420 Construction:**  
Remove the capscrews holding the pump to the base.
8. Remove the pump less the base to a convenient work area.

## **WARNING:**

**The use of a crane or hoist of adequate capacity is required.**

- B. Remove the capscrews holding the backhead (34) to the volute (30) but leave in the capscrews that hold the backhead (34) to the frame (90). On 5420 horizontal pumps, also remove the capscrews that hold the mounting feet (A28 and B28) to the pump.
- C. Install an eyebolt of adequate strength in the tapped (coupling) end of the shaft (4). Remove the frame (90) and rotating assembly from the volute (30).
- D. Support the frame and rotating assembly in a horizontal position.
1. Remove the impeller capscrew (9) and impeller washer (9A). On 10" 5410, 5420 and 5440 remove impeller nut (9).
  2. Because the impeller capscrew or impeller nut (9) is installed with Loctite®, it will be necessary to heat the capscrew to approximately 450 degrees F to break the bond.

## **WARNING:**

**To prevent possible serious personal injury, heat-resistant gloves must be worn when handling heated parts.**

3. On 10" 5410, 5420 and 5440 only, remove the capscrews that secures the impeller seal ring (1A) to the impeller (1).

- E. Remove the impeller (1) from the shaft (4). Impeller and shaft have a close tolerance, so it will be necessary to use a pulling device.

### **CAUTION:**

**Care should be taken not to damage the impeller when using a puller or similar device. Attach the puller or other equipment at the impeller vane area only. Do not use the impeller shroud.**

Because the impeller is installed with Loctite®, it will be necessary to heat the impeller (1) hub to approximately 450 degrees F to break the bond.

- F. Loosen the packing gland (19). For pumps with mechanical seals, refer to the Mechanical Seal section of this manual.
- G. Remove the capscrews that secure the backhead (34) to the frame (90). Remove the packing (212) (refer to Mechanical Seal section of this manual if a mechanical seal is used), seal water ring (10), gland (19) and radial bearing deflector (A126).
- H. Remove the thrust bearing deflector (B126). On 10" 5410, 5420 and 5440 pumps only, remove the impeller seal ring (1A).
- I. Shaft Assembly:

#### **T20 and T30 Frame Construction:**

Remove the capscrews and jackscrews that secure the thrust bearing housing (158) to the frame (90) and remove the shaft assembly from the frame (90) using the eyebolt installed in tapped (coupling) end of shaft (4). Remove the radial bearing (163) from the shaft (4) using a bearing puller. Remove the thrust bearing snap ring (168A) and the thrust bearing housing (158).

Remove the thrust bearing locknut (161) and lock washer (162) and then remove the thrust bearing (168) from the shaft (4) using a bearing puller.

#### **T40 Frame Construction:**

Remove the capscrews and jackscrews that secure the thrust bearing housing cover (159) and thrust bearing housing (158) to the frame (90). Remove the thrust bearing housing cover (159) and remove the shaft assembly from the frame (90) using the eyebolt installed in the tapped (coupling) end of the shaft (4).

Remove the radial bearing (163) from the shaft (4) using a bearing puller.

Remove the thrust bearing housing (158).

Remove the thrust bearing locknut (161) and lock washer (162) and then remove the thrust bearing (168) from the shaft (4) using a bearing puller. Remove the thrust bearing grease retainer (A206).

#### **T60 Frame Construction:**

Remove the capscrews that secure the thrust bearing housing cover (159), capscrew O-rings and thrust bearing housing (158) to the frame (90). Remove the thrust bearing housing cover (159).

Remove the shaft assembly and impeller adjustment shims (186A) from the frame (90) using the eyebolt installed in the tapped (coupling) end of the shaft (4).

Remove the radial bearing (163) from the shaft (4) using a bearing puller. Remove the radial bearing grease retainer (B206).

Remove the thrust bearing housing (158) from the shaft (4).

Remove the thrust bearing locknut (161) and lock washer (162) and then remove the thrust bearing (168) from the shaft (4) using a bearing puller. Remove the thrust bearing grease retainer (A206).

#### **T80 and 10" 5410, 5420 and 5440 Frame Construction:**

Remove the capscrews that secure the thrust bearing housing cover (159), capscrew O-rings and thrust bearing housing (158) to the frame (90). Remove the thrust bearing housing cover (159) and bearing adjustment shims.

Remove the capscrews that hold the radial bearing housing cover (140) to the radial bearing housing (139) and remove the radial bearing housing cover (140).

Remove the shaft assembly and impeller adjustment shims (186A) from the frame (90) using the eyebolt installed in the tapped (coupling) end of the shaft (4).

Slide the radial bearing housing (139) up off the radial bearing (163) so that the radial bearing can be removed from the shaft (4) using a bearing puller. Remove the radial bearing housing (139) from the shaft (4).

Remove the thrust bearing housing (158) from the shaft (4).

Remove the thrust bearing locknut (161) and lock washer (162) and then remove the two thrust bearings (A168 and B168) from the shaft (4) using a bearing puller. (10" 54X0 uses a double row ball bearing.)

### **CAUTION:**

**To prevent possible serious personal injury and damage to the bearings, whenever possible pressure should be applied to the inner bearing race only.**

### **IMPORTANT:**

**Because of possible damage or contamination during removal, bearings and grease retainers should not be reused and new bearings and grease retainers should always be installed.**

- J. The shaft sleeve (14) is secured with Loctite® and needs to be heated to approximately 450 degrees F to break the bond. Remove the shaft sleeve (14) from the shaft (4).

### **WARNING:**

**To prevent possible serious injury, heat-resistant gloves must be worn when handling heated parts.**

- K. Remove the lip seal (159A) from the thrust bearing housing (158) on T20 and T30 frames.  
Remove the lip seal (158A) from the thrust bearing housing (158) on T80 and 10" 54X0 frames.  
Remove lip seal (159A) from the thrust bearing cover (159) on T40, T60, T80 and 10" 54X0 frames.  
Remove lip seal (140A) from the frame (90) on T20, T30, T40 and T60 frames.  
Remove lip seal (140A) from the radial bearing housing cover (140) and lip seal (139A) from the radial bearing housing (139) on T80 and 10" 54X0 frames.

### **IMPORTANT:**

**Because of possible damage during disassembly, lip seals should not be reused and new lip seals should always be installed.**

- L. **5410 and 5440 Construction:**  
Remove the capscrews holding the volute (30) and fronthead (33) to the base (15) and remove the volute (30).  
Remove the capscrews holding the fronthead (33) to the elbow (44) and remove the fronthead (33).  
**5420 Construction:**  
Remove the volute (30) by removing the capscrews holding it to the fronthead (33).
- M. Pump disassembly is now complete. All parts should be thoroughly cleaned and inspected for wear or damage and replaced if required.

## **PUMP ASSEMBLY:**

### **CAUTION:**

**Read this entire assembly procedure and refer to the sectional drawings in this manual before proceeding.**

The following step-by-step instructions for assembly of the pump are essentially the reverse order of the instructions for disassembly. All new or cleaned parts should be moved to a dust-free location for assembly. Gaskets, lip seals, and bearings should not be reused and should always be replaced with Fairbanks Nijhuis replacement parts.

- A. **5410 and 5440 Construction:**  
Using a new volute gasket (156) between the volute (30) and fronthead (33) install them on the base (15) and secure with capscrews.  
Install a new elbow gasket (154) on the suction elbow (44) and secure the elbow to the fronthead (33) with capscrews.  
Connect the discharge piping to the volute (30).  
Using new cleanout cover gaskets (203 and 291) install the volute cleanout cover (202) and suction elbow cleanout cover (290) securing with capscrews.  
**5420 Construction:**  
Using a new volute gasket (156) between the volute (30) and fronthead (33), secure the volute with capscrews.

Connect the discharge piping to the volute (30).

Using a new cleanout cover gasket (203), install the volute cleanout cover (202) securing with capscrews.

B. Install lip seal (159A) on the thrust bearing housing (158) for T20 and T30 frames.

Install lip seal (158A) on the thrust bearing housing (158) for T80 and 10" 54X0 frames. Install lip seal (159A) on the thrust bearing cover (159) for T40, T60, T80 and 10" 54X0 frames.

Install lip seal (140A) on the frame (90) for T20, T30, T40 and T60 frames.

Install lip seal (140A) on the radial bearing housing cover (140) and lip seal (139A) on the radial bearing housing (139) for T80 and 10" 54X0 frames.

C. Install the shaft sleeve (14) onto the shaft (4):

NOTE: To ensure proper bonding, thoroughly clean all mating surfaces with solvent to remove all grease, oil, dirt, etc.

1. Apply a bead of Loctite® No. 609 completely around the shaft (4) on the impeller end of the shaft/sleeve fit.

2. Slide the shaft sleeve (14) partway onto the shaft (4) while rotating it at least one full revolution to evenly spread the Loctite.

3. Continue sliding the sleeve over the shaft until it butts firmly against the shaft shoulder.

NOTE: Allow the Loctite to cure for two (2) hours prior to operating the pump.

D. Shaft Assembly:

Preheat thrust bearings (168) and radial bearings (163) in an oil bath or oven.

### **IMPORTANT:**

**When heating bearings do not exceed 250 degrees F.**

**Pack the radial bearing (163) and thrust bearing (168) half full of grease. Refer to the bearing lubricating instruction in the maintenance section of the manual for specific grease recommendations.**

**Pressure should be applied to the inner bearing race only, to prevent damage.**

### **CAUTION:**

**To prevent possible serious personal injury, heat-resistant gloves must be worn when handling heated parts.**

#### **T20 AND T30 FRAME CONSTRUCTION:**

Slide the thrust bearing (168) on the shaft (4) and secure with the lock washer (162) and locknut (161).

Fill the upper portion of the thrust bearing housing (158) with grease and slide it over the thrust bearing (168). Install the thrust bearing snap ring (168A) in the thrust bearing housing.

Slide the radial bearing (163) on the shaft (4).

Using the eyebolt installed in the tapped (coupling) end of the shaft (4), install the shaft assembly into the frame (90). Secure the thrust bearing housing (158) to the frame with capscrews. Install the jackscrews but do not tighten until the assembly is completed.

#### **T40 FRAME CONSTRUCTION:**

Install the thrust bearing grease retainer (A206) on the thrust bearing (168) and slide it on the shaft (4), securing it with lock-washer (162) and locknut (161). Bearing arrangement is to be back-to-back for pumps using (2) single row contact bearings for the thrust bearing.

Install the thrust bearing housing (158) over the thrust bearing (168).

Slide the radial bearing (163) over the shaft (4).

Using the eyebolt installed in the tapped (coupling) end of the shaft (4), install the shaft assembly into the frame (90).

Fill the thrust bearing housing cover (159) with grease and slide it over the shaft and secure to the frame with capscrews. Install the jackscrews but do not tighten until the assembly is completed.

#### **T60 FRAME CONSTRUCTION:**

Install the thrust bearing grease retainer (A206) on the thrust bearing (168) and slide it on the shaft (4), securing it with lock-washer (162) and locknut (161). Bearing arrangement is to be back-to-back for pumps using (2) single row contact bearings for the thrust bearing.

Slide the thrust bearing housing (158) over the impeller end of the shaft and up over the thrust bearing (168).

Install the radial bearing grease retainer (B206) on the radial bearing (163) and slide it on the shaft (4). Using the

eyebolt installed in the tapped (coupling) end of the shaft (4), install the shaft assembly into the frame (90). Install impeller adjustment shims between the frame (90) and the thrust bearing housing (158) required for correct impeller clearance. (Refer to Impeller Running Clearance section of this manual.) Fill the thrust bearing housing cover (159) with grease and slide it over the shaft and secure to the frame with capscrews.

**T80 AND 10" 54X0 FRAME CONSTRUCTION:**

Slide thrust bearings (A168 and B168 respectively) onto the shaft (4) and secure with lock washer (162) and locknut (161). (10" 54X0 uses a double row ball bearing.)

Fill the lower portion of the thrust bearing housing (158) with grease and slide it over the impeller end of the shaft and up over the thrust bearing (168).

Fill the upper portion of the radial bearing housing (139) with grease and slide it over the shaft (4).

Slide the radial bearing (163) over the shaft (4).

Using the eyebolt installed in the tapped (coupling) end of the shaft (4), install the shaft assembly into the frame (90). Install impeller adjustment shims between the frame (90) and the thrust bearing housing (158) required for correct impeller clearance. (Refer to Impeller Running Clearance section of the manual.)

Fill the lower portion of the radial bearing housing cover (140) with grease and slide it over the shaft (4), securing to the radial bearing housing (139) with capscrews. Fill the upper portion of the thrust bearing housing cover (159) with grease and slide it over the shaft (4). A clearance of 0.008" to 0.010" is required between the thrust bearings. Install shims (186A) between the thrust bearing housing (158) and the thrust bearing housing cover (159) to achieve this clearance.

Set bearing clearance as follows:

1. Measure the gap between the thrust bearing housing cover (159) and the thrust bearing housing (158) with a feeler gauge. Record the value obtained.
2. Total shim thickness must be equal to the measured gap plus the 0.008" to 0.010" required clearance. Example: If the measured gap is 0.005", total shim thickness should be 0.005" plus 0.008" to 0.010", or 0.013" to 0.015".
3. After shim(s) (186A) are installed, tighten the capscrews which secure the thrust bearing housing cover (159) and thrust bearing housing (158) to the frame (90).
4. Bearing clearance should be checked as follows:
  - A. Attach a dial indicator to the bearing housing cover (159) or the frame (90) and position the indicator stem against the end of the shaft (4).
  - B. With the shaft as far as possible toward the impeller end of the pump, set the dial indicator to read "zero".

**IMPORTANT:**

**Do not force the shaft. Apply only enough force to move the rotating assembly.**

- C. Push the shaft (4) as far as possible toward the coupling end of the pump and read the total end-play on the dial indicator. To assure a correct end-play reading, push the shaft (4) back toward the impeller end of the pump to check that the indicator returns to "zero".
- D. Total end-play must be 0.008" to 0.010"; if not, adjust the thickness of the thrust bearing cover shim(s) (186A) by the required amount and recheck the clearance.
5. After the clearance is set, remove the capscrews, securing the thrust bearing housing (158) and cover (159) to the frame (90) and install O-rings on the capscrews and reinstall.
  - E. Install the thrust bearing deflector (B126) and radial bearing deflector (A126) on the shaft (4). On 10" 54X0 pumps only, install the impeller seal ring (1A).
  - F. Install the backhead (34) to the frame (90) and secure with capscrews.
  - G. Install the packing (212) and seal water ring (10) into the stuffing box in the reverse order in which they were removed. (For pumps using a mechanical seal, refer to the Mechanical Seal section of this manual.)
  - H. Install the gland (19) and hand tighten the gland bolts.
  - I. Install the impeller (1), impeller washer (9A) and impeller capscrew (9) according to the following procedure. (Note that the 10" 54X0 uses an impeller nut (9) in lieu of a capscrew.)
    1. Thoroughly clean the impeller bore, the end of the shaft, shaft threads and capscrew threads to ensure they are free from oil, dirt or any foreign matter.
    2. Inspect and measure the impeller bore, shaft fit diameter, key and keyway for wear. Measure in several locations along the length of the fit. If the clearance between the shaft and impeller exceed

0.003" anywhere along the lengths of the impeller bore, contact the factory for instructions for rework or replacement of components.

3. Apply a sufficient amount of Loctite® No. 609 to shaft and impeller bore to cover the entire impeller fit area.
4. Install the impeller key (102) in the shaft (4).
5. Slide the impeller (1) over the shaft, ensuring it butts firmly against the shaft sleeve.
6. Apply three or four drops of Loctite No. 609 to the impeller capscrew (or impeller nut) threads and install on shaft with the impeller washer (9A) in place. Impeller fastener torque values are shown in Table #3 in the technical data section of this manual. (Torque values are for SAE grade 8 steel only. If other materials are used, consult the factory for proper torque values.)

NOTE: To prevent the impeller from turning, use a board wedged in the vanes using care not to damage the vanes in any way.

- J. On 5420 pumps, if the mounting feet were removed, install them at this time.
- K. Install a new volute gasket (156) on the volute (30) and assemble the complete frame/rotating assembly onto the volute, securing with capscrews.
- L. Install all gauges and auxiliary piping such as stuffing box lubrication lines, grease lines, etc.
- M. Refer to the Impeller Running Clearance section of this manual for instruction on adjustment and set the proper clearance.
- N. Install the coupling key (272) and pump coupling half on the shaft (4). Reconnect to drive coupling half on flexible drive shaft.
- O. Install all shaft and coupling guards.
- P. The pump assembly is now complete. Refer to Operation section of this manual.

## **WEAR RINGS:**

### **REPLACING EXISTING RINGS:**

An impeller wear ring (17) and/or a fronthead wear ring (16) may have been supplied with your pump. If either or both of these require replacement due to wear, the following procedures should be followed:

#### **Wear Ring Removal:**

- A. If the wear ring requires replacement, it can be removed by heating it to 350–400 degrees F to break the Loctite® bond.

### **CAUTION:**

**To prevent possible serious personal injury, heat-resistant gloves must be worn when handling heated parts.**

- B. The ring may also be ground off if heating fails to affect removal.

### **IMPORTANT:**

**Care should be used to avoid damage to the ring set.**

#### **Wear Ring Installation:**

Because of the required close tolerances, replacement wear rings should be obtained from Fairbanks Nijhuis or their authorized representative.

### **IMPORTANT:**

**To ensure proper bonding, thoroughly clean all mating parts with solvent to remove all grease, oil, dirt, etc.**

- A. Apply a bead of Loctite No. 504 to the impeller completely around the middle of the wear ring fit and press the wear ring in place.
- B. Apply a bead of Loctite No. 504 to the fronthead completely around the middle of the wear ring fit and press the wear ring into place.

### **CAUTION:**

**To avoid distortion and ensure proper installation, be careful to press the wear rings evenly and completely into place. They should be firmly butted against the corresponding impeller or fronthead shoulder at the bottom of the wear ring fit.**

### **Adding Wear Rings:**

It is possible to add either or both impeller or fronthead wear rings to pumps that were not so originally equipped from the factory. This work should be done by a qualified machinist experienced in similar machining work. Contact the factory for parts, instructions and correct matching dimensions.

### **COUPLING REMOVAL AND INSTALLATION:**

Refer to the coupling manufacturer's literature supplied with the pump.

### **MECHANICAL SEALS:**

Mechanical seals covered by these instructions, when properly installed, will give satisfactory performance. To ensure proper installation, these instructions should be read carefully.

Refer to the Technical Data Drawing section of this manual for suggested seal water piping systems: clean water source water flush seal system; deadhead seal water piping system.

### **DOUBLE MECHANICAL SEALS:**

Standard double mechanical seals consist of two stationary seats with O-ring seals and a single spring rotating assembly with O-ring sealing and drive or O-ring sealing and elastomer drive ring.

### **Removal:**

By this time the frame assembly with backhead should have been removed to a clean work area.

- A. Remove the capscrews that secure the backhead (34) to the frame (90) and carefully slide it off the shaft sleeve.
- B. Remove the solid gland bolts and remove the gland (31).
- C. Remove the upper stationary seat (456A).
- D. Remove the seal rotating element (456).
- E. Remove the lower stationary seat (456A).
- F. Inspect all components for damage prior to reassembly. This should include the shaft sleeve. Replace the damaged part(s) or replace with a complete new seal.

### **Installation:**

- A. Remove any burrs or nicks on the sleeve (14) and apply a light coat of liquid soap or liquid detergent.

### **CAUTION:**

**Seal faces are lapped and polished to a mirror finish. It is imperative that sealing faces be handled with care and kept perfectly clean. DO NOT touch the sealing faces.**

- B. Slide the solid gland (31), mechanical seal upper stationary seat (456A) and mechanical seal rotating element (456) over the shaft sleeve (14), being careful not to damage the mechanical seal faces.

### **CAUTION:**

**The gland, stationary seat and rotating element must be far enough onto the shaft (4) so as not to interfere with the installation of the backhead (34).**

- C. Thoroughly clean the sealing box and install the lower mechanical seal stationary seat (456A). Use even pressure to install the seat.
- D. Carefully, so as not to damage the stationary seat (456A), slide the backhead (34) over the shaft (4) and shaft sleeve (14) and secure to the frame (90) with capscrews.
- E. Without touching the seal faces and using a slight twisting action, push the upper stationary seat and rotating element into the backhead (34) sealing box.
- F. When the seal spring can easily be compressed by hand into the sealing box, secure the gland (31) with capscrews to the backhead.

### **CARTRIDGE TYPE SEAL:**

The cartridge type seal consists of a preassembled seal assembly, which reduces handling of fragile seal faces.

### **Removal:**

By this time the frame assembly with backhead should have been moved to a clean work area.

- A. Loosen the retainer clips and rotate 90 degrees and tighten the setscrews to secure the seal lock ring to the gland.

- B. Loosen the setscrews that secure the lock ring to the sleeve.
- C. Loosen the bolts securing the seal gland to the backhead (34) and the capscrews that secure the backhead to the frame (90).
- D. Carefully remove the backhead (34).
- E. Slide the entire seal assembly from the shaft sleeve (14).
- F. Inspect all parts of the seal for signs of wear. If wear is present, replace the entire seal. If only the seal O-rings need to be replaced, refer to the factory for instructions.

**Seal Installation:**

- A. Remove any burrs or nicks on the sleeve (14) and apply a light coat of liquid soap or liquid detergent.
- B. Install the seal over the sleeve (14).
- C. Install the backhead (34) and secure to the frame (90) with capscrews.
- D. Slide the seal assembly into the sealing box of the backhead (34) and secure with gland bolts.
- E. Secure the seal lock ring to the sleeve using the setscrews provided.
- F. Loosen the setscrews holding the retainer clips in place and rotate 90 degrees and retighten the setscrews. These clips will be used again if the seal is removed for any reason.

**OPERATION:**

Special operating techniques are not required when using pumps equipped with mechanical seals. However, there are certain precautions that should be taken.

- A. Pumps should never be operated, even to test electrical connections, until the operator knows that there is fluid in the sealing box. In order to check for fluid in the sealing box, loosen seal water piping at the box. Tighten piping only after fluid has started flowing.  
Running the seal with an air bound sealing box is the same as running it without fluid. If the seal is set up for deadhead operation, fill the filter, piping and sealing box with clear liquid and vent all air out of the topmost sealing box pipe plug.
- B. Some seals will leak slightly when first run. This leakage should cease within a very short period of time.

**ROUTINE MAINTENANCE:**

Required maintenance at a very minimum as follows:

- A. Periodically (150 hours of operation) check to see that the pumped liquid is going through the sealing box out to the wet well or drain.
- B. Check that the gland bolts have not loosened and that the gland is flush with the sealing box.
- C. Occasionally (4000 hours of operation) clean out the filter on deadhead systems. System must be purged of air and filled with clear liquid as indicated in Operation.

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## **REPAIR PARTS:**

### **Ordering Parts:**

When ordering parts, give pump serial number, size, model number, a complete description and item number of each part. Refer to the drawing and parts list in the back of this manual. You may order parts from your local Fairbanks Nijhuis distributor. Consult your local telephone yellow pages under "Pumps" for the office nearest you.

You may also contact Fairbanks Nijhuis directly as follows:

#### **Fairbanks Nijhuis**

3501 Fairbanks Avenue  
P. O. Box 6999  
Kansas City, KS 66106-0999  
Phone 913-371-5000  
Fax 913-748-4025

### **Returning Parts:**

All materials or parts returned to the factory must have prior approval and a "Returned Goods Tag", listing the material to be returned and the reasons for the return. All material to be returned should be carefully packed to avoid damage in route from rough handling or exposure to weather. Contact the factory for shipping instructions. All material is to be returned freight prepaid.

Fairbanks Nijhuis makes improvements on its products from time to time and reserves the right to furnish improved parts for repairs. A part that is received and is not identical in appearance, or has a different symbol from the original part, may be interchangeable. Examine the part carefully before contacting your Fairbanks Nijhuis representative. The parts should never be returned to the factory without first obtaining proper authorization from your Fairbanks Nijhuis representative.

## **SERVICE:**

### **Warranty Service:**

For Warranty Service contact the facility from which your pump was shipped. Shipping facility address is:

#### **Kansas City, Kansas**

Fairbanks Nijhuis  
P. O. Box 6999  
3501 Fairbanks Avenue  
Kansas City, KS 66106-0999  
Phone 913-371-5000  
Fax 913-748-4025

### **Service After Warranty:**

For service after warranty on this pump or any other pumping equipment contact:

Pump Services Group – 1-800-648-PUMP or write:

#### **Pump Services Group**

Fairbanks Nijhuis  
P. O. Box 6999  
3501 Fairbanks Avenue  
Kansas City, KS 66106-0999  
Phone 913-371-5000  
Fax 913-748-4025

**TECHNICAL DATA**

Table #1

Pump	Nominal Impeller Clearance
2" 54 x 1	.010 - .020
3" 54 x 1	.010 - .020
4" 54 x 1	.010 - .020
2" 54 x 2	.010 - .020
3" 54 x 2	.010 - .020
4" 54 x 2	.010 - .020
4" 54 x 2CLV	.010 - .020
3" 54 x 3	.010 - .020
4" 54 x 3	.010 - .020
5" 54 x 3	.010 - .020
6" 54 x 3	.015 - .025
4" 54 x 4	.010 - .020
5" 54 x 4	.010 - .020
6" 54 x 4	.015 - .025
8" 54 x 4	.015 - .025
4" 54 x 5	.008 - .015
6" 54 x 5	.015 - .025
8" 54 x 5	.015 - .025
10" 54 x 5	.020 - .030
5" 54 x 6	.020 - .030
6" 54 x 6	.020 - .030
8" 54 x 6	.020 - .030

Table #2

Stuffing Box Item	Frame Size					10" 5410
	T20	T30	T40	T60	T80	
# Rings Packing Per Box	5	5	5	5	5	5
Packing Size	3/8	1/2	1/2	1/2	5/8	5/8
Seal Water Ring Width	3/4	1	1	1	1-1/4	1-1/4
Shaft Sleeve O.D.	1-7/8	2-1/2	3	3-5/8	4-1/2	8
Box I.D.	2-5/8	3-1/2	4	4-5/8	5-3/4	9-1/4
Box Depth	2-7/8	3-1/2	3-3/4	3-3/4	5	4-3/4

Table #3

Pump Size & Model	Pump Frame	Impeller Fastener Size	Tightening Torque (lb. - ft.)
All 54X1 & 54X2	T20	1/2 - 13	80
All 54X3	T30	5/8 - 11	120
All 54X4	T40	3/4 - 10	200
All 54X5	T40 & T60	7/8 - 9	240
10" 54X5	T80	1-1/4 - 7	240
5" & 8" 54X6	T40 & T60	7/8 - 9	240
6" 54X6	T60	1-1/4 - 7	240
6" & 8" 54X6	T60	1-1/4 - 7	240
10" 54X0	---	7/8 - 9	240

### FALK COUPLING ALIGNMENT DATA

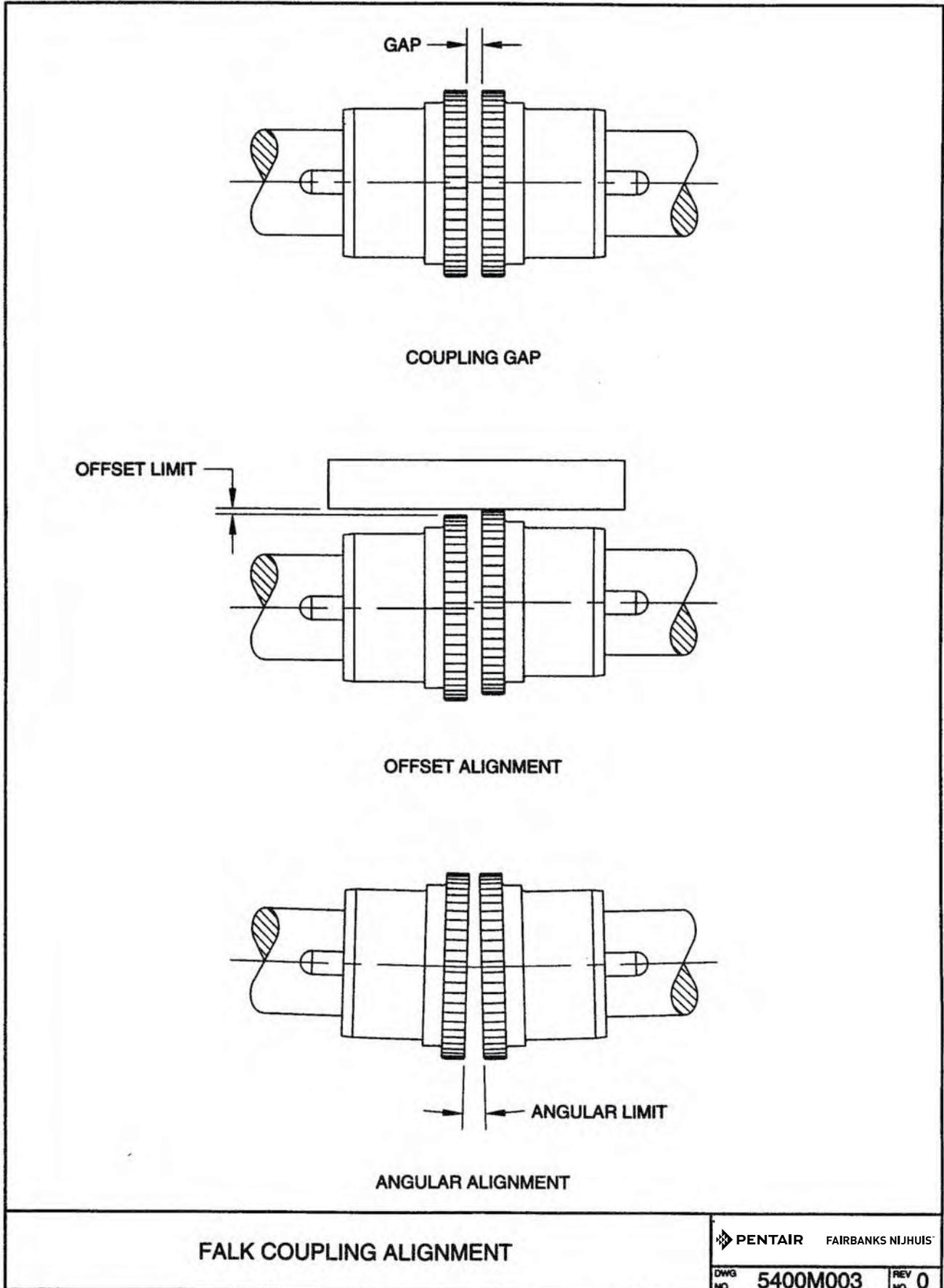
Size	Gap (Inches)	Installation Alignment Limits		Fastener Torque (lb./in.)
		Offset (Maximum) (Inches)	Angular (Maximum) (Inches)	
1020T	.125	.006	.003	100
1030T	.125	.006	.003	100
1040T	.125	.006	.003	100
1050T	.125	.008	.004	200
1060T	.125	.008	.005	200
1070T	.125	.008	.005	200
1080T	.125	.008	.006	200
1090T	.125	.008	.007	200
1100T	.188	.010	.008	260
1110T	.188	.010	.009	260
1120T	.250	.011	.010	650
1130T	.250	.011	.012	650
1140T	.250	.011	.013	650

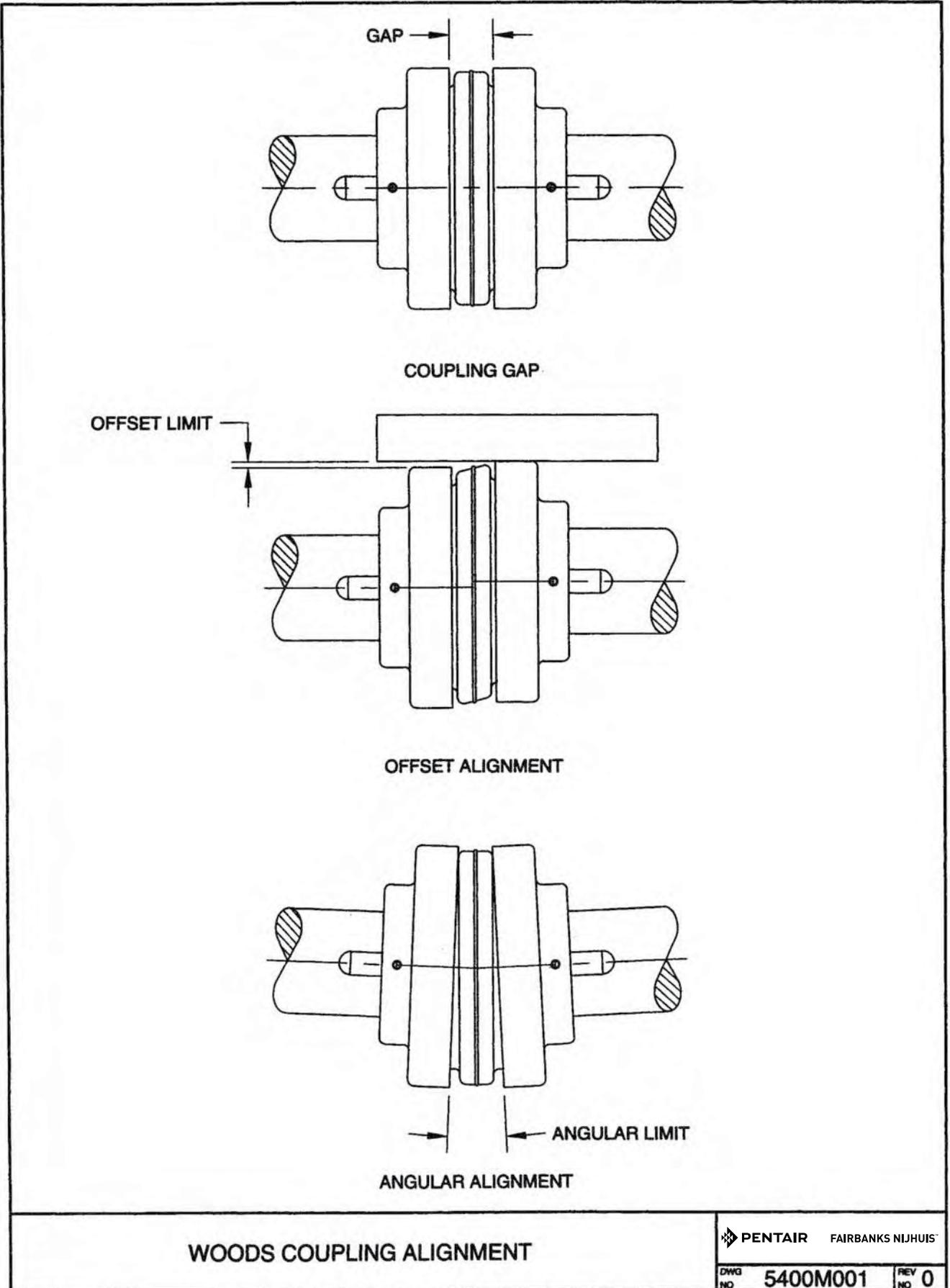
T1

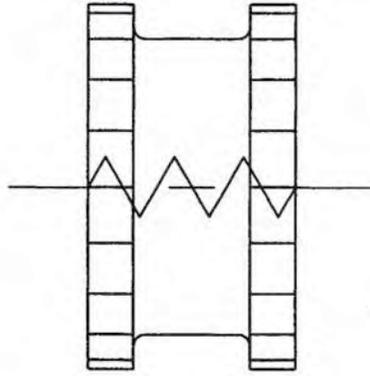
### WOODS COUPLING ALIGNMENT DATA

Size	Sleeve Type	Gap (Inches)	Installation Alignment Limits		Fastener Torque (lb./in.)
			Offset (Maximum) (Inches)	Angular (Maximum) (Inches)	
5S	JES	.750	.015	.056	155
6S	JES	.875	.015	.070	155
7S	JES	1.000	.020	.081	155
8S	JES	1.125	.020	.094	275
9S	JES	1.437	.025	.109	275
10S	JES	1.625	.025	.128	275
11S	E	1.875	.032	.151	275

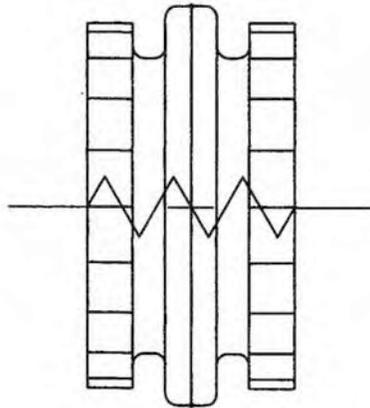
T2







TYPE JES

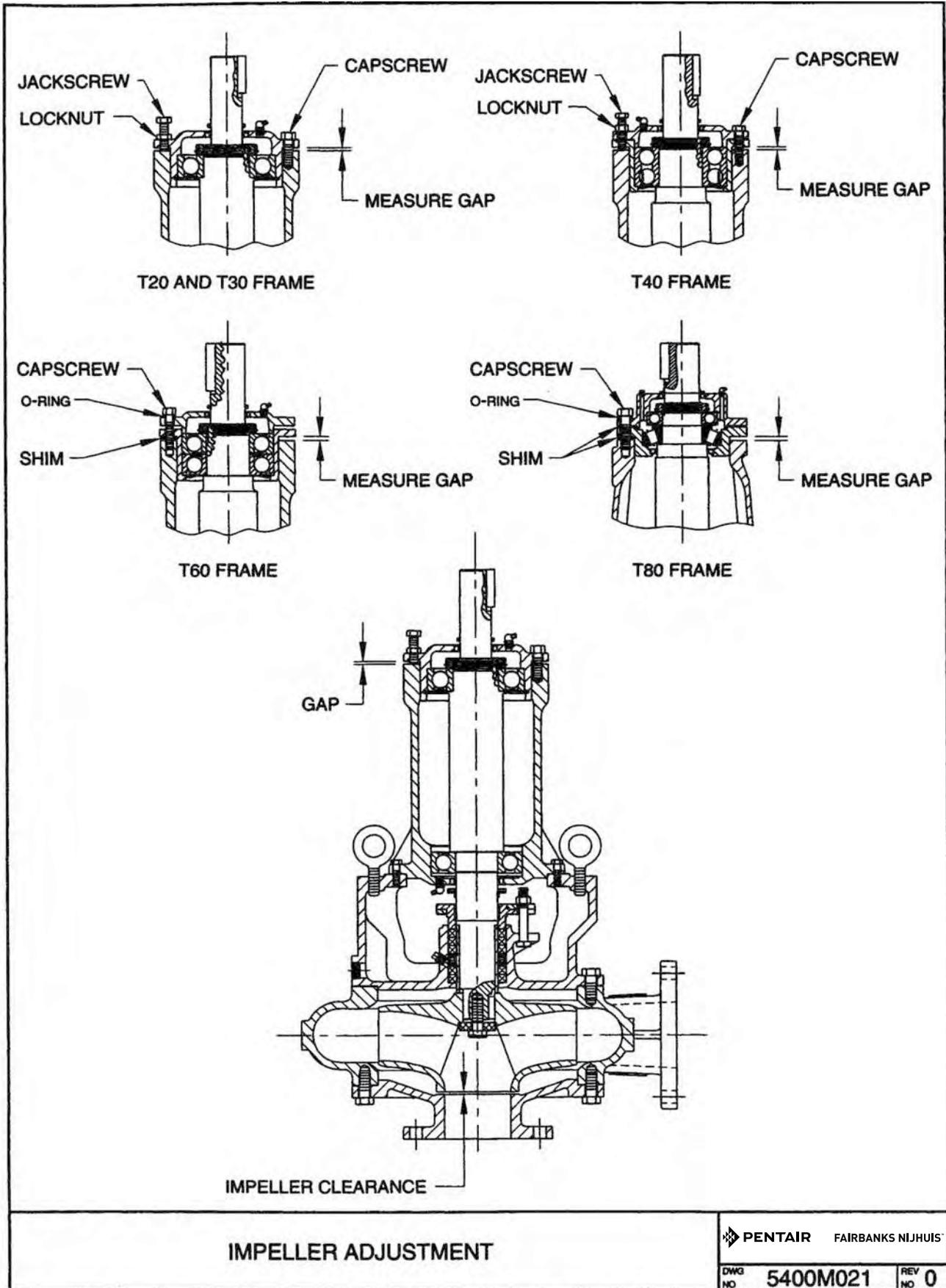


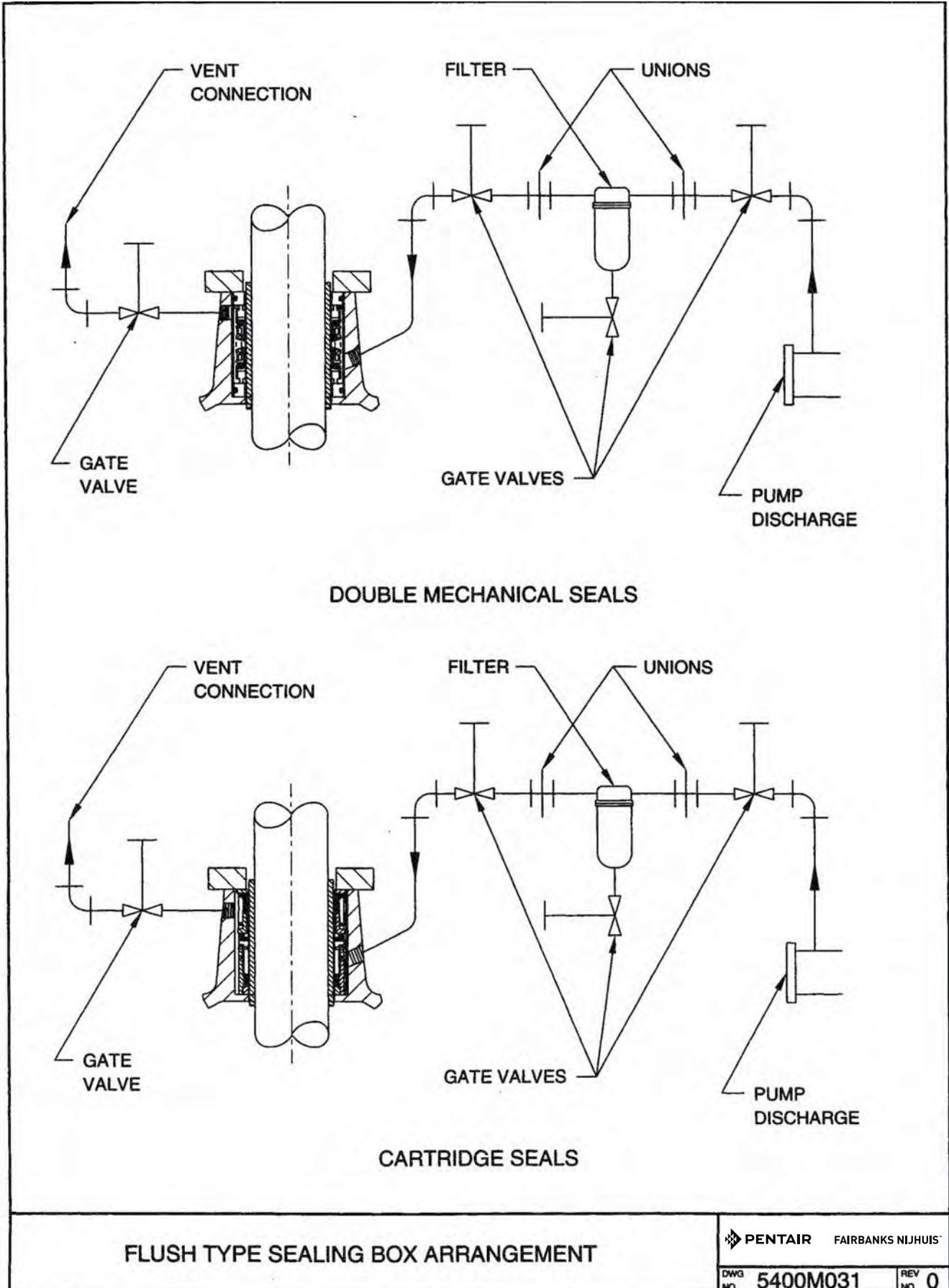
TYPE E

**NOTE:**

1. TYPE JES SLEEVES ARE MOULDED EPDM RUBBER AND ARE A ONE PIECE SPLIT CONSTRUCTION.
2. TYPE E SLEEVES ARE TWO PIECE MOULDED EPDM RUBBER SECURED BY A RETAINING RING.

**COUPLING SLEEVES****PENTAIR** FAIRBANKS NIJHUIS™DWG NO **5400M005** REV NO **0**



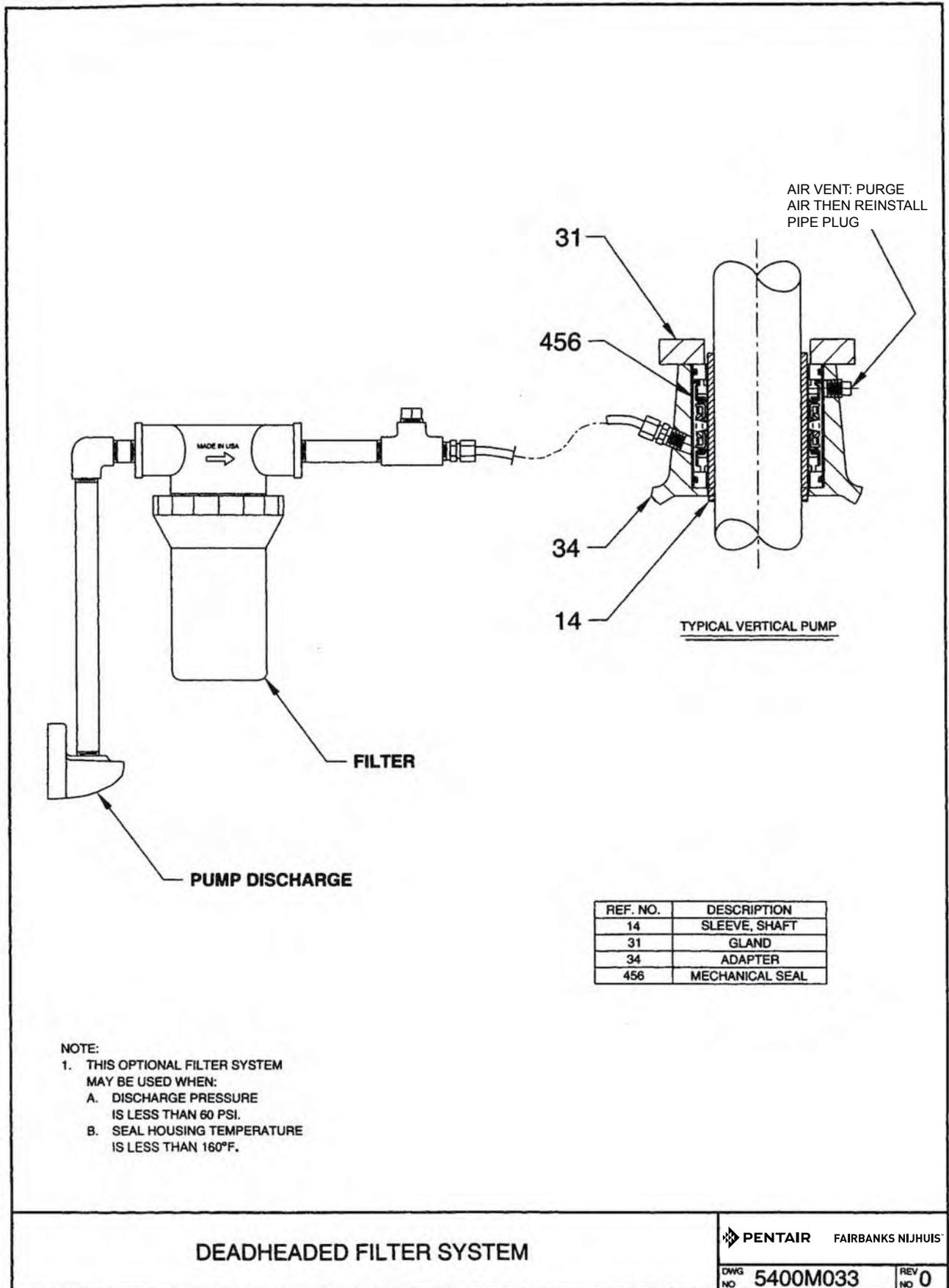


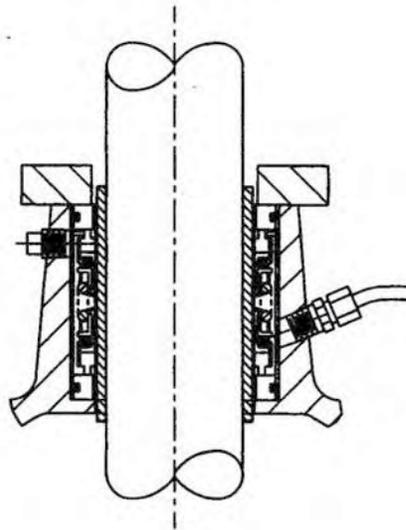
**FLUSH TYPE SEALING BOX ARRANGEMENT**

**PENTAIR** FAIRBANKS NIJHUIS

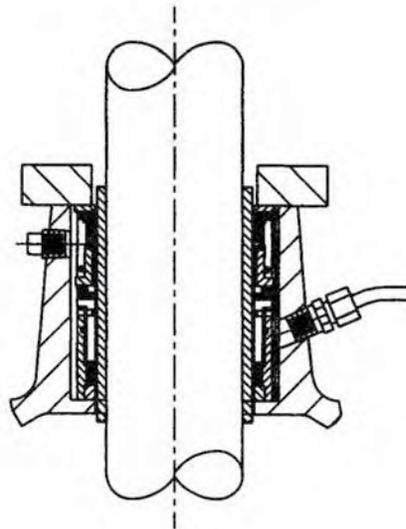
DWG NO **5400M031**

REV NO **0**





**DOUBLE MECHANICAL SEAL**

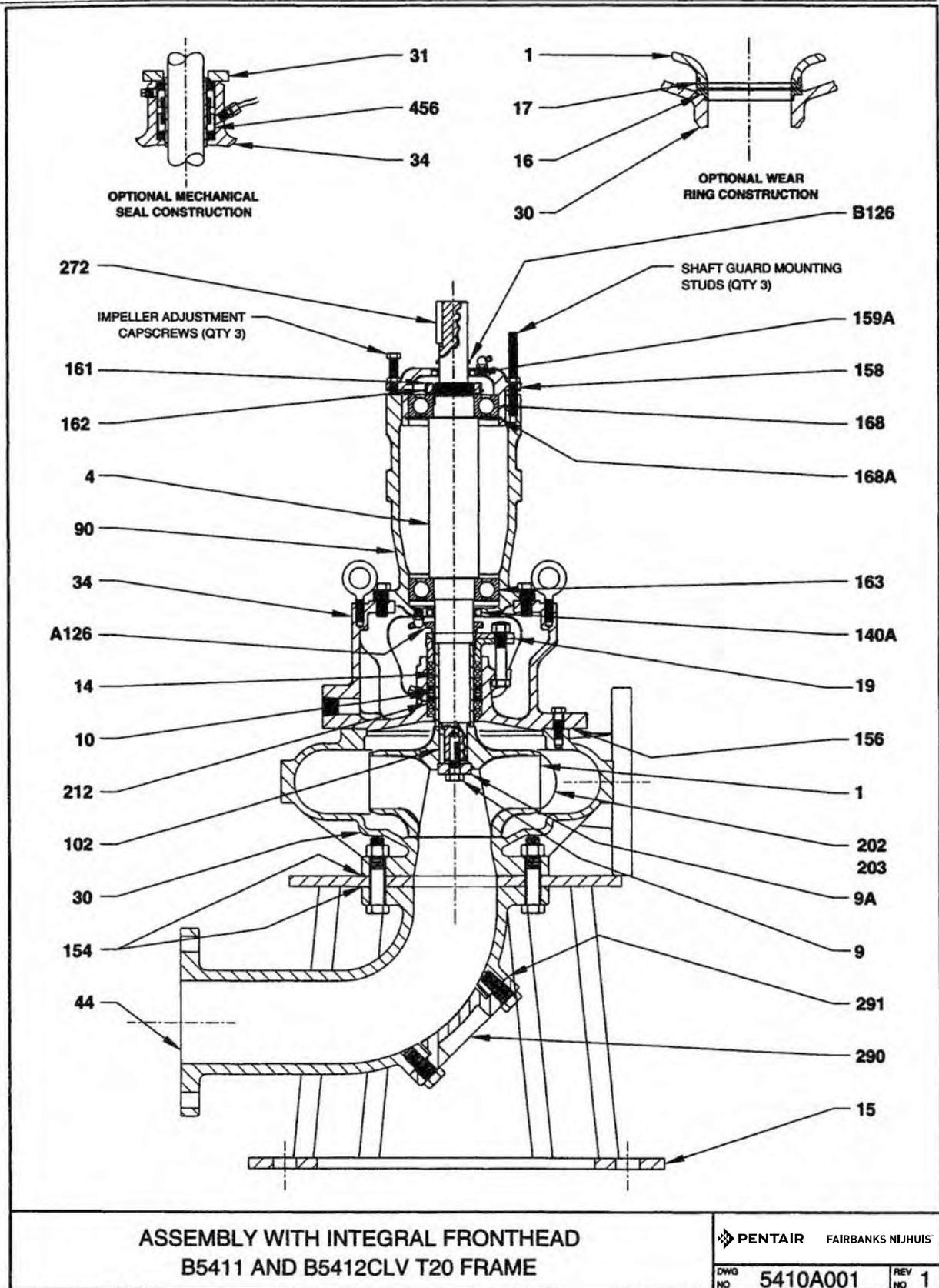


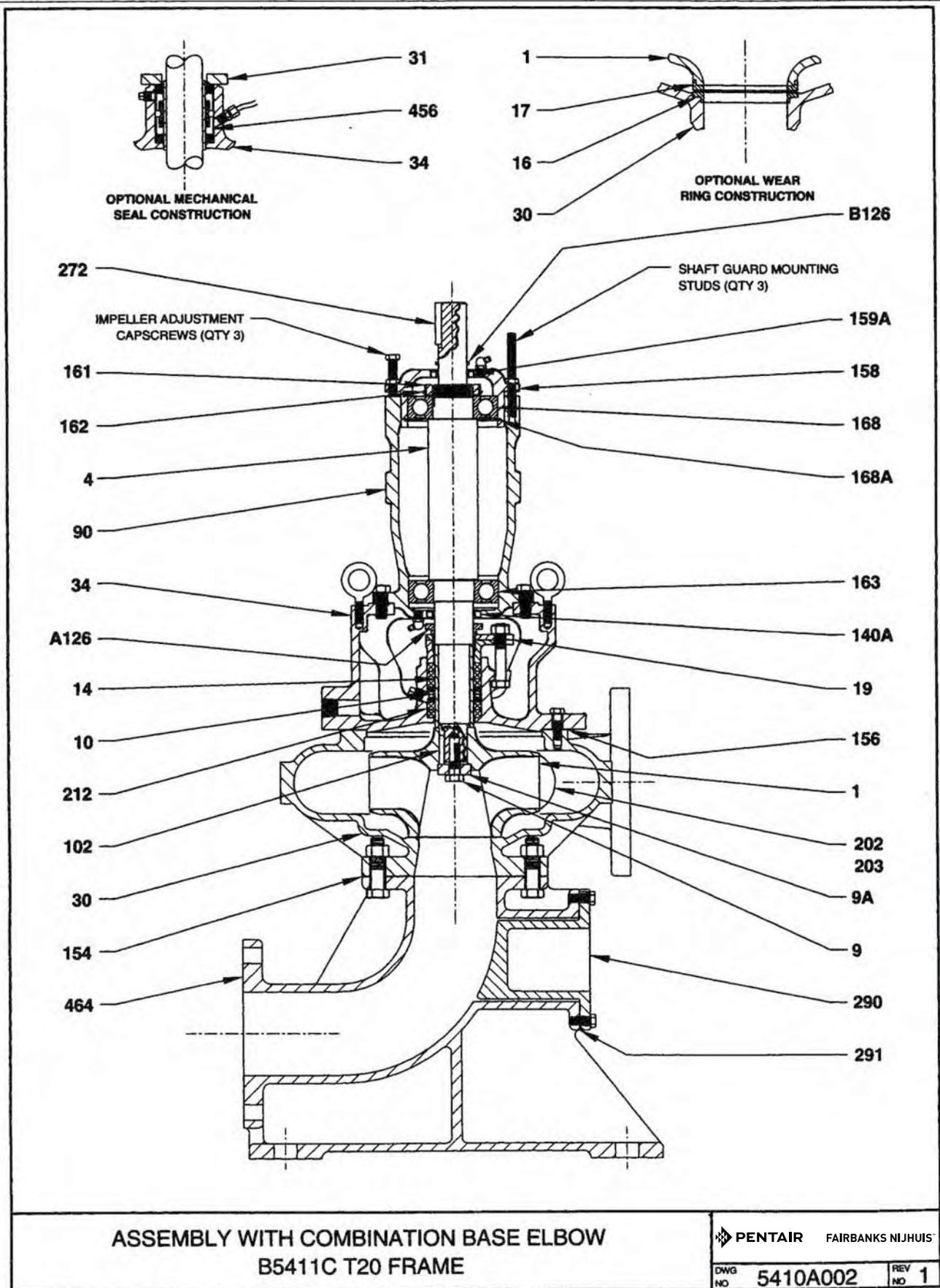
**CARTRIDGE MECHANICAL SEALS**

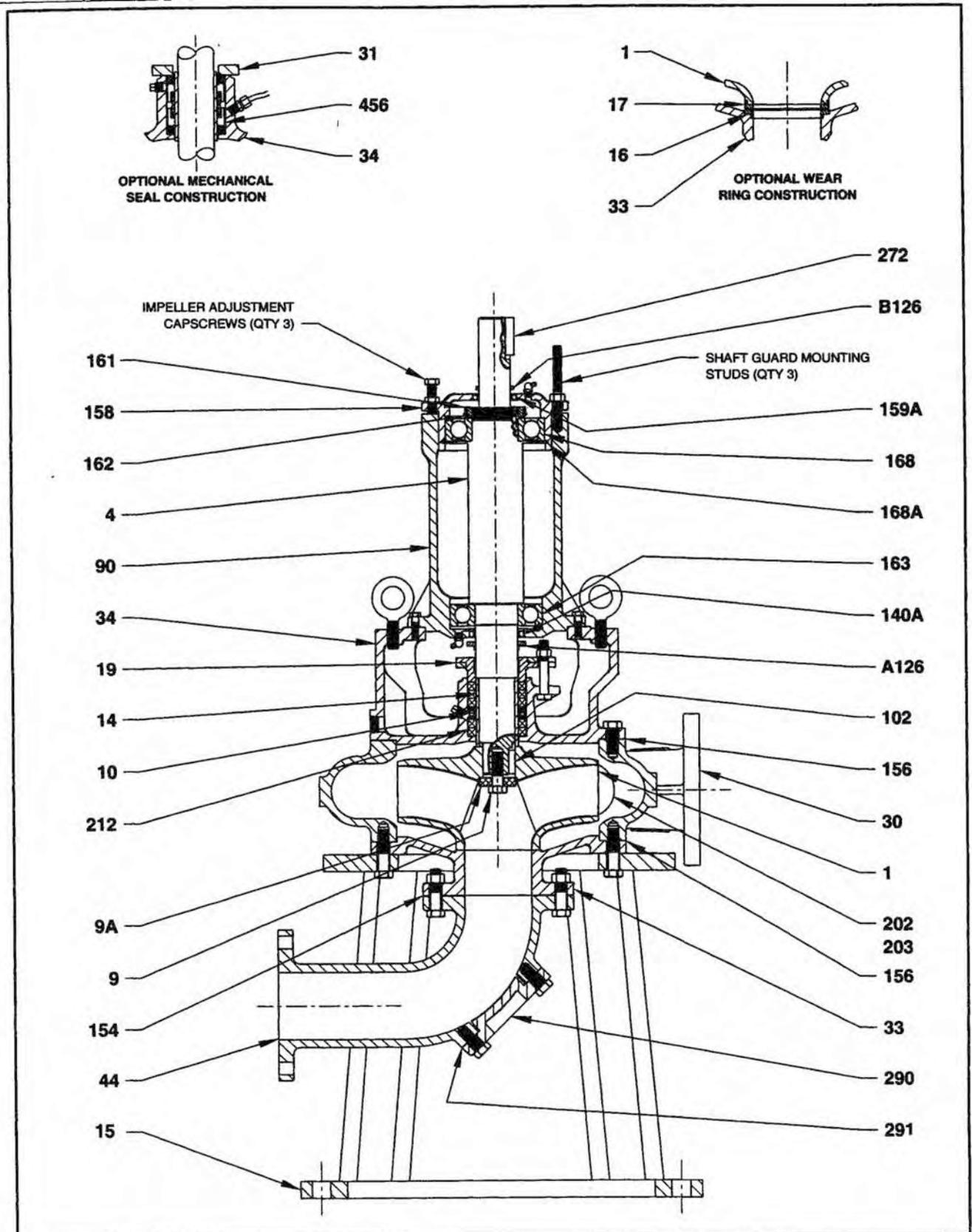
**TYPICAL MECHANICAL SEALS**

**PENTAIR FAIRBANKS NIJHUIS**

DWG NO **5400M035** REV NO **0**

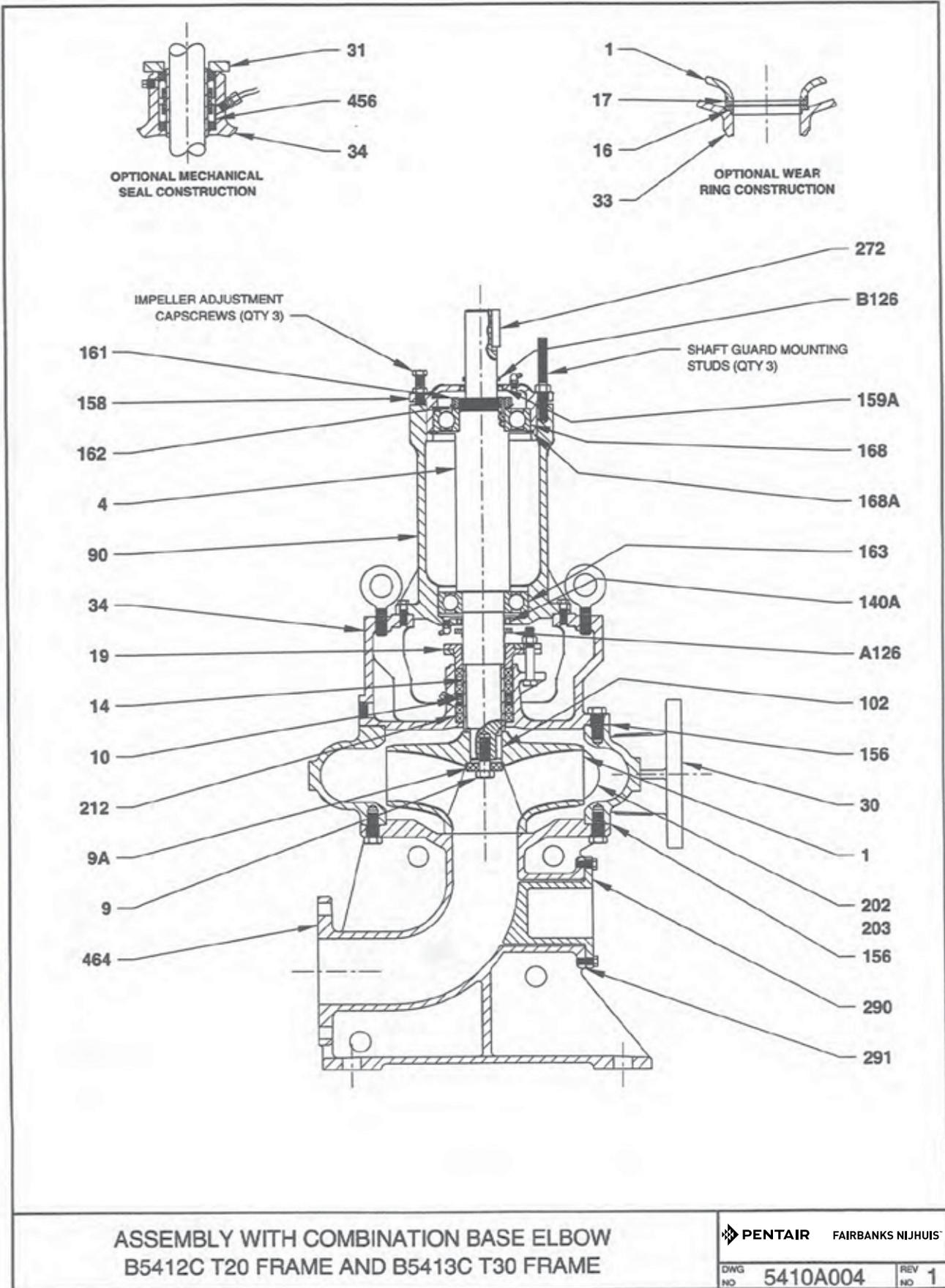


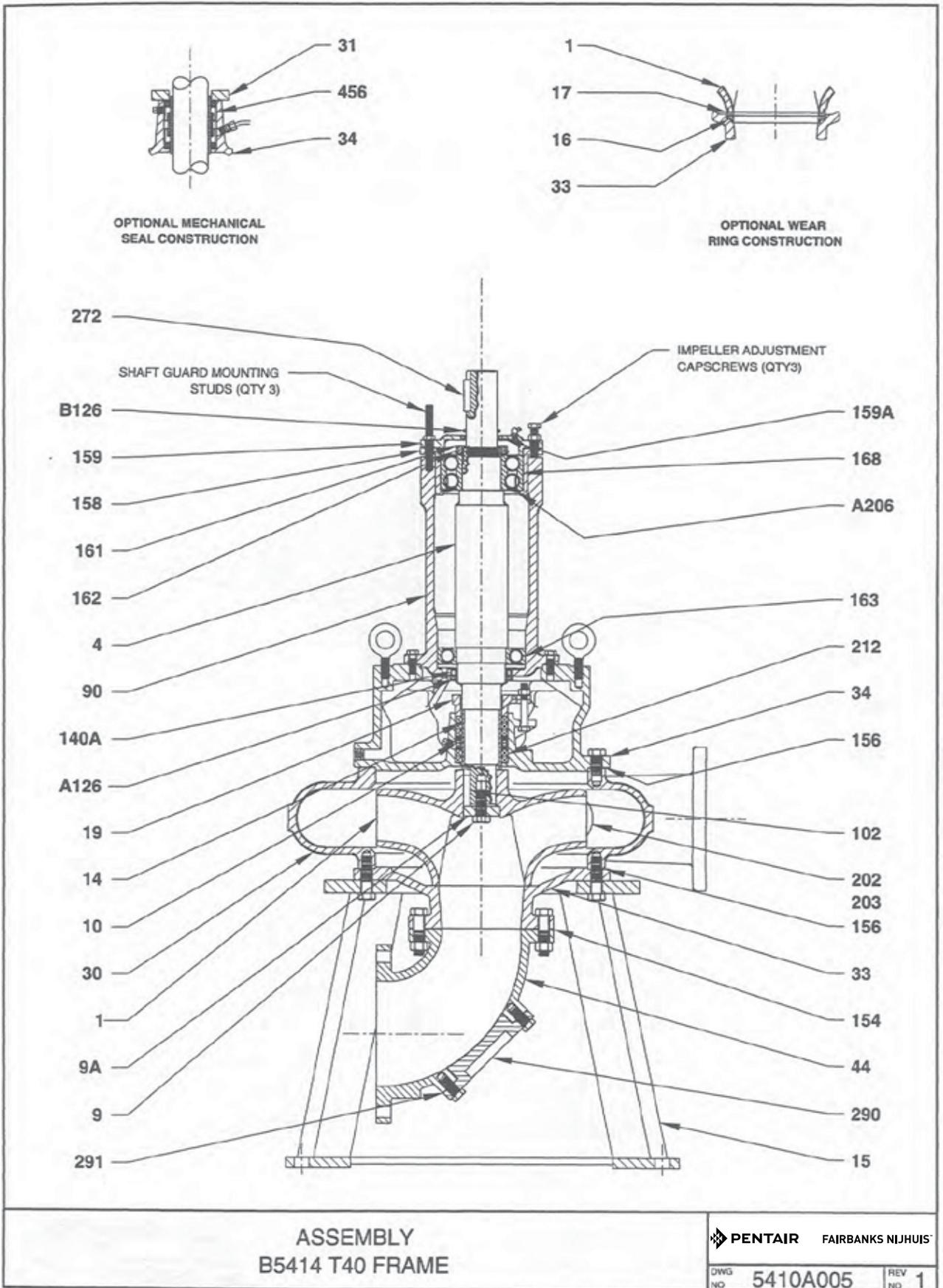


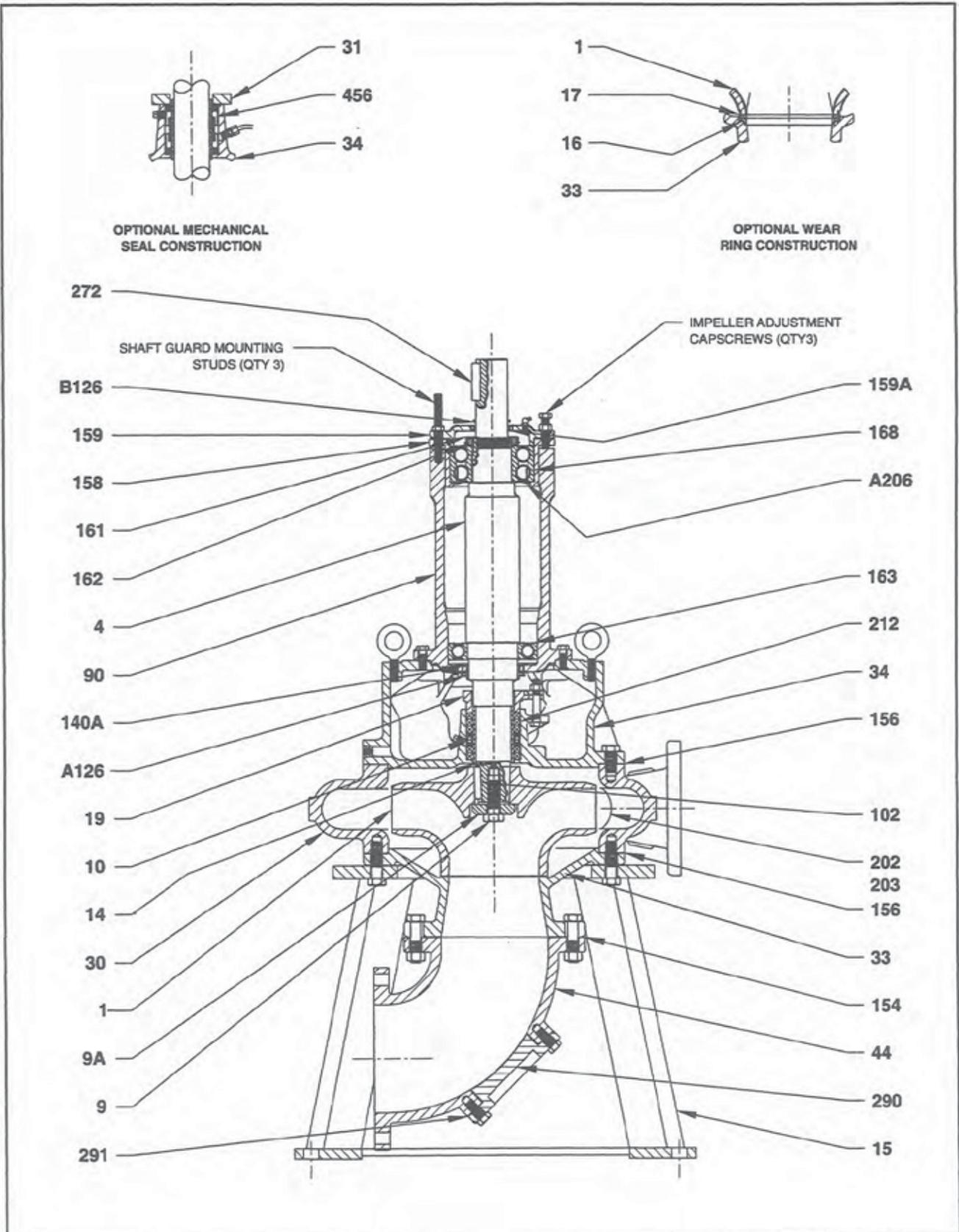


**ASSEMBLY**  
**B5412 T20 FRAME AND B5413 T30 FRAME**

<b>PENTAIR</b>		FAIRBANKS NIJHUIS®
DWG NO	<b>5410A003</b>	REV NO <b>1</b>



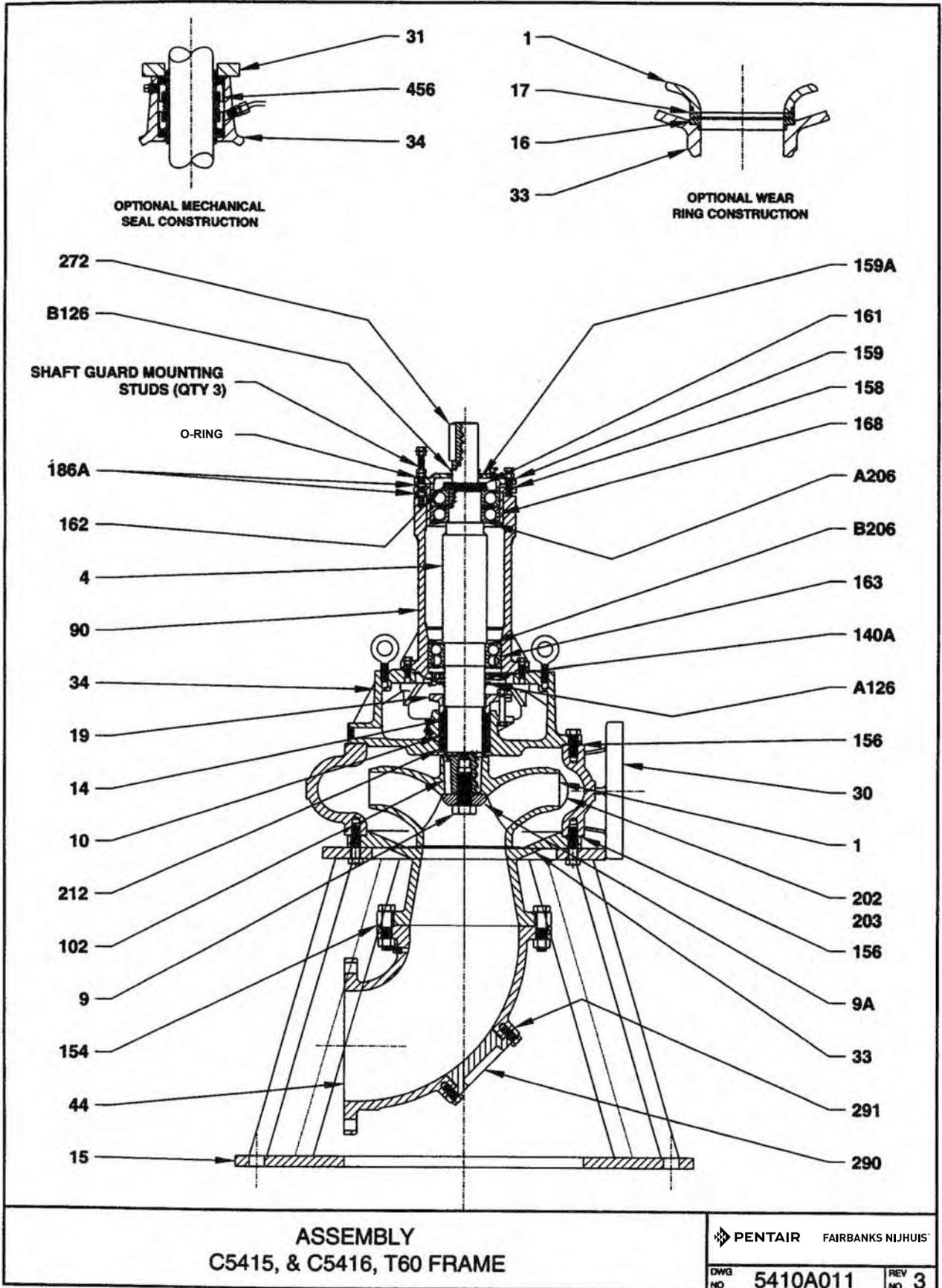


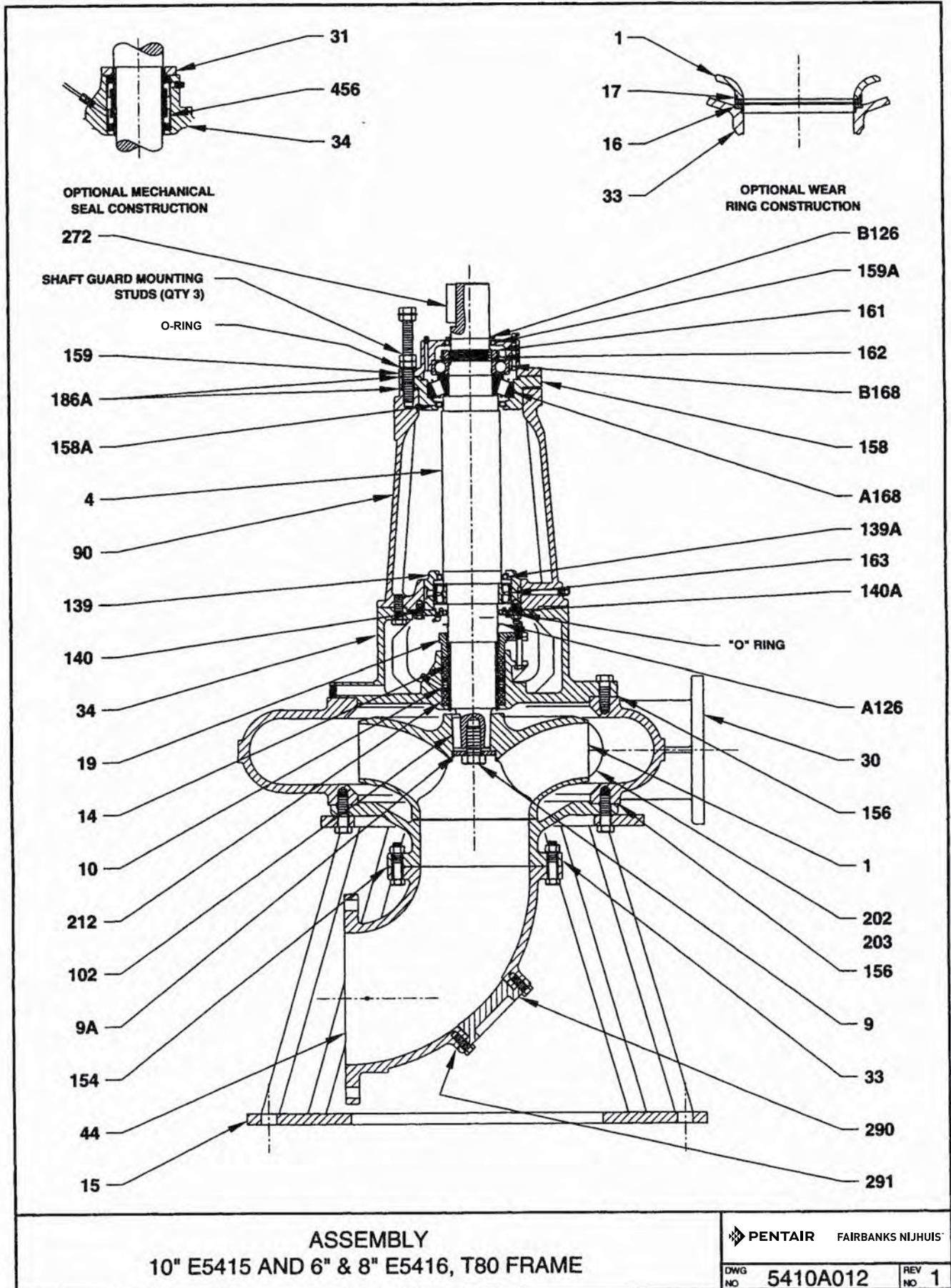


**ASSEMBLY**  
**4"-C5415 AND 5"-C5416 T40 FRAME**

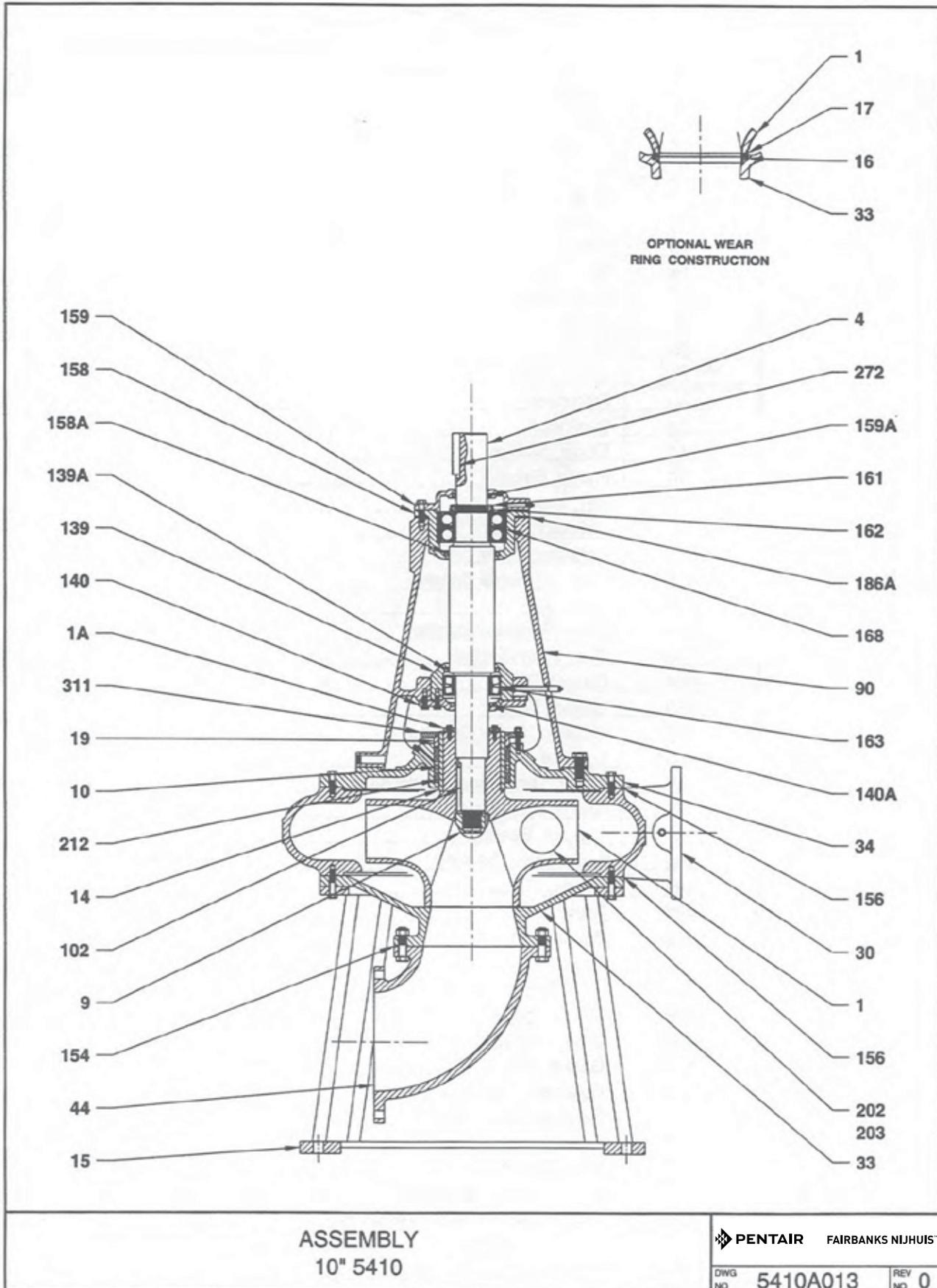
**PENTAIR** FAIRBANKS NIJHUIS®

DWG NO 5410A007 REV NO 2

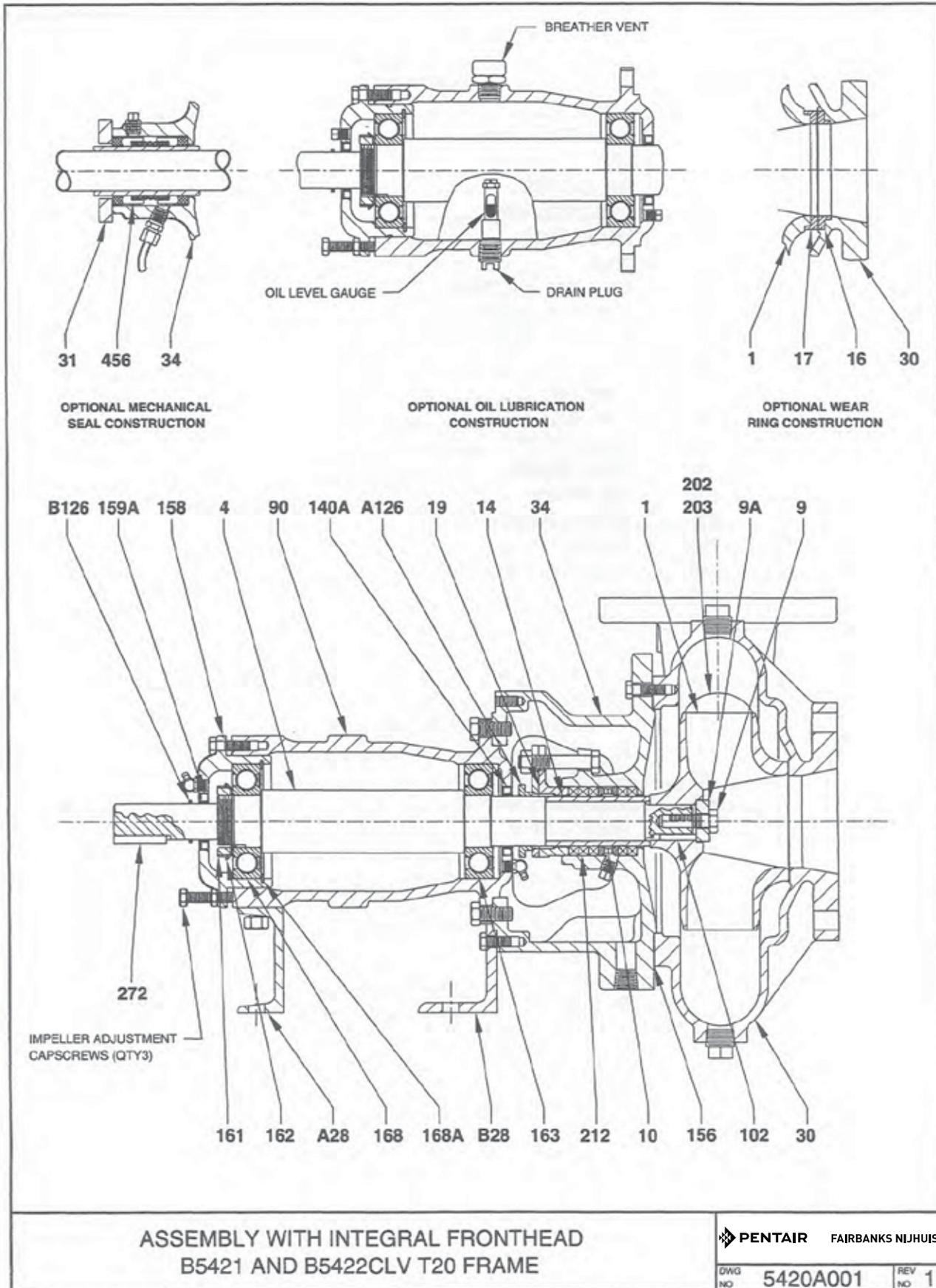


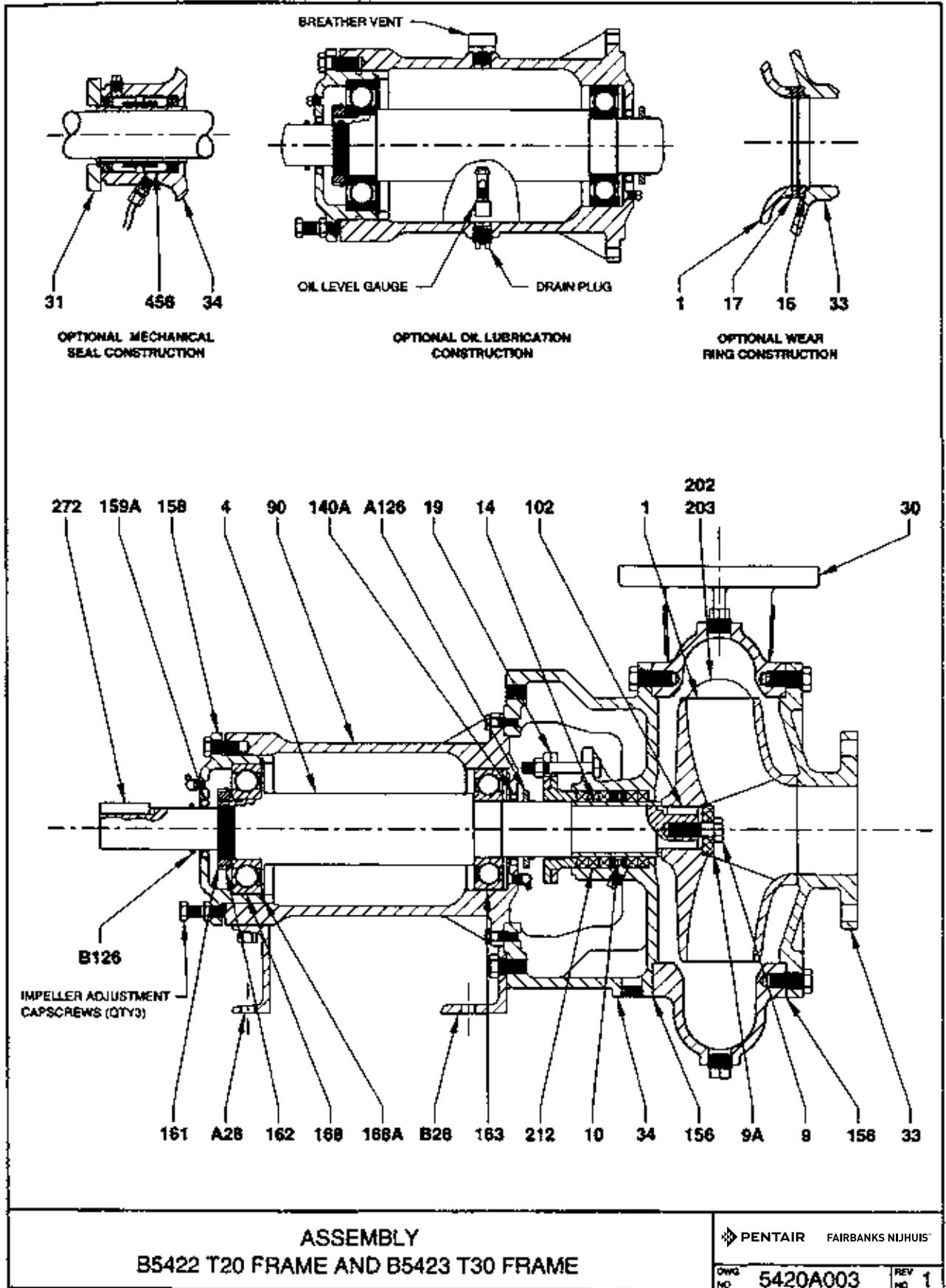


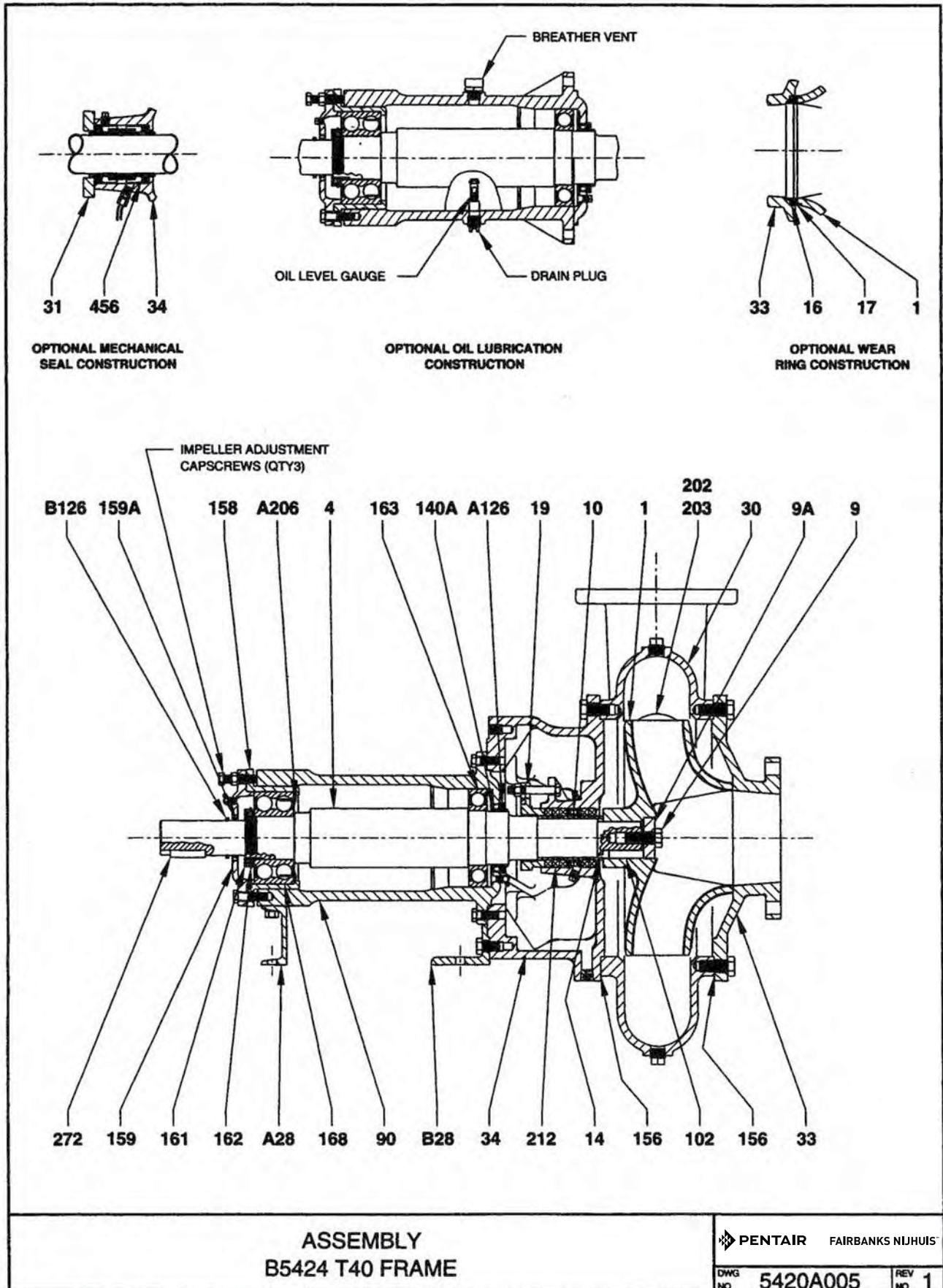
<b>5411 Through 5416 Parts List</b>	
<b>Part No.</b>	<b>Description</b>
1	Impeller
4	Shaft
9	Bolt, Impeller
9A	Washer, Impeller
10	Ring, Water Seal
14	Sleeve, Shaft
15	Base
16	Wear Ring, Fronthead
17	Wear Ring, Impeller
19	Gland Half, Interlocking
30	Volute
31	Gland, Solid
33	Fronthead
34	Backhead
44	Elbow, Suction
90	Frame, Bearing
102	Key, Impeller
A126	Deflector, Inner
B126	Deflector, Outer
139	Housing, Radial Bearing
139A	Lip Seal
140	Cover, Bearing Housing
140A	Seal, Inner Grease
154	Gasket, Elbow
156	Gasket, Volute
158	Housing, Thrust Bearing
158A	Lip Seal
159	Cover, Thrust Bearing Housing
159A	Seal, Outer Grease
161	Locknut, Bearing
162	Lockwasher, Bearing
163	Bearing, Thrust
168	Bearing, Thrust
A168	Bearing, Radial
B168	Bearing, Thrust
168A	Snap Ring, Bearing
186A	Shims, Impeller Adjustment
202	Cover, Volute Handhole
203	Gasket, Volute handhole Cover
A206	Retainer, Inner Grease
B206	Retainer, Outer Grease
212	Packing
272	Key, Coupling
290	Cover, Suction Handhole
291	Gasket, Suction Handhole Cover
456	Seal, Mechanical
464	Elbow, Combination Base Suction

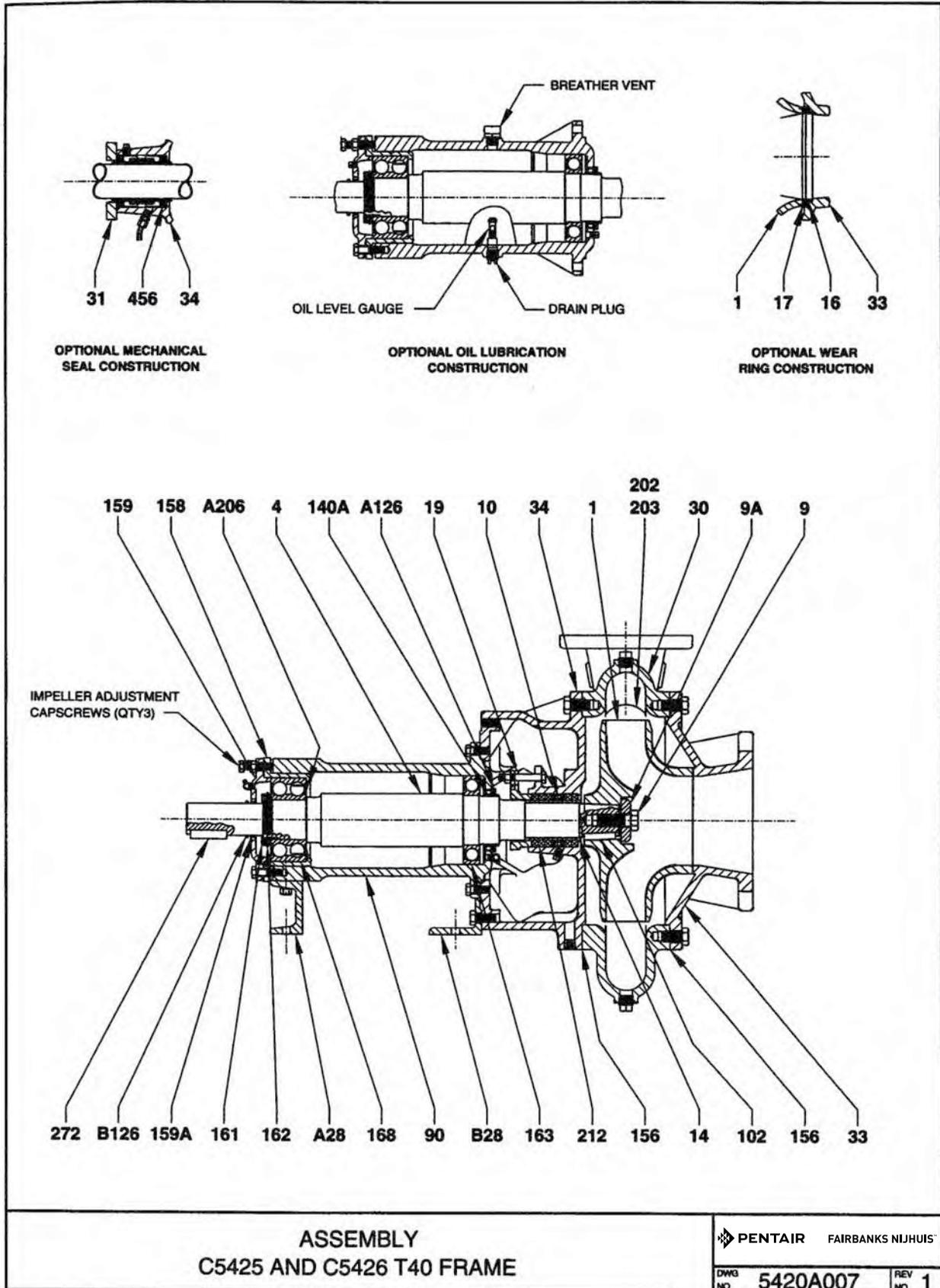


<b>10" 5410 Parts List</b>	
<b>Part No.</b>	<b>Description</b>
1	Impeller
1A	Ring, Impeller Seal
4	Shaft
9	Bolt, Impeller
10	Ring, Water Seal
14	Sleeve, Shaft
15	Base
16	Wear Ring, Fronthead
17	Wear Ring, Impeller
19	Gland Half, Interlocking
30	Volute
33	Fronthead
34	Backhead
44	Elbow, Suction
90	Frame, Bearing
102	Key, Impeller
139	Housing, Radial Bearing
139A	Lip Seal
140	Cover, Bearing Housing
140A	Seal, Inner Grease
154	Gasket, Elbow
156	Gasket, Volute
158	Housing, Thrust Bearing
158A	Lip Seal
159	Cover, Thrust Bearing Housing
159A	Seal, Outer Grease
161	Locknut, Bearing
162	Lockwasher, Bearing
163	Bearing, Radial
168	Bearing, Thrust
186A	Shims, Impeller Adjustment
202	Cover, Volute Handhole
203	Gasket, Volute Handhole Cover
212	Packing
272	Key, Coupling
311	Ring, Gland



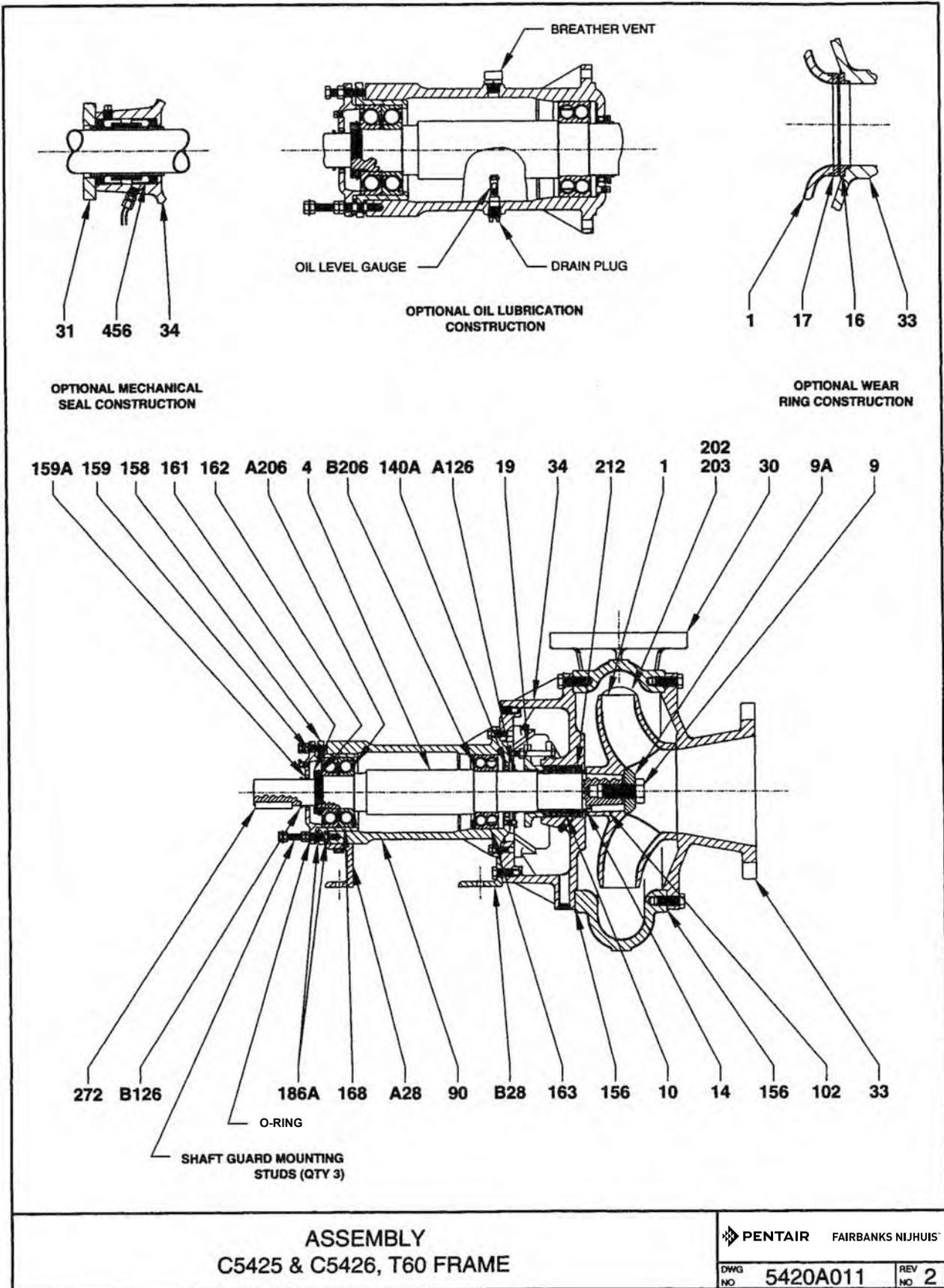


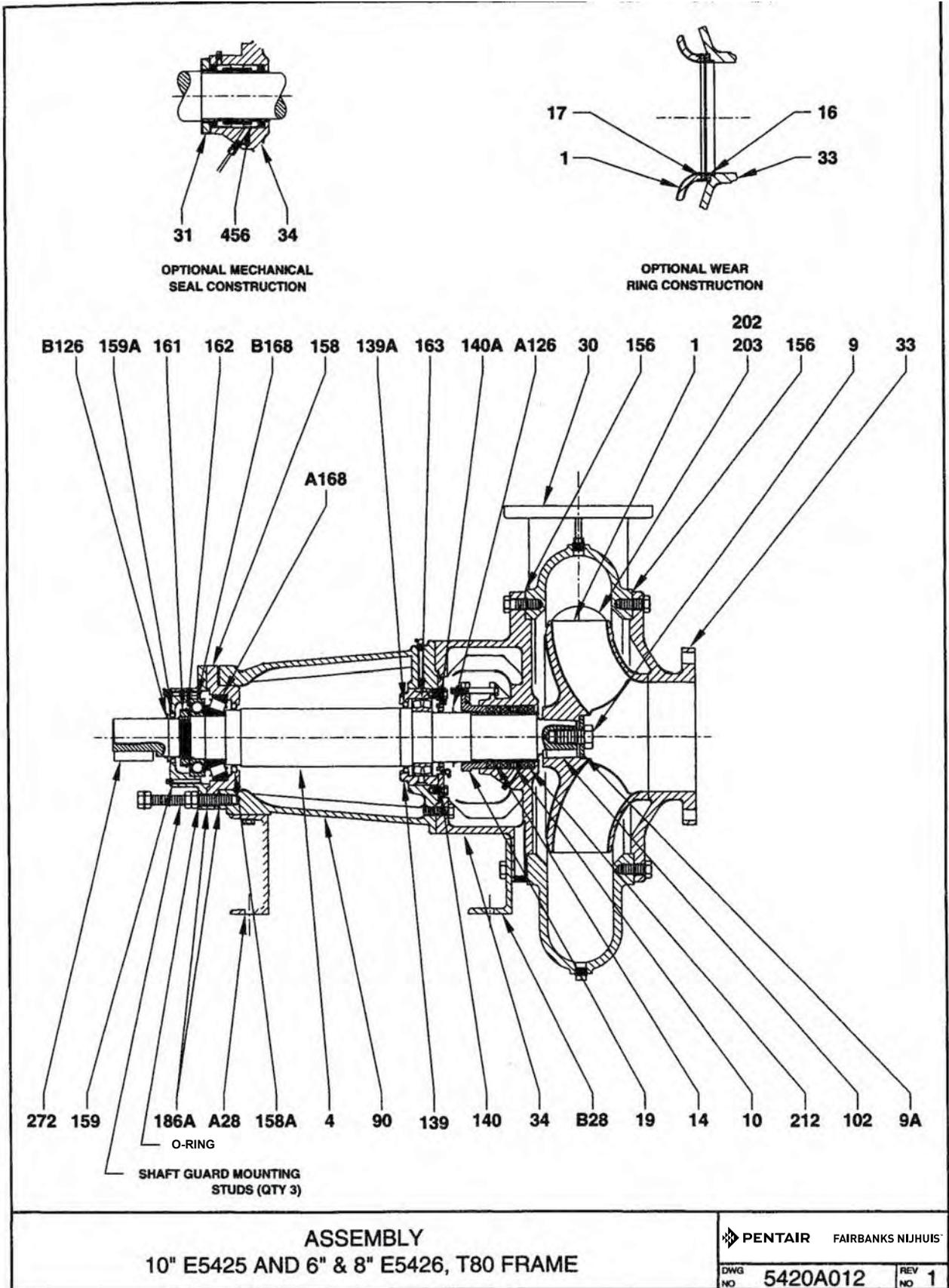




**ASSEMBLY**  
**C5425 AND C5426 T40 FRAME**

PENTAIR FAIRBANKS NIJHUIS	
DWG NO.	5420A007
REV NO.	1

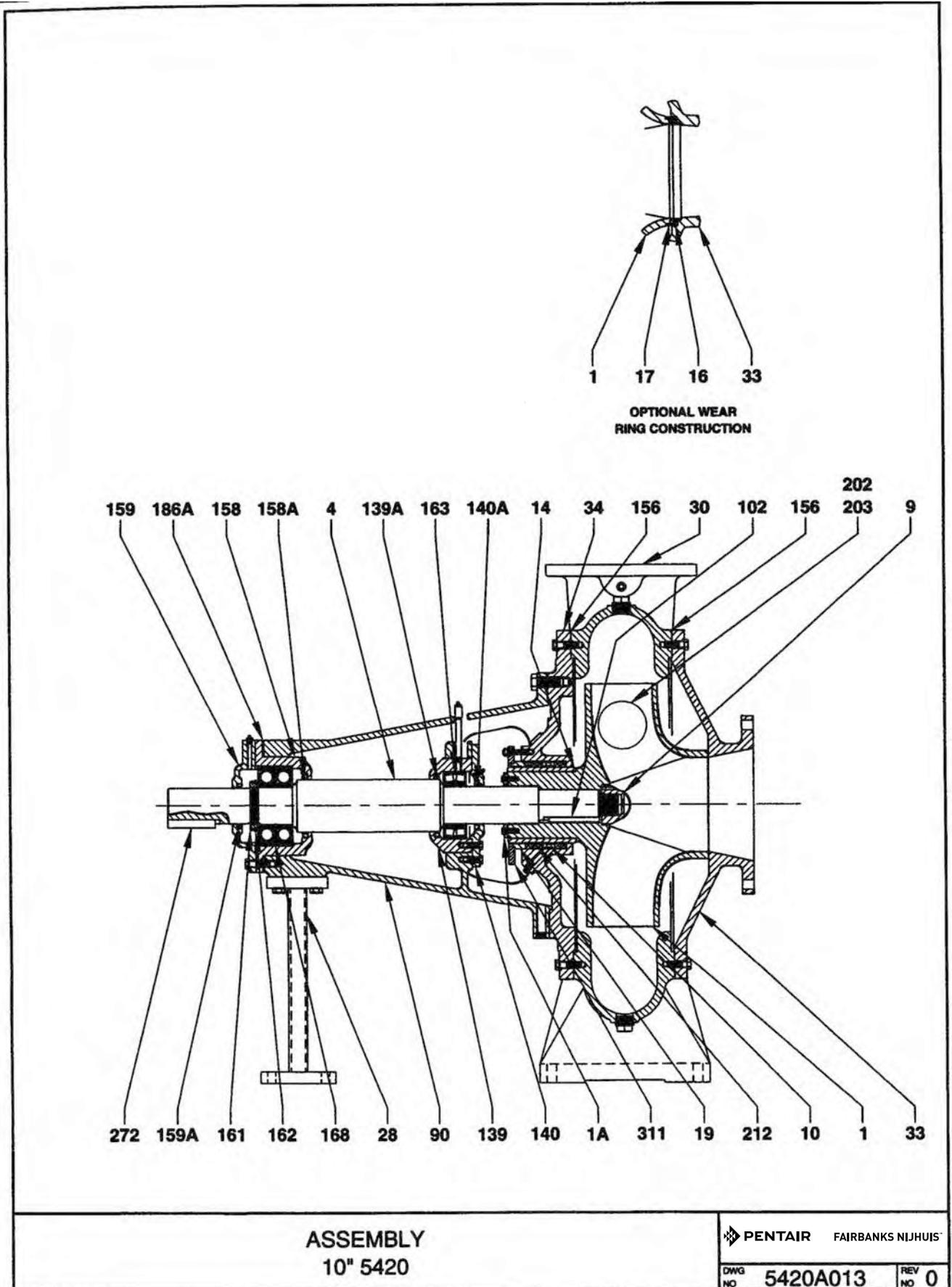




**ASSEMBLY**  
 10" E5425 AND 6" & 8" E5426, T80 FRAME

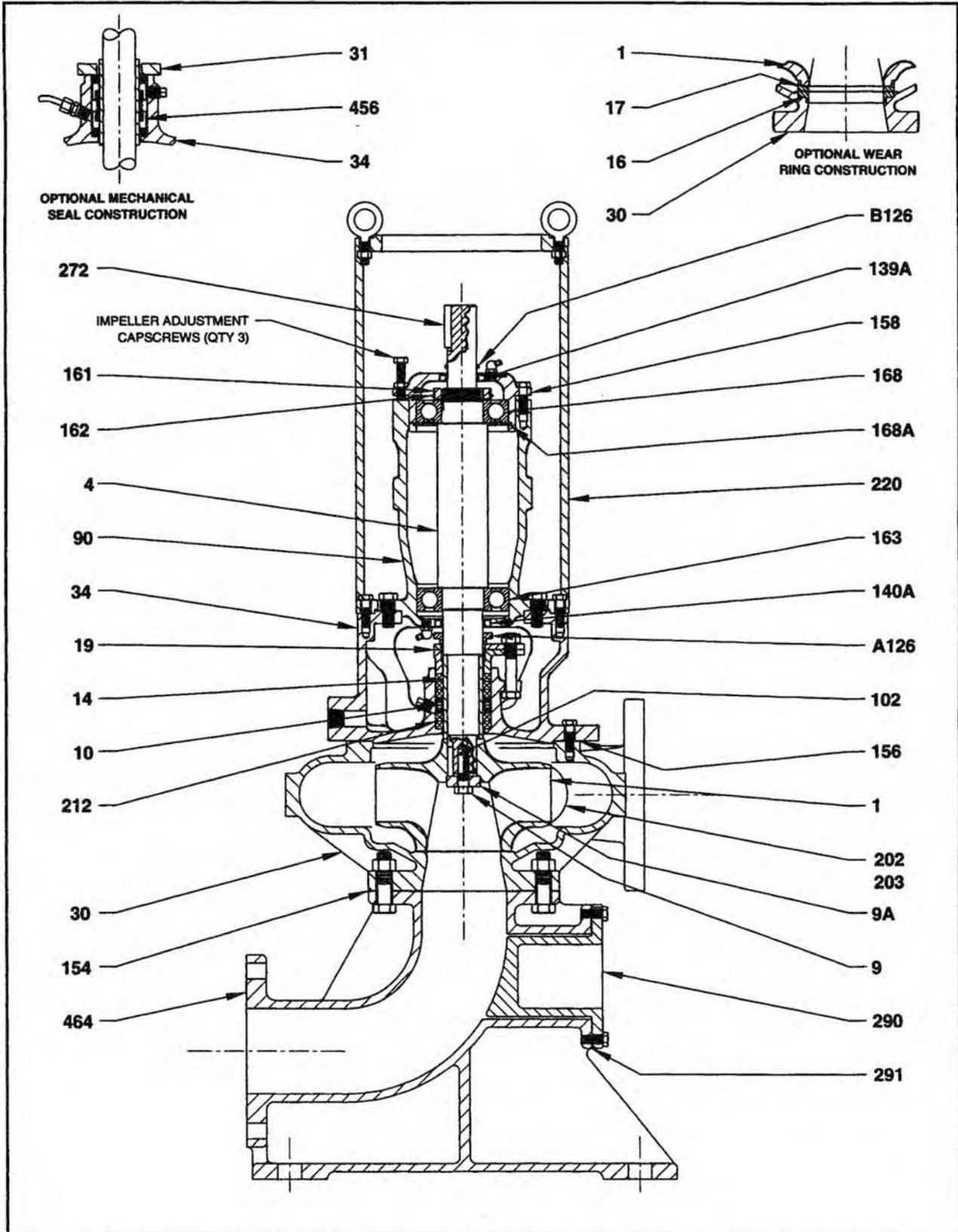
PENTAIR FAIRBANKS NIJHUIS	
DWG NO	5420A012
REV NO	1

<b>5421 Through 5426 Parts List</b>	
<b>Part No.</b>	<b>Description</b>
1	Impeller
4	Shaft
9	Bolt, Impeller
9A	Washer, Impeller
10	Ring, Water Seal
14	Sleeve, Shaft
16	Wear Ring, Fronthead
17	Wear Ring, Impeller
19	Gland Half, Interlocking
A28	Foot, Mounting
B28	Foot, Mounting
30	Volute
31	Gland, Solid
33	Fronthead
34	Backhead
90	Frame, Bearing
102	Key, Impeller
A126	Deflector, Inner
B126	Deflector, Outer
139	Housing, Radial Bearing
139A	Lip Seal
140	Cover, Bearing Housing
140A	Seal, Inner Grease
156	Gasket, Volute
158	Housing, Thrust Bearing
158A	Lip Seal
159	Cover, Thrust Bearing Housing
159A	Seal, Outer Grease
161	Locknut, Bearing
162	Lockwasher, Bearing
163	Bearing, Radial
168	Bearing, Thrust
A168	Bearing, Thrust
B168	Bearing, Thrust
168A	Snap Ring, Bearing
186A	Shims, Impeller Adjustment
202	Cover, Volute Handhole
203	Gasket, Volute Handhole Cover
A206	Retainer, Inner Grease
B206	Retainer, Outer Grease
212	Packing
272	Key, Coupling
456	Seal, Mechanical



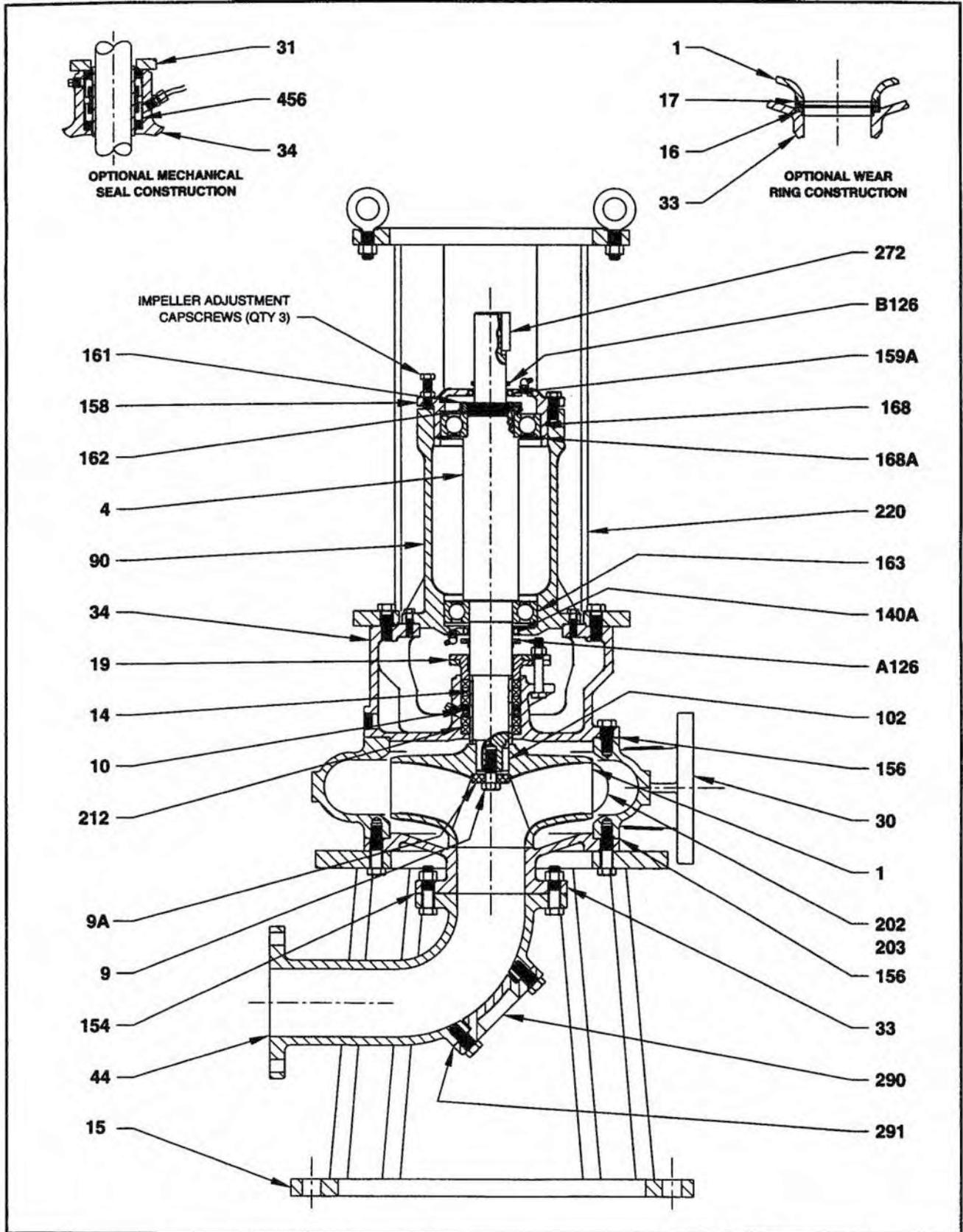
<b>10" 5420 Parts List</b>	
<b>Part No.</b>	<b>Description</b>
1	Impeller
1A	Ring, Impeller Seal
4	Shaft
9	Bolt, Impeller
10	Ring, Water Seal
14	Sleeve, Shaft
16	Wear Ring, Fronthead
17	Wear Ring, Impeller
19	Gland Half, Interlocking
28	Foot, Mounting
30	Volute
33	Fronthead
34	Backhead
90	Frame, Bearing
102	Key, Impeller
139	Housing, Radial Bearing
139A	Lip Seal
140	Cover, Bearing Housing
140A	Seal, Inner Grease
156	Gasket, Volute
158	Housing, Thrust Bearing
158A	Lip Seal
159	Cover, Thrust Bearing Housing
159A	Seal, Outer Grease
161	Locknut, Bearing
162	Lockwasher, Bearing
163	Bearing, Radial
168	Bearing, Thrust
186A	Shims, Impeller Adjustment
202	Cover, Volute Handhole
203	Gasket, Volute Handhole Cover
212	Packing
272	Key, Coupling
311	Ring, Gland





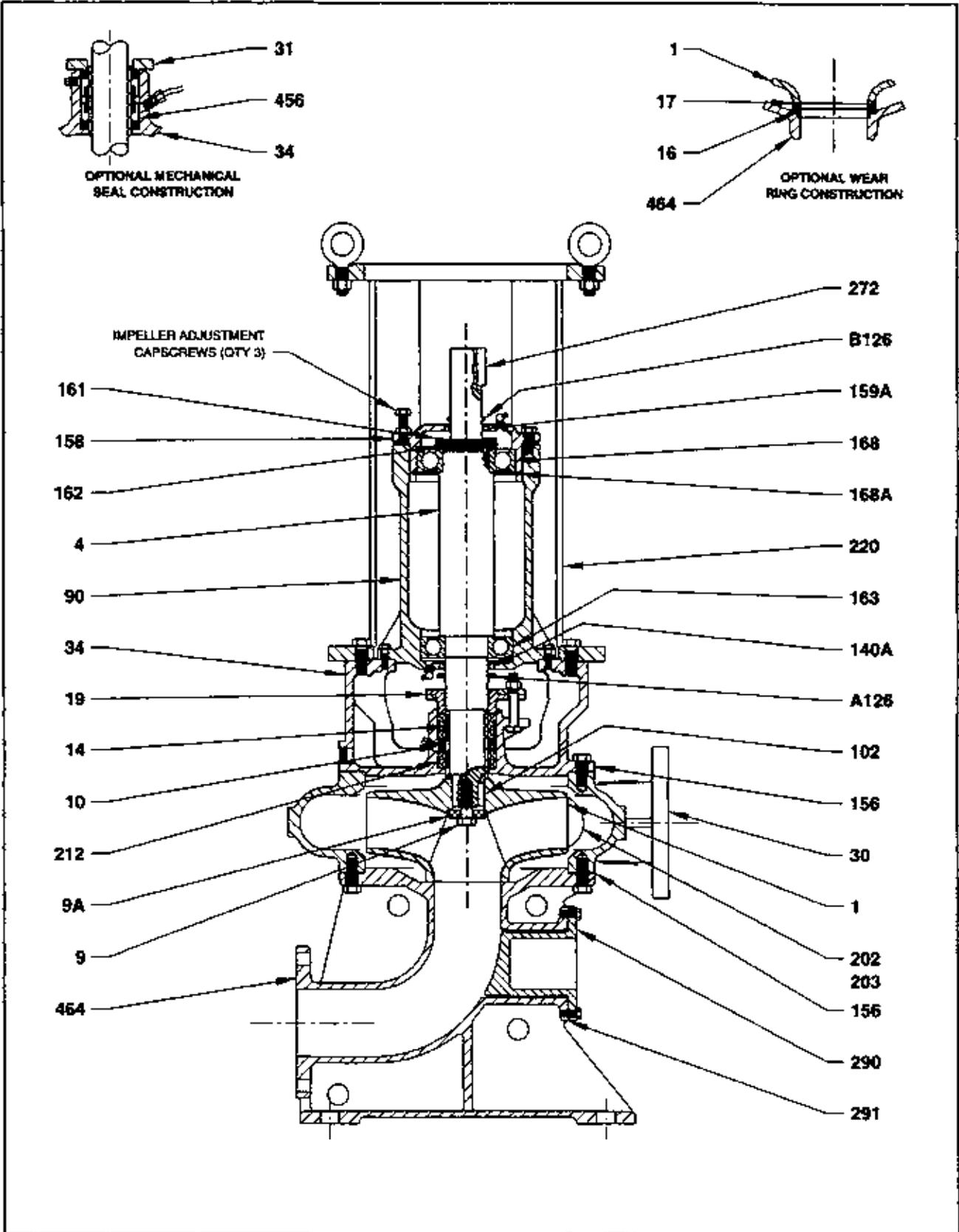
ASSEMBLY WITH COMBINATION BASE ELBOW  
B5441C T20 FRAME

PENTAIR FAIRBANKS NIJHUIS	
DWG NO 5440A002	REV NO 1



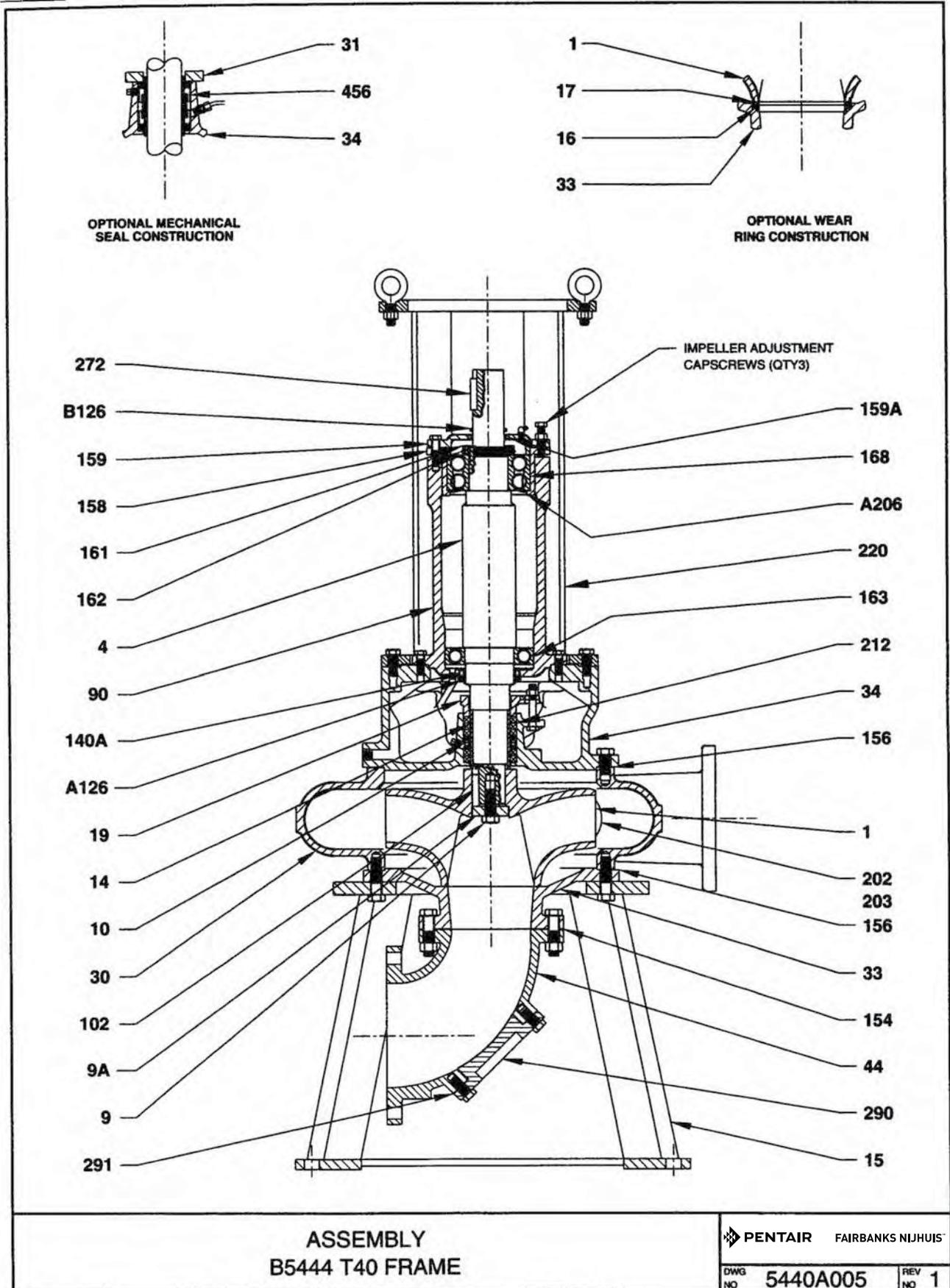
**ASSEMBLY**  
**B5442 T20 FRAME AND B5443 T30 FRAME**

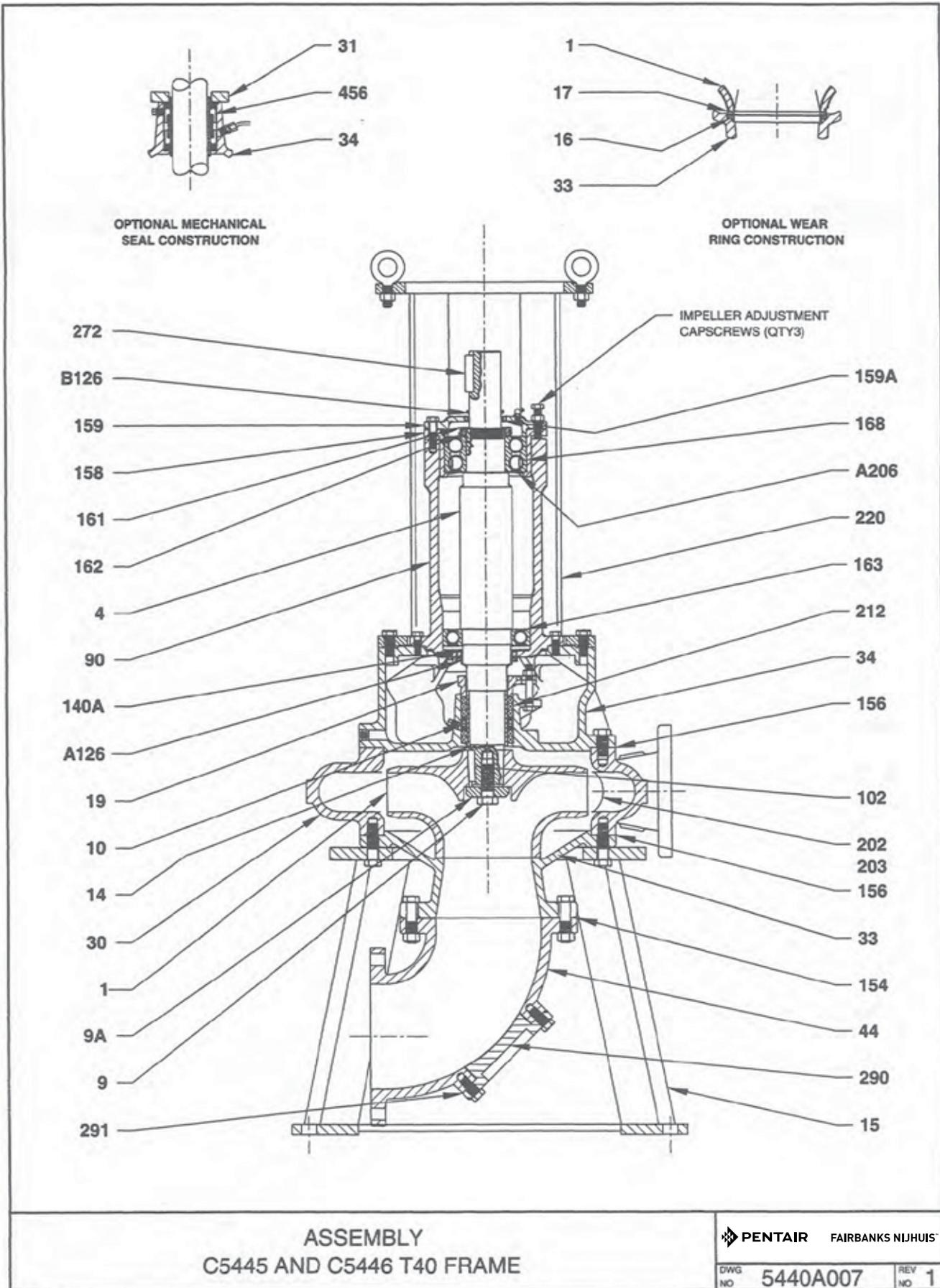
<b>PENTAIR</b> FAIRBANKS NIJHUIS®	DWG NO <b>5440A003</b> REV NO <b>1</b>
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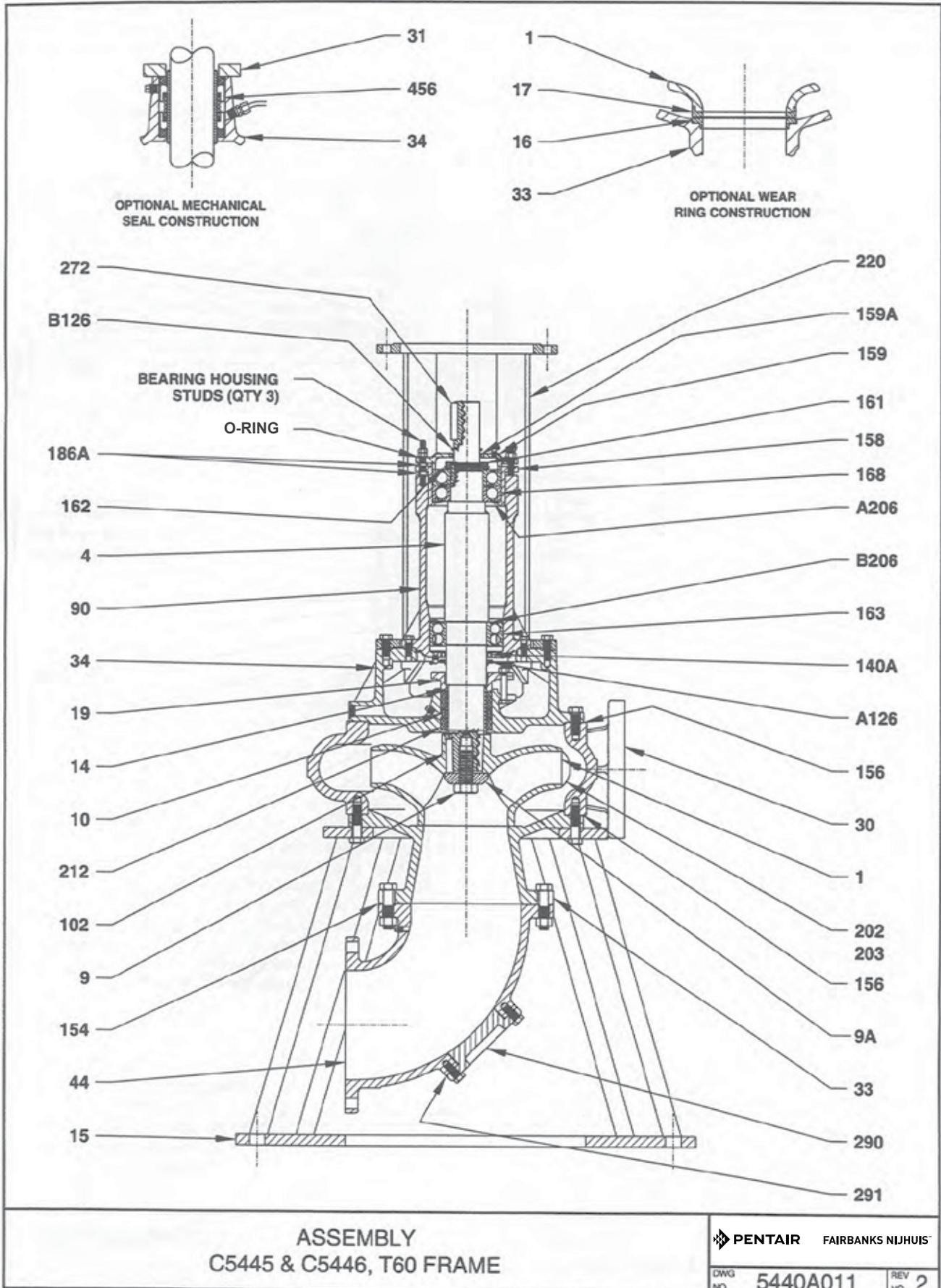


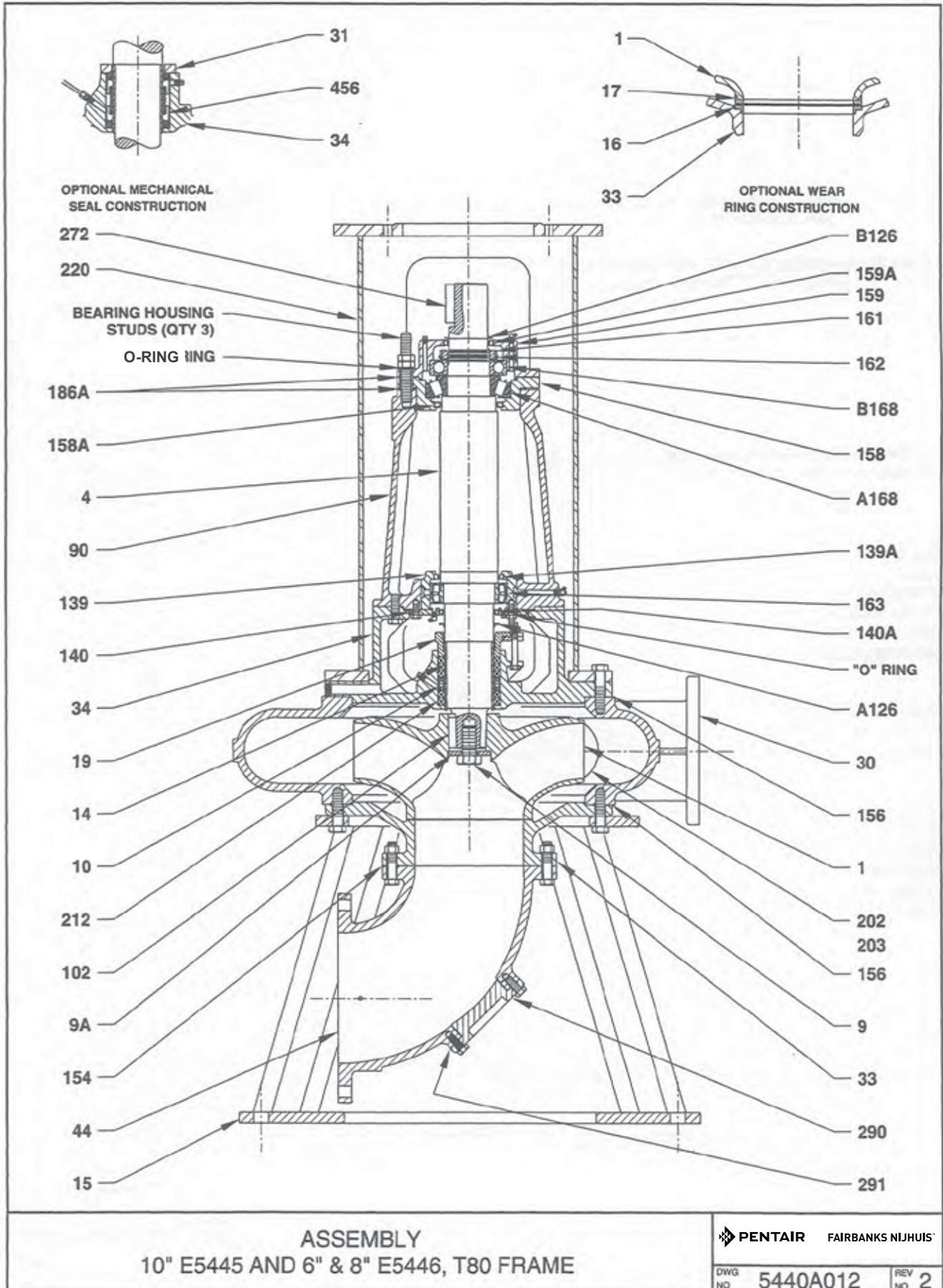
**ASSEMBLY WITH COMBINATION BASE ELBOW  
B5442C T20 FRAME AND B5443C T30 FRAME**

<b>PENTAIR</b> FAIRBANKS NIJHUIS®	
DWG NO. <b>5440A004</b>	REV NO. <b>1</b>

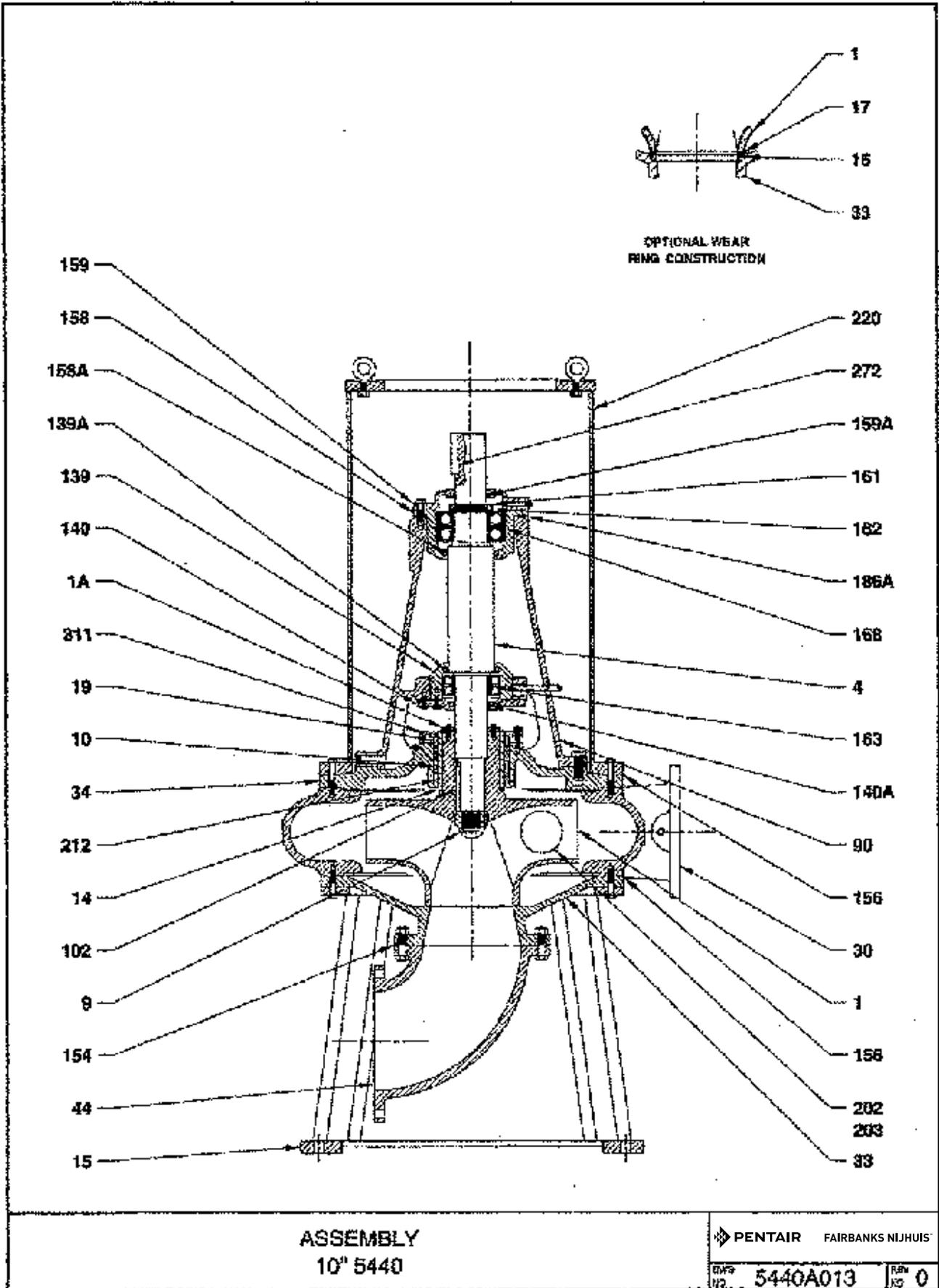








<b>5441 Through 5446 Parts List</b>	
<b>Part No.</b>	<b>Description</b>
1	Impeller
4	Shaft
9	Bolt, Impeller
9A	Washer, Impeller
10	Ring, Water Seal
14	Sleeve, Shaft
15	Base
16	Wear Ring, Fronthead
17	Wear Ring, Impeller
19	Gland Half, Interlocking
30	Volute
31	Gland, Solid
33	Fronthead
34	Backhead
44	Elbow, Suction
90	Frame, Bearing
102	Key, Impeller
A126	Deflector, Inner
B126	Deflector, Outer
139	Housing, Radial Bearing
139A	Lip Seal
140	Cover, Bearing Housing
140A	Seal, Inner Grease
154	Gasket, Elbow
156	Gasket, Volute
158	Housing, Thrust Bearing
158A	Lip Seal
159	Cover, Thrust Bearing Housing
159A	Seal, Outer Grease
161	Locknut, Bearing
162	Lockwasher, Bearing
163	Bearing, Radial
168	Bearing, Thrust
A168	Bearing, Thrust
B168	Bearing, Thrust
168A	Snap Ring, Bearing
186A	Shims, Impeller Adjustment
202	Cover, Volute Handhole
203	Gasket, Volute Handhole Cover
A206	Retainer, Inner Grease
B206	Retainer, Outer Grease
212	Packing
220	High Ring Base, with Coupling Guard
272	Key, Coupling
290	Cover, Suction Handhole
291	Gasket, Suction Handhole Cover
456	Seal, Mechanical
464	Elbow, Combination Base Suction



<b>5411 Through 5416 Parts List</b>	
<b>Part No.</b>	<b>Description</b>
1	Impeller
1A	Ring, Impeller Seal
4	Shaft
9	Bolt, Impeller
10	Ring, Water Seal
14	Sleeve, Shaft
15	Base
16	Wear Ring, Fronthead
17	Wear Ring, Impeller
19	Gland Half, Interlocking
30	Volute
33	Fronthead
34	Backhead
44	Elbow, Suction
90	Frame, Bearing
102	Key, Impeller
139	Housing, Radial Bearing
139A	Lip Seal
140	Cover, Bearing Housing
140A	Seal, Inner Grease
154	Gasket, Elbow
156	Gasket, Volute
158	Housing, Thrust Bearing
158A	Lip Seal
159	Cover, Thrust Bearing Housing
159A	Seal, Outer Grease
161	Locknut, Bearing
162	Lockwasher, Bearing
163	Bearing, Radial
168	Bearing, Thrust
186A	Shims, Impeller Adjustment
202	Cover, Volute Handhole
203	Gasket, Volute Handhole Cover
212	Packing
220	High Ring Base, with Coupling Guard
272	Key, Coupling
311	Ring, Gland

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## Fairbanks Nijhuis Standard Pump 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 will 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 EXW (Domestic Shipments) or FCA (International Shipments) 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, incidental, 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.