

**Installation
Operation
Maintenance Instructions**

**Model HD400 – HD550
Watercooled
Gas Compressor**

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Warning

Read the installation and maintenance information before commencing work on this equipment. Your attention is drawn to the health and safety information on page 4. Until the equipment into which the machine has been incorporated and the said equipment declared to be in conformity with the Machinery Directive, they must not be put into service.

Foreword

The HD series rotary gas compressor has been developed based on many years of experience in the compressor and vacuum pump industry. Using modern design techniques and production methods coupled with rigorous testing and high quality standards ensure this series of machines have a long, efficient and reliable service life.

These operating instructions have been written for all personnel who have responsibility to the machine, it contains all the necessary information required for the machine to have a long trouble free service life. This manual must be stored near the machine and read before attempting any work on it.

Ensure that all operation and maintenance is only performed by competent and trained personnel and any repairs use only original parts from the manufacturer.

General

The normal routine of running the machine is very simple. If it is carried out strictly at all times, many years of

trouble free service can be expected.

We emphasise three points of paramount importance-

1. Filtration of incoming air of gas
2. Lubrication
3. Cooling Water Supply

If possible provide a logbook so that the operator can enter daily readings. After several months a record will show whether the machine is performing as it did originally. If readings are to be taken the following are all that is required. Inlet and outlet air temperatures, suction conditions and oil drip rate.

A typical layout for the log book is shown in the table below.

Machine Log Book							
Date	Inlet Gas Temp.	Discharge Gas Temp.	Inlet Water Temp.	Discharge Water Temp.	Inlet Gas Pressure	Discharge Gas Pressure	Oil Drip Rate.

Operating Principle

Rotary sliding vane compressors and vacuum pumps are multi-cell machines, which work on the displacement principle. They provide a constant, low-pulsation supply of air or gas.

The machines have a cylindrical bored housing. The rotor, which is also cylindrical, is fitted eccentrically in the cylinder so that a crescent-shaped working chamber is formed. Movable rotor vanes are fitted in the longitudinal grooves in the rotor; centrifugal force and the force of the air or gas presses the blades against the cylinder-housing wall when the rotor turns.

The vanes divide the crescent-shaped working chamber into cells of different sizes. As the rotor turns, the cell volume on the intake side increases, and the cell draws air in at low pressure, at which point is open to the intake delivery line. As the rotor continues to turn, the cell is closed (see fig 1) and the volume of the cell decreases. This causes the enclosed air or gas to be compressed (see fig 2) and forced out through discharge delivery line under atmospheric pressure.

The machine can only be run in one direction, which is indicated by an arrow on the cylinder. The direction of rotation must not be reversed.

Read the installation and operating instructions carefully.

Rotating machinery and pressurised components, which may contain toxic, flammable or otherwise hazardous

media are potentially dangerous equipment if not operated and maintained correctly. It is imperative that all users of such equipment fully educate themselves to the potential dangers and satisfy themselves that the personnel responsible for installing, testing, commissioning, operating and maintaining the plant are competent to do so. Instruction manuals are provided for guidance but must assume some basic level of competence by users. If there are any doubts or ambiguities concerning correct procedures, ask Utile Engineering. **DO NOT TAKE RISKS.**

Certain machinery can generate high levels of noise which can be harmful if exposed to it for lengthy periods of time. Various codes of practice are in existence and users must ensure that adequate precautions are taken to prevent a health hazard to employees or third party.

Equipment with internal pressures above or below ambient pressures can create a hazard. Before attempting to investigate problems, service or maintain equipment, it must be safely depressurised or pressurised to ambient conditions. Also since the gaseous medium may be flammable, toxic, corrosive or otherwise hazardous it may be necessary to purge the installation with an inert gas, such as nitrogen. Special precautions are necessary for certain gases and the user must ensure that adequate procedures are implemented.

Moving parts of machinery must not be touched and all such parts must be adequately guarded. Suitable guards are provided and must be securely retained in position at all times.

Before commencing maintenance, servicing or making other adjustments, the prime mover and other equipment must be isolated electrically or otherwise immobilised to prevent accidental start-up. In this vein, a fully qualified electrician should carry out all electrical work and all electrical equipment should be isolated before it is touched and pneumatic or hydraulic controls depressurised and made safe. Procedures must also exist to ensure that electrical or other inputs cannot be restored accidentally during the maintenance or service period. Safety trips, emergency stop-buttons and other such devices (if fitted) are to be checked regularly to ensure that they continue to function correctly and will protect the installation and personnel in the event of an emergency.

NO attempt should be made to touch the machine whilst it is rotating. Particular care is needed when checking rotor clearances. Any movement of rotors may trap fingers.

Most machines, certain pipes and ancillaries become hot during operation whilst certain machines with sub-zero inlet temperatures may result in very cold surfaces. If it is possible for personnel to come into contact with such surfaces unknowingly or accidentally they should be guarded.

If severe vibration is observed, the cause of this should be immediately investigated and the situation rectified. Excessive vibration can lead to fatigue and other failures. Similarly, if during operation a significant change is noticed in the level of vibration, noise, temperature or any other parameter, the cause of such changes must be determined, and the cause rectified. Inlet filters must be inspected regularly so that liquid or debris is not allowed to enter the machine, which could cause damage and consequently injury to personnel.

During routine maintenance, coupling alignment should be checked for misalignment. Only approved lubricants must be used and quantities, etc must be checked regularly.

Before restarting after servicing, all nuts, set screws, etc must be checked for tightness, check all joints, for leaks and carry out purging as necessary before introducing the process gas. Also, before start-up, check the machine inlet and outlet isolating valves are open both non-return valves (if fitted) are the correct orientation.

Adjacent pipework and equipment must not impose undue forces and moments on the machinery flanges. All welding work must be carried out by an approved gas coded welder.

In order to prevent reverse rotation of machines, it is **ESSENTIAL** that a non-return valve be installed in the inlet pipework. Otherwise a hazardous situation can arise during a normal shutdown or if the prime mover power supply is interrupted for a period of time.

The environment around the installation may need to be monitored in order to detect gas leaks etc., and consideration must be given to the installation of gas detecting equipment, and the class of electric equipment. All personnel working in or passing through the area should be adequately warned by signs and trained to exercise appropriate safety precautions. Ensure the correct personal protective equipment is worn at all times.

Technical Specification

The model, machine serial number, year of manufacture, temperature class and zone rating for the machine appear on the machine data plate, other machine data can be found in the following table.

	Units	HD400	HD550
Maximum Pressure	Bar	3.45	3.45
Speed – Maximum	R.P.M.	1000	1000
Speed - Minimum	R.P.M.	700	700
Volume at 1 Bar at Max. Speed (Air)	m ³ /hr	610	810
Volume at 1 Bar at Max. Speed (Nat Gas (SG=0.6))	m ³ /hr	510	670
Absorbed Power at 1 Bar at Max. Speed (Air)	kW	31.50	43.50
Absorbed Power at 1 bar at Max. Speed (Nat Gas)	kW	27.75	38.00
Maximum Ambient Temperature	BC	40	40
Surface Temperature at Max. Press. at Max. Speed (Air)	BC		
Moment of Inertia	kg m ²	1.148	0.965
Noise Level at 1 metre	db (A)	87 - 98	87 - 98
Weight	kg	510	491

Note: Machine must not be used on any other gas than originally specified. Utile Engineering must be consulted if traces of any other gas are introduced into the machine.

Packaging

The packaging conforms to the relevant regulations. The symbols used on the packages are shown on the right. The machines are bolted down on a pallet and therefore should not move during transportation and either cased or shrink wrapped for general protection. The ancillary components are packed suitably within the case. The packaging and contents should be received in good condition. When unpacking do not remove the inlet/outlet protection covers.

The contents should be inspected against the advice note, notify Utile Engineering within 3 days of any items, which are damaged or are missing, followed by a written claim within seven days of the goods being delivered.

Storage

If the machine is not required for immediate installation, the machine should be stored in a clean, dry area protected from the weather. The intake and discharge port covers must remain in position until the machine is installed. We recommend that the shaft be turned a few revolutions by hand to ensure the machine is running free every month until the machine is installed.

The green protective coating on the shaft remains effective for approximately 1 year. If the machine is stored for a longer period of time, the coat must be renewed.

Handling

Skilled personnel working in accordance with safe working practices must carry out the lifting of machines. Before lifting the correct equipment must be available. Cranes, jacks, slings, and lifting beams must be capable of carrying the weight of the machine to be lifted. The lifting eyebolt situated in the top of the cylinder and a crane hook must be used when lifting or moving the machine (see fig 3). Do not use the machine ports or the shaft extension for lifting or moving the machine.

For weights see above in Technical Specification.

Installation

Before commencing installation, a site specific risk assessment, method statement and hazard identification list must be completed and adhered to. All work must be carried out in a safe area. Utile Engineering trained personnel or those trained to an equivalent standard should carry out installation, any claims for damage due to faulty installation will be void. The machine is delivered ready to be connected, with only the removal of the intake and discharge protection covers. All warning labels and instructions must be observed and retained with the machine. Before installation, ensure there is no damage to the machine and that it turns freely by hand.

Typical tools required for installation include: -

Set of spanners	Pipe Wrenches	Set of screwdrivers	Hacksaw
Hammer / mallet	Drill (low voltage)		

Typical bolt tightening torques are: -

Bolt Tightening Torques			
Size	Torque	Size	Torque
M4	4.00 Nm	M10	40.00 Nm
M5	6.00 Nm	M12	70.00 Nm
M6	10.00 Nm	M16	100.00 Nm
M8	18.00 Nm	M20	150.00 Nm

Location

The machine should be installed in a clean, dry, well-ventilated area. Allow adequate space and facilities for service, inspection and future expansion. A minimum of 0.75m of working space around the machine is recommended. Adequate space around the motor and machine, particularly any fan inlets, is also necessary to facilitate cooling airflow. Where several machines are installed in close proximity, care must be taken to ensure there is no recirculation of exhausted warm air.

Foundation

Simple slab type foundations, designed for static loadings only are satisfactory. The foundations should raise the machine to a reasonable height above the floor for convenient service and inspection. The use of anti-vibration mounts between the base and foundation are recommended, these absorb the vibrations generated by the rotating parts of the machine and insulate it against any vibration in the surrounding environment. Ensure that the anti-vibration mounts are evenly loaded. Foundation bolts should fix the base.

Cooling System

Ample supply of clean water is required. Dirty or scale forming cooling water coats the water passages, thereby reducing cooling efficiency. Where freezing conditions maybe experienced, extreme care must be exercised to prevent frost damage to the compressor and cooling system, core plugs are added to the cylinder to help in freezing conditions.

Electrical Supply and Connection

The voltage rating of the supply must be compatible with the motor and the fittings. All electrical installation must be carried out by a qualified electrician and in accordance with current regulations and within the framework of the Electricity of Work Regulation 1990. Ensure all electrical connections, plugs, sockets etc are secure before switching the supply on.

Earthing

It is important that the motor enclosure is soundly earthed by metallic earth continuity conductor, or by separate earth bonding, but in all cases the installation must be made and tested and approved for this feature by a qualified installer before the supply is applied to the motor.

Fitting Pulleys and Couplings

These should be bored to our standard limits (details supplied upon request) and fitted to the shaft with a screwing motion. On no account should they be driven on. Tapping of fittings onto the machine shaft with a hammer or mallet, causes bearing damage. This results in an increase in bearing noise and a significant reduction in bearing life. Attention should be paid to the guarding of all moving parts.

Drive Alignment

The rotor shaft must always be horizontal. There are three basis modes of misalignment, these are angular, parallel and axial (shown in fig. 4).

Flexible Coupling

1. Remove any dirt, oil, etc. from all mating surfaces. Place bush in hub and match half holes on both shafts.
2. Place setscrews loosely in threaded holes. Mount assembly in desired position on shafts.
3. Tighten setscrews. Place disc/flexible coupling in position, and bring the shafts together obtaining the manufacturers assembled length for the coupling given in their instructions.
4. To check for angular alignment: (see fig. 5)
Rotate the coupling through 90B and measure the distance between the faces. Repeat adjusting the shafts until four identical measurements are obtained.
To check for parallel alignment: (see fig. 5)

Place a straight edge across the coupling. The hubs will be in correct alignment when the straight edge contacts the 4 points squarely.

Drive Belts

1. Remove any dirt, oil, etc. from all mating surfaces. Place bush in hub and match half holes on both shafts.
2. Mount assembly in desired position on shafts ensuring both shafts are parallel and in correct alignment, use a straight edge, a correctly aligned drive will contact both pulleys squarely (see fig. 6).
3. Fit driving belts. Measure span of belts between tangent points of the two pulleys. A deflection of 1.5mm is obtained for every 100mm of the measured span. Compare the deflection force required with the table. If the force required is according to the table then the tension is suitable. Too little force indicates under-tension and visa-versa.
4. The belts should be tensioned towards the high side, to allow for the tension drop after the belts have been run-in. Belt tension should be checked daily in the first week after installation/renewal.

Warning:

Excessive tension on the pulleys will damage the bearings and lead to a probable shaft rupture.

Belts, which become charged electrostatically, must not be used in hazardous atmospheres.

Pipework

- The connecting pipework must be completely clean, dry and free from internal rust or scale.
- When fitting the intake and discharge pipework it is essential that adequate supports be provided and that it is properly aligned to prevent excessive strain being placed upon the machine, flexible pipe should be placed in the pipeline to remove this strain.
- Care must be taken to ensure that no foreign matter enters the machine or serious damage may result.
- An intake filter should be fitted into the intake side to prevent any particles from entering the machine.
- Use P.T.F.E. tape only as a jointing medium since surplus from jointing compounds will damage the blades if drawn into the machine.
- When the machine is delivering into or exhausting from a receiver, or working with a system having a large storage capacity, it is essential to fit a non-return valve in the pipework, preferably on the discharge side to prevent the machine from running in reverse on shutdown.
- Arrange both the intake and discharge pipework so that any condensate flows away from the machine.
- If user is installing their own protective switches and other devices these must be suitable for operation in the zone classified.
- All pipework and fittings must comply with IGE/UP/2 or the national standard for the country of installation.

Pre Start-up Checks

Before starting the machine for the first time after installation, maintenance or after a long downtime, make the following checks: -

- ✓ Ensure all the anchor bolts for the machine, base and motor are securely fastened.
- ✓ Check that the machine is free running by turning the shaft by hand through a few revolutions.
- ✓ Flick start the motor to check that the direction of rotation agrees with the arrow on top of the machine cylinder. Note this should be completed with the coupling/drive belts removed.
- ✓ Recheck coupling/drive alignment and retension (see page 7).
- ✓ Ensure all equipment is installed and earthed in accordance with current legislation.
- ✓ Check all piping connections. If the system is to be pressure tested, all gauges and pressure switches must be isolated or removed. Maximum purge or pressure test is 1.50 times the working pressure.
- ✓ Check all protective devices ensuring they are working correctly.
- ✓ Ensure personnel are adequately protected from accidental contact with all dangerous equipment.
- ✓ Fill the oil reservoir with Shell Corena P150 oil or equivalent, prime the oil lines to the machine.
- ✓ Instruct the operating personnel that the machine is operational.

Protective Devices

All pressure and temperature switches must be set and tested at the set point by simulating actual operation. With the machine running at the duty pressure after warming up, adjust the discharge temperature switch downwards to actuate and stop the machine. Reset the switch at the cut out temperature plus 10^BC - 15^BC in order to avoid false tripping from small and reasonable increases above normal levels.

Inlet low-pressure switches are wired normally open and set no lower than 10mbar. Outlet high-pressure switches

are wired normally closed, adjust the switch in the same manner as the temperature switch and reset at working pressure plus 10%. The pressure proving switch may be wired normally open or normally closed to make or break your circuit, the set pressure should be just below actual operating pressure.

After the first 50 running hours if fitted, remove the cone shaped mesh strainer from the inlet, clean and replace. If a large amount of debris is collected run for a further 50 hours repeating the process until the filter remains clean.

Start-up

Proceed as follows: -

- i. When starting compressors the intake valves are fully open. Compressors can usually be started against normal discharge pressure. Open cooling water supply and throttle to a moderate flow rate.
- ii. Some compressors are piped with a manual start-up bypass valve from discharge to intake, for pressure equalisation during startup, This must be fully opened before startup.
- iii. Start the drive motor and bring the machine up to operating speed.
- iv. When full speed is reached slowly close the manual start-up bypass valve. Regulate the water flow until the outlet water from the cylinder is $27^{\text{B}}\text{C} - 38^{\text{B}}\text{C}$ at operating pressure.
- v. Check and adjust the lubricator drip rate to that indicated in the lubrication section.
- vi. Check all protective devices and controls making sure they are working correctly.

Operating Notes

- Daily, check the oil drip rate through the indicator. Fill the oil reservoir.
- After the initial running in period, check belt tension. Belt squeal denotes a loose belt that requires tightening.
- Inspect the filter fitted to the inlet, regularly clean and renew the element when necessary. Excessive discharge temperature for normal operation, indicated by the rise in temperature shown in the logbook indicates inadequate cooling, faulty lubrication or a dirty intake filter. Stop and inspect the machine.
- Check the machine internally for wear every 10,000 running hours. (see Inspection and Service)
- The blade depth should be checked after the initial 2,000 running hours and thereafter every 5,000 running hours for wear and renew if the rubbing tips have worn to a depth of 63mm for HD400 or 66mm for HD550. Condensate if allowed to enter the machine can cause severe blade wear.
- If adjustment of the oil drip rate is required (see lubrication).
- If machine is on a standby service, run for a few minutes each week.

Stopping Procedure

Proceed as follows: -

- i. Trip out or Stop the drive motor.
- ii. Stop the cooling water immediately. If freezing conditions are likely to be encountered then drain off the compressor unless closed circuit cooling with anti-freeze is being used.

Lubrication

The recommended grade of oil is **Shell Corena P150** the typical physical characteristics right.

Prime oil pipes prior to initial start and every time machine is dismantled for service, as serious damage will occur if the machine runs unlubricated.

Oil feed rate per indicator is shown below. These can be increased/decreased pro-rata with speed.

Lubricator Maintenance

After filling the tank with oil.

Remove the sight glass vent screw and fill the drip reservoir approximately half full with oil. **Do not fill to the top.**

Loosen the union nut on the pump outlet.

Fill the pumps with oil and prime by manually pumping flushing unit until all air has been expelled and oil is observed around union nut. Tighten the union nut.

Note: The drip reservoir will eventually fill to the top and overflow if oil is not periodically drained from the drip reservoir to the level indicated. This is not uncommon in pressurised suction pumps.

Flow Rate

Loosen the locknut on the flushing unit.

Turn flushing unit anti-clockwise to increase oil flow, and clockwise to decrease flow.

Tighten locknut when desired flow is achieved.

Maintenance

Fully trained and competent staff must carry out any maintenance work. Utile Engineering offers contract maintenance services if required contact our service department.

When carrying out any maintenance and inspections always follow the health and safety guidelines on page 4.

A regular correct maintenance plan is essential to good operational reliability and a long service life for your machine. As operating conditions vary, no exact timings can be specified for wear checks, repairs and inspections, however the following plan can be used as a guide until time scales to better suit the machines environment are found.

The machine, ancillaries and surrounding area should be kept as clean as possible.

Ensure all items are properly held and supported during all aspects of maintenance as not to pose a problem for health and safety. Observe all lifting points and apply care when handling the equipment.

Ensure all machines and associated pipework have cooled down sufficiently before touching and attempting any maintenance.

Typical tools required for maintenance include: -

Set of spanners

Pipe Wrenches

Circlip Pliers

Set of screwdrivers

Vernier Gauge / Micrometer

Two-leg Pulley drawer

Set of Allen Keys

Hammer / mallet

Feeler Gauges

Typical bolt tightening torques can be seen on page 6.

New gaskets must be fitted every time the machine is dismantled.

Bearings and seals are recommended to be replaced after 15000 operating hours or 2 years whichever is sooner.

Blades must be replaced regardless of wear after 20000 operating hours as failure due to fatigue could cause serious damage.

After maintenance the machine and equipment must be treated, as new and all pre-commissioning checks should be made. Install all protective devices and controls properly after completion of work. Ensure all cabling, unions and guards are correct, secure and in place. Dispose of any used oil and cleaning solutions as prescribed by law.

Troubleshooting

The following table shows some typical problems and the remedies.

Note: If assistance is required in determining and correcting the fault with the machine then contact our service department.

1. Check Blade Wear

When carrying out any maintenance and inspections always follow the health and safety guidelines on page 4.

Fully trained and competent staff must carry out any maintenance work.

1.1 Carry out the following procedure after the first 2,000 running hours and repeat every 5,000-hour interval. Record all measurements.

1.2 With the pump stationary and with the system drained, remove the eyebolt or plug in the top of the machine cylinder and insert into the hole beneath a pointed measuring rod 6mm dia x 150mm long until contact is

made with the rotor (see fig. 8). Scribe a mark on the rod. Slowly rotate the shaft by hand until the rod drops onto the tip of the blade, scribe a second mark on the rod. Measure the amount of movement and renew the blades if this exceeds 6mm. Replace the plug or eyebolt.

2. Blade Inspection

When carrying out any maintenance and inspections always follow the health and safety guidelines on page 4. Ensure all electric circuits are isolated and cannot be switched on, and that the pipeline system has been cleared and is pressurised to atmospheric pressure. Fully trained and competent service personnel must carry out any maintenance work.

Inspection commences with the dismantling of the rear end, after removal of the oil tank and pipes.

- 2.1 Undo four nuts (41) and remove lubricator (17) taking care not to lose the coupling spider (18).
- 2.2 Undo six screws (24) and remove end cap (4) complete with mechanical oil seal seat. Remove 'O' ring (16) from the groove in coverplate. Inspect the faces of the mechanical seal for wear and replace complete seal if either are worn. Shims may be fitted between the end cap and the outer race of the roller bearing (9) and care must be taken not to lose or damage these items. Remove the mechanical seal (12) taking care not to damage the carbon face. If the seal sticks on the shaft, carefully prise free with a screwdriver between the spring locating ring and the locknut (14).
- 2.3 Remove the locknut (14) and tab washer (15).
- 2.4 Take off eight nuts (20) and washers (21) and remove coverplate (2) complete with outer race of roller bearing (9) and oil seal (13) by using 1/2"UNC x 3 1/2" long jacking screws in the dowel positions (22).
- 2.5 Measure and note the thickness of the gasket (26) fitted between the coverplate (2) and cylinder (1).
- 2.6 The blades (6) can now be removed from their slots for inspection.
Check the blades for lamination, chipping or charring on their rubbing edges and for concave wear. For any other wear other than polished surfaces or if blade depth is 63mm for HD400 or 66mm for HD550 or below then replace the blades.
When replacing blades a complete set must be replaced. The old blades must be disposed of according to the local government laws. When fitting new blades, ensure they slide freely in their slots and if necessary remove high spots with fine emery cloth. Lightly smear blade surfaces with oil before reassembly.
- 2.7 Inspect the visible part of the cylinder bore and rotor for any signs of excessive wear or scuffing and for excessive slot wear. If there is any sign of cylinder rubbing completely dismantle the machine. Factory reconditioning is recommended, but if work has to be carried out on site, we advise you most strongly to contact Utile Engineering Service Department for advice.
During inspection, determine if the correct oil is being used. Bearings, cylinder wall, rotor/shaft assembly and blades should show a polished surface with a light film of oil. Hard baked deposits indicate inferior oil, dirt or excessive temperature.

3. Reassembly after Blade Inspection

Reassemble in the reverse order, taking note of the following points: -

- 3.1 Ensure the blades are orientated correctly in their slots.
- 3.2 If coverplate gaskets have been replaced it is essential they are the same thickness as the originals, as clearances will be affected and could cause serious damage. Lightly smear with oil before replacing.
- 3.3 Replace coverplate over cylinder studs. Tighten retaining nuts to a torque of 55Nm.
- 3.4 Secure bearing locknut and tab washer and replace remaining parts. Soapy water should be used to re-assemble the mechanical seal onto the shaft.
- 3.5 When assembled make sure the compressor turns freely by hand.
- 3.6 Before fitting oil pipes, prime with correct grade of oil as described in the LUBRICATION section.

4. Cylinder Renewal

With the rear end coverplate (3) already removed as described in 2 for blade inspection, the next stage is to remove the drive end coverplate (2) and rotor/shaft assembly.

- 4.1 Undo six screws (23) and remove end cap (3) complete with mechanical oil seal seat. Remove 'O' ring (16) from groove in coverplate. Shims may be fitted between the end cap and outer race of bearing (10) and care must be taken not to lose these. Inspect both faces of the mechanical seal for wear and replace

complete seal if either are worn. Remove the mechanical seal (11) taking care not to damage the carbon face. If the seal sticks on the shaft, and carefully prise free with a screwdriver between the spring locating ring and locknut (14).

- 4.2 Undo and remove the locknut (14) and tab washer (15).
- 4.3 Take off eight nuts (20) and washers (21) and remove coverplate (2) complete with ball bearing (10), outer race of roller bearing (9) and oil seal (13) by using 1/2"UNC x 3 1/2" long jacking screws in the dowel positions (22). Measure and note the thickness of the gasket (26) fitted between the coverplate (2) and cylinder (1). Remove rotor assembly. The cylinder can now be replaced or rebored.
- 4.4 When reboring the cylinder the maximum allowable increase in diameter is 0.8mm to give a final bore of 267.50mm. Contact Utile Engineering for appropriate assembly instructions in this case.

5. Removal of Bearings and Seals

With the rear end coverplate (2) already removed as described in 2 for blade inspection.

- 5.1 Using a two-leg pulley drawer the roller bearing inner race (9) can be removed from the shaft.
- 5.2 Should the seal sleeve (7) show signs of wear, then it can be removed by careful machining. Before removal, record the width of the sleeve using a depth micrometer measuring from sleeve face to rotor face.
- 5.3 The bearing seal (13) and roller bearing outer race (9) can be pressed out of the coverplate for inspection.
- 5.4 Inspect the bearing, renew if it shows any signs of wear or pitting.
- 5.5 Examine the bearing seal (13) and renew if the wiping lip is worn or damaged.

With the drive end coverplate (2) already removed complete with rotor as described in 4 for cylinder renewal.

- 5.6 Using a two-leg pulley drawer the roller bearing inner race (9) can be removed from the shaft.
- 5.7 Should the seal sleeve (7) show signs of wear, then it can be removed by careful machining. Before removal, record the width of the sleeve using a depth micrometer measuring from sleeve face to rotor face.
- 5.8 The bearing seal (13) ball bearing (10) and roller bearing outer race (9) can be pressed out of the coverplate for inspection renew if they show any signs of wear or pitting.
- 5.9 Examine the bearing seal (13) and renew if the wiping lip is worn or damaged.

6. Reassembly Procedure

This section only applies when using original bore size or replacement cylinder. Before commencing reassembly ensure all components are perfectly clean and oilways are clear. Lightly smear the shaft with oil to assist assembly.

The correct clearances for these machines are: -

	HD400	HD550
Drive End Coverplate / Rotor	0.13mm / 0.18mm	0.13mm / 0.18mm
Rear End Coverplate / Rotor	0.78mm / 0.84mm	0.78mm / 0.84mm
Rotor / Cylinder	0.13mm / 0.15mm	0.13mm / 0.15mm

The clearances must be reset after:

- a) Renewal of seal sleeve.
- b) Refacing of coverplates or
- c) Facing rotor without removal of seal sleeve.

Reassembly should start with the resetting of clearances if any of the above three procedures have been completed. If not required go to 6.7.

- 6.1 Make accurate metal "dummy" distance piece to replace the ball and roller bearings. See Fig 9.
- 6.2 Slide new seal sleeve onto shaft. Fit "dummy" bearings into coverplate and slide assembly over shaft. Replace bearing locknut and washer and tighten. Replace end cap, shims and mechanical seal. Soapy water should be used to re-assemble the mechanical seal on the shaft.
- 6.3 Measure clearance between coverplate and rotor using a shim stock as Fig 10. This should be within +/- 0.25mm (0.001") of that shown on the machine clearance plate and excess will have to be ground from width of seal sleeve. After grinding repeat above procedure and recheck for correct clearance.
- 6.4 When correct clearance has been established the seal sleeve can then be fixed to the shaft thoroughly degrease components, use Loctite primer and 648 adhesive or equivalent. Press sleeve firmly against the

rotor whilst the adhesive is setting.

- 6.5 Grind the rear end replacement sleeve to length measured in 5.2 and fit to shaft by adhesive (See 6.4).
- 6.6 Slide inner races of roller bearings onto shaft hard against faces of seal sleeves. Inner and outer races must be kept as matching pairs.

Starting at the drive end

- 6.7 Position the bearing seal (13) into position in coverplate (2) ensuring the tension spring is facing the rotor.
- 6.8 Press the outer race of roller bearing (9) into position in the coverplate (2).
- 6.9 Lay the rotor/shaft assembly on the bottom of the cylinder (1), ensure the cylinder is orientated correctly.
- 6.10 Ease coverplate (2) onto the rotor/shaft complete with coverplate gasket. If coverplate gasket (26) has been replaced, it is essential that they are the same thickness as the originals, otherwise internal clearances will be affected and could cause serious damage. Lightly smear the gasket with oil before replacing.
- 6.11 Press in the ball bearing (10). The whole bearing assembly can be locked onto the shaft with the locknut (14) and tab washer (15).
- 6.12 When fitting the mechanical seal (11), wipe over the shaft with soapy water to assist the assembly, the seal can then be eased onto the shaft and pushed against the locknut. Replacement seal seats should be lubricated for easier fitting in the end cap.
- 6.13 The end cap (3) can now be fitted with the o-ring (16) and any appropriate shims.
- 6.14 Re-check rotor / cylinder clearance.
- 6.15 Place coverplate assembly onto cylinder (1) via location dowels and studs with coverplate gaskets (26) in place, tighten cylinder stud nuts to a torque of 55Nm.
- 6.16 Check rotor / cylinder clearance at rear end with straight edge and feeler as Fig 11. Add gaskets to this dimension to obtain clearance.

Reassemble rear end

- 6.17 Refit sliding blades (6) in their slots after lightly smearing with oil and removing any high spots with fine emery cloth. Ensure the blades are orientated correctly in their slots.
 - 6.18 Place the bearing seal (13) into position in the coverplate (2) ensuring the tension spring is facing the rotor.
 - 6.19 Press the outer race of roller bearing (9) into position in the coverplate (2).
 - 6.20 If coverplate gasket (26) has been replaced, it is essential that they are the same thickness as the originals, otherwise internal clearances will be affected and could cause serious damage. Lightly smear the gasket with oil before replacing.
 - 6.21 Place rear coverplate assembly onto cylinder (1) via location dowels and studs with coverplate gaskets (26) in place, tighten cylinder stud nuts to a torque of 55Nm.
 - 6.22 The whole bearing assembly can be locked onto the shaft with the locknut (14) and tab washer (15).
 - 6.23 When fitting the mechanical seal (12), wipe over the shaft with soapy water to assist the assembly, the seal can then be eased onto the shaft and pushed against the locknut. Replacement seal seats should be lubricated for easier fitting in the end cap.
 - 6.24 The end cap (4) can now be fitted with the o-ring (16) and any appropriate shims.
- Check that the shaft rotates freely by hand before refitting lubrication system.
- 6.25 Reposition coupling (18) taking care with the spider, replace lubricator (17). Prime oil pipes before use.

7. Spare Parts

A stock of the main wearing parts at the installation site is important to the constant availability and smooth running of the machine. We recommend the following parts and quantities to be kept in stock at the installation site.

Description	Part Number		Quantity
	HD400	HD550	
Blade	S 1830	S 1830	8
Roller Bearing – Drive & Rear End	H 1086	H 1086	2
Ball Bearing – Drive End	H 1087	H 1087	1
Mechanical Seal – Drive End	F 1188	F 1188	1
Mechanical Seal – Rear End	F 1192	F 1192	1
Bearing Seal	F 1190	F 1190	2
O-Ring	F 1189	F 1189	2
Gasket – Flange	K 1130	K 1130	2
Gasket – Coverplate	S 1890	S 1890	2
Drive Belt / Drive Coupling			1 set

Always quote the machine serial number when ordering spare parts.

No.	DESCRIPTION	PART NUMBER	QTY
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		HD400	HD550	
1	CYLINDER	S 1969	S 1969	1
2	COVERPLATE – DRIVE END	S 1824/1	S 1824/2	2
3	ENDCAP – DRIVE END	S 1826	S 1826	1
4	ENDCAP – REAR END	S 1827	S 1827	1
5	ROTOR/SHAFT ASSEMBLY	S 1828/1	S 1828/2	1
6	BLADE	S 1830	S 1830	8
7	SEAL SLEEVE	S 1894	S 1894	2
8	FLANGE	M 1234	M 1234	2
9	ROLLER BEARING	H 1086	H 1086	2
10	BALL BEARING	H 1087	H 1087	1
11	MECHANICAL SEAL – DRIVE END	F 1188	F 1188	1
12	MECHANICAL SEAL – REAR END	F 1192	F 1192	1
13	BEARING SEAL	F 1190	F 1190	2
14	LOCKNUT	B 1124	B 1124	2
15	TAB WASHER	B 1125	B 1125	2
16	O-RING	F 1189	F 1189	2
17	LUBRICATOR	T 1055	T 1055	1
18	COUPLING	P 1017	P 1017	1
19	STUD	S 1889	S 1889	16
20	NUT	B 1126	B 1126	16
21	WASHER	U 1007	U 1007	16
22	DOWEL	E 1021	E 1021	4
23	SOCKET HEAD CAP SCREW	G 1191	G 1191	6
24	SOCKET HEAD CAP SCREW	G 1192	G 1192	6
25	HEX HEAD SCREW	G 1147	G 1147	16
26	GASKET - COVERPLATE	S 1890	S 1890	2
27	GASKET - FLANGE	K 1130	K 1130	2
28	ADAPTOR	R 1084	R 1084	10
29	ELBOW	R 1208	R 1208	4
30	TEE ADAPTOR	S 1898/3M	S 1898/3M	1
31	TUBING NUT	R 1152	R 1152	16
32	OIL DELIVERY PIPE – END CAP – DRIVE END	X 1127	X 1127	1
33	OIL DELIVERY PIPE – END CAP – REAR END	X 1128	X 1128	1
34	OIL DELIVERY PIPE – COVERPLATE – DRIVE END	X 1129	X 1129	1
35	OIL DELIVERY PIPE – COVERPLATE – REAR END	X 1130	X 1130	1
36	OIL DELIVERY PIPE – CYLINDER – DRIVE END	X 1131	X 1131	1
37	OIL DELIVERY PIPE – CYLINDER – REAR END	X 1132	X 1132	1
38	OIL TRANSFER PIPE – DRIVE END	X 1120	X 1120	1
39	OIL TRANSFER PIPE – REAR END	X 1121	X 1121	1
40	STUD	D 1000	D 1000	4
41	NUT	B 1014	B 1014	4
42	OIL QUILL	S 1898	S 1898	1

After Sales Service

Contact the address or telephone number shown at the bottom of each page or our local distributor, for any after sales service, maintenance or service problems.

Contract maintenance, service exchange machines or a site visit by a Utile Engineering Service Engineer can also be arranged in the same manner.

Utile Engineering can also provide Training Programs for all your requirements, from maintenance repair to operator and supervisor training. They are structured to give specialist knowledge of our products and procedures including use of authorised spares. The enacting of the Health and Safety at Work Act focused attention on the responsibility of all parties, manufacturers, users and repairers on the repair of equipment. We strongly recommend that repairs should be carried out to the original specification using authorised replacement parts where necessary.

Warranty Claim Conditions

Utile offers a 12-month warranty against faulty parts and workmanship. This does not include components used in the production of packages, where the appropriate manufacturers warranty applies.

1. The warranty period commences from the first day that the operator receives the machine.
2. The warranty covers defective parts or workmanship used in the manufacture of the machine.
3. The operator must notify the company promptly of any failure (using the appropriate procedure – indicated below).

Please note: The company is not liable for any claim where: -

1. Damages or delay or any other consequential cost associated with the alleged defect, are incurred.
2. Malfunction caused by fair wear and tear, abnormal conditions of use, accident, neglect or misuse of equipment, or improper storage.
3. Deviation from operating specifications or other special terms of sale.
4. Improper operation, maintenance or repair.
5. Damage resulting during shipment or installation by other than company authorised personnel.
6. Freight charges for goods returned to the company's premises.

No allowances will be made for repairs or alterations carried out without the company's written consent or approval.

