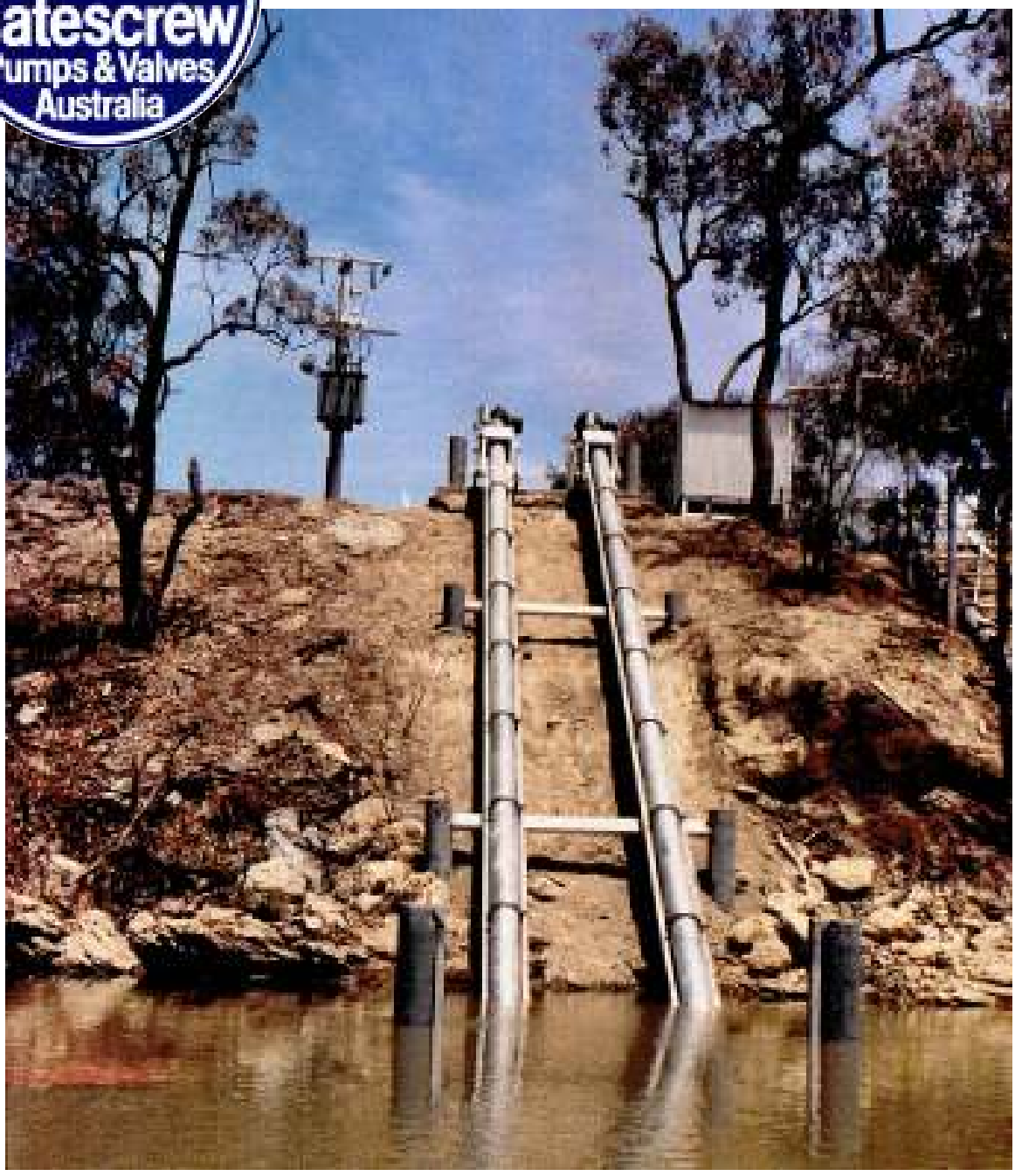
Operation & Service Manual
Pump # 7634

17/21 Axial Flow • Oil Lubricated • Angle Application
Four Stage • PTO Coupled



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Batescrew Pumps & Valves Australia

BATESCREW PUMPS

OPERATION & SERVICE MANUAL
17/21 OIL LUBRICATED
AXIAL FLOW

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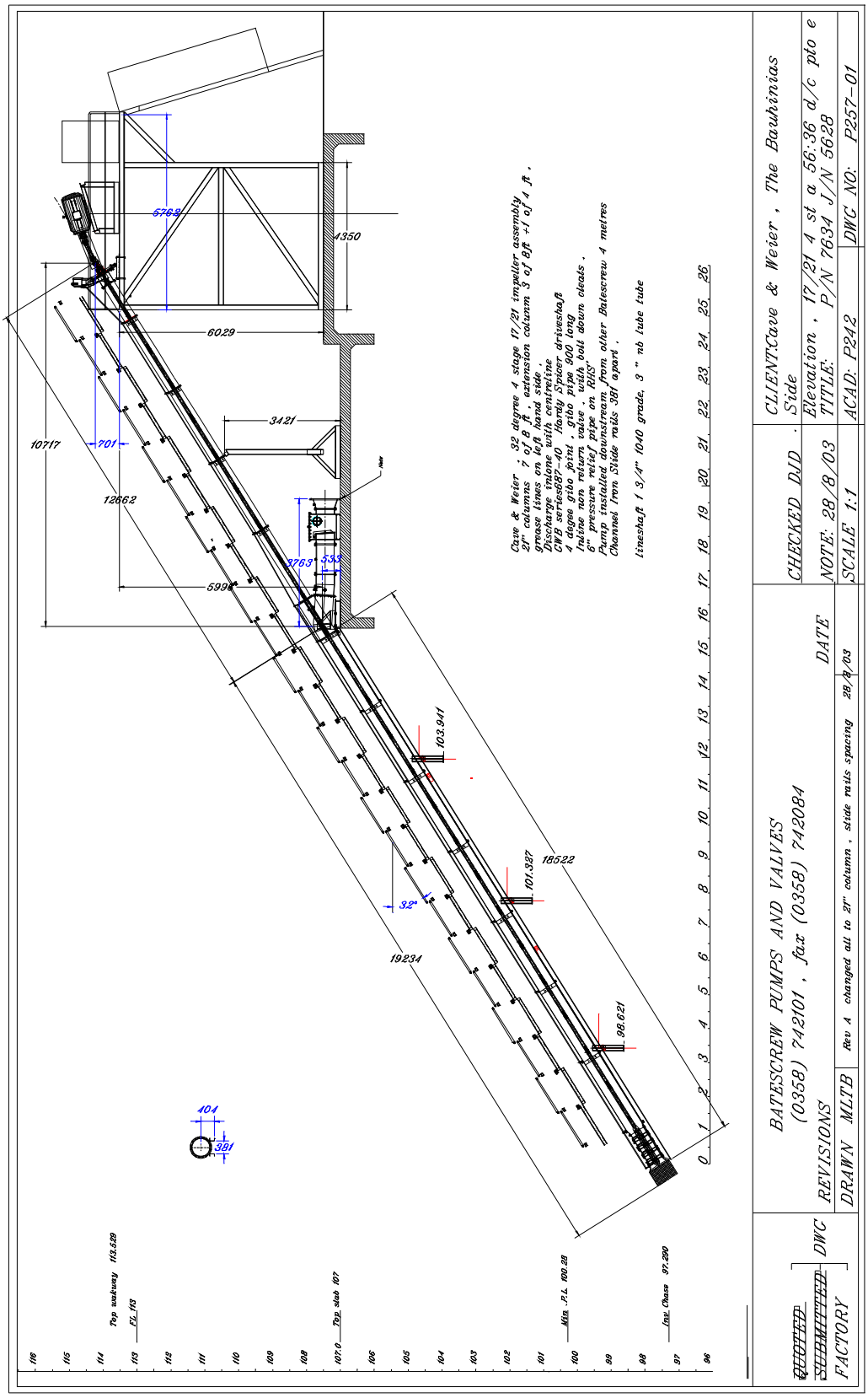
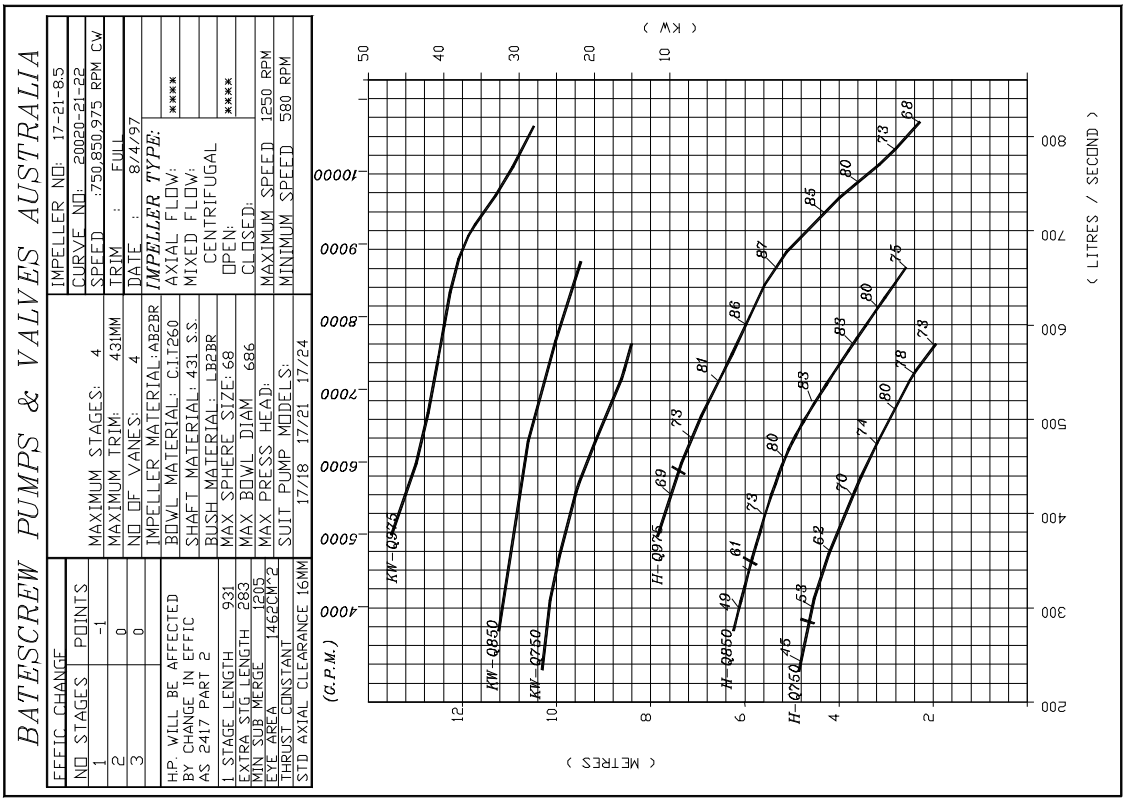

Cave & Weier , 32 degree 4 stage 17/21 impeller assembly
21" columns , 7 of 8 ft , extension column 3 of 8ft +1 of 4 ft ,
grease lines on left hand side .
Discharge flange with centreline
CWB series687-40 Hardy Shaw driveshaft
4 degree gibo joint , gibo pipe 900 long
Inline non return valve , with ball down cleats .
6" pressure relief pipe on RHS".
Pump installed downstream from other Batescrew 4 metres
Channel from Slide rails 381 apart ,
lineshaft 1 3/4" 1040 grade, 3 " nb tube tube
5762
1350
6029
3421
10717
701
12662
2763
330
5998
103.941
101.337
18522
32"
192234
98.621
404
381
Top walkway 113.529
FL 113
Top slab 107
Min. FL 100.28
Inv. Chase 97.290
BATESCREW PUMPS AND VALVES
(0358) 742101 , fax (0358) 742084
DATE
CHECKED DJD
CLIENT:Cave & Weier , The Bauhinias
Side
NOTE: 28/8/03
Elevation , 17/21 4 st a 56:36 d/c pto e
TITLE: P/N 7634 J/N 5628
SCALE 1:1
ACAD: P242
DWG NO: P257-01
REVISIONS
DRAWN MLTB
Rev A changed all to 21" column , side rails spacing 28/8/03
DWG
FACTORY

2 Introduction

Batescrew 17/21 Four Stage Angle application Axial Flow Pump

This pump set is a PTO Coupled, Electrically Driven, Angle Mounted, Irrigation Pump. The pump set was designed for pumping irrigation water from a river into a channel or pipe.
Potential Flow Rates 4 stage are up to 10,000 gpm (750 l/s) or Heads to 80 ft. (24 mtrs), Depending on demand requirements.

SINGLE STAGE CURVE DISPLAYED



3 Description

3.1 Strainer

3.2 Wet End Assembly

3.3 Column Assembly

3.4 Discharge Head

3.5 Drive Extension

3.6 Drive Shaft

3.7 Motor Mount

3.8 Drive Motor

3.9 Discharge Pipe

3.1 Strainer

The strainer serves to protect the impeller and stator from the entry of foreign bodies.
The design of the strainer is such as to have minimal effect on water flow whilst allowing the capture of possibly damaging material. All pumps shall be fitted with a protective strainer. On angle mounted pumps the strainer should be fitted to the intake where it should be checked for damage and cleaned regularly.
(Note: In such applications it is important that no foreign bodies be allowed to lodge across the screen and inhibit flow or the pump run without a screen as objects taken in may cause vibrations and severe damage to the pump).

WARNING Damage to pumps from intake of foreign bodies is not covered by warranty

The pump requires a solid base upon which it may be mounted, preferably at 12' centres up the bank i.e.: at each support rail join and a solid slab at the head and knee braces
The supply must be adequate and clear of debris to avoid the impellers running dry at low water levels.
Typically, a supply coverage of at least 1.5 times the intake diameter would be adequate however, river conditions can effect this. If in doubt as to the supply characteristics of your inlet ring Batescrew Technical Assistance for help.
Entrance velocities must be less than 2.5 ft/sec (0.6 m/sec).

3.2 Wet End Assembly

Consisting of four stages, each having 17" diameter Stator, Impeller and Running Ring also the wet end includes a 17" to 21" Column Adapter, fitted to the bottom will be a Bell Mouth, sized matched to the pump and including Bottom Bearing. Pump rotation is provided via the stainless steel drive shaft that is connected to the impellers by taper lock, locating clip and key.

The shaft and impellers are located in position horizontally by the bottom bearing and vertically by the top adjusting nut.

The pump impellers are balanced for vibrationless operation and should turn freely (with no roughness), if vibration or noise during running is encountered the pump may have been damaged, the factory should be contacted, and repairs made as soon as possible.

Any further damage caused by running a vibrating or damaged pump is not covered by warranty.

3.3 Column Assembly.

The column acts as a pipe line for the flow of water, it is also the support for the pump and shaft bearings. Shaft bearings are positioned every 4' (1.2m) along the column within the lube tube and are lubricated from header tank at a rate of 10 drips per minute during and for at least 20 minutes before the pump is run.

It is imperative that the oil header tank is never allowed to run dry or be filled with dirty or non-specified oil; **such action may cause serious damage to the pump.**

(The only oil recommended is SHELL TELLUS 32 or equivalent grade.)

WARNING: Such action will void warranty

Standard column lengths are 4 ft (1.2m) and 8ft (2.4m) flanged mild steel fully hot dipped galvanized, the line shaft is high tensile mild steel with a galvanized oil lubrication tube, lube joiner tubes, and mild steel muff couplings. Shafts and lube tubes are screwed together in 4ft (1.2m) lengths.

3.4 Discharge Head

Fitted to the top of the column is the Discharge Head unit which acts as the mounting point for column support, it also contains the top drive shaft, drive extension mounts. The discharge head unit also turns the water flow through 36 deg so that correct pipe alignment can be achieved. Usually, mounted to the discharge head is the oil reservoir that provides the lubrication for the bearings in the pump.

3.5 Drive Extension

The drive extension continues the lube tube and drive shaft from the discharge head to the thrust bearing mount at a point above flood level, it's purpose is drive shaft support and lubrication supply.

3.6 Drive Shaft

The drive shaft attaches to the top of the thrust bearing and connects the top shaft to the motor shaft.

The drive shaft must be covered with a safety cover by law and removal and operation without the safety cover is forbidden.

3 Description

3.7 Motor Mount

Motor mounting is achieved by a motor mounting frame which attaches to the pump mount plate and allows the motor to be attached in line with the pump shaft and thrust bearing, whilst allowing room for the drive shaft to be fitted and access for shaft end play adjustment to be performed.

3.8 Drive Motor

The motor is a solid shaft, foot mounted type, selected for the power requirements of the individual job. The RPM and HP of the motor are matched to the requirements of the pump at the rate and head required and should only be replaced with a similar motor. Wiring of the motor must only be done by suitably qualified personnel and correct safety protection must be fitted.

WARNING: The direction of rotation of the motor is critical and the fitting of a motor of the wrong rotation will destroy the pump immediately. Always check the motor direction by running the motor before fitting. No warranty covers damage by reverse rotation.

THE MOTOR DIRECTION MUST BE ESTABLISHED BEFORE CONNECTING THE PTO SHAFT TO THE MOTOR DRIVE SHAFT.

3.9 Discharge Pipe

The outlet is fitted with a Batescrew standard flange; adapters can be supplied to change this to any standard flange or seal joint required.

It should be noted that care should be taken in how the water is allowed to leave the pump outlet, the water should never be allowed to drop directly upon the ground as wash away will cause soil erosion.

The use of a bubbler or other suitable outlet structure of the appropriate size will eliminate any erosion and allow unrestricted water release.

4 Assembly and Installation

4.1 Pre-Installation

Before any installation can be performed the site must be prepared.
The Pump will require:

* A sound well constructed mounting pad at the top of the bank.
* Confirmation of river depth bench mark and flood levels confirming the supply's ability to deliver rate required.
* Electricity supply at the correct voltage and sufficient amps.
* Lifting device or crane to lift pump onto the slide rails.
* Site must be accessible with clear workspace.

4.2 Assembly

As a general rule these axial flow lift pumps are shipped from the factory in sections to facilitate easy assembly, The column support pylons should have been positioned previously and they should be firm and stable prior to work commencing. Please take careful note of all warnings and notations.

* Refer to the parts break down and check that all parts are present and in good order.
* Check that the pump length and diameter is correct and that a clear space of .5 to 0.75 times bell mouth width is achievable from the bell mouth to any objects or riverbank.

4.3 Fit Support Rails

* Check that the support pylons have been fitted every 12' down the bank, starting from the end of the concrete slab.
* A single pylon of substantial enough size and depth may be used and in this application the rail mount would be a cockie's perch type with support gussets each side of upright.
* The more traditional support is the single pylon each side system, with a cross rail of 5" channel mounted between the two upright supports via adjusting slide bolts. This setup gives ease of adjustment, stable support and plenty of adjustment potential.
* Fit the pump support into place on the concrete slab, in line with the position of the pylons, using chemical anchors or Loxin bolts for this job.

4.3 Fit Support Rails

* If customer supplied, or some other type of weld-insitue rail support pylons are to be used, bolt the support rails together, supported with bracing, then weld the cross rails onto the pylons, making sure of alignment and the 36 deg angle, then refer to the Pump Fitting section below.
* For BATESCREW supplied standard pump supports.
* Run two string lines down the bank to give alignment for pylon upright positioning.
* The knee braces are bolted to the pump support .

4.3 Fit Support Rails

* Install the pump knee brace support base onto the slab, aligned with the desired center of the pump and orientated to the desired line of the pump down the bank.
* Position the first set of upright support rail posts onto the pylons and attach the cross braces between them, check they are vertical and correctly aligned. When you are sure the uprights are true, drill the bolt holes and fit the anchors into the pylons.
* Bolt the first cross beam support between the first set of support uprights.
* Position the second set of support uprights & bolt the next cross bearer between them.
* Repeat the procedure until all the support bearers are in place.
* Join the slide rails together as you slide them into position on to the cross bearers down the bank.
* The last or top slide rail bolts to the pump knee brace support base that has fishplates to accept it.
* Using a string line and angle indicator, adjust the support cross beams to achieve the correct angle and straightness of the support rails.
* Check all nuts and bolts for correct tension.
* Do not fit the top knee braces to the pump support base (If you fit knee braces it will be in the way when assembling pump)
* Install the motor support frame and extension drive support rails, using a string line and angle indicator to get the correct alignment.

4.4 Fit Pump

* The wet end would have been supplied complete including the pump-to-column adaptor and some column sections, check that this is undamaged and clean.
* Using appropriate lifting equipment, lift the main pump assembly (wet end and attached column sections) from the ground to a position above and in line with the support rails (make sure the pump is held so that it sits at the correct angle and rotation for fitting).
* Lower the pump assembly until it sits correctly in the support rails and secure it using a strong lifting device, allow the pump to slide down the rails until the next column section and lube tubes will fit onto the work position.
* Apply liberal amounts of stag paste to the thread of one lube tube joiner and Screw the lube tube joiner half-way into the top of the lube tube protruding out of the top column section fitted to the pump.

4 Assembly and Installation

* Pump 250m1 of Tellus 32 or 42 oil into the top lube tube to pre lube the pump.
* Apply a small amount of never seize to the thread of the line shaft protruding from the lube tube in the pump and screw a muff coupling half-way onto the line shaft.
* Lift the next 8' section of drive shaft and lube tube from the ground and position at the correct angle to allow you to screw the line shaft into the muff coupling.
* Apply a small amount of never seize to the thread of the line shaft and screw the shaft into the muff coupling until it bottoms firmly onto the bottom line shaft.
* Apply liberal amounts of stag paste to the thread of the lube tube joiner and screw the suspended tube on to the joiner until it firmly butts against the bottom lube tube.
* Using an appropriate lifting sling, pick up the next column section and slide it along the rails, over the lube tube/Lineshaft, until it butts against the existing top column (make sure the spider mount web inside the column does not entangle the lube tube as it is fitted, this is best achieved by making sure the spider is positioned to the topmost point and the natural droop of the lube tube will allow the correct entry).
* Rotate the new column 180 degrees and fit the column flange bolts and nuts.
* Fit the lube tube clamp saddle and two bolts and nuts with lock nuts.
* Lower the pump assembly until the correct workstation is once again achieved.
* Repeat all the steps again until all column sections are installed.
* WARNING Do not forget to install 250 ml of oil into every lube tube, as pump seizure may result if not done.
* Fit the next section of lube tube and line shaft
* Using a suitable lifting sling lift the discharge head so that it sits at the correct angle and slide it over the lube tube until it is positioned against the top column, bolt it into place.
* Align the knee braces with the rails, and by moving the pump or braces, align the rails/pump/slab correctly using the multiple choice holes built into the head and knee braces.
* (If alignment is not correct, bolt holes in the knee braces may need to be reselected until correct ones are found, remove the slings and fit any additional bracketing.)
* Fit the bottom gland plate to the extension mount stool in the head.
* Fit the "o" ring seal over the lube tube and slide it down into place against the head extension sealing flange, smear the sealing flange with stag paste.
* Fit the first drive extension outer sleeve over the lube tube and bolt into place.
* Assemble the drive extension as you did with the column sections until all drive extensions, lube tubes and line shafts are fitted do not forget to install lubricant into lube tube.
* Fit the bearing mount to the top drive extension and bolt down.
* Install the tension nut to the top of the lube tube using stag paste to seal the joint, tighten firmly and bolt to the bearing mount.
* Coat the tension nut lip seal with lubricant and carefully install it into the tension nut.
* Install the last muff coupling and the top shaft

4 Assembly and Installation

* Install the extension drive mount plates to the motor mount tower.
* Fit the bearing mount stool and install the thrust bearing assembly.
* Align the slot in the thrust bearing hollow shaft with the keyway in the top shaft and install the drive key (make sure the drive key is firm but not binding as the shaft will need to slide so the correct top nut adjustment will be achieved).
* Install the motor to the motor mount frame, aligning it with the thrust bearing.
* Install the bottom half coupling and slide it down the shaft clear of the top nut area.
* Fit the top nut, being sure the locking screws are backed out (not fouling the thread).
* Screw the top nut down against the thrust-bearing boss, pulling the line shaft up until the nut firms up and the pump can be felt to seize as the impeller touches the stator.
* Back the top nut off 1.5 turns so that the impeller clears the stator.
* If the top nut runs out of thread call BATESCREW for help.
* If the line shaft does not drop as the top nut is backed off then the key way is most likely too tight or the line shaft is seizing at some point (repair and retry).
* When the top nut is correctly adjusted the pump should turn smoothly.
* Tighten the top nut locking screw (onto the keyway only).
* Install the top PTO drive coupling to the drive shaft on the motor
* Install the PTO shaft safety cover bottom half to the mount frame
* Install the PTO shaft to the thrust-bearing end only, using the high tensile bolts.
* Make sure that PTO **is not** in connected to the drive motor until motor rotation has been established. (Follow the directional arrow on pump).
* Install the oil tank and connect the oil lines to the tension nut with the fittings provided
* The line connectors are fitted each side of the tension nut, one supplies oil the the lube tubes and one gives vapor return from the oil cavity (it does not matter which fitting is on which hole unless one hole is higher than the other then the vapor line is to the highest hole.
* Set the adjustable dripper that is installed at the oil discharge line from the bottom of the tank to 10 drips per second at least 1/2 hour before starting the pump. (The dripper must be supplying oil, if the line fills then check for blocked lines or vapor lock, it may be necessity for the pump to be turned over in order to start the dripper working).
* Run the drive motor **uncoupled** from the PTO and make sure that the direction of rotation is correct.
* Only when you are sure that the rotation is correct, slide the PTO couplings into place, fit the bolts, and then install the PTO shaft safety cover top half.

NOTE: It is the responsibility of the installer to check motor direction prior to installation
Failure to do so may cause severe pump or motor damage thus voiding warranty.

* Fit the discharge pipe and gaskets

Install any concrete anchors making sure all mounts are sitting flat.

4 Assembly and Installation

4.5 Testing

* Check by hand that the pump turns freely with no noise or roughness.
* Check that all persons and animals are clear of the pump and that all safety devices are connected and in place, especially all intake guards and covers. Make sure all inlet and out let valves are open.
* Run the pump for 15 seconds and check for smooth operation and lack of noise.
* Check oil is running down the lubrication line (check dripper is clear and running)
* Check for excess temperature at tension nut.
* Check all bolts and connections and restart the pump for 5 minutes.
* If all is still well then turn pump over by hand and test for freeness and lack of noise.
* Check the pump at regular intervals for leaks or noises.
* Check and note motor amperage, volts, power factor, and river level at time of test.

5 Operation

5.1 Start-Up

* Always check safety covers are fitted, especially intake screens and electrical covers.
* Check all personnel and animals are clear of intakes and outlets including channels.
* Carry out service procedures as outlined in maintenance.
* Fill lubrication oil tank and start oil lubrication at 10 drops per minute at least 15 minutes before the pump in needed.
* Open the intake and outlet valves.
* Ensure that water is present.
* Turn on mains, check for electrical problems, (live components, bypassed fuses etc.)
* Start the motor and listen/feel for any unusual noises or vibrations.
* Adjust the flow with directional gate valves, if fitted.
* Check that seal leaks take up, if not, find the cause of leakage and adjust or repair.
* Safely secure the pump site (especially from children)

5.2 During Operation

* Check the pump every couple of hours for unusual noises or vibrations.
* Check the intake screen area for build up of foreign material at least twice a day.
* Watch for seal leakage and adjust/repair if needed.
* Check oil lubrication rate, adjust to 10 drops per minute if needed, fill oil tank as needed with clean SHELL TELLUS 32, TEXACO 32 or equivalent oil.
* On systems running continuously, grease bearings once a week (two pumps of SHELL ALVANIA EP3, MOBIL,TEXACO ALVANIA EP3 grease).
* Check motor temperature regularly to assure motor is not overloading and overheating.
* Check the tension nut for temperature and note motor amp draw.

5 Operation

5.3 Shut Down

* Turn off motor and isolate all electrical circuits.
* Shut all inlet and outlet gates.
* One minute after pump has stopped turning, close down lubrication oil flow.
* If bearings have not been greased then grease nipples whilst they are warm.
* Clean and secure site.
* Note any defects and have them fixed whilst pump is idle.
* Fill out pump user's register.

This operation direction outlines the suggested way to manually start, run, and close down your pump set.
It by no means covers every application and every eventuality.
Auto operation is not covered in this manual and correct operation of auto start stop and run pump stations must be set by the controller manufacturer/installer, bearing in mind the needs for protecting these pumps from running dry or out of lubrication.
If problems occur in start up or running of your pump set call Batescrew Technical Department for help.
Whilst Batescrew design and build these pumps with performance and safety in mind, it is solely the responsibility of the operator to always maintain & operate the equipment in a safe and appropriate manner, bearing in mind today's ever changing occupational and health requirements.

Special care must be taken in relation to appropriate safety covers on all moving parts.

6 Removal, Disassembly, and Assembly

6.1 Disassembly

The disassembly of the pump may be for any number of reasons. It is assumed here that disassembly is for impeller replacement.

* Note the direction of rotation of the pump (VERY IMPORTANT).
* Disassemble the pump in the reverse procedure as for assembly, as described earlier in this manual, until the drive extension has been removed.
* Unscrew the bolts securing the head to extension drive seal plate, then remove the seal plate and “o” ring seal.
* Disconnect the discharge pipe and remove it.
* Using a block and tackle plus a securing chain, or similar devices, secure the pump from sliding whilst allowing the pump to be slid upwards to gain access to all parts.
* Remove the two bolts attaching the head to the knee braces.
* Remove the column / head securing bolts
* Slide the head assembly upwards until access is gained to the first lube tube joiner.
* Unscrew the top lube tube from the joiner, slide the lube tube up to expose the first muff coupling.
* Unscrew the top line shaft out of the muff coupling, If you are unable to unscrew a coupling, strike opposite sides of the coupling at the same time with two 2kg hammers. (This loosens the coupling on the shaft, stretching the thread and, provided excessive damage is not done, the coupling may be reused. If in doubt replace the stretched coupling.) Unscrew the muff coupling from the lower line shaft.
* Remove the head assembly.
* Remove the lube tube joiner from the lower lube tube
* Lift the pump up the rails and support underneath the first column flange.
* Unscrew the top shaft muff coupling.
* Remove the lube tube clamp bolts and remove the half clamp.
* Clean the stag jointing compound from the surface of the lube tubes and joiners and remove the lube tube, line shaft.
* Remove the column bolts at next column to be removed and remove the column, exposing the next two lube tubes.
* Unscrew the next lube tube at the joiner and remove it
* Remove the lube tube joiner and then remove the next lube tube exposing the line shaft muff coupling
* Remove the line shaft from the muff coupling and remove the muff coupling and lube tube joiner

6 Removal, Disassembly, and Assembly

6.1 Disassembly

* Remove the lube tube clamp bolts and remove the half clamp.
* Remove the next column and repeat the above procedure until all column sections and lube tubes have been removed.
* Lift the wet end out of the rails and away to a stable and clean workspace.
* Prepare the wet end for transport or rebuilding.
* Clean and protect all column ends and registers.
* Check exposed bearing clearances and if needed open every column joint and remove, open every lube tube to check bearings and shafts. (This is advised as worn bearings will cause vibration and breakage problems later).
* It is strongly advised that the wet end be returned to the factory for repair or replacement, any worn components be replaced with the original equipment only.

* **Check column sections for corrosion and machined flanges for distortion or damage. Clean all reusable columns, pay special attention to the mating faces and registers.**
* **Inspect drive shafts for wear and corrosion. If corrosion is severe, replace only with genuine BATESCREW parts that are correctly end machined for true alignment.**
* **Check all bolts and nuts removed from the pump and replace any showing wear.**

6.2 Disassembly of Wet End Assembly.
IT IS RECOMMENDED THIS BE DONE BY BATESCREW

* Remove any lube tubes, shafts and grease line fittings that may still be attached.
* Remove the stator to column adapter bolts and remove the column adaptor.
* Remove the top stator to running ring bolts and remove the top stator, exposing the top impeller and impeller shaft ready to measure.
* Attachment of the impeller to the shaft is by taper lock, with bolt on retaining plate.

(The position of the top impeller on the shaft must be noted. Measure from the top (threaded end) of the shaft to the impeller face and also the taper lock face).

* Remove the intake bell to bottom running ring bolts and slide the intake from wetend.
* Unscrew stainless steel bolts attaching the taper lock plate to the impeller and remove the taper lock plate from the bottom impeller.
* Whilst protecting its end and thread, rest the top end of the impeller shaft on a solid surface. Being careful not to damage the impeller, give the impeller a swift blow from below. This will shock the impeller from the taper, allowing its removal.
* Remove the taper from the shaft
* Remove the impeller from the wet end
* Remove running ring to stator bolts and remove the running ring from the wet end.
* Remove the stator to second running ring bolts and slide the stator from the shaft, exposing the next impeller and locking plate.
* Repeat the procedure until all impellers and running rings have been removed.

6 Removal, Disassembly and Assembly

6.3 Assemble Wet End

* Clean and inspect all parts, replace anything that looks suspect, check shafts and bushes for wear, (If in doubt contact Batescrew Technical Service Department Ph 0358742101 or FAX 0358742084 for correct advice.
* Do not use non-original or modified parts, as quality and performance may suffer.
* INSIST on only repairing with BATESCREW original pump parts.
* BATESCREW stock most components for there pumps, these can be supplied upon demand through your local irrigation agent or direct from BATESCREW SALES.
* Do not return defective or worn parts into service as failure may cause severe damage to other pump components.

Assemble Wet End

* The correct position of the impeller on the shaft must have been established during disassembly, if this was not done contact BATESCREW for help.
* Install the top impeller taper on to the shaft at the location measured during disassembly (large end away from the threaded end of the shaft).
* Slide the impeller onto the taper and fit the taper locking plate.
* Install and tighten the locking plate bolts evenly, securing impeller the shaft, checking that the dimension from end of the shaft to the taper has not changed.
* Install the top running ring onto the top stator.
* Slide the shaft and impeller into the stator/running ring assembly.
* Fit the second stator to the top running ring and bolt into place.
* Lock the impeller shaft so that the top impeller is up, firm against the top stator.
* Slide the impeller onto the shaft, firm up against the second stator assembly.
* Install the taper to the shaft and up into the impeller.
* Fit the second impeller locking plate and bolts but do not tighten them yet.
* Making sure that both the top and second impellers are firm against their stators, thus locating them onto the shaft at the correct spacing, tighten the locking plate bolts.
* Install the second running ring and the third stator.

Check after each impeller is fitted that end float has not been diminished, indicating correct impeller placement on the shaft.

* Repeat the above until all impellers and running rings have been fitted.
* Install the intake bell to the bottom running ring.
* Check clearance of the shaft in the bushes and Lip seals, replace if necessary. For wear limits and clearances refer to TOLERANCES section of this manual.
* Check impeller tip to running ring clearance (max. allowed is 3mm overall).
* Check the list in this manual, to be sure you have the correct lubricants and sealant ready.

6 Removal, Disassembly, and Assembly

6.4 Reassemble Pump

* Reverse procedure used to dissemble the pump, then follow assembly section #4.
* Make sure all lubrication tubes are tight. Test shafts on "V" blocks to check for straightness.
* Make sure you assemble the lube tube joiner/bearings equally onto each tube.
* Muff couplings must be screwed equally onto each line shaft, the machined shaft ends must be touching each other in the muff couplings, so that correct alignment is maintained, if this is not done vibrations and early pump failure will result.
* Check each shaft for bends, wear, corrosion, damage to machined ends or threads.
* Only replace shafts with Original parts that are machined to fine tolerances, the use of incorrectly finished shafts will destroy the pump and may cause irreparable damage.
* Use the correct lubrication and sealants from the list in this manual as you assemble.
* Fill every lube tube with 250 ml SHELL TELLUS 32 or equivalent oil as you assemble them.
* Align all parts to the specifications given in the table in this manual.
* Check after each stage for signs of tightness or roughness that would indicate incorrect alignment or faulty assembly.
* Adjust the top nut to the original position, if the pump is loading up adjust a further one turn, if this does not give correct Impeller positioning you may have not aligned the impeller back onto the shaft in the correct position. You may need to dismantle the pump to correct this. For help ring Batescrew Technical Department

Before reconnecting the drive, always check the direction of rotation is correct, as stated in original installation. A drive turning in the wrong direction will destroy your pump. Always check, even if you believe it has not been altered. Just in case!

7. Alignment and Positioning Data

Alignment and Positioning	NOTES
Column to flange alignment:	Align O.D. of each flange with 150mm ruler on the outside of the flange in 4 positions.
Lube tube to lube tube:	Must butt up tight and evenly spaced.
Shaft to shaft in joiners:	Must butt up tight and evenly spaced in joiner.
When assembling:	Rotate shaft after each component is attached, to ensure correct alignment.
Shaft inside lube tube:	Must be in the centre at all times, if not, look for a bent shaft, lubricant between shafts/joiner, non-original or damaged shafts.
Straightness of shafts:	Shafts set on V blocks and checked for straightness, 0.003" per 4ft (0.07mm per 1200mm).
Bush clearance on shaft:	0.003" per 1" of diameter, plus 0.004".

7. Tolerances

PART NAME	TOLERANCE
LIP SEAL	
TOP ROLLER BEARING	Ref. skf
BOTTOM ROLLER BEARING	Ref. skf
TENSION NUT LIP SEAL	-1.5 mm
TENSION NUT BUSH	0.15 mm
LUBE TUBE JOINER BUSH	0.15 mm
LUBE TUBE ADAPTER BUSH	0.15 mm
STATOR BUSH	0.15 mm
STATOR LIP SEAL	0.15 mm
THROTTLING BUSH	0.15 mm
BELL MOUTH BUSH	0.15 mm
IMPELLER to R/R.RING	3.00 mm

8. Lubrication chart <u>Recommended Oils and Greases</u>

PART	LUBRICANT
Oil lubrication tank:	Shell Tellus 32 or equivalent.
Grease nipples:	Shell Alvania EP3 or equivalent.
Special Fittings.	

Service Schedule

Clean motor cooling fins and air intakes:	Every 30 days in std conditions and every 7 days in severe conditions.
Fill oil tank:	Every day if running continuously, or 15 minutes before start on intermittent use.
Grease nipples:	Once a week continuous running, once a month on intermittent, 2 pumps only in each.
Check drive shaft coupling:	Once a month.
Check attaching nuts and bolts:	Once a month.
Check pump for vibrations, noise etc:	Twice a day on continuous use or every start up on intermittent use.
Check inlet screen:	Daily.
Check wiring and lines:	Every start up.
Position	**Lubricant / Sealant**
On the shaft inside bush:	Smear of TEFLON grease.
On the shaft inside lip seal:	SILICON grease.
On bolts & inside nuts:	COPPER based grease.
Between grease line fittings:	TEFLON tape or paste.
Between flange faces:	Mix 1/2 multigrade oil & black TAR paint.
On shaft inside couplings:	COPPER based grease.
On lube tube joints:	STAG jointing compound or TEFLON paste.
On shaft inside thrust bearing:	COPPER based grease.
On tension nut face to head:	STAG jointing compound.
On oil line fittings:.	TEFLON tape or paste

9. Trouble Shooting

Pumpset is hard to turn.	
Cause	**Remedy**
Top shaft nut not properly adjusted:	Refer to Batescrew.
Lineshaft bearing not lubricated:	Check adequate oil flow from drip feeder.
Line shaft bent:	Remove and repair or replace.
Sand blocking impeller assembly:	Remove and clear sand.
Misalignment in pump:	Remove and refer to 'Overhaul' section.
Water in oil tank:	Pump seal failure refer to 'Overhaul' section, condensation in tank.
Gland too tight:	Adjust.
Object inside pump jamming impeller:	Remove and repair or replace.
Discharge head not bolted square to column	Adjust or clean and re-align.
Misaligned thrust bearing, gland or tension nut:	Adjust or clean and re-align.

Pumpset vibrations	
Cause	**Remedy**
Drive coupling misaligned or damaged:	Realign or replace.
Drive motor or mounting bolt loose:	Tighten or replace.
Motor mount misaligned:	Realign mount or replace
Motor out of balance:	Repair motor, check for vermin in motor.
Impeller damaged or fouled:	Remove pump and repair/replace or clear.
Damaged or worn line shaft bearings:	Remove pump and repair.
Strainer partially blocked:	Clean or repair.
Vortexing water flow entering pump:	Reduce speed to see if it stops:
Insufficient submergence:	Install in a deeper sump.
Pumpset worn out:	Remove, refer to 'Overhaul' section.
Motor bearing failure:	Repair motor, check lubrication.
Foundation not sufficient under pumpset:	Remove and reinstall correctly.

9. Trouble Shooting

Pump is producing insufficient or varying flow rates.	
Cause	**Remedy**
Strainer blocked:	Remove pumpset and clear strainer.
Pump starving for water:	Provide more submergence for pump.
Submerged eddy currents:	Ensure more even flow to pumpset.
Drive coupling failure:	Replace coupling, check alignment.
Motor seizing:	Repair motor, check for rubbish at inlet.
Broken line shaft:	Remove and repair.
Muff Coupling disconnected:	Remove and replace/repair (check D.O.R.)
Motor speed too slow (one phase failure):	Replace motor or check supply (fuses).
Static water level has dropped:	Repair/deepen sump.
Impeller loose on shaft:	Remove and replace/repair.
Discharge line closed or blocked:	Open valve or clear obstruction.
Column holed or blocked:	Remove and replace/repair.
Impeller or stator damaged or worn:	Remove and replace/repair.
Excessive head:	Check discharge head , refer specifications.
Density or quality of pumped material poor:	Check supply cleanliness.

10. Tools

Although no special tools are needed, some operations are easier and safer with appropriate tools.

* Impeller slide hammer

This is a machined slide that fits over the impeller shaft and is used to insert and release taper sleeves in impellers. Accurate impeller positioning can be difficult without this tool and an impeller is easily damaged when removed by any other means.

Other Tools that may be required

* Stillson wrench 18" (2 sets).
* Medium size podger bar.
* Feeler gauge set.
* Set square.
* 2 only 5lb engineers hammers.
* Hook wrench 32-76 mm.
* Screw drivers.
* Fine cut file.
* Cleaner and cloth.
* Vee Blocks and dial gauge.
* Medium size brass hammer.
* Imperial and metric Allen key sets.
* Spirit level.
* Vernier and measuring tapes
* String line.
* Socket sets metric.
* Imperial and metric ring spanners.
* Emery cloth.
* Lifting jib or crane.
* Chain tongs.

11. Pump Specifications

PUMP TYPE	AXIAL	**PUMP SERIAL #**	7634	**PUMP SIZE**	17/21
MOUNT TYPE	ANGLE	**DRIVE TYPE**	DIRECT COUPLED	**DESIGNED FLOW**	10100gpm
MOTOR TYPE	Client supplied	**MOTOR SERIAL #**	Client supplied	**DESIGNED HEAD**	52ft TOTAL
MOTOR HP RATING	250 HP	**PRODUCTION DATE**	08/2003	**DESIGNED RPM**	1470
MOTOR (DIR.)	C/W	**INSTALLATION DATE**	2003	**DESIGNED HP**	200 HP

BATESCREW PUMPS AND VALVES SERVICE HISTORY. PUMP # 7634

DATE INSTALLED

12. Service Records Log

DATE	MOTOR HRS	COOLING FINS CLEANED	DRIVE COUPLING CHECKED	INTAKE STRAINER CLEANED	PUMP VIBRATION CHECK	BOTTOM BEARING GREASED	TOP BEARINGS GREASED	GLAND CHECK	COMMENT

BATESCREW PUMPS AND VALVES SERVICE HISTORY. PUMP # 7634

DATE INSTALLED

12. Service Records Log

DATE	MOTOR HRS	COOLING FINS CLEANED	DRIVE COUPLING CHECKED	INTAKE STRAINER CLEANED	PUMP VIBRATION CHECK	BOTTOM BEARING GREASED	TOP BEARINGS GREASED	GLAND CHECK	COMMENT

13. WARRANTY

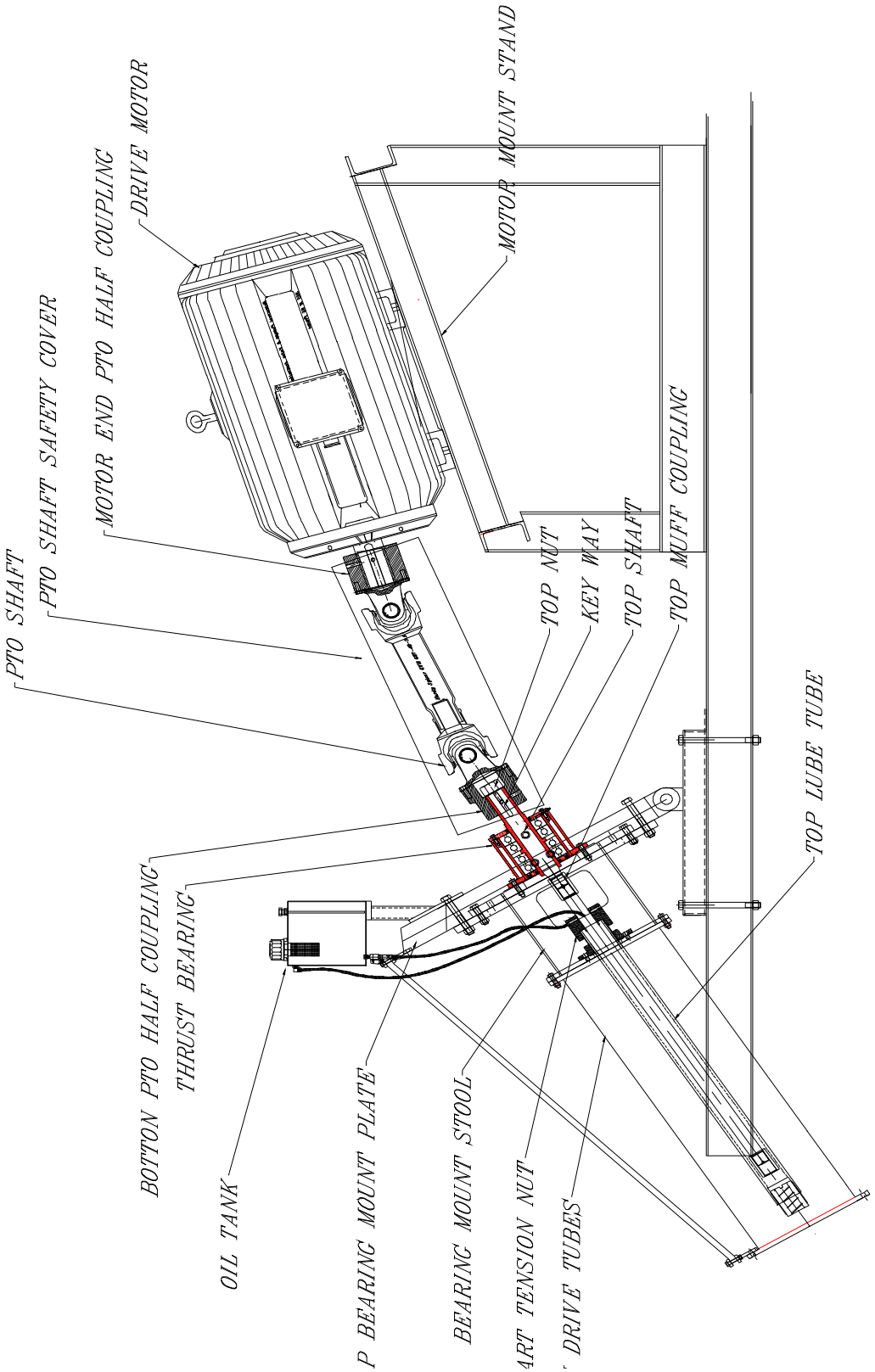
The Company undertake that the goods manufactured by the Company shall be of first class materials and of sound workmanship, and that the company will make good or replace any defective parts therein, which under proper use, may appear within six months of dispatch from the company's works, and which have proven to be due solely to the use of defective materials or bad workmanship.
Provided always that such parts are promptly returned free to the company's works unless otherwise arranged and any defective parts to the Company's property.
The repaired or new parts will be returned to the site.
Any goods not of the Company's manufacture, included in this tender, are sold under such warranty only as the makers give us, and we are able without legal expense to enforce, but are not guaranteed by us in any way whatsoever.
The warranty does not cover malfunction resulting from misuse, negligence, alterations, accident, or lack of performance of normal maintenance service, loss of time, inconvenience, loss of use of equipment, or other consequential damages.
The warranty does not exclude any condition, or warranty implied by the trade practices act. 1974, or any state legislation, but in all other respects, the warranty is in lieu of other warranties, expressed or implied, and all other obligations or liabilities. No promise, representation, or statement, by any employee, representative, or agent of the Company, or by any other person, shall add to, vary, or modify this warranty, or give use to any obligation on the part of the company.
Further, no promise, representation, or statement by any employee, representative, or agent of the Company, relating to the suitability of the equipment for any purpose shall bind the company or give rise to any obligation on the behalf of the Company.

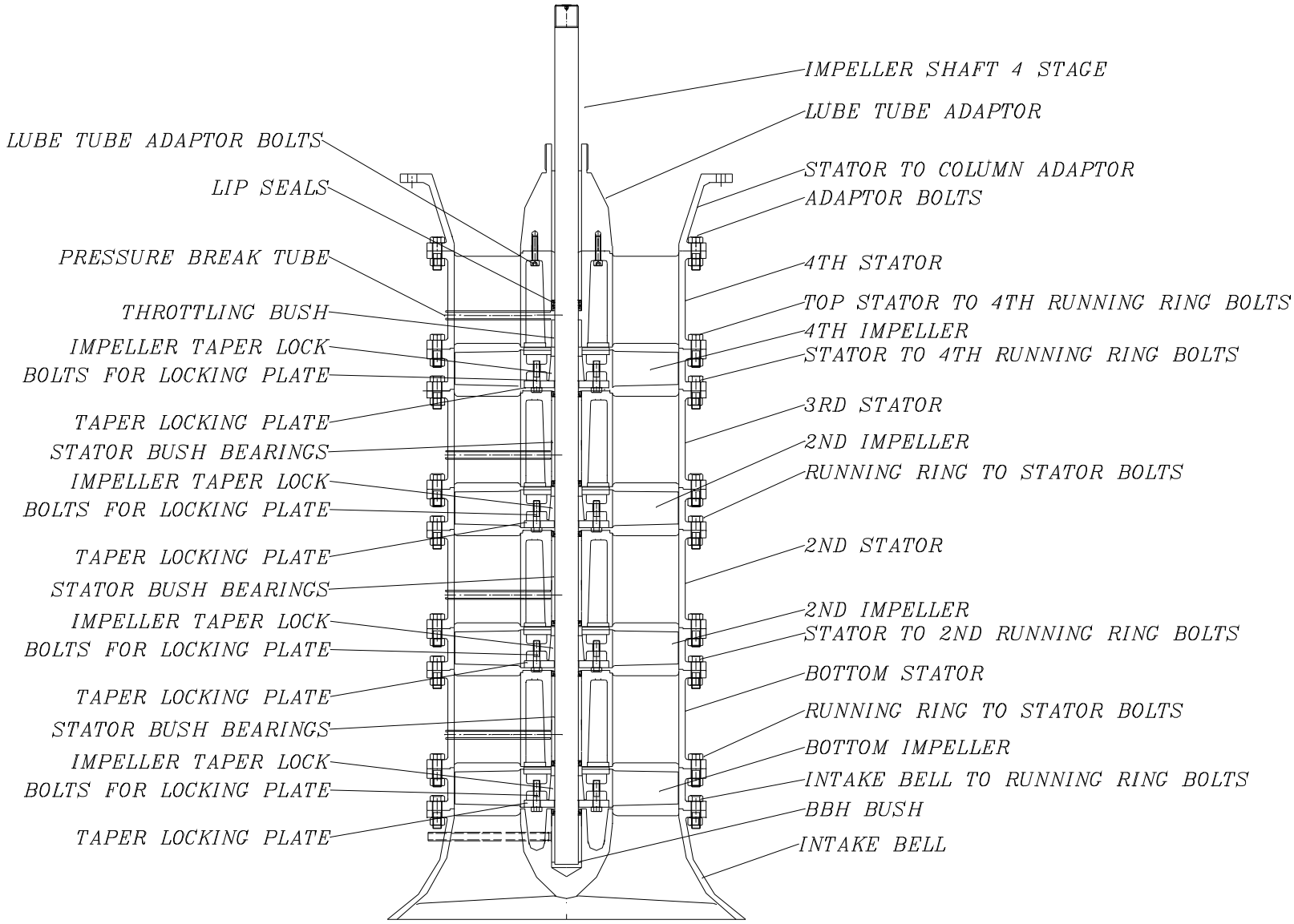
PUMP RECORD SHEET.				DATE	07/08/2003	PUMP,NO:	**7634**
CLIENT:	**Cave & Weier**			PUMP SIZE:	**17/214sta o/l 56:36d/c pto e**		
	a/c The Bauhinias			JOB NO:	**5628**		
PHONE NO:	**0749842600**			QUOTE NO:	**DD5023**		
FAX NO:	**0749842522**			ORDER NO:	**22259**	ACC NO	
ADDRESS:	**4 Daniel st , Emerald**					DATE ORDE	17/07/2003
DELIVERY ADDRESS	**tobe arranged**						
CARRIER & DETAILS:							
CONSIGNMENT NO:					CARRIER NO:		
DATE OF DELIVERY:	13/09/2003	SOLD BY:	**DD**		AGENT:		
	ANGLE APPLICATION					ROTATION	**CW**
ELECTRIC			DIRECT COUPLED/PTO		10100gpmat52.4ft 200 hp		
NO OF STAGES	**4**	IMPELLER;	**17-21-8 1/2**		TRIM:	**Full**	
STRAINER	**yes**	TYPE	**basket+plate**		LOCKING PLATE	**yes**	
B.B.H. LUBRICATION		**grease**			TOP STATOR LUBE	**oil**	
COLUMNS		**21" gal 8ft clamp 88.9 7 off**			Inter stator lube	**grease**	
EXTENSION COLUMN		**14" gal clamp 88.9 4of + 1 of 4 ft ?**					
HEAD		**21" *36 degree oil**		MOUNT PLATE	**knee braces**		
IMPELLER SHAFT		**1 3/4" x 64"**		THREAD SIZE	**1 3/4" nf rh**		
LINESHAFT		**1 3/4" 1040 grade 96" long 11 off**					
INTERMEDIATE TOP SHAFT		**1 3/4" 431 S/S x Len Re**		**Req x 1170**			
TOP SHAFT		**2" 431 S/S x Len Req**	**x 450**		**key 200 long top th200 80**		
MUFF COUPLINGS		**1 3/4" nf rh x 14**					
CENTRE BEARING HOLDERS		21" clamp 88.9			NUMBER	**7of 21"+4of 14"**	
BOTTOM LUBE TUBE		**3" gal *54" m/fm**	**48"fm/fm**				
LUBRICATION TUBE		**3nb 88.9 od *48" gal 22 off**					
TOP LUBE TUBE		**3" x 1235**					
LUBE TUBE JOINERS		**3" x 1-3/4" x 23**					
TENSION NUT		**C4TN 3"* 1 3/4"**			GLAND	**O ring+2plates**	
THRUST BEARING		**No5**		WATER COLLED			
OIL TANK & FITTINGS		**1 gallon set**					
LTJ		**3"*1 3/4 " 23 off**					
	DISCHARGE PIPE						
FLANGE PUMP END				FLANGE PIPE END			
LENGTH					ANGLE		
MATERIAL					PAINT		
GASKET & BOLTS SET				SPARE FLANGE & PIPE O.D.			
	HARDY SPICER DRIVESHAFT						
SERIES	**GWB687-40**	COMPRESSED LENGHT	30"		EXTENDED LENGTH	32"	
	ADAPTORS						
PTO DRIVE COUPLING BORE DIAM		**?**	REG		NO HOLES & DIAM		
KEY WAY WIDTH			DEPTH				
PTO DRIVEN COUPLING BORE DIAM		**2 3/4"**	REG		NO HOLES & DIAM		
KEY WAY WIDTH		**1/2"**	DEPTH	**1/4"**	PTO GUARD	**yes**	
	ELECTRIC MOTOR (client to supply)						
MAKE	HP		SPEED		FRAME		
FOOT MOUNTED		FLANGE MOUNTED					
notes:	**grease lines on RHS**						
	correction bend						
	double gibopipe						
	inline non return valve + 6" outlet for PRV V/N 3394						
	Bermad 6" pressure relief valve setting = 6.1Mts						
	tension nut mount 14" diameter						
	discharge pipe adaptor to 700 table D						
	pto guard						
	knee braces						
	Slide Rail spacing 15"						
	Modify screen and Bellmouth to suit slide rails						
	support from bottom rring to slide rails to suit 21"column						

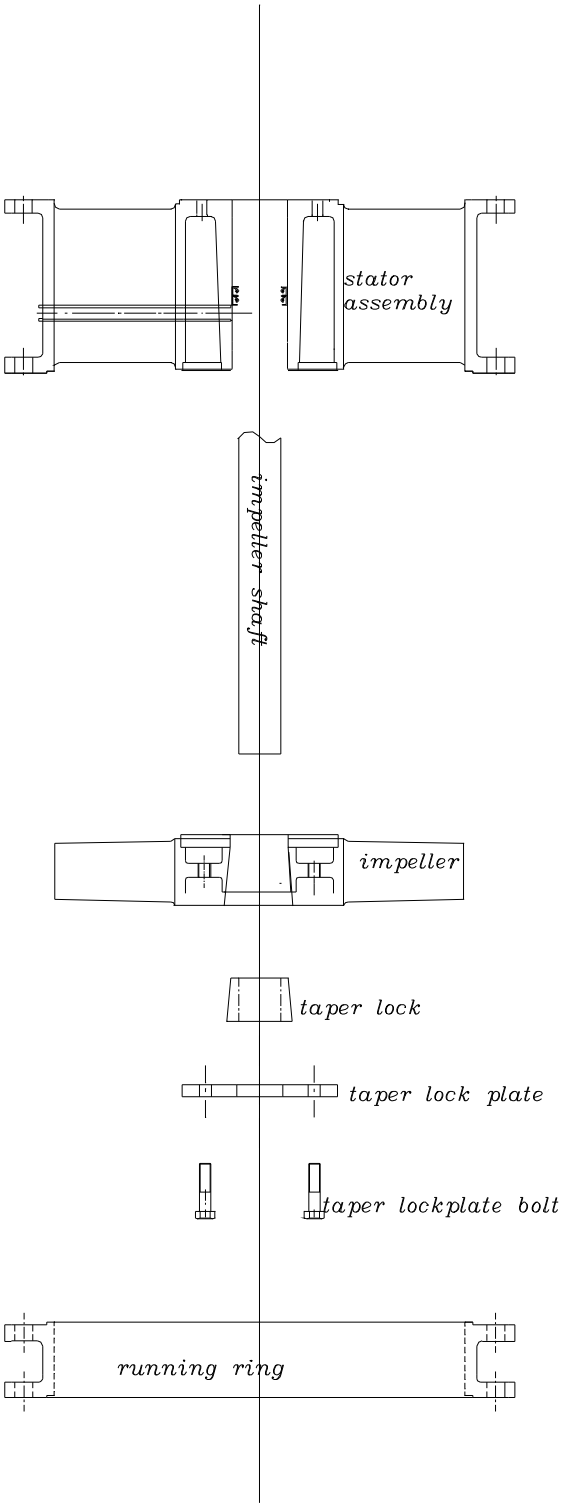
BATESCREW PUMPS RECORD SHEET		PUMP NO 7634 DATE 07-Aug-03		
Cave & Weier		17/214sta o/l 56:36d/c ptcJOB NO: 5628		
NUMBER	**DESCRIPTION**	**SIZE**	**NO OF**	
17-1-S	**INLET SCREEN**	17" S/S MESH 477 long	1	12
12mm35G	**BOLTS & NUTS (IS/BBH)**	12mm x 35mm GAL	4	0.2
17-3-5	**B.B.H. A2(G.L.)**	17" A2 B.B.H.-G/L	1	69
17-3-7	**LB2 BUSH (G.L.)**	LB2 1-3/4"x2-1/4"x3"	1	0.72
LS0-17	**LIPSEAL G/L (s.s spring)**	1-3/4"x2-1/4"x3/8"	1	0.05
17-3-9	**BBH GREASE TUBE (G.L.)**	15NB S/S x 235 MM	1	
38FGLSF	**FLEXIBLE G/L with S/S Fittings**	3/8 R/H & S/S FITT	1	0.2
16mm55G	**BOLTS & NUTS (BBH/RR)**	16mm x 55mm GAL	16	0.4
17218A2	**IMPELLER 17-21-8 1/2**	17"A2 17-21-8-1/2	4	60
17-7-1	**TAPER SLEEVE**	1-3/4" (C.I)	4	2.4
17-7-3	**LOCKING PLATE**	17" LOCK/PLATE	4	10
12mm50SS	**IMPELLER BOLTS**	12mm x 50mm 304S.S.	24	2
17-7-7	**SLINGER PLATE**	17" SLING/PLATE	4	8.8
17-6-2	**RUNNING RING (S.S.)**	17" S.S. R/R FAB	4	112
16mm55G	**BOLTS & NUTS (RR/ST)**	16mm x 55mm GAL	112	4
17-8-4	**STATOR A2 (G.L.)**	17"STATOR G/L	3	195
17-8-4-7	**BUSH (G.L.)**	LB2 1-3/4"x2-1/4"x2-3/4"	6	1.98
LS0-17	**LIPSEAL G/L (s.s spring)**	1-3/4"x2-1/4"x3/8"	6	0.3
17-8-15	**STATOR GREASE LINE(G.L.)**	15NB S/S x 235 MM	3	0.6
3838SN	**NIPPLE**	3/8 HEX NIPPLE S.S.	3	1
38FGLSF	**FLEXIBLE G/L with S/S Fittings**	3/8 R/H & S/S FITT	3	1.5
17-8-6	**A2 STATOR (O/L)**	17" A2 O/L	1	65
17-8-13	**SEAL PLATE (A2)**	17" M.S.	1	2
17-8-14	**GRUBSCREW (A2 ONLY)**	10mm x 45mmcsk	2	0.05
17-8-TB	**THROTTLING BUSH**	LB2 1-3/4"x2-1/4"x1-1/2"	1	0.4
LS0-17	**LIP SEALS (0/L)**	1-3/4"x2-1/4"x3/8"	2	0.05
17-8-6-9	**STATOR BUSH (O.L.) A2**	1-3/4"x2-1/4"x4"RHscr	1	0.9
12mm40SH	**S/HEAD C/SCREW(A2)**	12mm x 40mm S/H-C/S	6	0.5
17-8-6-14	**L.T.ADAPTOR (O.L.)**	17" L.T.A x 2-1/2 L/T	1	20
17-8-6-15	**L.T.A. BUSH (O.L.)**	1-3/4"x2-1/4"x6"LB2	1	1.44
17-8-16	**STATOR P/BREAK TUBE**	15NB S/S x 235 MM	1	0.2
13442134R	**IMPELLER SHAFT (4STAGE)**	1-3/4"SS x 6.4" x 1-3/4R	1	13
16mm55G	**BOLTS & NUTS (STA/ADP)**	16mm x 55mmGAL	16	1
17-21A	**ADAPTOR 17/21**	17"-21" ADP (C.I)	1	42
16mm55G	**BOLTS & NUTS (ADP/COL)**	16mm x 55mm GAL	16	1
21-17-8	**COLUMN 8 FT x 21"**	21"x96" CLAMP GAL	7	1624
16mm55G	**NUTS & BOLTS COL/COL**	16mm x 55mm GAL	96	9.1
300LT54MF	**BOT/LUBE TUBE COL/PUMP**	3" GAL X 48 FM X FM	1	23.1
300LT48FF	**3"NB GAL L/T x 48" F/M x F/M**	3"GAL x 48" F/M x F/M	22	451
300J134LS	**LUBE TUBE JOINERS**	3"tube x 1-3/4"shaft	23	85.1
1	**TOP INTER SHAFT W/L S/S**	1-3/4"S/SDia x Len Req	1	
2	**TOP SHAFT S/S**	2"S/SDia x Len Req	1	
16mm55G	**BOLTS & NUTS (COL/HEAD)**	16mm x 55mm GAL	16	
300TTFM	**TOP LUBE TUBE**	3"GAL Len to suit	1	
134MCR12	**MUFF COUPLING**	1 3/4" RH M.S.	14	25
134MS96R	**LINESHAFT 8 FT O/L 1040m/s**	1-3/4"1040 x 96"RH	11	342.7
21-25-2	**DISCHARGE HEAD 36 DEG**	21"x36 DEG GAL	1	312
3	**O RING**	6 mm diameter 3 1/2" i.d.	1	
4	**O RING BOTTOM PLATE**	12 mm Jig #0057	1	1
5	**O RING TOP PLATE**	12 mm plate jig #oo57	1	
12mm65G	**NUTS & BOLTS 0 RING PL**	12mm x 65mm GAL	4	0.15
6	HEAD / EXT COL ADAPTOR PLATE	8" reg male to 18" reg female 12mm	1	15
14-17-8	**COLUMN 8 FT x 14"**	14" x96"COL CLAMP 3"	4	520
12mm65G	**BOLTS & NUTS (H/AP/COL)**	12mm x 65mm GAL	12	
12mm45G	**BOLTS & NUTS (COL/COL)**	12mm x 45mm GAL	48	

14-17-4	**COLUMN 4 FT x 14"**	14" x 48"COL GAL	1	70
3002TN	**TENSION NUT (2 PART)**	4-T/Nx 3"Bate	1	
3002N134R	**NUT (2 PART)**	4-NuTx3"Bx1-3/4"	1	
LS134TN	**TENSION NUT LIPSEAL**	1-3/4"x2-1/2"x3/8"	1	
13	**T NUT /STOOL BOLTS**	SHCS M12 * 30	4	
7	**TENSION NUT STOOL**	as per drawing	1	45
10	**TOP PLATE**	762 profile drawing	1	35
11	**PLATE/STOOL BOLTS**	M16 * 70 mm	8	
12	**STOOL/BEARING BOLTS**	M12 * 50	6	
OT0001	**OIL TANK & FITTINGS STD**	4 LITRE	1	7.5
38GL6MS	**GR/LINE & FITTINGS S/S**	3/8 S/S x 6mtr LEN 30m * 4	1	
1L0GB	**GR/LINE BRACKETS & BOLTS**	FAB M.S 1 LINE	13	13
No5 BEARING ASSEMBLY				
5-BH	**BEARING HOUSING**	No5	1	18.5
5-BC	**BEARING CARRIER**	No5	1	7.5
LS4BH	**TOP LIP SEAL**	75.95.10	1	
5-CAP	**BEARING CAP**	No5	1	1.6
5-6315	**TOP BEARING**	6315	2	13
5-7315	**BOTT BEARING**	7315	2	3.2
LS4BH	**BOTT LIP SEAL**	75.95.10	1	
8mm30ZP	**BOLTS**	5mm x 30mm Z/P	6	
5-375CS	**CRUB SCREW**	10mm x 10mm	2	
6mmGNS	**ST/GREASE NIPPLE**	6mm	1	
012100400	**KEY**	1/2"1"4"	1	0.5
134TN12NF	**TOP NUT&CRUB SCREW B/D**	1-3/4"x12TPI x10mmC/S	1	1
12mm45G	**BOLTS & NUTS (Bear - Head)**	12mm x 45mm GAL	6	
34BPVC	**COOLING PIPES**	3/4" Braided PVCx20" 13 m * 2	2	
34T12BSP	**COOLING PIPE ADAPTORS**	No P3 3/4"T x 1/2"BSP	2	
2230SSHC	**HOSE CLAMPS STAINLESS**	1A 22-30 S/S	4	
DIRECT DRIVE PARTS				
17-75	**MOTOR (CLIENT TO SUPPLY)**	SGA D355MC6 CMG	1	
21-81	**PTO ADAPTOR (motor)**	C.I. 95 mm 25 mm	1	10
21-82	**PTO SHAFT**	GWB687-40	1	35
21-83	**NUTS & BOLTS (Pto -Agd/Adp)**	1/2" unc * 1 1/2	8	
21-85	**PTO ADAPTOR (Bearing)**	C.I. 2 .750" 1/2" * 1/4"	1	10
21-86	**NUTS & BOLTS (Pto -Mtr/Adp)**	1/2" unc * 1 1/2	8	
21-89	**PTO GAURD**	300 i.d.*5mm * 1050 long	1	10
8	**ANGLE BRACKET**	as per drawing	1	20
9	**ANG BRACKET / PLATE BOLTS**	M20 * 150 long	4	
14	**COMPO BEND**	21" TB 320:320 c/c 21" TB 4 deg	1	100
15	**HEAD/ C BEND BOLTS**	M20 * 65	16	5
16	**GASKET**	21" Table B	1	
17	**O RING**	20 mm diameter 527 i.d.	1	
18	**O RING BOLTS**	M20 * 75 mm	16	5
19	**LOOSE FLANGE**	as per drawing	1	10
20	**GIBO PIPE**	527 o.d. * 1000 long	1	150
21	**O RING**	20 mm diameter 527 i.d.	1	
22	**O RING BOLTS**	M20 * 75 mm	16	5
23	**LOOSE FLANGE**	as per drawing	1	10
24	**INLINE N. R. V. V/N 3394**	21" TB :21" TB inline Gal+legs+PRV	1	200
25	**ADAPTOR**	21" TB :700 T D 300 long	1	100
26	**NRV/ADAPTOR BOLTS**	M20 * 75 mm	16	5
27	**PRESSURE RELIEF VALVE**	Bermad 150 mm 7 m setting	1	6
28	**RELIEF VALVE /NRV BOLTS**	M16 * 65	8	5
29	**KNEE BRACES**	21" gal pair	1	20
30	**KNEE BRACE / HEAD BOLTS**	M24 * 50	2	
31	**NAMEPLATE**	P/N 7634 J/N 5628 970 RPM	1	

15. Component Parts Drawings




IMPELLER SHAFT 4 STAGE
LUBE TUBE ADAPTOR
LUBE TUBE ADAPTOR BOLTS
STATOR TO COLUMN ADAPTOR
LIP SEALS
ADAPTOR BOLTS
PRESSURE BREAK TUBE
4TH STATOR
THROTTLING BUSH
TOP STATOR TO 4TH RUNNING RING BOLTS
4TH IMPELLER
IMPELLER TAPER LOCK
STATOR TO 4TH RUNNING RING BOLTS
BOLTS FOR LOCKING PLATE
3RD STATOR
TAPER LOCKING PLATE
2ND IMPELLER
STATOR BUSH BEARINGS
RUNNING RING TO STATOR BOLTS
IMPELLER TAPER LOCK
BOLTS FOR LOCKING PLATE
2ND STATOR
TAPER LOCKING PLATE
STATOR BUSH BEARINGS
2ND IMPELLER
IMPELLER TAPER LOCK
STATOR TO 2ND RUNNING RING BOLTS
BOLTS FOR LOCKING PLATE
BOTTOM STATOR
TAPER LOCKING PLATE
RUNNING RING TO STATOR BOLTS
STATOR BUSH BEARINGS
BOTTOM IMPELLER
IMPELLER TAPER LOCK
INTAKE BELL TO RUNNING RING BOLTS
BOLTS FOR LOCKING PLATE
BBH BUSH
TAPER LOCKING PLATE
INTAKE BELL


stator
assembly
impeller shaft
impeller
taper lock
taper lock plate
taper lockplate bolt
running ring