

EQUIPMENT REPAIR REPORT

Date:

Page 1 of 12

Customer:

Our Reference: Sales Order #5000005109

Your Reference: Spindle Oil Pump

Subject: Gould's 3196 1x2-10

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"
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Thank you for choosing ProSpec Technologies Inc. as your source for this repair estimate. We appreciate the opportunity to provide you with this assessment. Following is a report of our findings and a quotation for the work required.

EQUIPMENT INFORMATION

Description: Horizontal End Suction Pump (bare Pump)

Manufacturer: ITT Gould's

Type: ANSI

Model: 1X2-10 MT, 1800 rpm, originally supplied with 316 SS casing, 316 SS stuffing box, 316 SS impeller (impeller is currently CD4MCu)

Serial Number Reference:

Lubrication: Oil

Shaft Sealing: Empty Stuffing Box

Rotation: CW when looking from the motor

Impeller: Originally stainless steel 10.000" diameter (now 6.5" diameter)

Duty: The original duty point was 60 usgpm @ 115 feet on diesel fuel @ 300 deg F with a S.G. of 0.82.

OBSERVATIONS

We received the pump unassembled and less the mechanical seal. Upon receipt a thorough inspection of the unit was conducted. The exterior of the pump was found to be in generally good condition. The pump was originally supplied with a 316 stainless steel impeller. It has since been replaced with a CF 4MCu impeller.

Upon further investigation of the pump we found the casing as received, showing extensive damage due to erosion-corrosion. The gouging is 1/4" deep in some areas. It is likely that the fluid

is mostly free of large abrasive particles. The damage was most probably caused by a combination of abrasion from very small particles and a high fluid velocity and flow turbulence due to casing surface imperfections, discontinuity and pump operation at a very low flow causing extensive recirculation. The casing may have also suffered from the effects of the impeller contacting the casing while in operation. The casing can be weld repaired but the amount of welding required is extensive and the casing would require a complete re-machining to ensure all of the surfaces are true. Casing replacement is recommended. With the replacement of the casing and impeller the pump hydraulics will once again be in accordance with what was originally supplied.

The impeller shows evidence of erosion with the vanes worn thin and smooth. The inside of the vanes have small channels running the length of the vane. This is caused by the same erosion that is occurring in the casing. This impeller also shows signs of an impact with the casing where there is evidence of matching marks. This impeller would require extensive welding and machining. It is more economical to replace the impeller than it is to repair it.

The shaft was found in good condition. We checked the shaft for grooves and pitting. We checked the shaft for straightness and for bearing fits. All were in accordance with the attached table and the shaft is okay for re/use.

The shaft sleeve (126) is acceptable for re/use and should seal properly when used with cartridge seal. The stuffing box has some damage from the high fluid velocity / abrasion wear however it is not extensive and is acceptable for re/use.

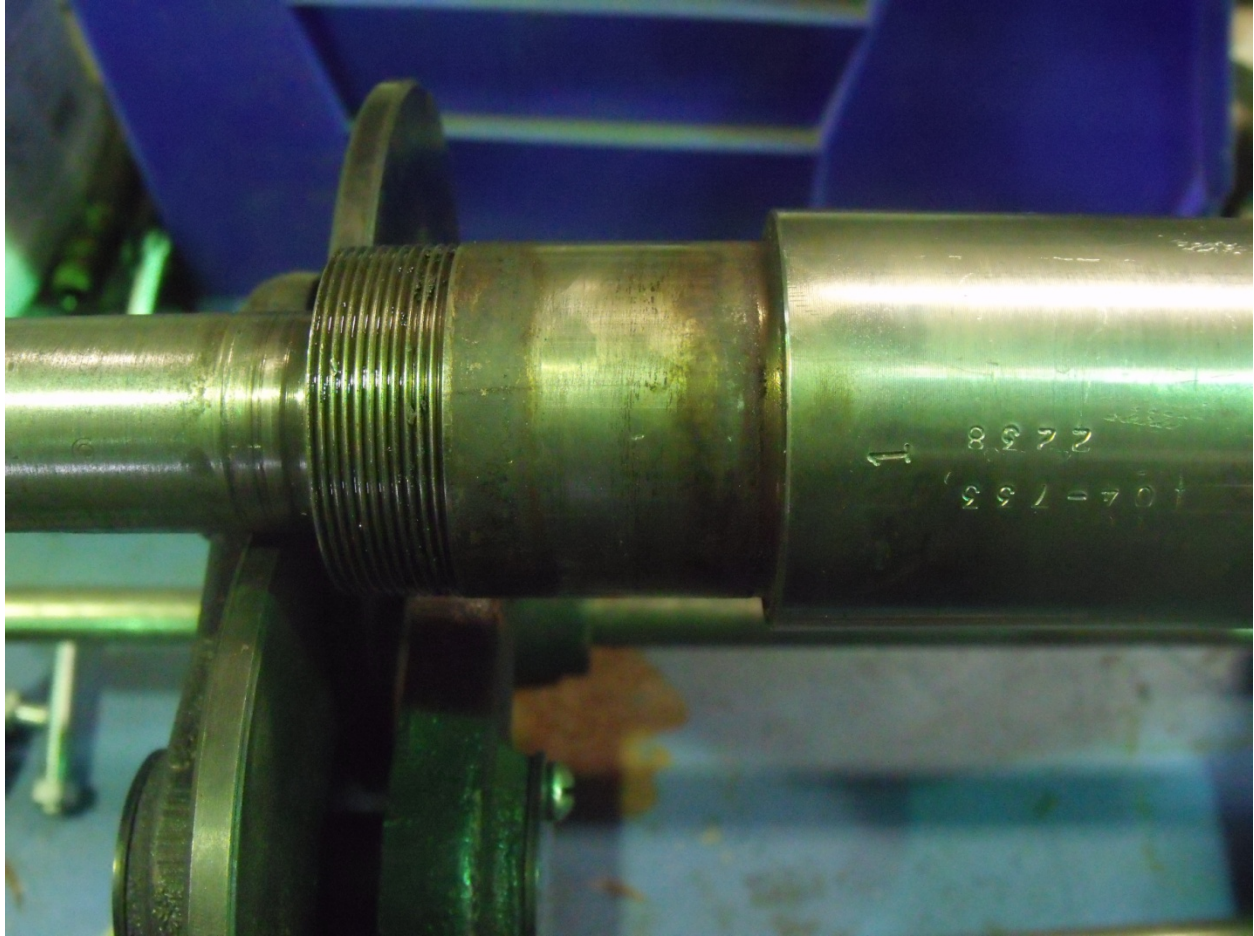
The bearing frame bearing fits on are within the manufacturers tolerance and there are no sign of spinning or extensive wear. Upon further disassembly we did find the thrust bearing (Item 112) and radial bearing (168) worn and in need of replacement.

As part of a sound repair we will replace the window site glass, bearing locknut, lock washer and change all of the o-rings and gaskets.

If we proceed with the repair we would like to confirm the operation temperature, fluid characteristic and head and flow conditions. We would like you assist in trying to resolve the wear issues on the wet end components.

SCOPE OF WORK

- Receive unit, perform initial visual inspection and record findings.
- Disassemble unit, perform rough cleaning, detailed inspection and record findings.
- Sand blast/chemically clean the parts as required and polish all machine fit surfaces.
- Clean and prepare exterior surfaces for finish coat. Mask off accordingly.
- Chase all threads, utilize new stainless steel fasteners as required and assemble with never seize thread lube.
- Reassemble pump with the new casing, impeller, lip seals, site glass, bearings and all gaskets and o-rings as required.
- Apply Goulds Blue paint to the exterior non-machined surfaces.
- Apply appropriate tags and identification plates.
- Touch up finish, package and prepare for shipment.



The shaft is in good condition 'see shaft tolerance p for details 'registered fits' measure within manufactures tolerances and the shaft has no indication of grooving or evidence of extensive wear.



The casing as received is showing extensive damage due to erosion-corrosion. The gouging is $\frac{1}{4}$ " deep in some areas. It is likely that the fluid is mostly free of large abrasive particles. The damage was most probably caused by a combination of high fluid velocity and flow turbulence due to casing surface imperfections and discontinuity as well as the effects of the impeller contacting the casing while in operation.



The impeller shows evidence of erosion. The inside of the vanes have small channels running the length of the vane, this is caused by the same erosion that is occurring in the casing. This impeller also shows signs of an impact most likely with the casing where there is evidence matching the marks on the impeller. This impeller would require extensive welding and machining. It is more economical to replace the impeller than it is to repair it.

INSPECTIONS

The pump parts must be inspected to the following criteria before they are reassembled to insure the pump will run properly. Any part not meeting the required criteria should be replaced.

NOTE: Clean parts in solvent to remove oil, grease or dirt. Protect machined surfaces against damage during cleaning.

Casing

The casing (100) should be inspected for cracks and excessive wear or pitting. It should be repaired or replaced if it exceeds the following criteria (Figs. 88, 89 & 90).

1. Localized wear or grooving greater than 1/8 in. (3.2 mm) deep.
2. Pitting greater than 1/8 in. (3.2 mm) deep.
3. Inspect case gasket seat surface for irregularities.

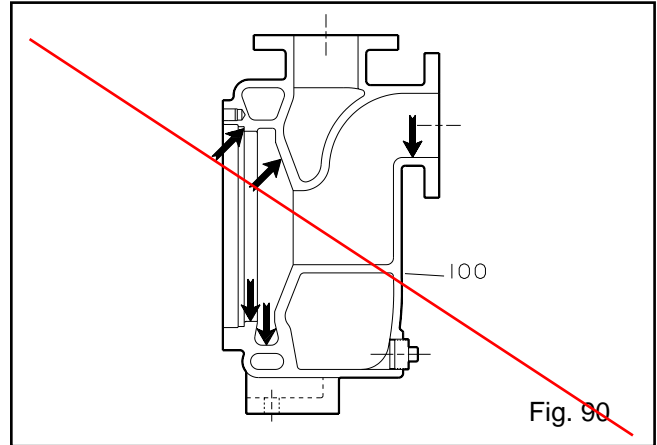


Fig. 90

Impeller

1. Inspect impeller (101) vanes for damage. Replace if grooved deeper than 1/16 in. (1.6 mm) or if worn evenly more than 1/32 in. (0.8 mm). (Area "a" in Fig. 91).
2. Inspect pumpout vanes for damage. Replace if worn more than 1/32 in. (0.8 mm). (Area "b" in Fig. 91).
3. Inspect leading and trailing edges of the vanes for cracks, pitting, and erosion or corrosion damage. (Area "c" in Fig. 91).

The cut water is eroded

Severe wear (see photos). wear greater than 1/8" deep

3196, HT 3196,
LF 3196, NM 3196,
3198

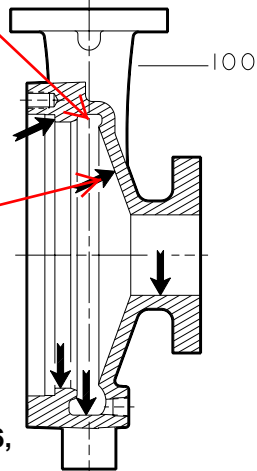


Fig. 88

The impeller is severely worn at the locations c and a. See photo

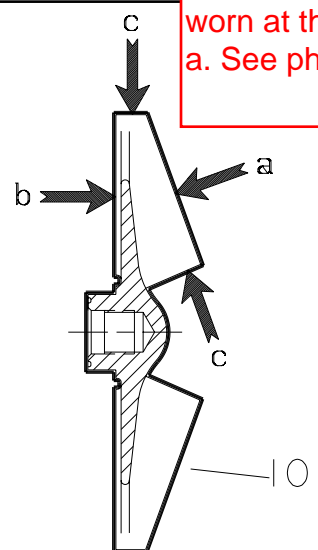
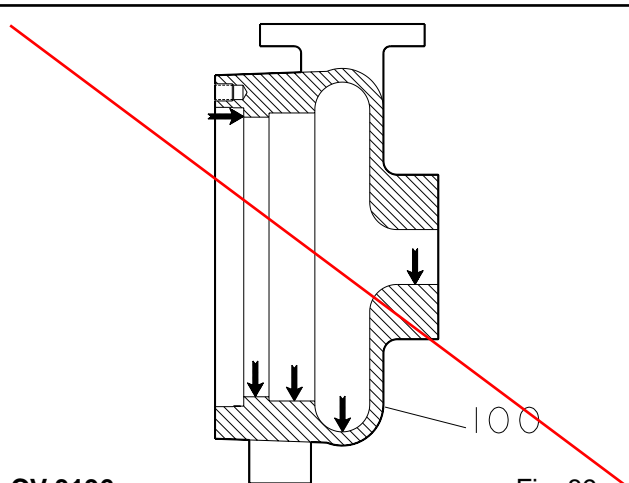
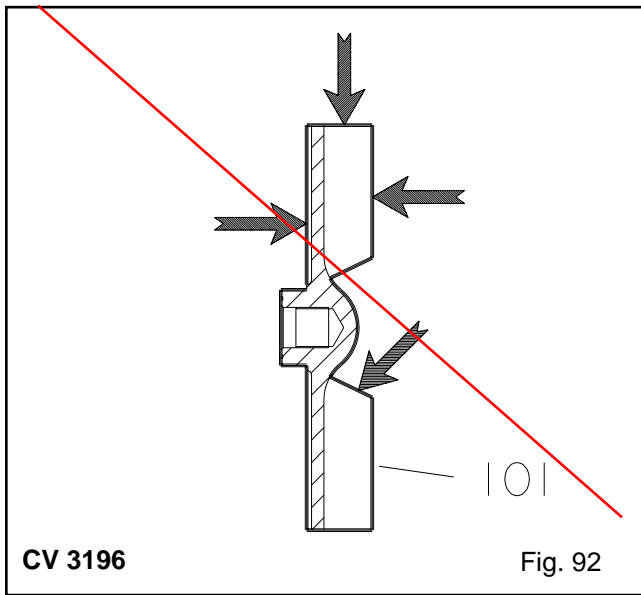


Fig. 91



CV 3196

Fig. 89



CV 3196

Fig. 92

NOTE: For CV 3196 impeller, the face of the impeller is cast, not machined. The face runout need not be checked.

Frame Adapter

1. Check frame adapter (108) for cracks or excessive corrosion damage. Replace if any of these conditions exist (Fig. 93).
2. Make sure gasket surface is clean.

NOTE: The 3198 frame adapter is not interchangeable with any other model's adapter.

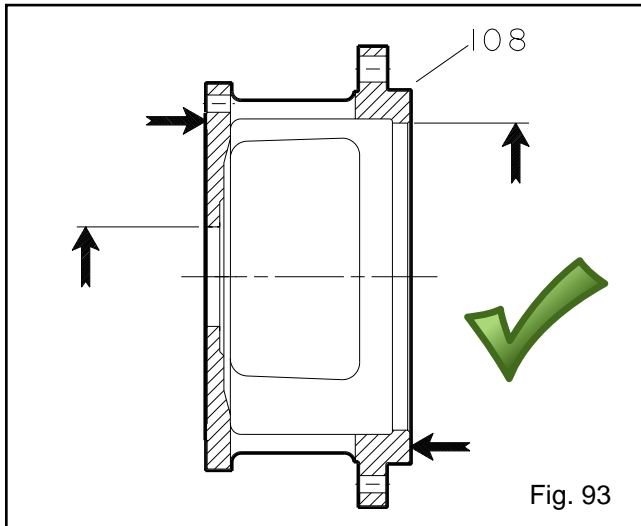


Fig. 93

Shaft and Sleeve - All Except 3198

1. Check bearing fits. If any are outside the tolerance in Table 8, replace the shaft (122) (Fig. 94).
2. Check shaft straightness. Replace shaft if runout exceeds values in Table 12.
3. Check shaft and sleeve (126) surface for grooves, pitting. Replace if any are found (Fig. 95).

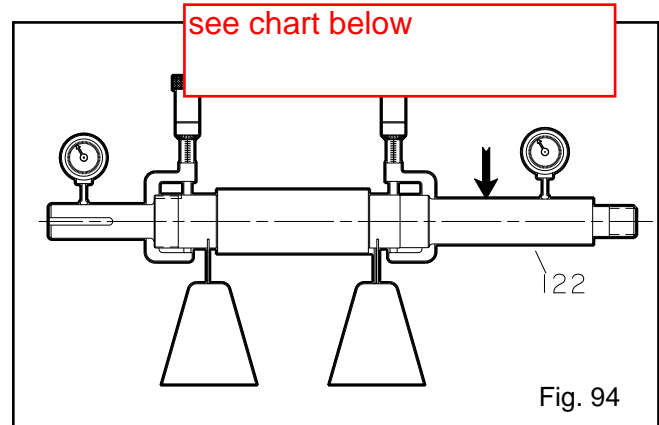


Fig. 94

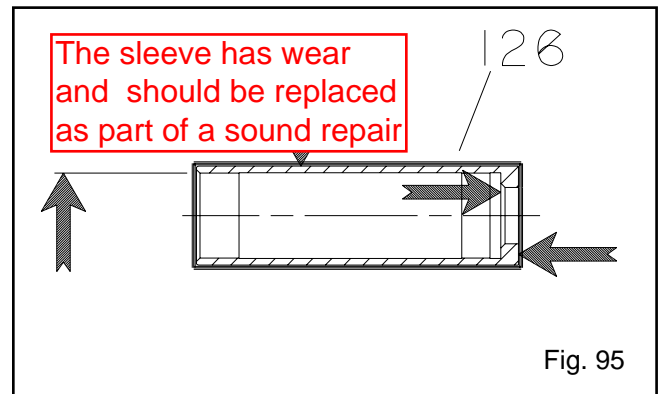


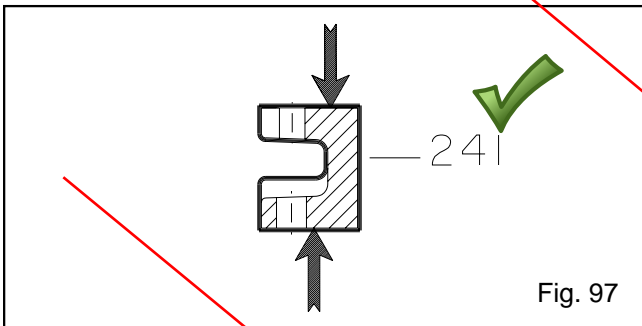
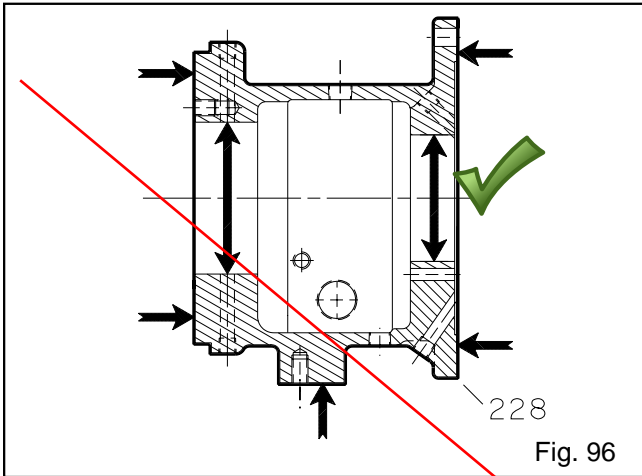
Fig. 95

Shaft and Sleeve - 3198

The 3198 is offered with a metallic sleeve which uses the standard 3196 (ANSI products) shaft. It is also offered with a Teflon® sleeve. The use of the Teflon® sleeve requires a special shaft and a different inboard labyrinth oil seal. The inspection procedures are the same as those listed above for the balance of the products.

Bearing Frame

1. Visually inspect bearing frame (228) and frame foot (241) for cracks. Check frame inside surfaces for rust, scale or debris. Remove all loose and foreign material (Figs. 96, 97).
2. Make sure all lubrication passages are clear.
3. If frame has been exposed to pumpage, inspect for corrosion or pitting.
4. Inspect inboard bearing bore according to the Alignment Troubleshooting table found in the *Installation* section.



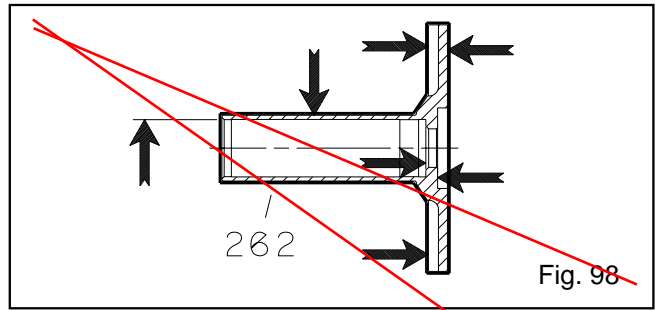
C-Face Adapter

For C-Face adapter inspections, See *Appendix V*.

Dynamic Seal Repeller

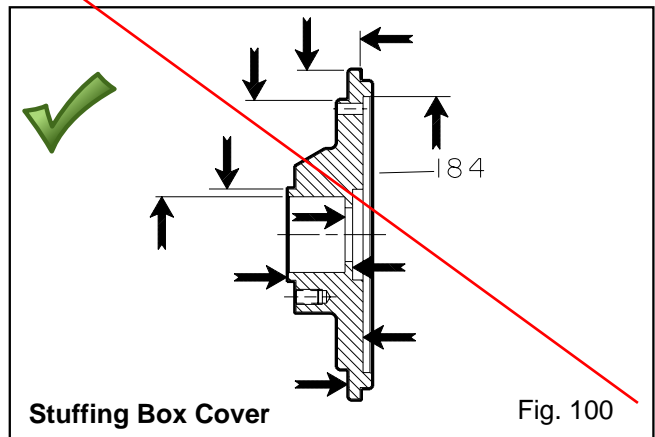
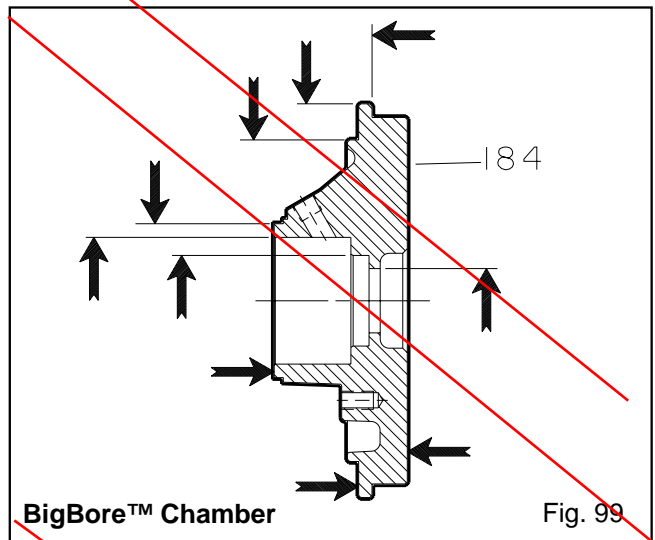
(3196, CV 3196, LF 3196 only)

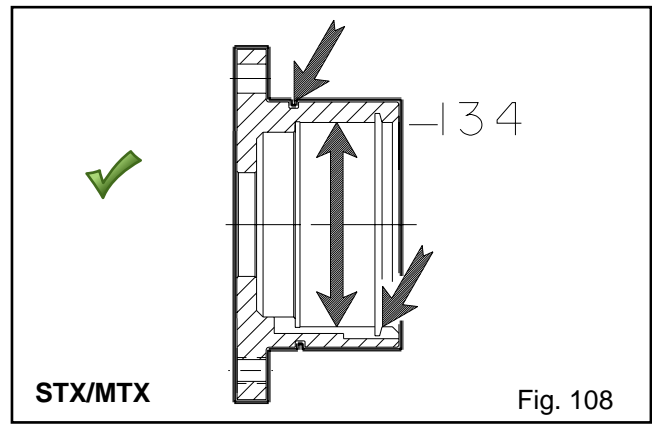
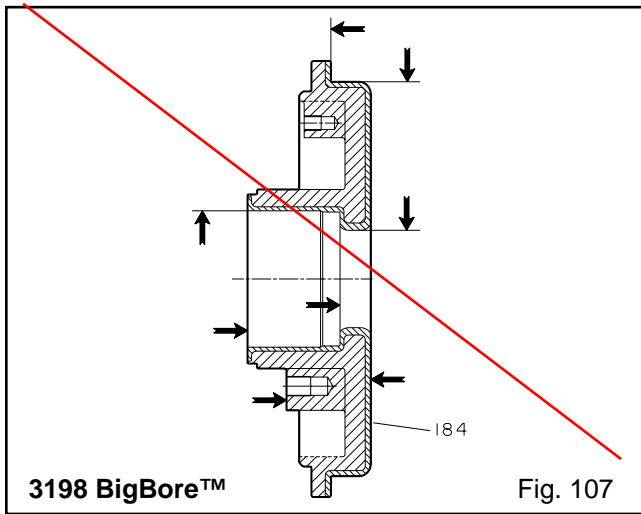
1. Inspect dynamic seal repeller (262) vanes for damage. Replace if grooved deeper than 1/16 in. (1.6 mm) or if worn evenly more than 1/32 in. (0.8 mm) (Fig. 98).
2. Inspect sleeve surface for grooves, pitting or other damage. Replace if damaged.



Seal Chamber/Stuffing Box Cover and Dynamic Seal Backplate

1. Make sure seal chamber/stuffing box cover (184) and dynamic seal backplate (444) gasket surface is clean at adapter face (Figs. 99 - 107).
2. Replace if there is any pitting or wear greater than 1/8 in. (3.2 mm) deep.





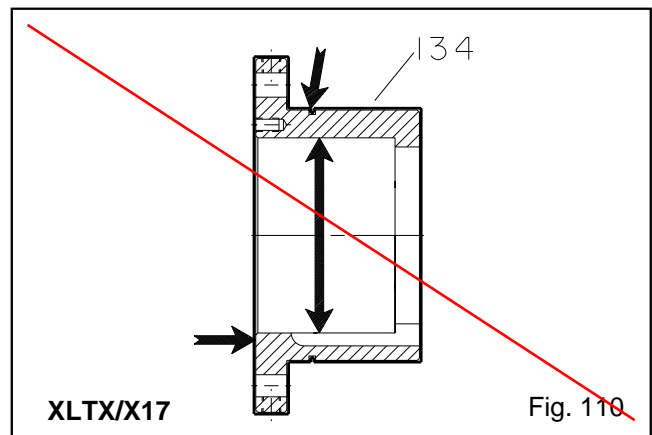
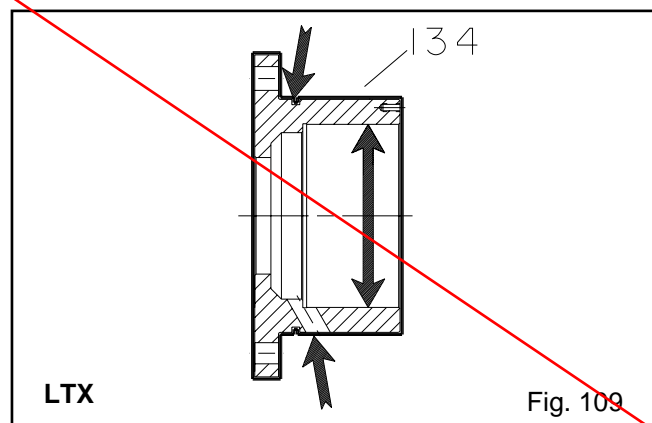
Bearings

1. Ball bearings (112A, 168A) should be inspected for contamination and damage. The condition of the bearings will provide useful information on operating conditions in the bearing frame. Lubricant condition and residue should be noted, oil analysis is often helpful. Bearing damage should be investigated to determine cause. If cause is not normal wear, it should be corrected before pump is returned to service.

DO NOT RE-USE BEARINGS.

Bearing Housing

1. Inspect bearing housing (134) bore according to *Table 8*. Replace if dimensions exceed *Table 8* values.
2. Visually inspect for cracks and pits.
 - STX, MTX* - Snap ring groove must not be cracked (Fig. 108).
 - LTX* - Grooves and holes must be clear (Fig. 109).
 - XLTX-X, X17* - Gasket surface must be clean (Fig. 110).



6

Labyrinth Seals

1. Labyrinth seal (332A, 333A) O-rings should be inspected for cuts and cracks. Replace as needed.

**Table 8
Bearing Fits & Tolerances**

According to ABEC I standard

| | STX in. (mm) | MTX in. (mm) | LTX in. (mm) | XLT-X, X-17 in. (mm) |
|----------------------------------|--|--|--|--|
| Shaft O.D. Inboard | 1.3785 (35.013) 1.3781 (35.002) | 1.772 1.7722 (45.013) ✓ 1.7718 (45.002) | 2.1660 (55.015) 2.1655 (55.002) | 2.5597 (65.015) 2.5592 (65.002) |
| Clearance | 0.0010 (0.025) tight 0.0001 (0.002) tight | 0.0010 (0.025) tight 0.0001 (0.002) tight | 0.0012 (0.030) tight 0.0001 (0.002) tight | 0.0012 (0.030) tight 0.0001 (0.002) tight |
| Bearing I.D. Inboard | 1.3780 (35.000) 1.3775 (34.988) | 1.7717 (45.000) 1.7712 (44.988) | 2.1654 (55.000) 2.1648 (54.985) | 2.5591 (65.000) 2.5585 (64.985) |
| Frame I.D. Inboard | 2.8346 (72.000) 2.8353 (72.019) | 3.937 3.9370 (100.000) ✓ 3.9379 (100.022) | 4.7244 (120.000) 4.7253 (120.022) | 5.5118 (140.000) 5.5128 (140.025) |
| Clearance | 0.0012 (0.032) loose 0.0000 (0.000) loose | 0.0015 (0.037) loose 0.0000 (0.000) loose | 0.0015 (0.037) loose 0.0000 (0.000) loose | 0.0017 (0.043) loose 0.0000 (0.000) loose |
| Bearing O.D. Inboard | 2.8346 (72.000) 2.8341 (71.987) | 3.9370 (100.000) 3.9364 (99.985) | 4.7244 (120.000) 4.7238 (119.985) | 5.5118 (140.000) 5.5111 (139.982) |
| Shaft O.D. Outboard | 1.1815 (30.011) 1.1812 (30.002) | 1.772 1.7722 (45.013) ✓ 1.7718 (45.002) | 1.9690 (50.013) 1.9686 (50.002) | 2.5597 (65.015) 2.5592 (65.002) |
| Clearance | 0.0008 (0.021) tight 0.0001 (0.002) tight | 0.0010 (0.025) tight 0.0001 (0.002) tight | 0.0010 (0.025) tight 0.0001 (0.002) tight | 0.0012 (0.030) tight 0.0001 (0.002) tight |
| Bearing I.D. Outboard | 1.1811 (30.000) 1.1807 (29.990) | 1.7717 (45.000) 1.7712 (44.988) | 1.9685 (50.000) 1.9680 (49.988) | 2.5591 (65.000) 2.5585 (64.985) |
| Housing I.D. Outboard | 2.8346 (72.000) 2.8353 (72.019) | 3.937 3.9370 (100.000) ✓ 3.9379 (100.022) | 4.3307 (110.000) 4.3316 (110.022) | 5.5118 (140.000) 5.5128 (140.025) |
| Clearance | 0.0012 (0.032) loose 0.0000 (0.000) loose | 0.0015 (0.037) loose 0.0000 (0.000) loose | 0.0015 (0.037) loose 0.0000 (0.000) loose | 0.0017 (0.043) loose 0.0000 (0.000) loose |
| Bearing O.D. Outboard | 2.8346 (72.000) 2.8341 (71.987) | 3.9370 (100.000) 3.9364 (99.985) | 4.3307 (110.000) 4.3301 (109.985) | 5.5118 (140.000) 5.5111 (139.982) |

SHAFT RUNOUT CHECK

Sales Order Number 500005109

Run out on pump disassembly

| At Coupling Diameter | At Bearing Diameter 1 | At Bearing Diameter 2 | At Impeller Diameter |
|----------------------|-----------------------|-----------------------|----------------------|
| 0.000 | 0.0000 | 0.0000 | 0.002 |

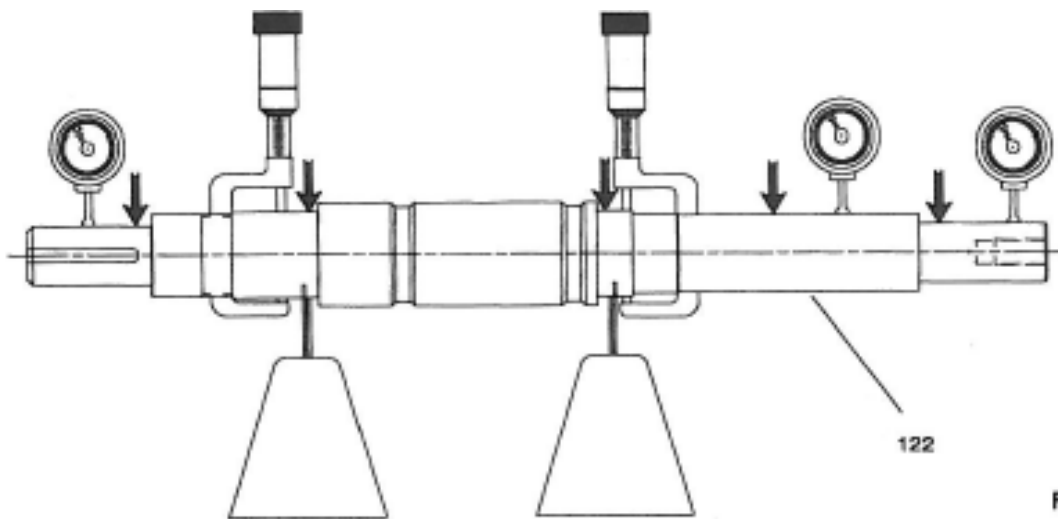


Fig. 33

Completed repair at shipping.

