

File: SERVICE MANUAL — Section 70
Replaces: Nothing (New Information)
Dist: 3, 3b, 3c

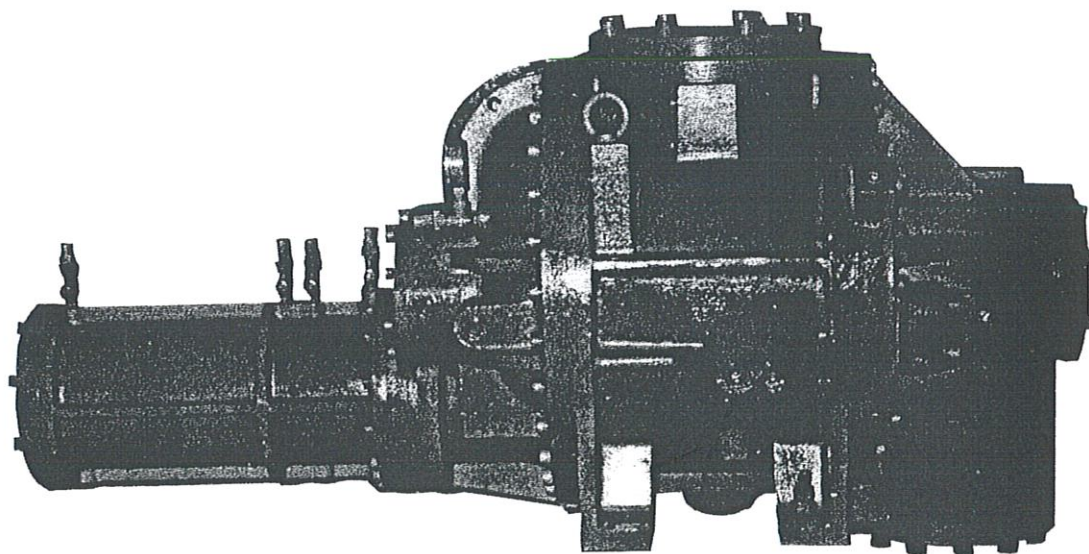
115
S70-117 SM/OCT 85



Service Manual

FRICK ROTARY SCREW COMPRESSORS

Models TDSH-163 thru -283



FRICK TDSH SCREW COMPRESSOR
SERVICE MANUAL

TABLE OF CONTENTS

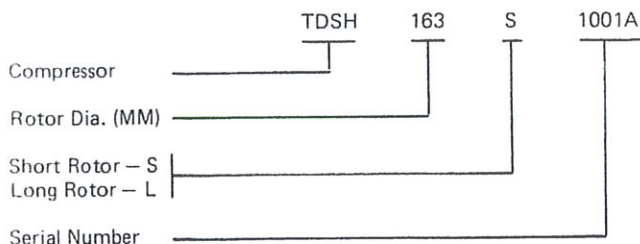
GENERAL	Page
General Maintenance	3
Preventive Maintenance Inspection	3
Inspection Schedule	3
SECTION 1 - SHAFT SEAL	
Removal	4
Installation	5
OUTDATED - USE S70-251 SM	
SECTION 2 - SLIDE VALVE CONTROL	
Removal	6
Installation	6
SECTION 3 - SLIDE STOP INDICATOR	
Removal	7
Installation	7
SECTION 4 - CYLINDER ASSEMBLY, TDSH-163, 193 and 233	
Removal	8
Disassembly	9, 10
Inspection	10
Assembly	11
Installation	12
SECTION 4A - CYLINDER ASSEMBLY, TDSH 283	
Removal and Disassembly	13
Disassembly - Slide Stop, Slide Valve	14
Inspection	14
Assembly and Installation	14
SECTION 5 - TDSH COMPRESSOR	
Disassembly	15 thru 17
Assembly	18 thru 21
SECTION 6 - COMPRESSOR TO BASE INSTALLATION	21

GENERAL

This manual provides recommended instructions for removal, disassembly, assembly and installation of all Frick manufactured TDSH compressors installed on RWB II units.

Whenever contacting Frick Company for parts orders or technical inquiries the full model and serial number must be used to avoid errors.

MODEL and SERIAL NUMBER EXPLANATION



GENERAL MAINTENANCE

Proper maintenance is important in order to assure long and trouble-free service from your screw compressor. Some areas critical to good compressor operation are:

1. Keep refrigerant and oil clean and dry, avoid moisture contamination. After servicing any portion of the refrigeration system, evacuate to remove moisture before returning to service. Water vapor condensing in the compressor while running, or more likely while shut down, can cause rusting of critical components and reduce life.
2. Keep suction strainer clean. Check periodically, particularly on new systems where welding slag or pipe scale could find its way to the compressor suction. Excessive dirt in the suction strainer could cause it to collapse, dumping particles into the compressors.
3. Keep oil filters clean. If filters show increasing pressure drop indicating dirt or water, stop compressor and change filters. Running a compressor for long periods with high filter pressure drop can starve the compressor for oil and lead to premature bearing failure.
4. Avoid slugging compressor with liquid refrigerant. While screw compressors are probably the most tolerant to ingestion of some refrigerant liquid of any compressor type available today, they are not liquid pumps. Make certain to maintain adequate superheat and properly size suction accumulators to avoid dumping liquid refrigerant into compressor suction.

Keep liquid injection valves properly adjusted and in good condition to avoid flooding compressor with liquid. Liquid can cause a reduction in compressor life and in extreme cases can cause complete failure.

5. Protect compressor during long periods of shut down. If compressor will be setting for long periods without running it is advisable to evacuate to low pressure and charge with dry nitrogen or oil, particularly on systems known to contain water vapor.
6. Preventive maintenance inspection is recommended any time a compressor exhibits a noticeable change in vibration level, noise or performance.

PREVENTIVE MAINTENANCE INSPECTION and SERVICE

Frick TDSH screw compressors are designed and manufactured to give many years of trouble-free operation. A preventive maintenance program assures this maximum compressor life and minimizes costly unscheduled unit downtime. Immediate inspection should be made if increased sound or vibration, increased shaft seal leakage, erratic slide valve operation, fluctuating oil pressure, loss of compressor efficiency, increased oil usage or oil contamination is noticed. Major inspection should be made, per the following schedule, even if no deviations from normal operation is noticed:

MAJOR INSPECTION and SERVICE INTERVALS (MAY INCLUDE BEARING REPLACEMENT)

BOOSTER DUTY	75,000 HRS
HIGH STAGE DUTY	40,000 HRS
GAS PROCESSING OR HEAT PUMP DUTY HIGHER THAN NORMAL HIGH STAGE OPERATING PRESSURES	25,000 HRS

See unit IOM manual for maintenance and service required on other unit components.

TORQUE DATA

Fastener torque data is listed below. REFER TO THIS DURING ASSEMBLY AND INSTALLATION.

TORQUE SPECIFICATIONS BASED ON LUBRICATED APPLICATION

CAP SCREW	TORQUE FT/LB	SIZE SOCKET
M 4	2	3
5	4	4
6	7	5
8	18	6
12	58	10
16	144	14
20	260	17
22	368	17

TOOL KIT

A kit of special tools required for servicing the TDSH compressor is available and consists of one (1) each of the following:

Male Thrust Bearing Tool
Female Thrust Bearing Tool
Lock Washer Tab Bender Tool
Slide Valve Locking Tool
Rotor Endplay Checking Tool
Spindle Extension Tool (TDSH -283)
Male Rotor Locknut Spanner Wrench
Spindle Locknut Spanner Wrench
Slide Stop Piston Spanner Wrench
Seal Housing Puller
Inlet Bore Cover and Balance Piston Puller
Female Outlet Cover

SECTION 2 — SLIDE VALVE CONTROL POTENTIOMETER and SEAL REPLACEMENT

Two different types of seals have been used for sealing the potentiometer control rod.

The service procedure is the same for both arrangements.

A. REMOVAL

1. Remove slide valve potentiometer cover and cover gasket. Discard gasket.
2. Remove and replace potentiometer if faulty. Refer to S70-115 IOM, Section 4-3-2.3-5 for procedure.
3. Remove potentiometer mounting bracket. FIG. 7
4. Remove plug from cylinder bottom port SC1 and drain oil. Reinstall plug.
5. Remove helical rod, rod seal and cylinder cover assembly.
6. Remove helical rod seal as outlined below.
 - A. Remove and retain collar or snap ring as applicable.
 - B. Remove seal cover plate and pull helical rod from cylinder cover.
 - C. From cylinder cover remove and discard O-ring or V-Ring seal as applicable.

B. INSTALLATION

1. Install a new oiled O-ring or ~~V-ring seal assembly as applicable~~ in cylinder cover.
2. Install helical rod and seal cover plate.
3. Secure helical rod using retained collar or snap ring. Rod must turn freely.

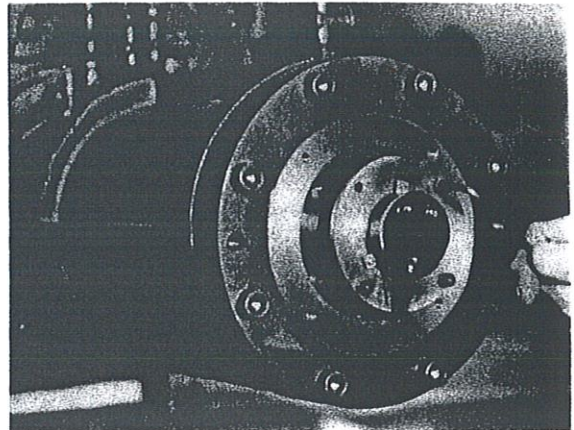
NOTE: When collar is used with the helical rod pushed against cylinder cover there must be .005 inch clearance between collar and seal cover plate.

4. Install assembled helical rod, rod seal and cylinder cover.

CAUTION: Make sure groove in helical rod engages with drive pin in slide valve spindle.

5. Install potentiometer mounting bracket, potentiometer, new cover gasket and cover.

FIG.
7



SECTION 3 — SLIDE STOP POTENTIOMETER and ROD RE-PLACEMENT

A. REMOVAL

1. Remove slide stop potentiometer cover and cover gasket. Discard gasket.
2. Remove and replace potentiometer if faulty or remove mounting bracket with potentiometer attached. Refer to S70-115 IOM, Section 4-3-2.3-6 for procedure. Fig. 8.

NOTE: Early versions of the TDSH compressor used an adjustable potentiometer mounting bracket. When replacing potentiometer on these compressors remove and discard mounting bracket as potentiometer is furnished with bracket.

3. Remove seal plug, slide stop indicator rod, spacer, spring and plug external O-ring. Discard O-ring. FIG. 9 and 10
4. Remove indicator rod and internal O-ring from seal plug. Discard O-ring.

B. INSTALLATION

1. Install in the reverse order of removal using new oil coated O-rings and gasket.

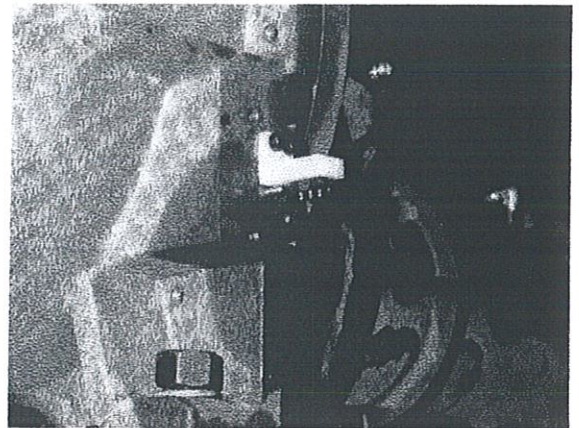


FIG.
8

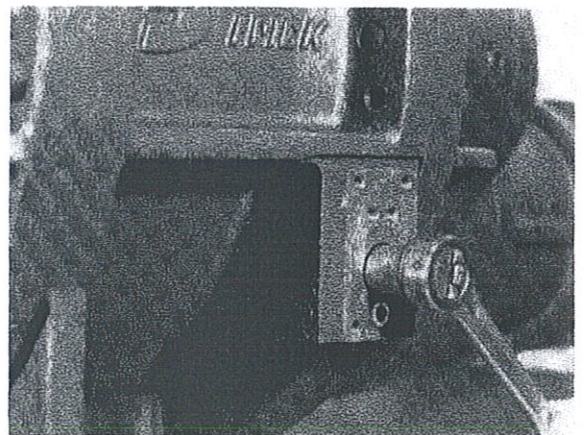


FIG.
9

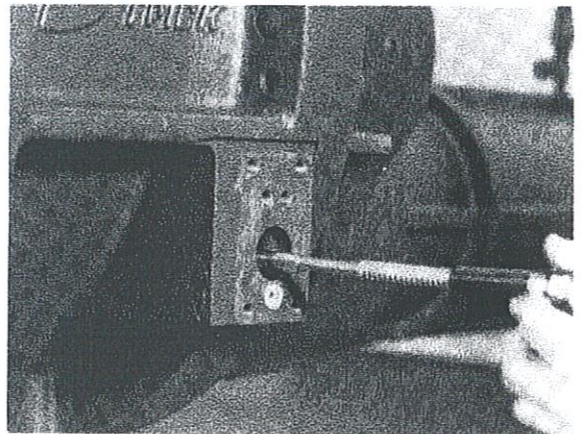
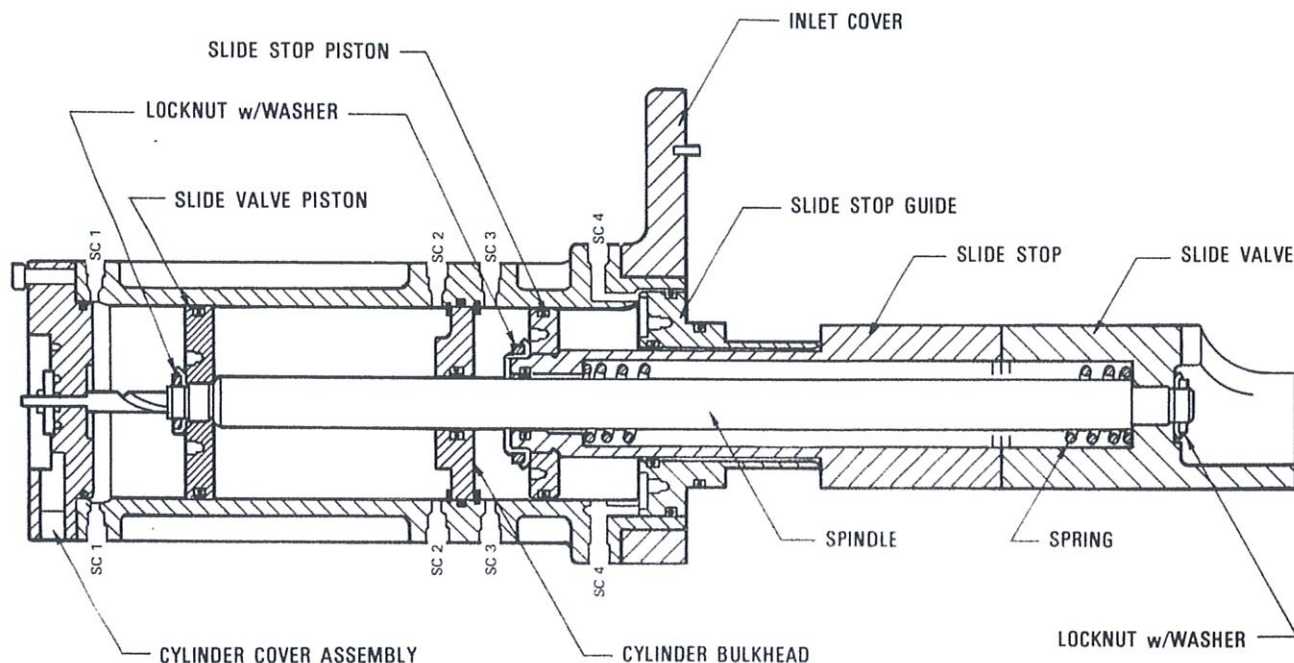


FIG.
10

SECTION 4 — CYLINDER ASSEMBLY - TDSH 163, 193 and 233



A. REMOVAL

WARNING — SLIDE STOP POTENTIOMETER AND INDICATOR ROD MUST BE REMOVED PRIOR TO REMOVING CYLINDER ASSEMBLY.

1. Remove plug from oil drain port SC9 located in bottom center of inlet case and drain oil. Reinstall plug.
2. Remove the four (4) plugs from cylinder drain ports SC1, 2, 3, and 4 located in the bottom of the cylinder and drain oil. Reinstall plugs.

NOTE: Early versions of the TDSH compressors do not have these drain plugs.

3. Remove slide valve potentiometer cover, cover gasket, potentiometer and mounting bracket. Refer to Section 2.
4. Remove slide stop potentiometer cover, cover gasket, potentiometer and mounting bracket. Refer to Section 3.
5. Remove cap screws attaching cylinder assembly and inlet cover to inlet case. FIG. 11
6. Install a 3/8" valve in cylinder top port SC2 and pressurize with dry nitrogen to 30 psig.
7. Attach a sling to support and balance the cylinder assembly, pull assembly straight out until slide valve clears inlet case.

NOTE: A fabricated lifting eye using 3/8" pipe installed in cylinder top port SC4 may be used in lieu of sling. FIG. 12

8. Crack valve in port SC2, slowly bleed pressure to atmosphere, allowing slide valve to extend to its full stroke.

WARNING — Use caution as spring pressure is considerable.

FIG. 11

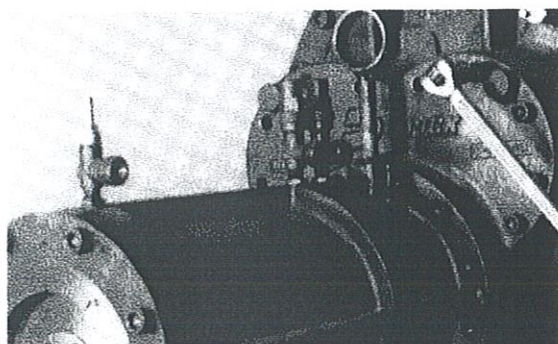
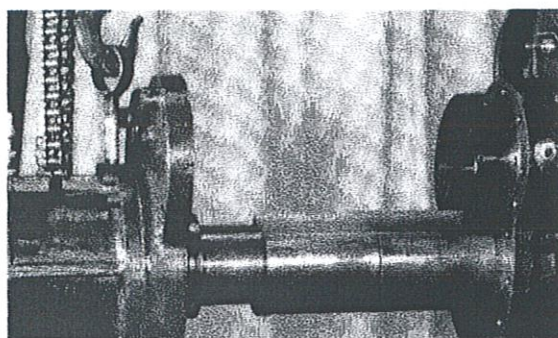


FIG. 12



B. DISASSEMBLY

It is recommended that when disassembling the cylinder assembly all O-rings, glyd rings and lock washers be removed and discarded.

1. Remove inlet cover from cylinder assembly.
2. Remove cylinder cover. FIG. 13

CAUTION — To prevent damage to potentiometer shaft pull cover straight off until shaft is disengaged from drive pin in spindle.

3. Set cylinder upon cylinder cover face — slide valve up. FIG. 14

WARNING — Slide valve is under high spring tension, use caution in disassembly.

4. Bend back tab on slide valve locknut lock washer.
5. While pressing down on slide valve to relieve pressure on locknut, remove locknut and lock washer. FIG. 15
6. Slowly release spring pressure letting slide valve slide up off spindle.
7. Remove spring and reinstall locknut.
8. Install a 3/8" valve in cylinder top port SC3 and slowly pressurize with dry nitrogen until movable stop assembly pops out of cylinder. Lift stop assembly off spindle. FIG. 16 and 17

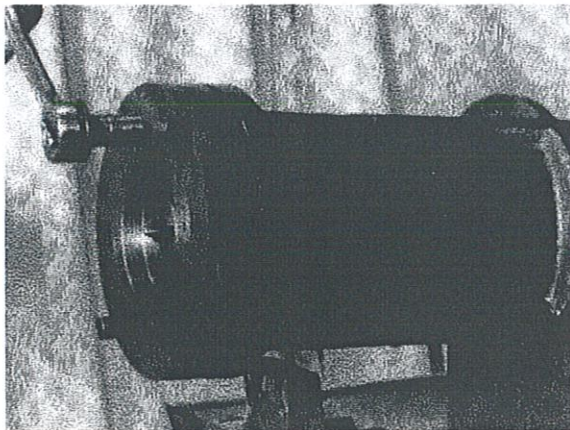


FIG.
13

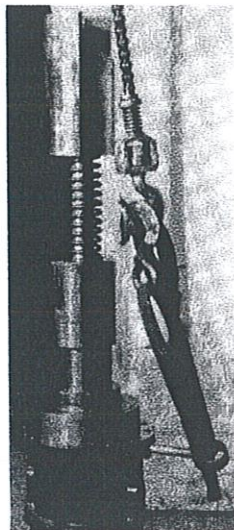


FIG.
14

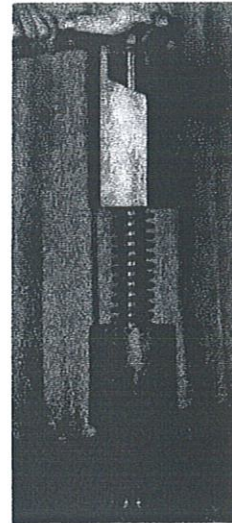


FIG.
15

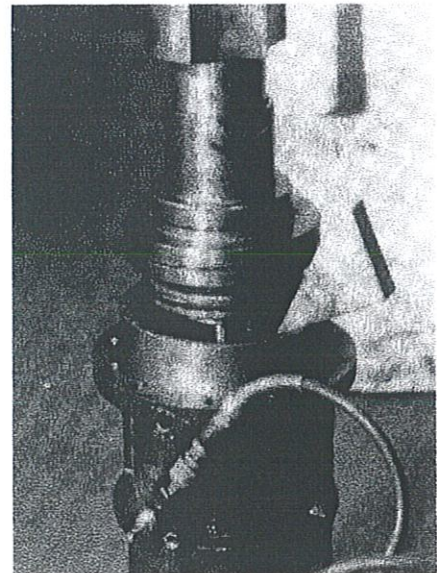


FIG.
16

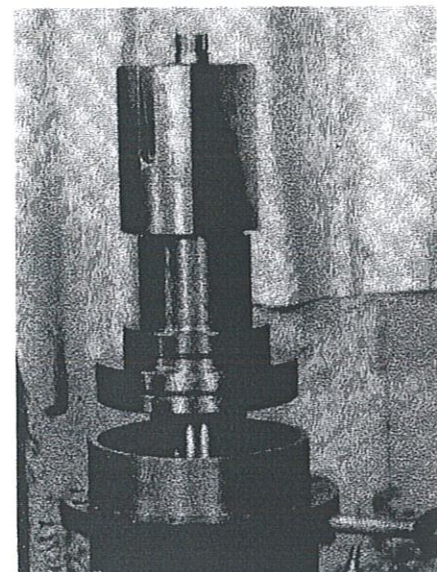


FIG.
17

9. Place cylinder on its side. Bend back lock washer tab securing slide valve piston locknut. Remove locknut, lock washer and slide valve piston. Discard lock washer. FIG. 18

NOTE: On compressors operating at less than 2500 RPM remove the slide valve piston stop which is on the spindle between piston and bulkhead.

10. From the compressor end of the cylinder remove the spindle.
11. Remove and retain snap rings securing bulkhead in cylinder. FIG. 19
12. Use a wood block to push bulkhead from cylinder. FIG. 20
13. Bend back tab on slide stop piston locknut lock washer. Remove locknut and lock washer. Discard lock washer. FIG. 21
14. Remove slide stop piston from slide stop. FIG. 22
15. Remove slide stop from slide stop guide.

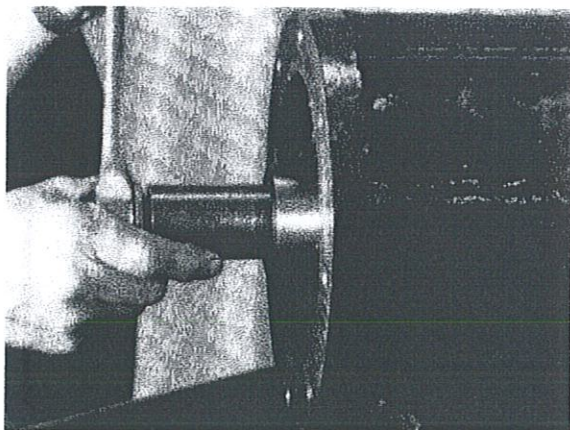


FIG.
18

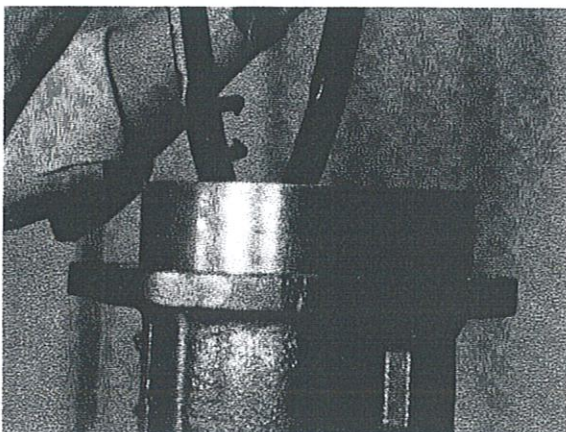


FIG.
19

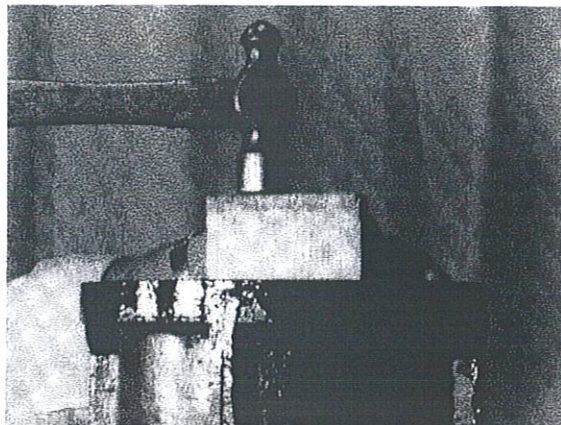


FIG.
20

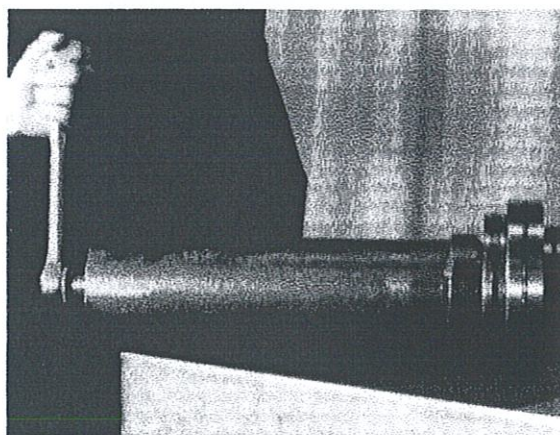


FIG.
21

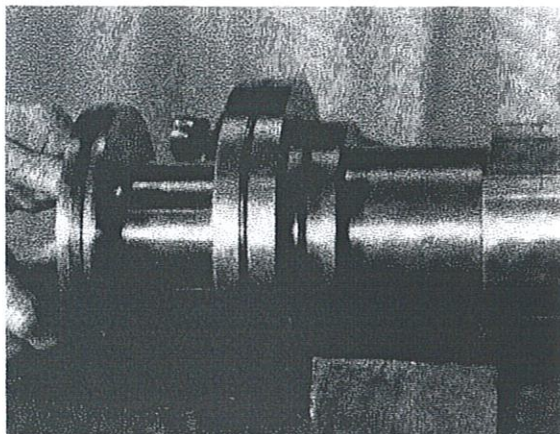


FIG.
22

C. INSPECTION

Clean and inspect all parts.

Ground surface of spindle must be free of scratches, nicks or dents.

Cylinder bore may be honed lightly to restore a good surface. Replace if deeply scratched or pitted.

D. ASSEMBLY

1. To install an internal teflon glyd ring in the cylinder bulkhead, movable slide stop or slide stop cover use the following procedure:

- A. Clean part applicable and insert new O-ring into groove.

- B. Heat new glyd ring to ~~212°F (100°C)~~ ^{120°F (50°C)} for 20 minutes in an oil pot or oven.

- C. While hot place glyd ring in groove over O-ring, immediately size glyd ring by pushing mating part through bore. Sizing is completed when glyd ring cools (approximately 5 minutes).

NOTE: For sizing cylinder bulkhead and movable slide stop use polished end of spindle assembly. For slide stop cover use movable slide stop.

2. Set cylinder upon cylinder cover face and install a snap ring in the third groove in the cylinder from the compressor end or top.

CAUTION — Care must be taken not to damage honed surface of cylinder.

3. Place new oiled O-ring in second groove in cylinder.
4. Push cylinder bulkhead with glyd ring through O-ring until firmly seated on snap ring. Secure by installing snap ring in third groove of cylinder.
5. Lightly oil machined surface of movable slide stop and push through bore of slide stop cover.
6. On threaded end of slide stop install new O-ring, slide stop piston, lock washer and locknut. Tighten lock nut until tab on lock washer aligns with slot in nut. Bend washer tab into slot to secure nut.
7. Place new O-ring in piston groove then split glyd ring over O-ring.
8. Place new oiled O-ring in large diameter groove in slide stop cover.
9. Carefully, so not to damage piston glyd ring, push assembled slide stop piston and cover into cylinder until cover is seated.
10. Install O-ring on polished end of spindle (end with drive pin). Oil O-ring and polished surface of spindle then carefully so not to damage glyd rings, push spindle through movable slide stop and cylinder bulkhead.
11. Lay cylinder on its side and push spindle forward until spindle just clears cylinder cover face.

CAUTION — Unpolished surface of spindle must not enter glyd ring in movable slide stop.

12. Install slide valve piston, lock washer and locknut. Tighten locknut until slot in nut aligns with lock washer tab. Bend tab to secure nut.
13. Install O-ring then split glyd ring into groove in piston. Push piston and spindle assembly back into cylinder.
14. Install assembled potentiometer shaft and cylinder cover.

CAUTION — Make sure shaft groove engages with drive pin in spindle.

15. Install a 3/8" valve in cylinder top port SC1 and pressurize to 30 psig with dry nitrogen.

16. Place spring over slide valve spindle into slide stop pocket then place slide valve with spring pocket over spindle and spring.
17. Compress slide valve spring by pushing down on slide valve. Install new lock washer with tab and locknut. Tighten locknut until washer tab aligns with slot in locknut, bend tab into slot to secure.
18. Crack 3/8" valve in cylinder top port SC1 and slowly bleed pressure to atmosphere.
19. Install inlet cover to cylinder assembly.

E. INSTALLATION

1. Install new oiled O-ring in groove in slide stop cover.
2. Lightly oil slide valve and slide stop.
3. Install a 3/8" valve in cylinder top port SC2 and pressurize to 30 psig with dry nitrogen.
4. Sling cylinder assembly and align peaks of slide valve and slide stop with the vertical center line of inlet cover. FIG. 23
5. With slide valve facing inlet case slowly move assembly forward through inlet case until slide valve contacts rotor case.

CAUTION — Do not bump slide valve against rotor case.

6. Install a 3/8" — 16 UNC x 4-1/4" bolt in inlet case port SC9 until contact is made with slide valve, slowly turn bolt in, raising slide valve while applying pressure on the cylinder assembly until it comes in contact with the guide surface in rotor case. Back out bolt 1/8 turn and continue to push assembly forward into position. FIG. 24

NOTE: Do not force. If resistance is felt, rotate cylinder assembly back and forth while applying pressure to aid in alignment.

7. Remove the 3/8" bolt and install pipe plug.
8. Secure assembled cylinder and inlet cover to inlet case. FIG. 25
9. Crack 3/8" valve in cylinder top port SC2 and slowly bleed pressure to atmosphere.
10. Install slide stop indicator rod assembly.
11. To check the operation of the slide stop indicator rod and the suction valve potentiometer rod proceed as outlined.
 - A. Slide Stop Indicator Rod — Apply and relieve pressure to port SC3. The rod should move 10 mm. (.393")
 - B. Slide Valve Potentiometer Rod — Apply and relieve pressure to port SC2. The rod should rotate 300° with slide stop in low Vi position (toward inlet end).
12. Install slide stop indicator potentiometer bracket, potentiometer, cover and gasket.
13. Install slide valve potentiometer bracket, potentiometer and cover.

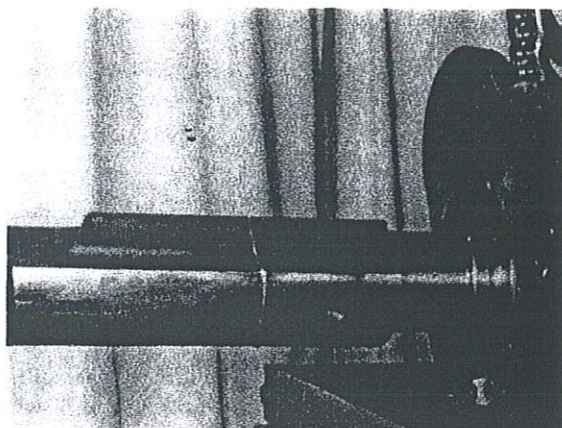


FIG.
23

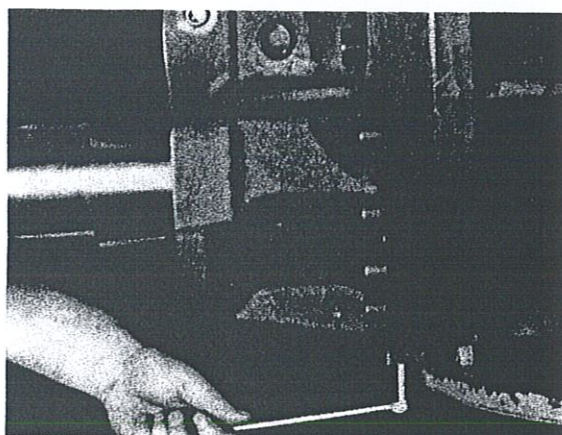


FIG.
24

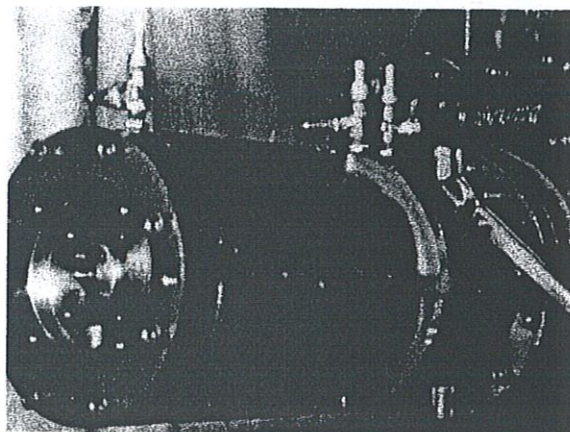
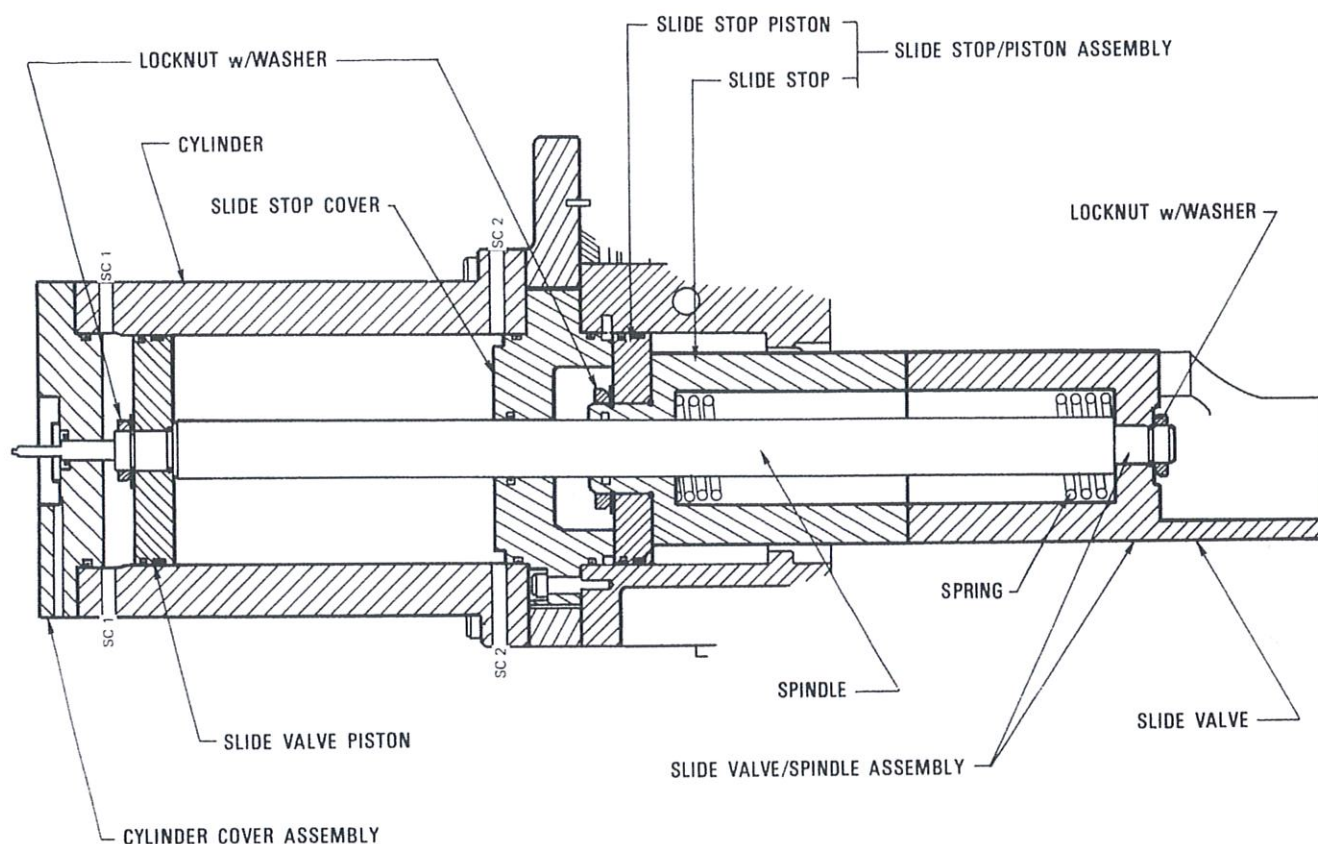


FIG.
25

SECTION 4A - CYLINDER ASSEMBLY - TDSH 283



A. REMOVAL and DISASSEMBLY

WARNING - SLIDE STOP POTENTIOMETER AND INDICATOR ROD MUST BE REMOVED PRIOR TO REMOVING CYLINDER ASSEMBLY.

It is recommended that when disassembling the cylinder assembly all O-rings, glyd rings, slyd ring bearings and lock washers be removed and discarded.

1. Remove plug from oil drain port SC4 located at the bottom of inlet case and drain oil. Reinstall plug.
2. Remove the two (2) plugs from cylinder drain ports SC1 and SC2 located in the bottom of the cylinder and drain oil. Reinstall plugs.
3. Remove slide valve control potentiometer cover, potentiometer, mounting bracket and attaching parts.
4. Remove slide stop potentiometer cover, cover gasket, potentiometer, mounting bracket and attaching parts. Discard cover gasket.
5. Remove slide stop indicator rod assembly by turning out seal plug and withdrawing rod assembly.
6. Install a 3/8" valve in cylinder top port SC2 and pressurize with dry nitrogen to 30 psig.
7. Remove plug from top SC6 port in the face of outlet case. Install slide valve locking tool.
8. Crack valve in port SC2, slowly bleed pressure to atmosphere.
9. Remove cylinder cover from cylinder.

CAUTION - To prevent damage to potentiometer shaft pull cover straight off until shaft is disengaged from drive pin in spindle.

10. Remove cylinder from inlet case cover.

CAUTION - Cylinder weight must be supported and cylinder must be pulled straight off to prevent damage to cylinder bore and slide valve piston.

11. Bend back tab on slide valve piston lock washer. Remove locknut and lock washer. Discard lock washer.
12. Remove slide valve piston and O-ring. Discard O-ring.

NOTE: On compressors operating at less than 2500 RPM remove the slide valve piston stop which is on the spindle between piston and slide stop cover.

13. Remove inlet case cover from inlet case.
14. Install spindle extension tool on end of spindle.

WARNING - Movable slide stop cover is under high spring load - caution must be taken when removing.

15. Remove alternately three (3) of the five (5) cap screws securing movable slide stop cover to inlet case.
16. Install three (3) jack bolts and spacer in holes where cap screws were removed. Tighten nuts on jack bolts, then remove remaining cap screws.
17. Loosen nuts on jack bolts evenly until spring tension is released.
18. Remove jack bolts and slide stop cover.

19. Remove slide stop piston and stop assembly.
20. Remove spring then spindle extension tool.
21. Remove spindle and slide valve assembly.
22. Remove slide valve locking tool.

B. DISASSEMBLY — SLIDE STOP, SLIDE VALVE

If upon inspection of the spindle slide valve assembly and/or piston slide stop assembly no defects are found, disassembly is unnecessary. If defects are found proceed as outlined.

1. Bend back tab on slide valve lock washer. Remove locknut and lock washer. Discard lock washer.
2. Remove slide valve from spindle.
3. Bend back tab on movable slide stop piston lock washer. Remove locknut and lock washer. Discard lock washer.
4. Remove slide stop piston and O-ring from slide stop.

C. INSPECTION

Clean and inspect all parts.

Ground surface must be free of scratches, nicks or dents.

Cylinder bore may be lightly honed to restore a good surface. Replace if deeply scratched or pitted.

D. ASSEMBLY and INSTALLATION

1. To install an internal teflon glyd ring in the movable slide stop or slide stop cover use the following procedure:
 - A. Clean part applicable and insert new O-ring into groove.
 - B. Heat new glyd ring to ~~212°F (100°C)~~ ^{120°F (50°C)} for 20 minutes in an oil pot or oven.
 - C. While hot place glyd ring in groove over O-ring, immediately size glyd ring by pushing mating part through bore. Sizing is completed when glyd ring cools (approximately 5 minutes).
- NOTE: For sizing use polished end of spindle assembly.
2. Assemble spindle and slide valve if disassembled. Secure slide valve to spindle using locknut and new lock washer. Tighten locknut until slot in nut aligns with lock washer tab. Bend tab to secure nut.
3. Assemble piston and movable slide stop if disassembled. On slide stop place new O-ring, piston and new lockwasher. Install locknut and tighten until slot in nut aligns with washer tab. Bend tab to secure nut.
4. Install slide valve locking tool in top SC6 port in the face of outlet case.
5. Lightly oil spindle and slide valve assembly, then install in compressor.
6. Screw spindle extension tool on end of spindle.
7. Install spring over extension tool and spindle. Make sure spring is seated in counterbore of slide valve.

CAUTION — Care must be taken not to damage the polished surface of the spindle.

8. Install new slyd ring bearing, O-ring and split glyd ring on movable slide stop piston.

WARNING — When installing movable slide stop piston assembly or movable slide stop cover care must be taken not to damage polished surface of spindle, internal and external glyd rings and slyd ring bearing.

9. Slide assembled movable slide stop and piston on extension tool seating spring in counterbore of slide stop.
10. Place a new oiled O-ring on inboard flange of movable slide stop cover then slide cover on extension tool.

CAUTION — Support weight of slide stop cover until cover is jacked into position.
11. Install three (3) jack bolts with spacers through holes in slide stop cover into inlet case. NOTE: Jack bolts should be placed at 2, 6 and 10 o'clock.
12. Align peak of slide stop with vertical center line of compressor.
13. Tighten the nuts on the jack bolts evenly pushing the slide stop cover and slide stop into inlet case bore until slide stop contacts rotor case.
14. Install a 1/2" — 20 UNC x 4-1/2" bolt in inlet case port SC4 until contact is made with slide stop. Slowly turn bolt in, raising slide stop while applying pressure on the slide stop until it comes in contact with the guide surface in rotor case. Back out bolt 1/8 turn and continue to jack slide stop and cover into position.
15. Use two (2) cap screws at 4 and 8 o'clock. Secure movable slide stop cover to inlet case.
16. Remove jack bolts and install cap screws. Torque all five (5) cap screws.
17. Remove spindle extension tool.
18. Place a new oiled O-ring on outboard flange of slide stop cover then install inlet case cover.
19. Place O-ring then slide valve piston on spindle and secure with lock washer and nut. Tighten locknut until tab on lock washer aligns with slot in locknut then bend tab into slot to secure nut.
20. Install slyd ring bearing, new O-ring and split glyd ring on piston.
21. Supporting cylinder, carefully so not to damage slyd ring bearing and glyd ring, slide cylinder over slide valve piston. Secure cylinder to inlet case cover and torque cap screws.
22. Install cylinder cover and potentiometer shaft assembly. Make sure potentiometer shaft groove is aligned with drive pin in spindle.
23. Install 3/8" valve in cylinder top SC2 port and pressurize to 30 psig with dry nitrogen.
24. Remove slide valve locking tool from top SC6 port in face of outlet case and install NPT plug.
25. Crack 3/8" valve and slowly relieve pressure to atmosphere.
26. Install movable slide stop indicator rod assembly, potentiometer bracket, potentiometer, cover and gasket.
27. Install slide valve potentiometer bracket, potentiometer and cover.

SECTION 5 – TDSH COMPRESSOR

A. DISASSEMBLY

1. Drain oil from compressor. The drain port is located at the bottom center of the inlet casing and identified as, SC9 on TDSH 163, 193 and 233, SC4 on TDSH 283.
2. Remove movable slide stop potentiometer and rod assembly. Refer to Section 3.
3. Remove cylinder assembly. Refer to Section 4.
4. Use cover/piston puller and remove male and female balance piston covers from inlet case. FIG. 26

5. Remove and discard cover O-rings.

6. Remove snap ring from male rotor. FIG. 27

7. Use cover/piston puller and remove male balance piston. FIG. 28

8. Remove male balance piston sleeve and back-up ring. Discard O-ring.

NOTE: Later machines incorporate a one piece sleeve and back-up ring.

NOTE: Steps 9 thru 11 are not applicable to the TDSH 283 compressors as no female balance piston is used.

- ✓9. Remove snap ring from female rotor. FIG. 29
10. Use cover/piston puller and remove female balance piston. FIG. 30
11. Remove female balance piston sleeve and back-up ring. Discard O-rings.
12. Remove rotor shaft seal. Refer to Section 1.
13. Remove shaft seal drive ring.

FIG.
27

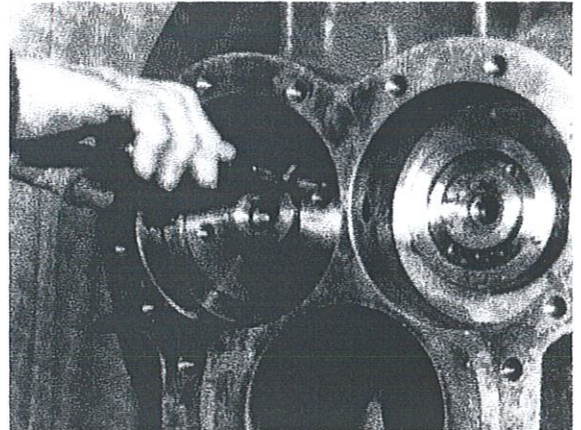


FIG.
28

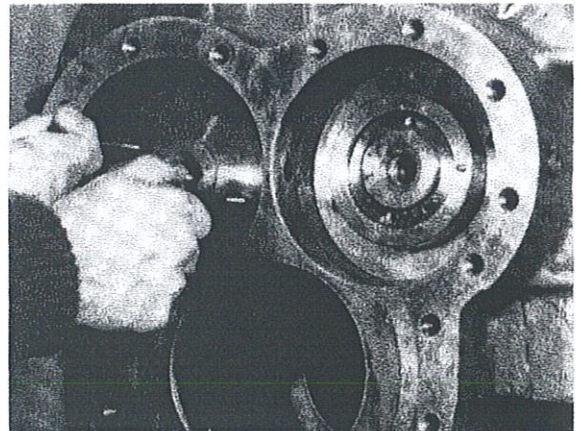


FIG.
29

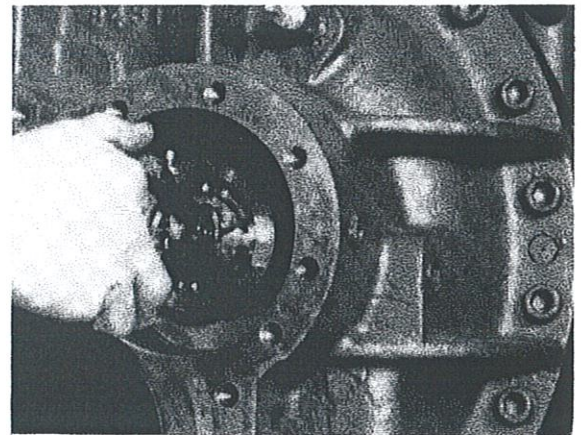


FIG.
30

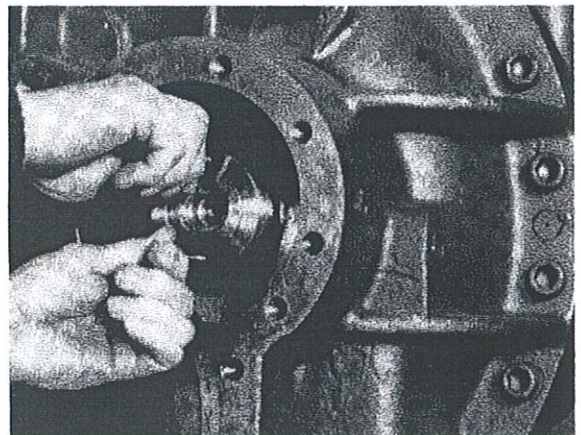
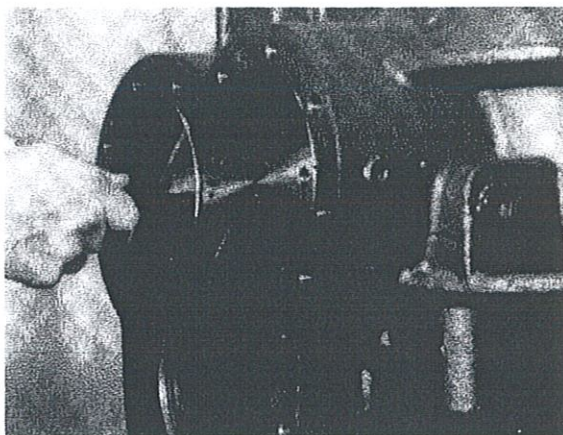


FIG.
26



14. Remove seal drive pin from rotor shaft. FIG. 31
15. Bend tab back on lock washer, remove locknut, lock washer and bearing spacer from male rotor. FIG. 32
16. Loosen cap screws securing female rotor bearing cover evenly until spring washer pressure is released. Remove cap screws, cover and spring washer. FIG. 33
17. Remove female bearing housing spacer. FIG. 34
18. Remove Nylok cap screw, washer, bearing plate and dowel pin from end of female rotor. Discard Nylok cap screw. FIG. 35
19. Drive out dowel pins which align inlet case with rotor case. FIG. 36
20. Attach sling to support inlet case, then remove attaching cap screws. FIG. 37

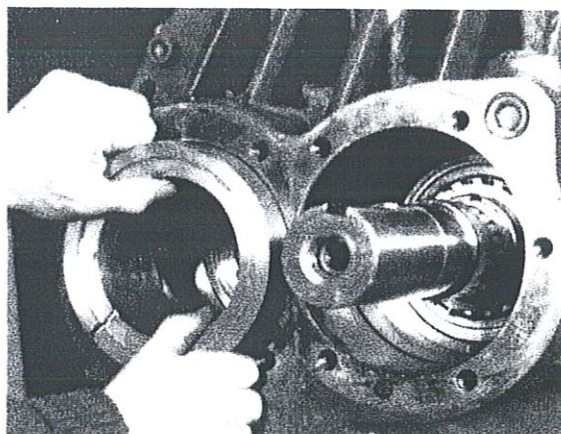


FIG.
34

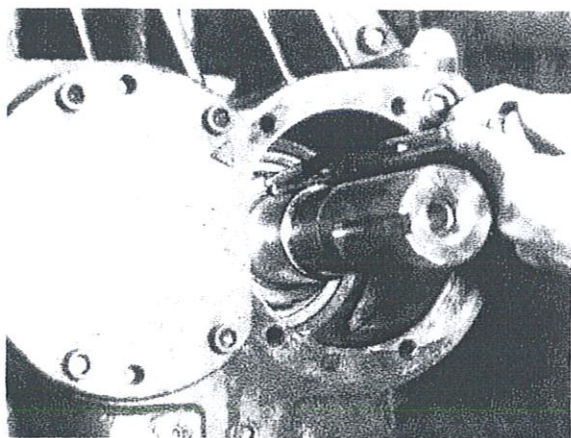


FIG.
31

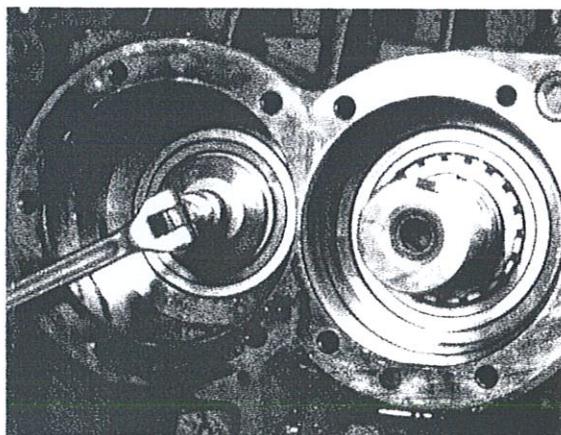


FIG.
35

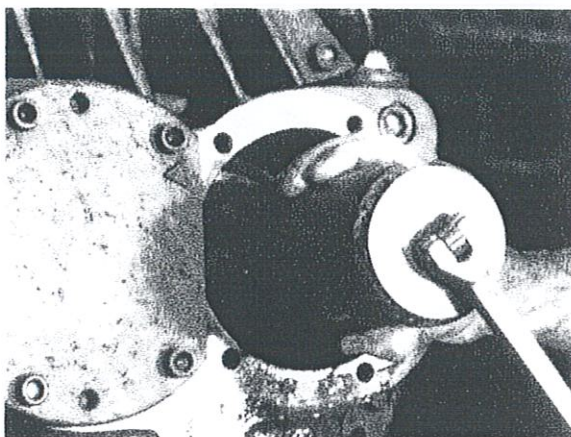


FIG.
32

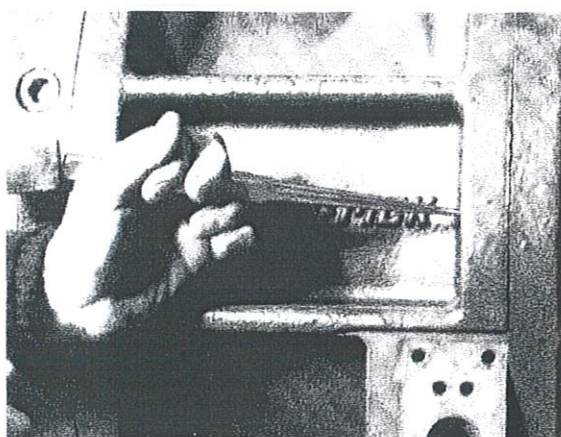


FIG.
36

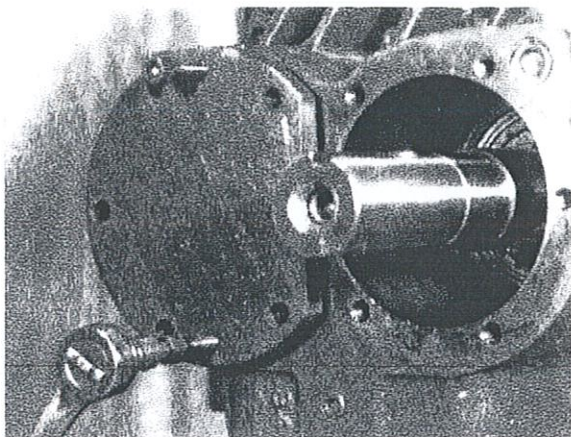


FIG.
33

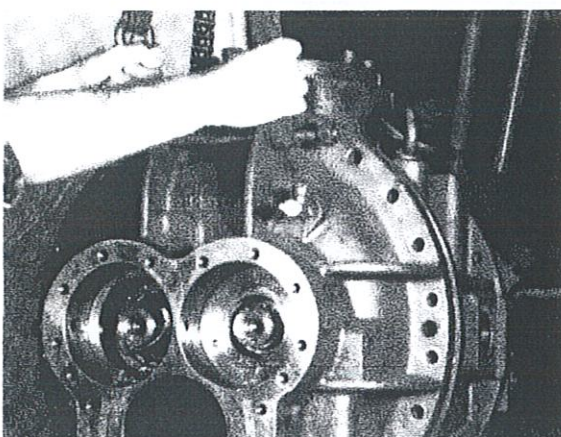


FIG.
37

21. Using jack bolts, push inlet case apart from rotor case. FIG. 38

CAUTION —Keep sling taut and move inlet case straight out until clear of rotors to prevent damage to roller bearings and rotors.

22. Use male thrust bearing tool and push male rotor clear of thrust bearing inner races. (You will hear inner races drop). FIG. 39

23. Use female thrust bearing tool and push female rotor clear of thrust bearing inner races. (You will hear inner races drop). FIG. 40

24. From the inlet end pull male rotor approximately 2/3 of the way out. Support rotor with a sling around center of rotor and remove. Repeat procedure for female rotor. FIG. 41

CAUTION — Care must be taken to prevent damage to rotor sealing strip.

25. Remove from outlet case both male and female rotor thrust bearings, bearing back-up rings and bearing back-up plates.

26. Drive out dowel pins which align outlet case with rotor case.

27. Remove outlet case attaching cap screws, then use jack bolts to separate outlet case from rotor case and remove outlet case. FIG. 42

28. Roller Bearing Removal — When roller bearings are removed they should be discarded and replaced with new bearings.

- A. Remove both snap rings from inlet case retaining roller bearing outer races.
- B. Use a brass drift and drive bearing outer races from inlet and outlet cases. **NOTE:** Damage to bearings during removal is insignificant as they should not be reused.
- C. Use a bearing puller and remove bearing inner races from both ends of male and female rotors. FIG. 43

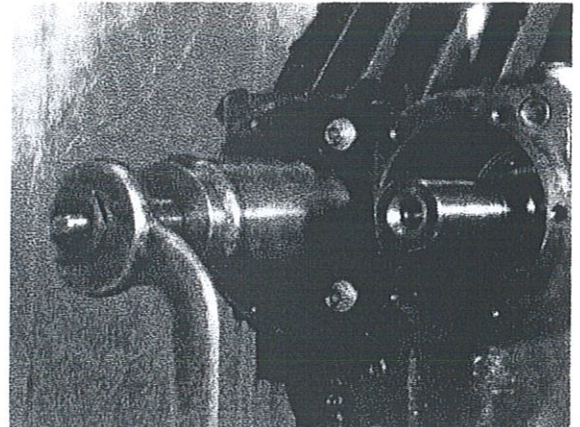


FIG.
40

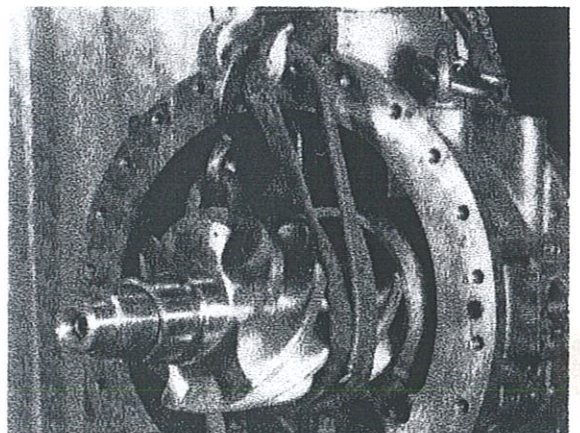


FIG.
41

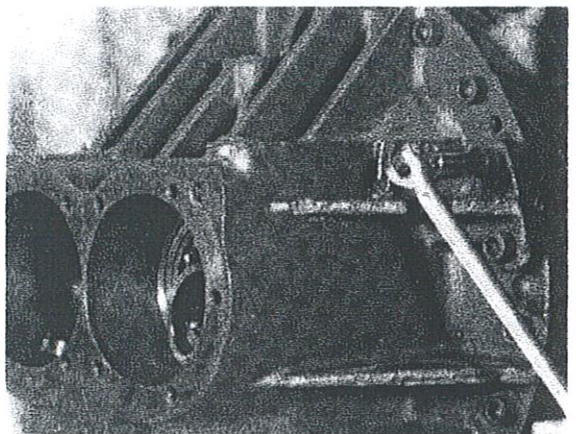


FIG.
42

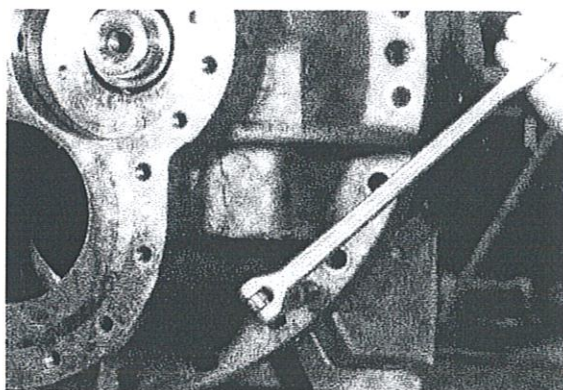


FIG.
38

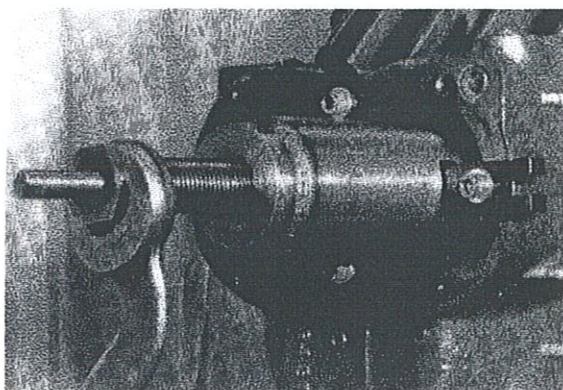


FIG.
39

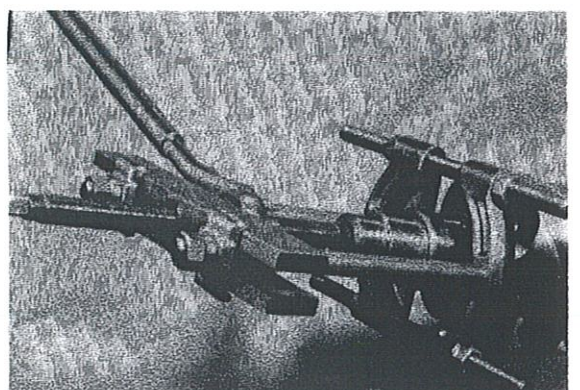


FIG.
43

B. ASSEMBLY

1. Roller Bearing — Roller bearing inner and outer races must be kept as a matched set — do not mix.

Heat bearing inner race on oil pot or oven to no more than ~~250°F (125°C)~~ *200°F - 93°C*

2. Install inner race on rotor. Be sure race is seated firmly against rotor shoulder. NOTE: Put a thin coating of molybdenum disulfide powder on rotor where inner race will be seated. Wipe off excess.
3. Install outer race in applicable case. Outer races may either be pressed into position with a hydraulic press or ~~cooled with R-22~~ and slid into position. Race must be seated squarely against shoulder in case. Install retaining snap rings in inlet case. **cooled w/dry ice or freezer*
4. Attach outlet case with roller bearing outer races and new O-ring to rotor case. Use a light coat of grease to retain O-ring in place.
5. Align dowel pin holes in rotor case with dowel pin holes in outlet case. Install round dowel pin in male rotor side pin hole.
6. Install diamond shaped dowel pin in female rotor side pin hole.

WARNING — Contact surface of dowel pin must be in the vertical direction — not horizontal.

7. Torque attaching cap screws in crisscross sequence starting with cap screw nearest male rotor side dowel pin.
8. Locate serial number stamped on helix lobe of female rotor at outlet end. Follow the lobe to the inlet end. Use a grease pencil or layout dye to mark this lobe on the inlet end.
9. Install female rotor, end with serial number goes in first. After installing turn rotor until marked lobe points toward male rotor.

CAUTION — Care must be used not to damage sealing strips on lobes.

10. Locate serial number stamped in root of helix lobe on outlet end. Mark face of rotor at this position with grease pencil or layout dye.
11. Install male rotor aligning root mark with marked lobe of female rotor.

CAUTION — Care must be used not to damage sealing strips on lobes.

12. Attach inlet case with roller bearing outer races and new O-ring loosely to rotor case. Use a light coat of grease to retain O-ring in place.
13. Align dowel pin holes and install round dowel pin in male rotor side pin hole.
14. Install diamond shaped dowel pin in female rotor side pin hole.

WARNING — Contact surface of dowel pin must be in the vertical direction — not horizontal.

15. Secure inlet case to rotor case using six (6) cap screws spaced evenly around inlet case. Torque cap screws.
16. Check rotor end play between inlet and outlet cases. Attach end play tool to rotor and inlet cover, male rotor first. With tool push rotor forward until it contacts outlet case. FIG. 44
17. Attach dial indicator to outlet case and rotor, male rotor first. Set indicator at zero (0). FIG. 45

18. Use end play tool to pull rotor back until it contacts inlet case. Read indicator. FIG. 46

Clearance Specifications:	TDSH 163	.024"/.033"	.025
	TDSH 193	.023"/.036"	.028
	TDSH 233	.025"/.039"	.031
	TDSH 283	.030"/.038"	

WARNING — If end play clearance is not within above specifications consult Frick Company.

19. Repeat Steps 16 thru 18 for female rotor.

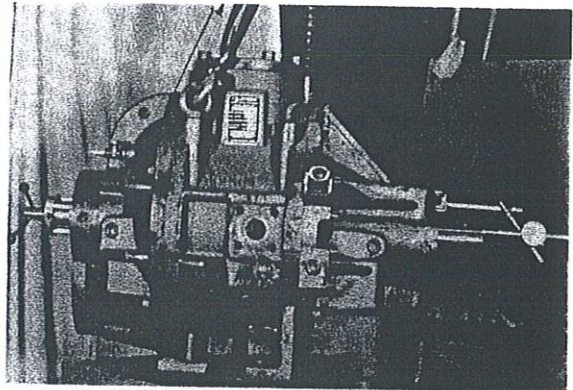


FIG.
44

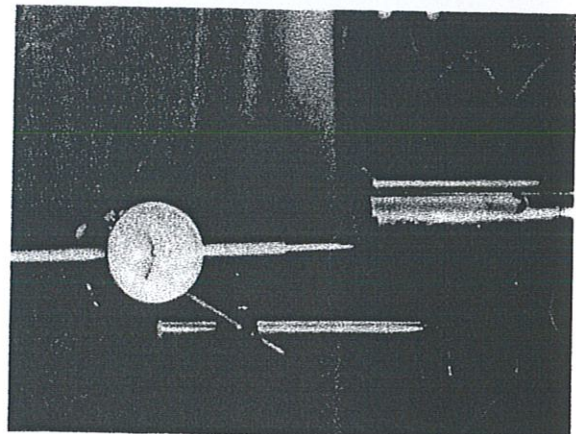


FIG.
45

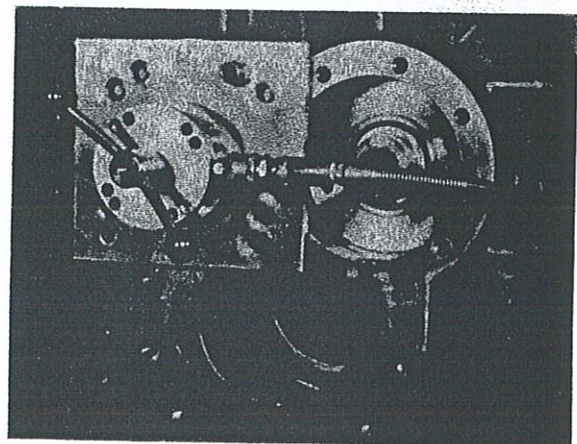


FIG.
46

20. Installation of Thrust Bearings — When the TDSH compressor has been disassembled for preventive maintenance it is recommended that new thrust bearing kits be used. The bearing kit consists of a new thrust bearing, anti-rotation O-ring or roll pin, bearing back-up ring and bearing adjusting washer. The bearing back-up ring is ground for proper stand out and cannot be interchanged between bearings.

Whether you are installing a new thrust bearing kit or re-installing removed parts the procedure is the same.

NOTE: On early versions of TDSH compressors there are two (2) roll pins in the bearing back-up ring — remove these pins.

21. Place bearing adjusting washer on male rotor. Chamfer on washer must be inboard against shoulder of rotor.
22. Install bearing back-up plate with narrow face inboard.
23. Coat inboard inner race of thrust bearing with a light coat of molybdenum disulfide powder. Wipe faces clean of powder.
- NOTE: Inboard side of thrust bearing inner and outer races are identified by the letter "A" on the flat face of race. The face with the letter "A" must be installed facing the rotor body.
24. With flat face "A" of inner race toward rotor body start race on rotor shaft. Use bearing installation tool to seat inner race against bearing adjusting washer. FIG. 47

26. With the letter "A" on bearing race facing the rotor body install the assembled bearing back-up ring and outer race into the outlet case.
27. Coat thrust bearing outboard inner race with molybdenum disulfide powder. Wipe face clean and start race on rotor shaft with radius side toward rotor body.
28. Using bearing installation tool push outer race until seated against inboard race.
29. Install bearing spacer (TDSH 163, 193), lock washer and locknut.

NOTE: Do not bend tab on lock washer.

30. Repeat Steps 21 thru 28 for female side.
31. Install retaining washer, anti-rotation pin and cap screw.
32. Check outlet end clearance — Attach end play tool to rotor and inlet cover, male rotor first. Apply air and push rotor forward. FIG. 48
33. Attach dial indicator to outlet case and rotor, male rotor first. Set indicator at zero (0). FIG. 49
34. Use end play tool to pull rotor back. — Read and record indicator reading.

35. Recommended outlet end clearance:

TDSH 163 and 193	.0075"
TDSH 233	.0085"
TDSH 283	.0090"

The difference between indicator reading and recommended end clearance is the amount to be ground from adjusting washers. Example:

Rotor	MALE	FEMALE
Dial Reading	.0155"	.0175"
Recom. Clearance	.0085"	.0085"

Amount to be ground .007" .009"

Repeat Steps 32 thru 34 with female rotor then remove end play tool and dial indicator.

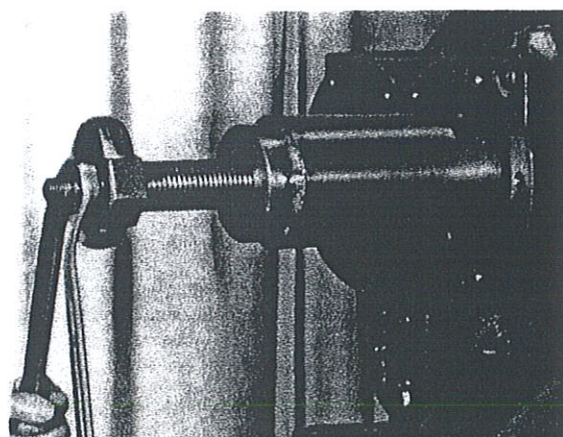


FIG.
47

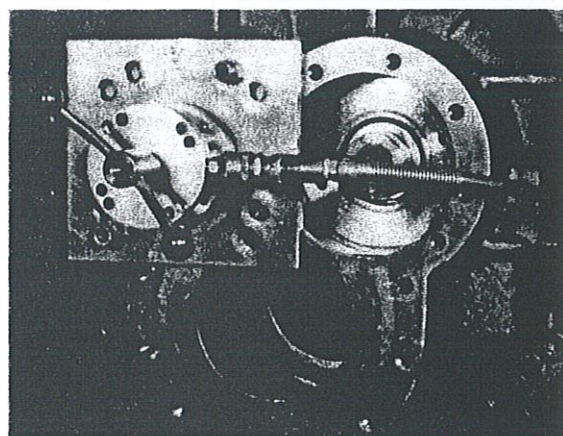


FIG.
48

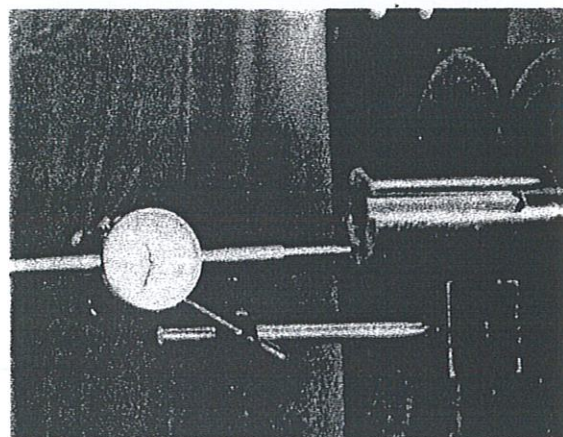


FIG.
49

36. Remove inlet case. Refer to Section 5A Steps 19 thru 23.
37. Remove locknut, lock washer and spacer from male rotor (TDSH 163, 193).
38. Remove cap screw, anti-rotation pin and retaining washer from female rotor.
39. Use male thrust bearing tool and push male rotor clear of thrust bearing inner races.
40. Use female thrust bearing tool and push female rotor clear of thrust bearing inner races.
41. Remove bearing back-up rings, thrust bearing outer races and bearing adjusting washers which are to be ground to new dimensions.

To calculate dimensions use the following example procedure:

Thrust Washer	MALE	FEMALE
Original Thickness		
Amount to be removed (Step 34)	<u>.0010</u>	<u>.0005</u>
New Thickness		

WARNING — Adjusting washers must be parallel within .0004".

42. From inlet end push rotors forward, then reinstall inlet case. Refer to 5B Steps 12 thru 15.
43. Reinstall thrust bearings using redimensioned bearing adjusting washers and recheck outlet end clearance. Refer to 5B Steps 21 thru 35.

Outlet end clearance must be within the following limits:

TDSH 163, 193	.0065" - .0095"
TDSH 233	.0075" - .0105"
TDSH 283	.008" - .011"

If clearance is still more than the maximum the spacer is too thick and can be reground.

If clearance is less than minimum a new bearing adjusting washer must be used.

44. When outlet end clearance is within tolerance bend down tab on male rotor lock washer.
45. Install remaining cap screws attaching inlet case to rotor case. Tighten cap screws in a crisscross pattern.
46. Install 5h8 x 10 mm seal drive pin in male rotor. FIG. 50
47. Install seal distance ring on male rotor. FIG. 51

CAUTION — Slot in distance ring must engage with seal drive pin.

48. Install seal. Refer to Section 1.
49. Install female distance sleeve.

CAUTION — Alignment slot must be, inboard for TDSH 193 and 283, outboard for TDSH 163 and 233.

50. Install female spring washer and special female outlet case cover.

CAUTION — Spring washer must contact the distance sleeve.

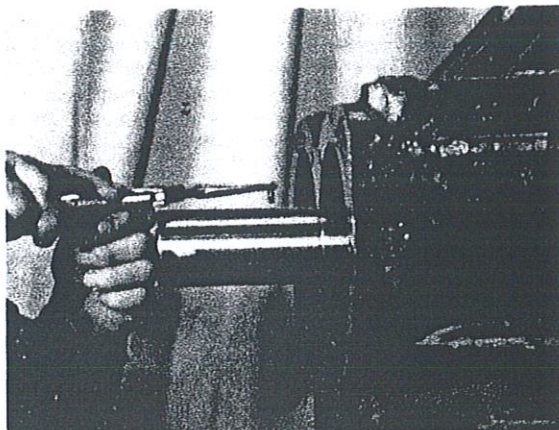


FIG.
50

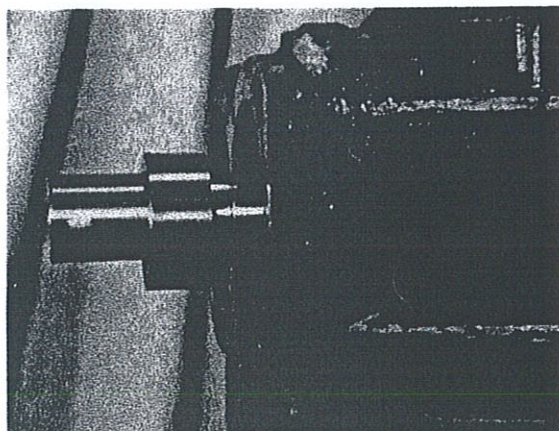


FIG.
51

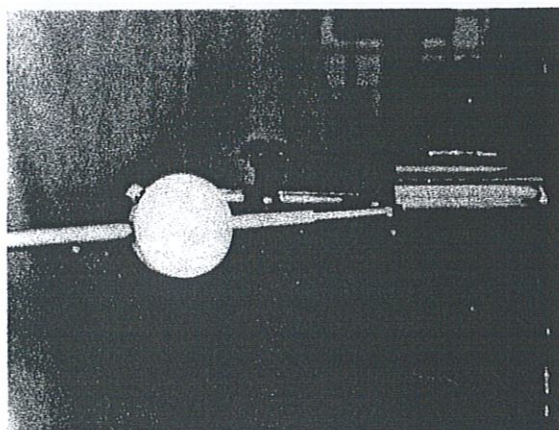


FIG.
52

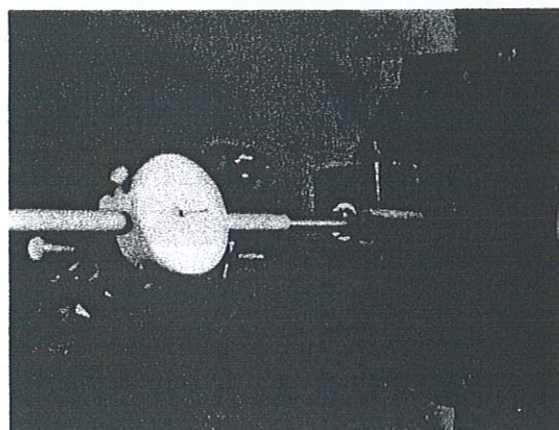


FIG.
53

51. Check outlet end clearance. Refer to Step 32 thru 35.
FIG. 52 and 53

Measured end clearance must be within the following limits:

TDSH 163, 193	.001" - .0049"
TDSH 233	.001" - .0054"
TDSH 283	.001" - .0056"

52. Remove special female outlet case cover and install original cover.

CAUTION — On TDSH 163 and 233 the alignment pin in cover must align with slot in distance sleeve.

WARNING — There are two (2) versions of male balance piston cover, piston sleeve and/or spacer used on some TDSH compressors.

The early version uses the two (2) piece piston sleeve and spacer arrangement with balance piston cover less roll pin. Applicable for TDSH 163, 193 and 233.

The later version uses a one (1) piece piston sleeve/spacer and balance piston cover with roll pin. Applicable for all TDSH compressors.

Check the version you have and proceed with the applicable instructions.

EARLY VERSION — TDSH 163, 193 and 233

53. Place new oiled O-ring on piston sleeve spacer and install in male rotor bore of inlet case.
54. Place balance piston sleeve on flat surface, place balance piston inside piston sleeve and with feeler gauges check the clearance between piston and sleeve diametral.
- Clearance Specification .003" — .005".
Replace at .008"
55. Place new O-ring in balance piston sleeve and install with the roll pin at 9 o'clock in male rotor bore of inlet case.
56. Install male balance piston on male rotor aligning slot in piston with pin in rotor shaft.
57. Secure balance piston with snap ring.
58. Place new oiled O-ring on male balance piston cover and install with tapped puller holes vertical and right side oil slot aligning with piston sleeve roll pin.

LATER VERSION — ALL TDSH COMPRESSORS

- 53A. Place balance piston sleeve/spacer on flat surface. Place balance piston inside piston sleeve/spacer and with feeler gauges check clearance between piston and sleeve/spacer diametral.
- Clearance Specification .003" — .005".
Replace at .008"
- 54A. Place new oiled O-ring on male balance piston sleeve/spacer and install in male rotor bore of inlet case with slot out-board at 12 o'clock.
- 55A. Install male balance piston on male rotor aligning slot in piston with pin in rotor shaft.
- 56A. Secure balance piston with snap ring.
- 57A. Place new oiled O-ring on male balance piston cover and install with roll pin at 12 o'clock mating with slot in balance piston sleeve/spacer.

If installed correctly the tapped puller holes in piston cover

will be, vertical for TDSH 163, 193 and 283, horizontal for TDSH 233.

NOTE: Balance piston for female rotors are only used in TDSH 163, 193 and 233 compressors. ~~Not used in TDSH 283 compressors.~~

59. Place new oiled O-ring on female balance piston sleeve spacer and install in female rotor bore of inlet case.
60. Place female balance piston sleeve on flat surface. Place female balance piston inside piston sleeve and with feeler gauges check the clearance between piston and sleeve diametral.
- Clearance Specification .003" — .005".
61. Install female balance piston on female rotor aligning slot in piston with pin in rotor shaft. Secure balance piston with snap ring.
62. Place new O-ring on female balance piston sleeve and install over balance piston, roll pin should be at 3 o'clock.
63. Place new oiled O-ring on female balance piston cover and install with tapped puller holes vertical and the left side oil slot aligning with piston sleeve roll pin.
64. Install cylinder assembly — Refer to Section 4E.

SECTION 6 — COMPRESSOR TO BASE INSTALLATION

It is important when installing a TDSH compressor on a compressor base that excessive stress is not imposed on the compressor casing when it is bolted down, therefore the following procedure is recommended:

WARNING— Not following recommended procedure can cause excessive load on compressor and may lead to premature bearing failure or slide valve binding.

Install new gasket on surface of discharge flange of package and bolt compressor to flange. Torque to 260 FT/LB oiled.

If compressor feet come up off the base place shims under feet to reduce gap to less than .005" then bolt down compressor with shims in place.
.002"

If compressor feet DO NOT come up off the base when compressor is bolted to discharge flange, remove compressor and place two (2) gaskets on discharge flange and repeat above.