ATTACHMENT B

Operation and Maintenance Manual,

Existing Main Dewatering Pumps

(MDP-1 and MDP-2)

Pump Well #3

DD#3 Main Dewatering Pumps

Date Installed: 1999

Johnston Pump Company
800 Koomey Road
Brookshire, Texas 77423-8803

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Pump(s) Serial Number: **98JA1307** **MAY 15, 1999**

Customer: **THE CHAPPY CORPORATION**

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INSTALLATION MANUAL

" NOTICE "

THE FOLLOWING PAGES ARE THE INSTRUCTIONS FOR THE INSTALLATION OF A JOHNSTON PUMP. THESE INSTRUCTIONS SHOULD BE READ CAREFULLY. AFTER READING, ANY QUESTIONS, TECHNICAL ADVICE OR REQUESTS FOR ASSISTANCE NEEDED SHOULD BE DIRECTED TO

JOHNSTON PUMP COMPANY
800 Koomey Road
Brookshire, Texas 77423
Telephone (713)934-6009

SAFETY PRECAUTIONS

PERSONNEL MUST, AT ALL TIMES, BE PROTECTED FROM ROTATING SHAFTS AND COUPLINGS. ALL SCREENS AND PROTECTIVE DEVICES FURNISHED WITH THE PUMPS, DRIVERS AND RELATED EQUIPMENT MUST BE INSTALLED PRIOR TO START-UP AND MUST BE IN PLACE DURING OPERATION. COUPLING GUARDS THAT ARE SHIPPED LOOSE ARE TO BE INSTALLED. DRILL THE DISCHARGE HEAD FOR 1/4-20 SELF TAPPING, HEX HEAD CAPSCREWS AT APPROXIMATELY 6" CENTERS. USE 1/4" FLAT WASHERS WITH EACH CAPSCREW WHEN FASTENING THE GUARD IN PLACE. IF PROTECTIVE DEVICES ARE NOT FURNISHED, THEN THE USER MUST PROVIDE THE SAFETY EQUIPMENT IN CONFORMANCE WITH REGULATIONS, CODES AND STATUTES APPLICABLE TO THE SITE OF OPERATION.

INSTALLATION MANUAL
STORAGE PROCEDURES

GENERAL

Check all parts and assemblies for shortages and freight damage. Claims for shortages must be made in writing at the time of delivery. Freight claims for damage must be made with the delivering carrier at the time of delivery. Carriers will not honor freight claims unless the damaged freight is inspected by the carrier's inspector.

It is suggested that a check of parts and material against the Bill of Material be made jointly with a Johnston Pump representative and customer representative.

NO CLAIMS FOR SHORTAGES WILL BE HONORED BY JOHNSTON PUMP COMPANY AFTER THE MATERIAL HAS BEEN PLACED IN STORAGE.

Storage of equipment not manufactured by Johnston Pump Company will have special instructions supplied by its manufacturer.

PERIOD OF STORAGE - SHORT - ONE MONTH OR LESS AFTER DELIVERY

Rust preventative applied to material for shipment is usually satisfactory unless equipment is stored in an area subject to extreme humidity or air borne corrossive gases. In this case, the customer must apply proper preservative. (Consult your lubrication specialist.)

EXTENDED STORAGE - MORE THAN ONE MONTH

A. Completely assembled pumps -

It is the customer's responsibility to perform the following steps:

(1) Storage area must be reasonably level, stable ground not subject to flooding.

(2) Units must be supported on blocks at intervals along their length to keep the weight off the flanges and the suction bell.

(3) The suction and discharge openings should be closed to prevent dirt, animals or vandals from entering.

(4) Small pumps shipped on skids may be stored as received, provided the skids have not been damaged in transit.

(5) All machined surfaces and exposed shafting must be coated with rust preventative adequate to protect these areas for the length of storage. (Consult your lubrication specialist.)

(6) Periodic inspection of machined areas coated with rust preventative should be made and areas which appear to be breaking down must be recoated as necessary.

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ESTABLISHED 1909

Code: GD-OLMF

INSTALLATION MANUAL
OIL LUBRICATED CONSTRUCTION
GENERAL DESCRIPTION

Johnston Vertical Turbine Pumps are composed of four major sub-assemblies:

I. Bowl assembly consisting of;
   a. suction piece
   b. impeller
   c. discharge bowl
   d. pumpshaft
   e. enclosing tube adapter
   f. strainer when used
   g. inter bowl (more than one stage)

II. Column assembly consisting of;
   a. column
   b. lineshaft
   c. enclosing tube
   c. lineshaft bearing and coupling

III. Discharge asembly consisting of;
   a. fabricated steel or cast elbow
   b. shaft sealing assembly

IV. Driver, as designated

NOTE:

Oil lubricated pumps are units that use oil supplied from a reservoir to lubricate all the bearings with the exception of those in the bowl assembly and driver.

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INSTALLATION MANUAL
OIL LUBRICATED CONSTRUCTION

GENERAL INFORMATION

THIS IS GENERAL INFORMATION WHICH MAY BE SUPERSEDED OR MODIFIED BY ANY "SPECIAL" INSTRUCTION SHEETS CONTAINED HEREIN FOR THE SPECIFIC CONSTRUCTION OF YOUR PUMP AND EQUIPMENT.

RECEIVING

Inspect all material as it is received from the carrier.

NOTE:
Because of the possibility of damage not noted on the first inspection, it is recommended that the bill of lading be marked at the time of receipt; "Subject To Inspection For Hidden Damage".

CAUTION:
IF DAMAGE IS FOUND, NOTIFY THE DELIVERING CARRIER. A CLAIM MUST BE FILED WITH THAT CARRIER.

INSTALLATION EQUIPMENT

The installation of a vertical pump requires the use of a hoist. This may be in the form of a portable derrick, a permanent derrick, tripod or other suitable and safe hoisting means.

Whichever type of equipment is used, it should be of sufficient height to accommodate the section of column.

Wire rope blocks and metal windlasses are recommended as the best lifting equipment. These must be fitted with sufficient length of flexible steel cable. The load hook must have a good, easy-working swivel.

The installing rig should be rated to hold the weight of the complete pump with an adequate safety factor.

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In addition to the lifting equipment, the usual compliment of pump installer's tools are required. These normally include but are not limited to the following:

one set of installing elevators
two installing clamps
two sets of chain tongs
two cable slings of suitable length
one piece of 1/2" rope, approximately ten feet long
pipe joint compound
cleaing solvent
two paint brushes
a can of light grease
tube tension plate wrench
a gallon of turbine oil equivalent to S.A.E #10 for each 100 feet of tube and shaft assembly

LAYOUT OF PUMP PARTS FOR INSTALLATION
OIL LUBRICATED PUMPS - THREADED OR FLANGED COLUMN

(1) Uncrate and layout all parts on suitable timbers. Arrange the components in a manner that is convenient for the site and for the equipment to be used during the installation. Keep all parts away from the dirt. Be sure all the parts are clean and that the threads are protected at all times.

CAUTION:
NEVER DROP ANY CRATE OR PART TO THE GROUND. ALWAYS USE SKIDS.

(2) Compare the parts against the quantities listed on the bill of materials.

(3) Cleans the lineshaft of all grease, oil and foreign matter.

(4) Tube and shaft are ordinarily shipped assembled. If not, the shaft would be slipped into the tube, taking care not to damage the shaft bearing which will serve as a coupling for the five foot lengths of tube.

(5) Slide each shaft and tube section into the matching length of column.

CAUTION:
GREAT CARE SHOULD BE TAKEN IN HANDLING THE SHAFTING. DO NOT INSTALL A BENT OR SPRUNG SHAFT.

NOTE 1

The headshaft and the tube tension nipple should be left in the shipping crate until you are ready to install them.

NOTE 2

The top end of the threaded column section is that end on which the column coupling is located.

NOTE 3

The top end of the flanged column section is that end which has the male register.

NOTE 4

Shaft couplings should be centered so that the air relief hole is located where the shafts butt.

NOTE 5

Clean all threads, shaft ends, couplings and mating surfaces just before the connection is made. Use a solvent and wire brush.

NOTE 6

Pipe joint compound should be used on column threads, tube-connector threads and shaft threads. Do NOT use pipe joint compound on the ends of the shaft.

NOTE 7

Prior to the installation of components received assembled, all nuts and bolts must be checked for tightness since they may have loosened during transportation.

INSTALLATION INSTRUCTIONS
ASSEMBLED PUMP

(1) Check all nuts and bolts for tightness. They must be tight before installation.

(2) Check the mounting flange of the pump and the matching flange on the foundation, if there is one, for burrs and nicks. These must be smoothed with a mill file.

(3) Attach a lifting device to the upper end of the assembled pump and raise it to a vertical position over the mounting foundation.

CAUTION:

WHEN A STRAINER IS ATTACHED TO THE SUCTION END OF THE PUMP, USE CARE NOT TO DAMAGE THE STRAINER WHEN RAISING THE ASSEMBLY TO THE VERTICAL POSITION. DO NOT ALLOW THE SUCTION END TO DRAG OR SUPPORT THE TOTAL WEIGHT OF THE ASSEMBLED PUMP.

(4) Lower the unit until the mounting flange of the pump rests on the foundation.

CAUTION:

WHEN THE PUMP IS FITTED WITH EXTERNAL LINES SUCH AS GREASE, BY-PASS, FLUSH ETC. EXTREME CARE MUST BE USED NOT TO DAMAGE THESE LINES WHILE RAISING OR LOWERING THE ASSEMBLY.

(5) When the headshaft is shipped separately, clean the threads and stab the headshaft. Hand tighten only. Threads are left-hand.

(6) Install the shaft sealing assembly, when shipped separately, in accordance with the instructions included in this manual.

(7) Mount the drive and align the pump in accordance with the instructions included in this manual.

(8) Adjust the impellers in accordance with the instructions included in this manual.

CAUTION:

WHEN CONNECTING PIPING TO THE PUMP DO NOT PUT A STRAIN ON THE PUMP AS THIS MAY CAUSE MISALIGNMENT.

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INSTALLATION INSTRUCTIONS
BOWL ASSEMBLY

(1) Determine if a suction strainer and/or suction pipe are to be used with the pump. This will be shown on the bill of material or the packing list. When suction strainer and/or suction pipe is used see separate instruction sheets for their installation.

(2) Attach the elevators to the bowl assembly.

(3) Raise the assembly to a vertical position directly over the foundation and lower it until the elevators are supported by the foundation.

NOTE:

During this process be careful not to damage the strainer or suction pipe.

Code: IS-TC

INSTALLATION INSTRUCTIONS

THREADED COUPLING

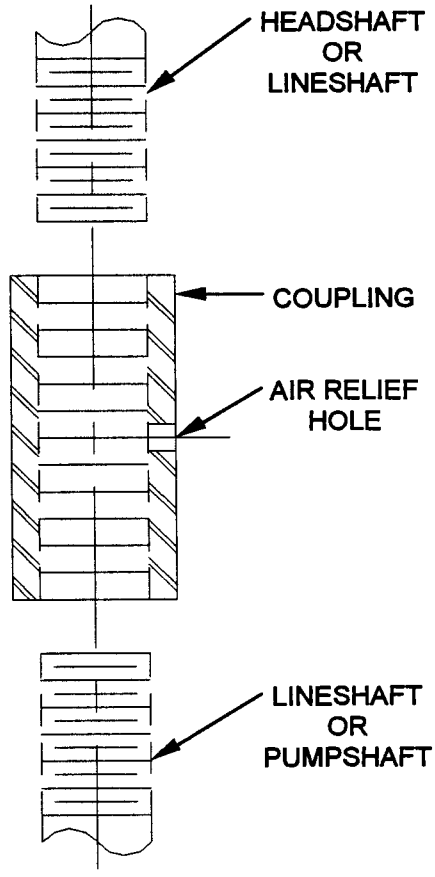
NOTE:
Start all threads by hand. Threads are left-hand. Start assembly of the lineshaft at the pumpshaft.

(1) Thread a coupling onto the shaft.

(2) Locate the air relief hole where the shafts will butt together.

(3) Lower a lineshaft and couple the shaft. Butt the shaft ends tightly together using pipe wrenches but do not distort.

Follow the same procedure for subsequent sections of shafting.



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INSTALLATION INSTRUCTIONS
TOP COLUMN
FLANGED COLUMN— OIL LUBRICATED

(1) Thread a lineshaft screw bearing into the top section of the enclosing tube.

(2) Thread a shaft coupling on the top section of lineshaft and hand tighten.

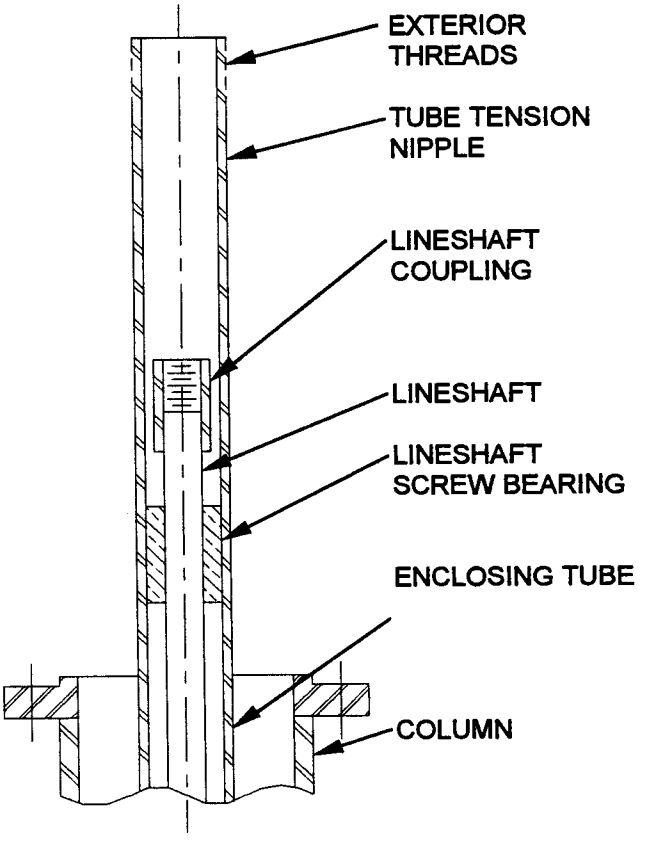
(3) Connect the the tension nipple to the top lineshaft screw bearing and tighten with a pipe wrench.

(4) Raise the top column over the tube tension nipple, lower and bolt it in place.

CAUTION:
CARE MUST BE TAKEN NOT TO DAMAGE THE THREADS ON THE TUBE TENSION NIPPLE.

(5) Clean the face of the top flange and apply a light coat of grease to hold the gasket in place.

(6) Place the gasket on the flange face.



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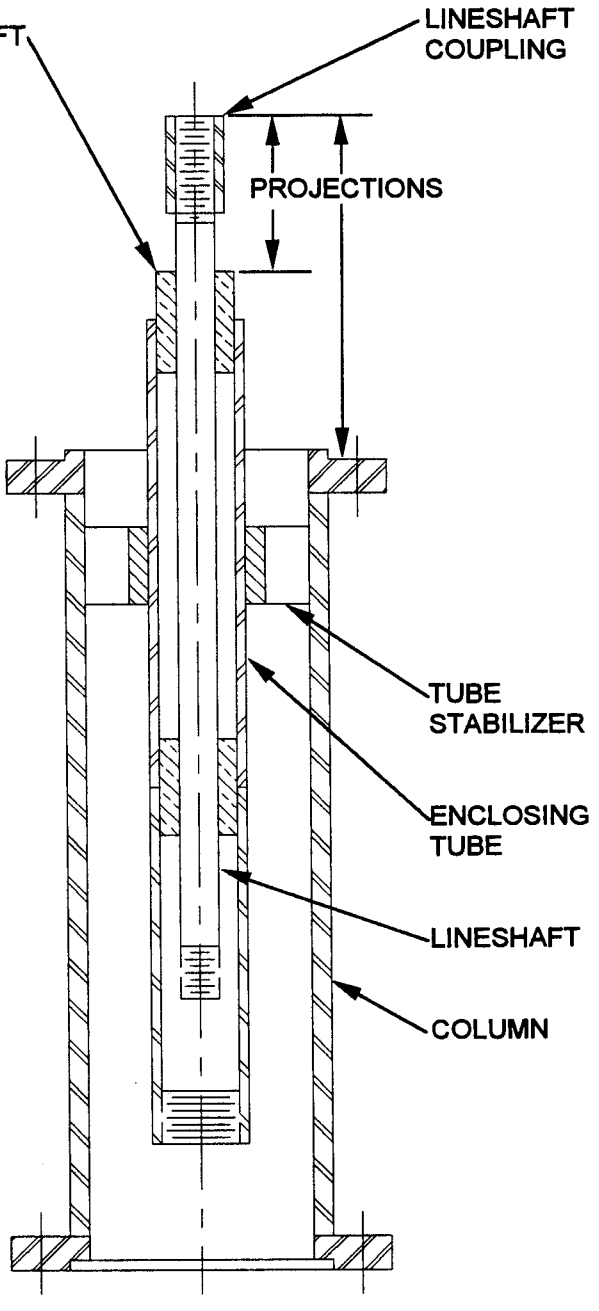
Code: IS-C-OLF

INSTALLATION INSTRUCTIONS
COLUMN ASSEMBLY
FLANGED COLUMN - OIL LUBRICATED

The accompanying illustration is a sectional drawing of an oil lubricated, flanged column assembly in the installed position.



Before installing the bottom column section check the pumpshaft projections. These are the distances from the column flange seat to the top of the pumpshaft, and from the tube seat to the top of the pumpshaft. Make a note of these dimensions for future reference. They will have to be verified after each section of column is added to the pump.

(1) Attach the elevators to the top of the bottom column just beneath the flange.

(2) With the rope, throw a timber hitch around the column approximately one foot above the bottom flange which matches the bowl flange. Then throw a double half hitch around the tube and a double half hitch around the shaft.

(3) Raise the entire column, tube and shaft assembly to a vertical position directly over the bowl while tailing in the assembly. (See figure 1.)

NOTE:
Care must be taken to prevent the tube and shaft from slipping or binding as they are being raised.

(4) Lower the column assembly and couple the lineshaft to the pumpshaft. Butt the shaft ends tightly together using pipe wrenches, but do not distort. (See figure 2.) The shaft threads are left-hand.

(5) Screw the enclosing tube on so that it butts to the tube adapter tightly. Use pipe wrenches, but do not distort. The tube threads are left-hand.

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(6) Check the column and bowl flange for burrs and nicks which should be smoothed with a mill file.

(7) Lower the column to the registered fit and bolt the flange faces together. The bolts should be tightened uniformly, working to opposite sides of the flange. Do not distort.

(8) Raise the entire assembly sufficiently to remove the lower elevators and lower the entire unit until the upper elevators are resting on the foundation.

(9) Verify that the shaft and tube are centered in the column. If they are not centered, the shaft and/or tube may have been bent and must be removed.

(10) Measure the distance from the flange face to the top of the shaft and from the tube seat to the top of the shaft, and compare these measurements with those noted previously. The measurements should be within 1/8 inch.

(11) Add approximately one pint of the proper oil to the enclosed tube. (See lubrication sheet "Operating Instructions - Lubrication Chart")

(12) Install a lineshaft screw beaing and a lineshaft coupling.

Follow the same procedure for subsequent sections of column.

(13) Pumps to be operated at 1800 RPM or below require tube stabilizers to be at 40 foot intervals, starting 15 feet above the bowl assembly.

Pumps to be operated at 2900 RPM and above require tube stabilizes to be at 30 foot intervals, starting 15 feet above the bowl assembly.

In either case the last stabilizer should be approximately 15 feet below the discharge head.

(14) Wet the tube stabilizer with water (DO NOT USE OIL) and force it over the projecting end of the shaft enclosing tube. Locate the tube stabilizers two or three inches below the top of the column. It is not necessary to fasten the tube stabilizers in place.

INSTALLATION INSTRUCTIONS
DISCHARGE HEAD ASSEMBLY
OIL LUBRICATED

(1) Raise the head over the tube tension nipple, lower and bolt it to the top column flange.

CAUTION:
CARE MUST BE TAKEN NOT TO DAMAGE THE THREADS ON THE TUBE TENSION NIPPLE.

(2) Raise the entire unit and remove the installing clamps. Lower the entire unit until the head rests on the foundation.

(3) Install the tube tension plate. Using a tube tension wrench, tighten it on the tube tension nipple. The tube tension nipple threads are left-hand.

(4) Adjust the tube tension by stretching the tube about 1/8 inch per 100 feet of tubing or about 1-1/4 turns of the tube tension plate per 100 feet of tubing.

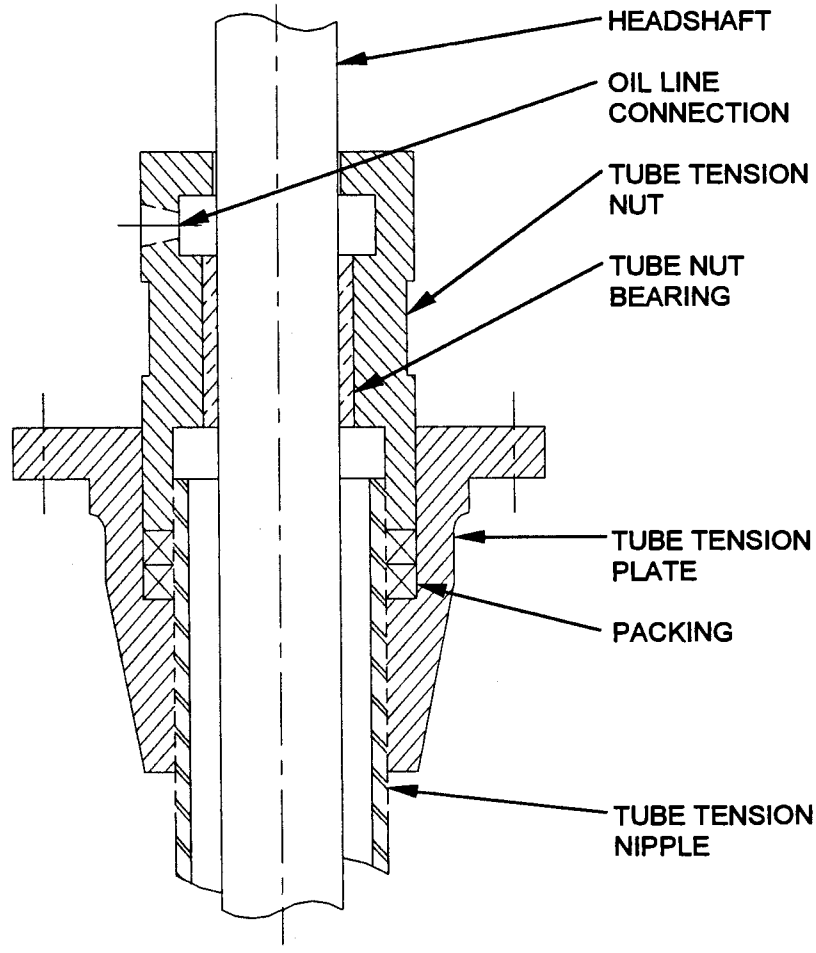
(5) Bolt the tube tension plate to the head.

(6) Stab the headshaft through the tube tension nipple and hand tighten only. Headshaft threads are left-hand.

(7) Install the two rings of packing.

NOTE:
Be sure the oil passage in the tube tension nut is clear.

(8) Install the tube tension nut and tighten.



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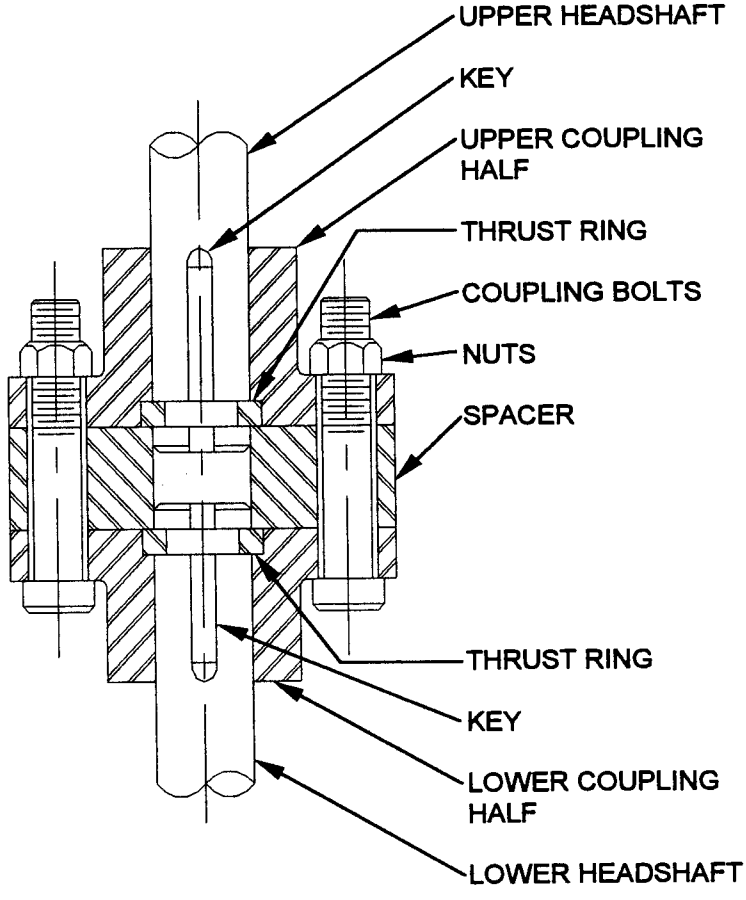
Code: IS-RFC

INSTALLATION INSTRUCTIONS
RIGID FLANGED COUPLING

(1) Make sure all mating surfaces are clean and free of any burrs or chips.

NOTE:
Keys should be a slip fit in the headshaft keyway. Dress to fit.



(2) Slip a key and coupling half over the lower headshaft.

(3) Place a thrust ring in the thrust ring groove of the lower headshaft.

(4) Complete steps 5 and 6 on hollow shaft drive instruction sheet IS-HSD-TPH-RC.

(5) Slip a key and coupling over the upper headshaft.

(6) Place a thrust ring in the thrust ring groove of the upper headshaft.

(7) Place the spacer on the pump coupling half.

(8) Line up the bolt holes on the coupling halves and the spacer. Orient keyway at 180°. Bolt securely together.

(9) Complete the hollowshaft drive installation in accordance with instruction sheet IS-HSD-TPH-RC.

(10) Check the shaft alignment just below the pump coupling half by means of a dial indicator. The total runout at this point should not exceed .003" for 3000 RPM or faster units, or .006" for slower speed units. Preferably, the runout should be as close to .000" as possible. Care must be used in rotating the shaft for this check so that the play in the lower drive bearing does not give a false reading. Removing the coupling bolts and rotating the drive coupling half relative to the spacer can result in a lower runout.

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Code: IS-HSD

INSTALLATION INSTRUCTIONS
HOLLOW SHAFT DRIVE

Make sure the pump is aligned. Do not plumb the discharge head and drive, but adjust the discharge head ring base or flange by using steel wedges or shims so that the headshaft is centered in the drive hollow shaft. The wedges or shims are to be placed beneath the discharge head or sub-base where used.

(1) Remove the drive cover and the top drive coupling.

(2) Try the drive coupling by slipping it over the headshaft. This must be a sliding fit - if necessary file, dress and polish, but do not use force. Remove the coupling and try the gib key in the headshaft keyway and in the coupling keyway. This must also be a sliding fit, but not loose.

(3) Raise the drive and check for burrs and nicks on the mounting register. These should be smoothed with a mill file.

(4) Lower the drive over the headshaft and bolt to the discharge head.

CAUTION:
CARE MUST BE TAKEN NOT TO DAMAGE THE THREADS ON THE HEADSHAFT OR BEND THE HEADSHAFT.

(5) Check the pump alignment.

(6) Grout the discharge head to the foundation. Make a neat and stiff mixture of nonshrinking grout. Raise the discharge head a few inches and coat that portion of the foundation which will support the pump with a coating of grout. Be sure that the wedges or shims are not changed during this operation.

(7) Lower the head back to position on the wedges, allowing the grout to squeeze out. Recheck to be certain the headshaft is still centered in the drive hollow shaft.

(8) Remove the excess grout and allow the grout to set for 48 hours before proceeding.

ELECTRIC DRIVES - Connect the motor terminals to the leads from the starter panel. Bump the motor to make sure the rotation is counter clockwise when viewed from above. If rotation is wrong, interchange any two leads on three phase motors. On single phase motors follow the manufacturer's instructions which accompany the drive. After changing the connections, recheck the rotation.

(9) Slide the coupling in place and insert the gib key. The top of the key should be slightly below the top of the drive coupling. Thread the adjusting nut on the headshaft.

(10) Adjust the impeller in accordance with the impeller adjustment instructions.

(11) Check and lubricate the drive in accordance with the drive lubrication instructions.

(12) The unit is now ready for starting.

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Code: IS-HSD-TPH-RC

INSTALLATION INSTRUCTIONS
HOLLOW SHAFT DRIVE
TWO PIECE HEADSHAFT
RIGID FLANGED COUPLING

Make sure the pump is aligned. Do not plumb the discharge head and drive, but adjust the discharge head ring base or flange by using steel wedges or shims so that the headshaft is centered in the drive hollow shaft. The wedges or shims are to be placed beneath the discharge head or sub-base when used.

(1) Remove the drive cover and the top drive coupling.

(2) Try the drive coupling by slipping it over the headshaft. This must be a sliding fit - if necessary file, dress and polish, but do not force. Remove the coupling and try the gib key in the headshaft keyway and in the coupling keyway. This must be a sliding fit, but not loose.

(3) Raise the drive and check for burrs and nicks on the mounting register. These should be smoothed with a mill file.

(4) Install a coupling half on the lower headshaft. See instruction sheet 'Rigid Flanged Coupling.'

(5) Lower the drive and bolt it securely to the discharge head.

ELECTRIC DRIVES - Connect the drive terminals to the leads from the starter panel. Bump the drive to make sure the rotation is counter clockwise when viewed from above. If the rotation is wrong, interchange any two leads on three phase drive. On single phase motors, follow the manufacturer's instructions which accompany the drive. After changing the connections, recheck the rotation.

(6) Stab the upper headshaft through the drive hollow shaft. If the drive is supplied with a steady bushing or a guide/centering bearing. Lubricate the upper headshaft with oil and use care when stabbing. Complete the assembly of the coupling per the instructions on sheet 'Rigid Flanged Coupling.'

(7) Check the pump alignment.

(8) Grout the discharge head to the foundation. Make a stiff mixture of nonshrinking grout. Raise the discharge head a few inches and coat that portion of the foundation which will support the pump with a coating of grout. Be sure that the wedges or shims are not changed during this operation.

(9) Lower the head back to position on the wedges, allowing the grout to squeeze out. Recheck to be certain the headshaft is still centered in the drive hollow shaft.

(10) Remove the excess grout.

(11) Slide the top drive coupling in place and insert the gib key. The top of the key should be slightly below the top of the drive coupling. Thread the adjusting nut on the headshaft.

(12) Adjust the impellers in accordance with the impeller adjustment instructions.

(13) Check the shaft alignment in accordance with step #10 on instruction sheet 'Rigid Flanged Coupling.'

(14) Check and lubricate the drive in accordance with the drive lubrication instructions.

(15) The unit is now ready for operation.

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INSTALLATION INSTRUCTIONS
HOLLOW SHAFT DRIVER
IMPELLER ADJUSTMENT
SEMI-OPEN AND MIXED FLOW IMPELLERS

(1) Use a suitable wrench and raise the shaft by turning the adjusting nut 1/6 of a turn at a time until the impellers break free. At this point the rotating assembly will turn easily, usually by hand.

(2) Impeller adjustment – raise the shaft the additional amount shown below.

a. 50 FEET MAXIMUM SETTING

.020"	4" through 14" pumps
.030" (1/32")	16" through 24" pumps
.050"	25" through 36" pumps
.180" (3/16")	42" through 56" pumps

b. SETTING OVER 50 FEET
For pump(s) serial no. _____, _____ inches

(3) Turn the adjusting nut to the nearest hole in the drive coupling for both adjustments.

(4) Install the lock screws.

CAUTION:
DO NOT RUN THE PUMP WITH THE IMPELLERS DRAGGING.

NOTE:
Dragging will occur at shut-off if the impellers are set properly at condition point.

NOTE:
ELECTRIC DRIVE - The use of a clamp-on ammeter to check motor load after the preliminary setting of impellers is highly recommended. In this manner the impellers can be set with the least allowable clearance with which they can operate without dragging. Compare the ammeter reading with the data stamped on the motor nameplate. Readjust if necessary.

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ESTABLISHED 1909

Code: IS-OA

INSTALLATION INSTRUCTIONS
OILER ASSEMBLY

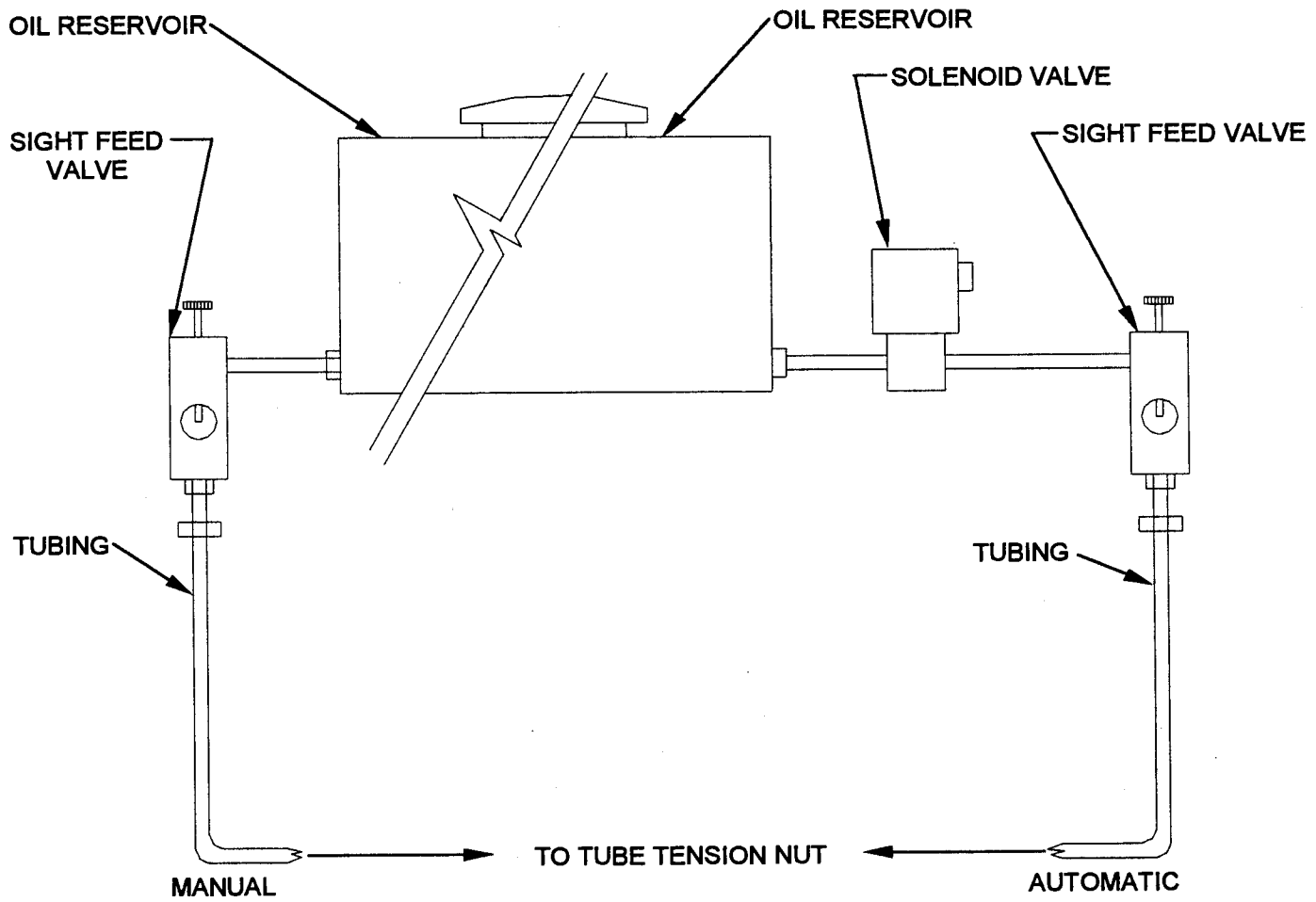
(1) Bolt the oil reservoir and bracket to the head.

(2) Connect the oil reservoir to the tube tension nut with the fittings and tubing supplied.

(3) Install a pipe plug in the opposite end of the oil reservoir.

(4) Verify that the solenoid valve is the correct voltage and connect it to the electrical power.

(5) Fill the oil reservoir with the proper viscosity turbine oil. (See lubrication sheet 'Lubrication Chart.')



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OPERATING INSTRUCTIONS
START-UP OPERATION
OIL LUBRICATED

(1) Check to be sure the oil reservoir is full of the proper oil. See lubrication Chart OS-LC.

(2) Adjust the sight feed valve to one drop per second.

(3) Bump the drive to tighten all threaded lineshaft couplings. This is necessary only on the initial start after installation.

(4) Recheck the impeller adjustment.

(5) Check to make sure the pumpshaft tums freely.

NOTE:
Steps 6 and 7 apply to turbine pumps only.

(6) Set the discharge valve to a nearly closed position before starting the pump on a new installation.

(7) Start the pump and then open the valve slowly after the liquid begins to flow.

CAUTION:
THE PUMP IS NOT WARRANTED FOR PUMPING FOREIGN MATERIAL IN THE LIQUID. All foreign material should have been removed from the sump, well system, etc. before the pump was installed. This is the only way to avoid damage which occurs when foreign material is pumped.

In the event foreign material is encountered, the following instructions will minimize the damage:

I. It is strongly recommended that the pump not be stopped. If it is stopped under such conditions, the foreign material suspended in the liquid may settle in the pump bowls and impellers causing them to seize.

II. Stop the unit after the fluid has cleared.

III. Determine the extent of the damage incurred in pumping the foreign material. It may be necessary to pull the unit to check this.

NOTE:
Should repairs be necessary, they will not be covered under the warranty of the equipment.

(8) After the fluid being pumped has cleared, adjust the sight feed valve to one drop of oil per minute per each 40 feet of column. For the first week of operation the drip rate should be no less than 5 drops per minute.

Johnston Pump Company
800 KOOMEY ROAD
BROOKSHIRE, TEXAS, 77423

NOTE:
Manual and automatic lubricators use the same adjustments. Manual lubricator must be shut off when the pump is idle.

There are several operating hints which, if followed, will assure a longer life for your Johnston pump. These are:

a. Should the pump lose its prime or break suction, shut it down. DO NOT RUN IT DRY. The impellers and bearings, which have small clearances, are apt to bind and cause serious trouble.

b. It is better to operate the pump without suction lift. Ideal operating conditions call for at least ten feet of submergence for the top bowl. This may vary, depending on the installation. For example; a small capacity pump in a large diameter well will require less submergence than a large capacity unit in a smaller well.

c. It is better to throttle a pump if the capacity is too great for the supply rather than let it break suction. Only turbine and mixed flow pumps may be throttled and should be limited to 50 percent of design flow.

NOTE:
Throttling may effect impeller adjustment and driver load.

d. When the pump is stopped, the flow of water backing down through the column will cause the pump to rotate backward if the unit is not equipped with a foot valve or a driver with a non-reverse ratchet. If power is supplied at this time it places a severe strain on the shafting, which may break or result in other damage. Always allow the unit to stop completely before restarting.

e. Never let the discharge pipe be supported entirely by the discharge head. Concrete or steel structures should be the principal support.

f. If operating in a closed system, an air relief valve should be installed on the discharge pipe between the discharge head and the check valve. Air must be admitted to the column when the pump is stopped and vented when the unit is started.

g. Keep the oil supply container covered. Do not permit the container to collect dirt.

h. Check the oil reservoir at least once every eight hours to assure an adequate supply of lubricant.

OPERATING INSTRUCTIONS
LUBRICATION CHART

CAUTION:

Do not use automotive or diesel engine lubricating oils for lineshaft lubricants.

The oils listed below are recommended for lubricating the lineshaft bearings of a Johnston Oil Lubricated Pump.

Lyondell (ARCO)	**Duro 32**
Exxon Company	**Terresstic**
Mobil Oil Corporation	**DTE #797**
Phillips Petroleum Company	**Magnus 150**
Shell Oil Company	**Turbo #32**
Sun Oil Company	**Sunvis #916**
Texaco Inc.	**Regal 32 (R&O)**
Chevron USA	**Chevron GST #32**
Citgo..	**PaceMaker 32**

The suction bearing is packed at the factory, when the type of service permits, and will not require further attention until the pump is removed from service. Repack this bearing before the pump is re-installed.

CAUTION:

Do not lubricate this bearing if minor contamination of fluid cannot be tollerated.

Bearings equipped with grease fittings should be lubricated approximately every 500 hours of service.

The greases listed below are recommended for lubricating the suction bearings and bearings with grease fittings.

Lyondell (ARCO)	**Litholine H EP #2**
Exxon Company	**Lidok EP #2**
Mobil Oil Corporation	**Mobilux EP #2**
Phillips Petroleum Company	**Philube EP #2**
Shell Oil Company	**Alvania EP #2**
Sun Oil Company	**Sun Prestige EP #2**
Chevron USA	**Duralith EP #2**
Citgo	**Premium Lithium EP#2**

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BROOKSHIRE, TEXAS, 77423
ESTABLISHED 1909

The greases listed below are recommended for automatic lubricator applications and for grease packing the shaft enclosing tube for grease lubricated lineshaft bearings.

	Normal Temperature	Low Temperature
Lyondell (ARCO)	**Litholine H EP #1**	**Litholine H EP #00**
Exxon Company	**Lidok EP #1**	**Lidok EP #0**
Mobil Oil Corporation	**Mobilux EP #1**	**Mobilux EP #0**
Phillips Petroleum Company	**Philube EP #I**	**- - -**
Shell Oil Company	**Alvania EP #1**	**Alvania EP R/0**
Sun Oil Company	**Sun Prestige EP #1**	**Sun Prestige EP #0**
Texaco Inc....	**Novatex #1**	**Low Temperature EP**
Chevron USA	**Duralith EP #1**	**Duralith EP #0**
Citgo	**Premium Lithium EP #1**	**Premium Lithium EP #0**

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OPERATING INSTRUCTIONS
TROUBLE SHOOTING

INSUFFICIENT G.P.M. and/or PRESSURE

(1) Speed too slow (check motor voltage)
(2) Gas or air in well
(3) Low water level (pump bowls not submerged)
(4) Pump suction broken
(5) Column or column joints defective
(6) Impellers partially clogged
(7) Impellers loose or damaged
(8) Strainer or suction partially clogged
(9) Cascading (falling water in well)
(10) Wrong direction of rotation
(11) Worn or damaged pump bowls
(12) Worn bowl bearings

USING TOO MUCH POWER

(1) Speed too high
(2) Improper impeller adjustment - dragging
(3) Pumping sand or foreign material
(4) Crooked well
(5) Pump out of alignment
(6) Shafting bent
(7) Rotating element binding
(8) Worn bearings

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MAINTENANCE INSTRUCTIONS
BOWL ASSEMBLY
ASSEMBLY - DISASSEMBLY
"SPECIAL"

SUCTION/BOWL LINER

Your bowl assembly is equipped with a suction/inter bowl liner. The liners are held in place by a press fit and machine screws. The liners are replaceable.

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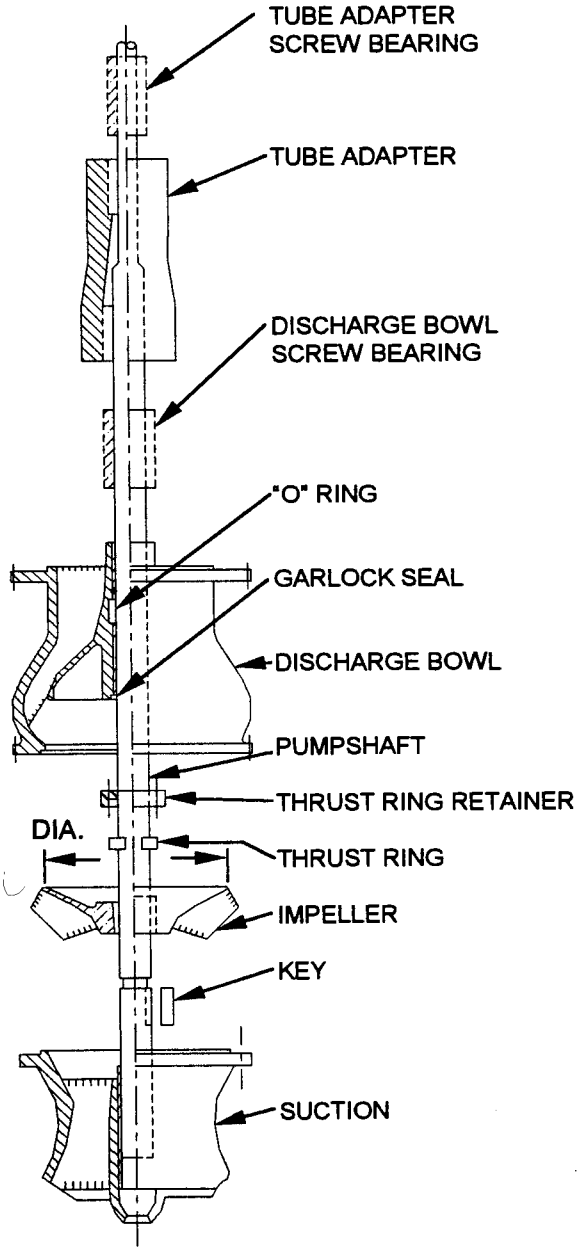
MAINTENANCE INSTRUCTIONS
BOWL ASSEMBLY- OIL LUBRICATED
MIXED FLOW
THRUST RING CONSTRUCTION

Read these instructions thoroughly before commencing to disassemble or reassemble a bowl assembly.



ASSEMBLY

(1) Lay out the parts of the bowl assembly and check against the bill of material for ports and quantities.

(2) Check the diameter of the impeller against the trim shown on the bill of material.

(3) Install the bearings in the bowls. Also install the bearings in the suction. The suction bearing will project above the suction bearing hub.

(4) Install the Garlock seal in the bottom of the discharge bowl hub with lip down and bolt on the retainer plate when used.

(5) Determine from which end of the bowl assembly the work is to commence:

a. If the thrust ring is located on the bottom of the impellers, begin assembly from the discharge end of the bowl assembly.

b. If the thrust ring is located on the top of the impellers, begin assembly from the suction end of the bowl assembly.

c. In the event that the bowl assembly is furnished with a thrust ring on the top of one impeller and on the bottom of the other impeller, commence assembly at the suction end of the bowl assembly.

(6) Place a key in the keyway of the pumpshaft and slide the impeller over the key.

NOTE:
Keys must be a sliding fit in the keyway of the pumpshaft and impellers.

(7) Place the thrust ring in the thrust ring groove of the pumpshaft.

(8) Place the thrust ring retainer over the pumpshaft and thrust ring. Bolt it to the impeller.

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BROOKSHIRE, TEXAS, 77423
ESTABLISHED 1909

(9) Place the pumpshaft into the suction or discharge bowl. (Depending on the location of the thrust ring.)

NOTE:
Steps 10, 11, 12, 13 and 14 apply to multistage units only.

(10) Place the bowl assembly in a vertical position.

(11) Slip an intermediate bowl over the end of the pumpshaft and bolt the bowl in position.

(12) Place the next key and impeller on the pumpshaft.

(13) Place shims on the top of the impeller hub so that the top of the shims is level with the bottom of the thrust ring groove.

(14) Place the thrust ring and thrust ring retainer in position and bolt the retainer to the impeller.

(15) Proceed to install the remaining bowls and impellers.

(16) Install the "O" ring slinger on the shaft in line with the by-pass ports located in the discharge bowl.

(17) Verify that the pumpshaft projection is as specified on the bill of material. The projection is the distance from the end of the shaft to the face of the flange when the shaft is in its lowest position.

(18) Thread the discharge bowl screw bearing into the discharge bowl.

(19) Pack the tubing adapter with waterproof grease.

(20) Thread the tubing adapter on the discharge bowl screw bearing and tighten.

(21) Thread the tubing adapter screw bearing into the tubing adapter.

(22) Check the projection of the shaft above the tube seat. The projection should be checked when the impellers are in the lowest position.

(23) Pack the suction hub with waterproof grease through the bottom, and install the pipe plug and/or cover plate. When packing this bearing the shaft should be at its lowest position. Excess grease will prevent the impeller from seating properly.

NOTE:
When pumping a grease dissolving fluid or operating at high temperatures, omit step 23.

(24) The bowl assembly is ready to install if the rotating element turns freely by hand.

DISASSEMBLY

To dismantle the bowl assembly, reverse the procedure described above.

MAINTENANCE INSTRUCTIONS
RECOMMENDED SPARE PARTS

Replacement or spare parts must be ordered by the following procedure:

(1) List the Serial Number of the pump.

(2) List the Part Number (from the Bill of Material).

(3) List the Quantity.

(4) Complete Part Description (from the Bill of Material)

The following list represents the parts subject to the most wear:

Bowl Assembly Bearings

Lineshaft Bearings

Shaft Sealing Assembly Bearing

Wear Rings / Liners

Packing

Complete Mechanical Seal (less gland and sleeve)

The following list of parts are recommended to be stocked if down time is critical.

Gaskets and/or "O" Ring

Rotating Parts

Wear Rings / Liners

Driver Bearings

Mechanical Seal Sleeve

Johnston Pump Company
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BROOKSHIRE, TEXAS, 77423
ESTABLISHED 1909

JOHNSTON PUMP COMPANY

Bill-of-Material

As Of 05/17/99

Done By:

Description: PUMP ASSEMBLY

Sales Order: 98JA1307

Model: Rev:

Customer: CHAPPY CORPORATION

ECO No:

Date of Last ECO: 01/08/99

Part Number	Description	Item Number	Qty Per Assembly	UM
98JA1307-1	HEAD,ASSY-SE-30.00X36-OL	1	1.000	EA
63381-111	ELBOW,DISCH-A-30.00X36	1	1.000	EA
5410-1-301	NAMEPLATE,ASSY-SERIAL,HEAD,LG	2	1.000	EA
63382-111	SHAFT GUARD HALF 12.00X84.00	3	2.000	EA
HW1000-158-316	CAPSCREW,HEX-1/2-13NC X 1.00	4	8.000	EA
HW1000-160-316	CAPSCREW,HEX-1/2-13NC X 1.50	5	18.000	EA
HW1009-12-316	NUT,HEX-1/2-13NC	6	18.000	EA
CD98JA1307-4	BOX,PKG ASSY-OL-4.00X2.68	7	1.000	EA
669-1-333	OILER ASSY- 440/480 VOLT	8	1.000	EA
669-9-333	OILER MANUAL BY-PASS LINE	9	1.000	EA
TF1005-2-B02	TUB,INST-0.25	10	15.000	FT
CD98JA1100-3	CPLG,ASSY-2.68X2.68-RIGID	11	1.000	EA
HW1000-406-316	CAPSCREW,HEX-1 1/2-6NC X 5.50	12	32.000	EA
HW1009-21-316	NUT,HEX-1 1/2-6NC	13	32.000	EA
63424-036	MOTOR PLATE 51" DIA. X 30 1/2	14	1.000	EA
HW1000-203-070	CAPSCREW,HEX-3/4-10NC X 2.00	15	4.000	EA

Bill-of-Material Done By:
As Of 05/17/99

Description: PUMP ASSEMBLY Sales Order: 98JA1307

Model: Rev: Customer: CHAPPY CORPORATION
ECO No:
Date of Last ECO: 01/08/99

Part Number	Description	Item Number	Qty Per Assembly	UM
98JA1307-2	COL,ASSY-FLG-36X4.00X2.68-OL	2	1.000	EA
63384-111-48.87	COL,FLG-36X0.375-N11	1	1.000	EA
63383-111-120.00	COL,TPR-36X30X0.375X120.00-N11	2	1.000	EA
13189-720	GASKET,COL-36PO	3	2.000	EA
HW1000-206-316	CAPSCREW,HEX-3/4-10NC X 2.75	4	28.000	EA
HW1000-208-316	CAPSCREW,HEX-3/4-10NC X 3.25	5	28.000	EA
HW1009-14-316	NUT,HEX-3/4-10NC	6	28.000	EA
4570-376	TUBE,ENCL-4.00X60.00-S	7	3.000	EA
6636-376-48.87	TUBE,TENS-4.00X48.87-S	8	1.000	EA
4784-836	BRG,THD LS-2.68X4.00-L-GRV	9	3.000	EA
4685-318	SHAFT,LINE-2.68X120.00-THD	10	1.000	EA
4687-318	CPLG,SHAFT-2.68X3.50X06.00-THD	11	1.000	EA
5571-318-120.50	SHAFT,LWR-HD-2.68X120.50-FLG	12	1.000	EA
5570-416-142.00	SHAFT,UPR-HD-2.68X142.00-FLG	13	1.000	EA
5659-1-060	NUT,ADJUSTING ASSY-2.68	14	1.000	EA

JOHNSTON PUMP COMPANY

Bill-of-Material

As Of 05/17/99

Done By:

Description: PUMP ASSEMBLY Sales Order: 98JA1307

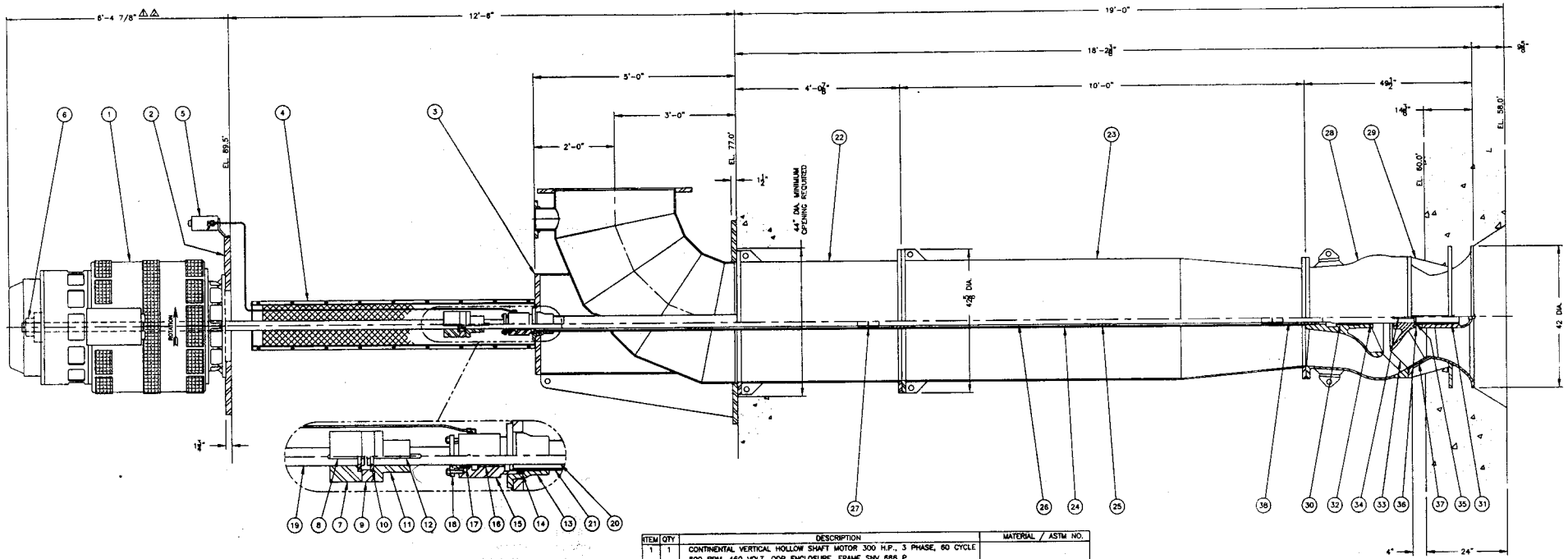
Model: Rev: Customer: CHAPPY CORPORATION

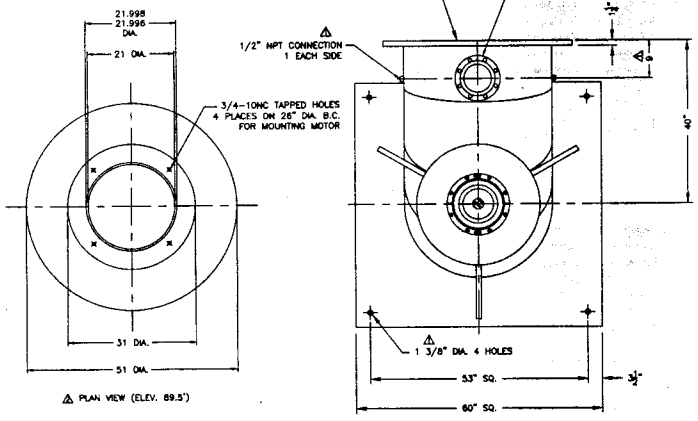
ECO No:

Date of Last ECO: 01/08/99

Part Number	Description	Item Number	Qty Per Assembly	UM
98JA1307-3	BOWL,ASSY-30PS-1 STG-OL	3	1.000	EA
63377-130	BOWL,MF-30MS-DCH-4.12-WF	1	1.000	EA
12074-111	LIFTING LUG FOR 30MS BOWL	2	2.000	EA
HW1000-202-316	CAPSCREW,HEX-3/4-10NC X 1.75	3	8.000	EA
36130-932	BRG,SLV-3.43X4.12X09.50	4	1.000	EA
4784-836	BRG,THD LS-2.68X4.00-L-GRV	5	1.000	EA
20108-905	IMP,MF-30PS-KEY-5 VANE	6	1.000	EA
6905-316	RING,THR-3.06X3.81X0.50	7	1.000	EA
6906-316	PLATE,RET-3.81X6.37X0.62-SC	8	1.000	EA
HW1001-121-316	CAPSCREW,SKT-3/8-16NC X 1.25	9	6.000	EA
K1000-08-05.50-316	KEY,SQ-0.87X0.87X05.50	10	1.000	EA
63378-130/XXX	BELL,MF-30MS-SPC-4.12-LNR	11	1.000	EA
9931-932	BRG,SLV-3.43X4.12X12.00	12	1.000	EA
PF1012-08-130	PLUG,PIPE-SQ.HD.-1 1/2"-NPT	13	1.000	EA
10253-1-301	NAMEPLATE,ASSY-SERIAL,BOWL	14	1.000	EA
6912-701-55.18	SHAFT,PMP-3.43X55.18-2.68-SPC	15	1.000	EA
4687-318	CPLG,SHAFT-2.68X3.50X06.00-THD	16	1.000	EA
HW1000-203-316	CAPSCREW,HEX-3/4-10NC X 2.00	17	24.000	EA
HW1000-209-316	CAPSCREW,HEX-3/4-10NC X 3.50	18	24.000	EA
HW1009-14-316	NUT,HEX-3/4-10NC	19	24.000	EA
13258-720	GASKET,COL-30-PO	20	2.000	EA
CD98JA1307-3	SEAL,LIP-3.43X4.50X0.50	21	2.000	EA

DO NOT SCALE DRAWING





△ PLAN VIEW (ELEV. 89.5')

PLAN VIEW (ELEV. 77.0')

ITEM	QTY	DESCRIPTION	MATERIAL / ASTM NO.	
1	1	CONTINENTAL VERTICAL HOLLOW SHAFT MOTOR 300 H.P., 3 PHASE, 60 CYCLE 600 RPM, 460 VOLT, ODP ENCLOSURE, FRAME SNV 686 P		
2	1	MOTOR PLATE	STEEL A36	
3	1	30 X 36 SURFACE DISCHARGE ELBOW - 3/8" WALL	FAB STL A53 & A36	△
4	1	SHAFT GUARD	316L S.S. A276 & A240	
5	1	OILER ASSY, 1 GAL. - 460 VOLT W/MANUAL BY-PASS		
6	1	ADJUSTING NUT	STEEL A108-1018	
7	1	MOTOR COUPLING	STEEL A108-1045	
8	1	KEY MOTOR CPLG.	STEEL A108-1018	
9	1	SPACER	STEEL A108-1045	
10	2	THRUST RING	STEEL A108-1045	
11	1	PUMP COUPLING	STEEL A108-1045	
12	1	KEY & PIN ASSY.	STEEL A108-1018	
13	1	TUBE TENSION PLATE	CAST IRON A48 CL. 30	
14	2	PACKING	GARLOCK #31	
15	1	TUBE TENSION NUT	STEEL A108-1018	
16	1	BEARING - T.T. NUT	BRONZE B505-C932	△
17	3	PACKING RINGS	GRAFOIL	△
18	1	PACKING GLAND ASSY.	BRONZE B584-C953	
19	1	UPPER HEADSHAFT - 2 11/16" DIA.	416 ST. STL. A582	
20	1	LOWER HEADSHAFT - 2 11/16" DIA.	316L ST. STL. A276	△
21	1	TUBE TENSION NIPPLE - 4" X-HVY PIPE	316L ST. STL. A312	△
22	1	TOP COLUMN PIPE - 36" O.D. X 3/8" WALL	FAB STL A53 & A36	
23	1	BOTTOM COLUMN PIPE - 36" X 30" X 3/8" WALL	FAB STL A53 & A36	
24	3	ENCLOSING TUBE - 4" X-HVY PIPE	316L ST. STL. A312	△
25	4	BEARING - LINESHAFT	BRONZE B584-C836	△
26	1	LINESHAFT - 2 11/16" DIA.	316L ST. STL. A276	△
27	2	SHAFT COUPLING	316L ST. STL. A276	△
28	1	DISCHARGE BOWL	CAST IRON A48 CL. 30	
29	1	SUCTION BELL	CAST IRON A48 CL. 30	
30	1	BEARING - DISCH. BOWL	BRONZE B505-C932	△
31	1	BEARING - SUCT BELL	BRONZE B505-C932	△
32	2	LIP SEAL	BUNA-N & ST. STL.	
33	1	IMPELLER - 30PS (5 VANE-DYNAMICALLY BALANCED)	BRONZE B584-C905	△
34	1	KEY - IMPELLER	316 ST. STL. A276	
35	1	THRUST RING	316 ST. STL. A276	
36	1	IMPELLER RETAINER	316 S.S. A743 CF-8M	
37	1	LINER - SUCT. BELL	BRONZE B584-C865	
38	1	PUMPSHAFT	MONEL B164	

NOTES:
1. COLUMN & BOWL ASSY. JOINTS WILL BE GASKETED AND FASTENED WITH 316 ST. STL. HARDWARE.
2. INSIDE AND OUTSIDE OF DISCH. ELBOW, COLUMN PIPE AND BOWL ASSY. WILL BE COATED WITH SCOTCH COAT 134 16 MILS DRY FILM THICKNESS.
△ 3. A COVER PLATE AND GASKET WILL BE FURNISHED FOR THE SUCTION BELL.
△ 4. (32) 1 1/2"-6NC BOLTS 5 1/2" LONG & NUTS WILL BE FURNISHED FOR DISCHARGE FLANGE

CONDITIONS

FLOW	30000 U.S. GALLONS PER MINUTE
TOTAL DYNAMIC HEAD	28 FEET
LIQUID PUMPED	SEA WATER
SPECIFIC GRAVITY	1.025
TEMPERATURE	AMBIENT

CUSTOMER

CUSTOMER	THE CHAPPY CORPORATION
PURCHASE ORDER NO.	834-6952
SITE	PORTSMOUTH NAVAL SHIPYARD DRYDOCK NO. 3
TAG NO.(S)	PUMP # 1 & #2
APPLICATION	MAIN DEWATERING PUMP

APPROX. WEIGHTS

DRIVER	4800 LBS.
DISCHARGE HEAD ASSY	5000 LBS.
COLUMN ASSY	3700 LBS.
BOWL ASSY	2750 LBS.
TOTAL	16250 LBS.

JOHNSTON PUMP COMPANY

SERIAL NO. 98JA1307
QUOTE NO.

THIS PRINT CERTIFIED CORRECT BY

△

SECTIONAL ILLUSTRATION 30 X 36 SURF. ELBOW - 36 X 4 X 2 11/16 COLUMN - 1 STAGE 30PS BOWL ASSY.

NO.	REVISION	BY	DATE
△	REVISED TO DATE	R.G.	9/8/99
△	REVISED TO DATE	R.G.	2/24/99

JOHNSTON PUMPS
800 KOOMEY ROAD
BROOKSHIRE, TEXAS 77423
TEL 281-934-6009
JOHNSTON PUMP IS A DIVISION OF FLOW PRODUCTS, INC.

PLOT SCALE 1"=1'-3"
DRAWN R. GUIDA 01/12/99
CHECKED D. ADKINS 1/14/98
APPROVED

DRAWING NO. H-7739-D

Johnston Pump Company
800 Koomey Road
Brookshire, Texas 77423-8803

Certificate

of Compliance

Customer: **THE CHAPPY CORPORATION**

Date: **January 11, 1999**

Customer P.O. Number: **834-6952**

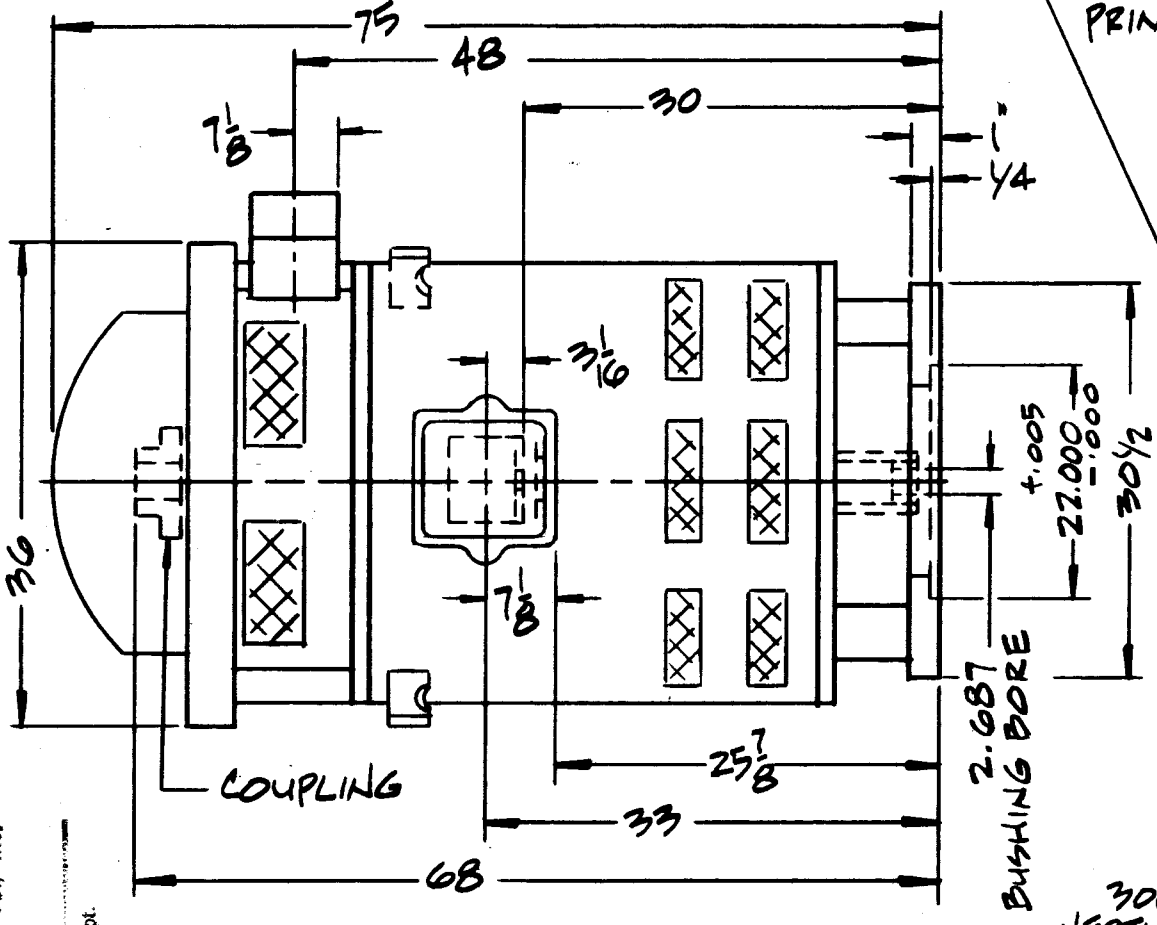
Subject Article: **(2) JM MIXED FLOW PUMP JM30PS**

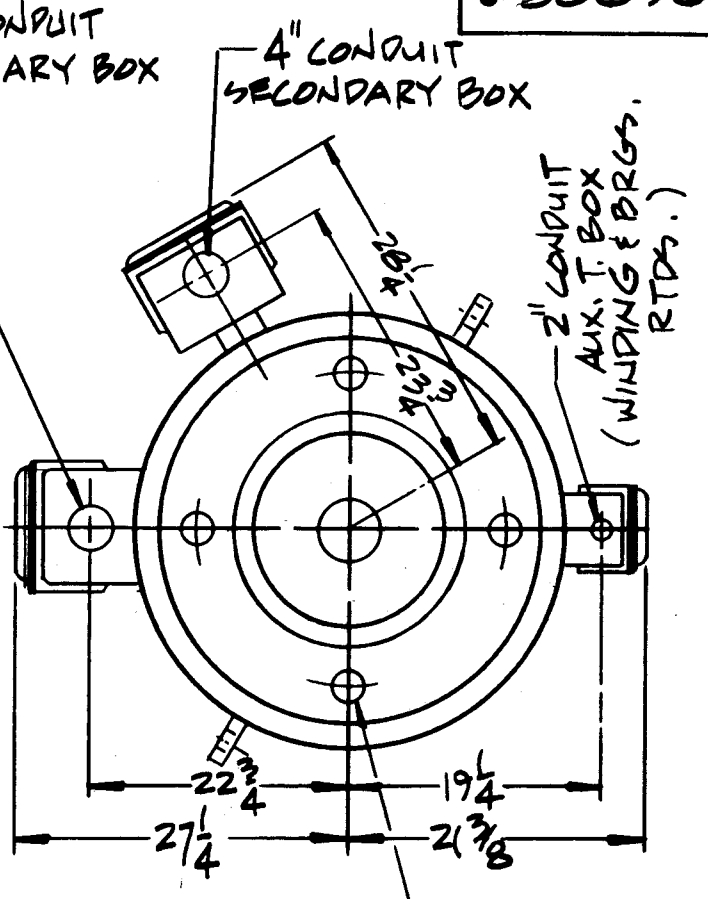
Serial Number: **98JA1307-A-B**

It is hereby certified that all articles, materials, processes and finished parts used, are in conformance with pertinent specifications and quality requirements shown in the purchase order.

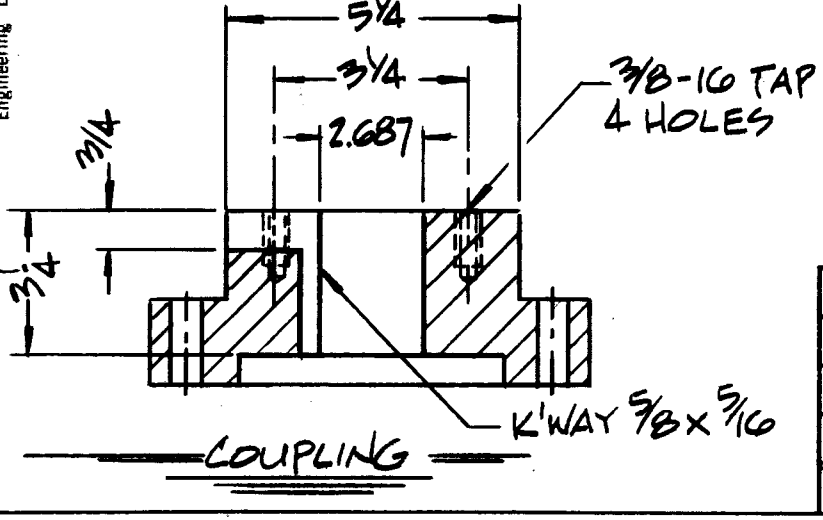
Debbie Zook
Documentation Coordinator

C-88656





300 HP. @ 600 RPM.
VERTICAL HOLLOW SHAFT
WOUND ROTOR WITH NRR
ROTATION CCW. VIEWING FROM
TOP OF MOTOR. OIL LUB. HI-THRUST
BALL BEARINGS. MOTOR WT.
APPROX. 5600 LBS.



CONTINENTAL ELEC. CO., INC.
Engineering Dept.

	DIMENSION OUTLINE OF VERT. SLIP RING MOTOR 5NV686 HSP
	CONTINENTAL ELECTRIC CO., INC. NEWARK, N. J.
REF. C86254	DRN. BY: JT 1-19-99 CHK'D BY: APP'D BY: JT
MS. / FO. I6210	C-88656

CONTINENTAL ELECTRIC Co. Inc

CUSTOMER	PACO / JOHNSTON PUMPS		
C.E.C.O. F.O.	I 6210		
APPROVED BY	CORNELIU A. PETRESCU S.E.E.	DATE	12.28.98
		REVISED	05.14.99

VERTICAL, WOUND ROTOR, HSP WP - I, CONTINUOUS DUTY, 1.15 S.F., CLASS " F " INSULATION, 40 °C R/R @ 1.0 S.F. @ 40 °C AMBIENT, HIGH THRUST, OIL BATH BALL BEARING @ TOP, GREASE LUBRICATED BALL BEARINGS @ BOTTOM, WITH A " B - 10" LIFE OF 100,000 HOURS, 3 KLIXXONS N/C IN WINDING & SIX WINDING RTD's (TWO / PHASE) & FOUR BEARING RTD's (TWO / BRG .) ALL RTD's TO BE 100 OHMS PLATINUM , NON REVERSE RATCHET, CCW ROTATION VIEWD FROM TOP

SECONDARY VOLTAGE = 340 V SECONDARY CURRENT = 386 A

CERTIFIED CORRECT
CONTINENTAL ELEC. CO., Inc.

Engineering Dept.

MOTOR PERFORMANCE DATA

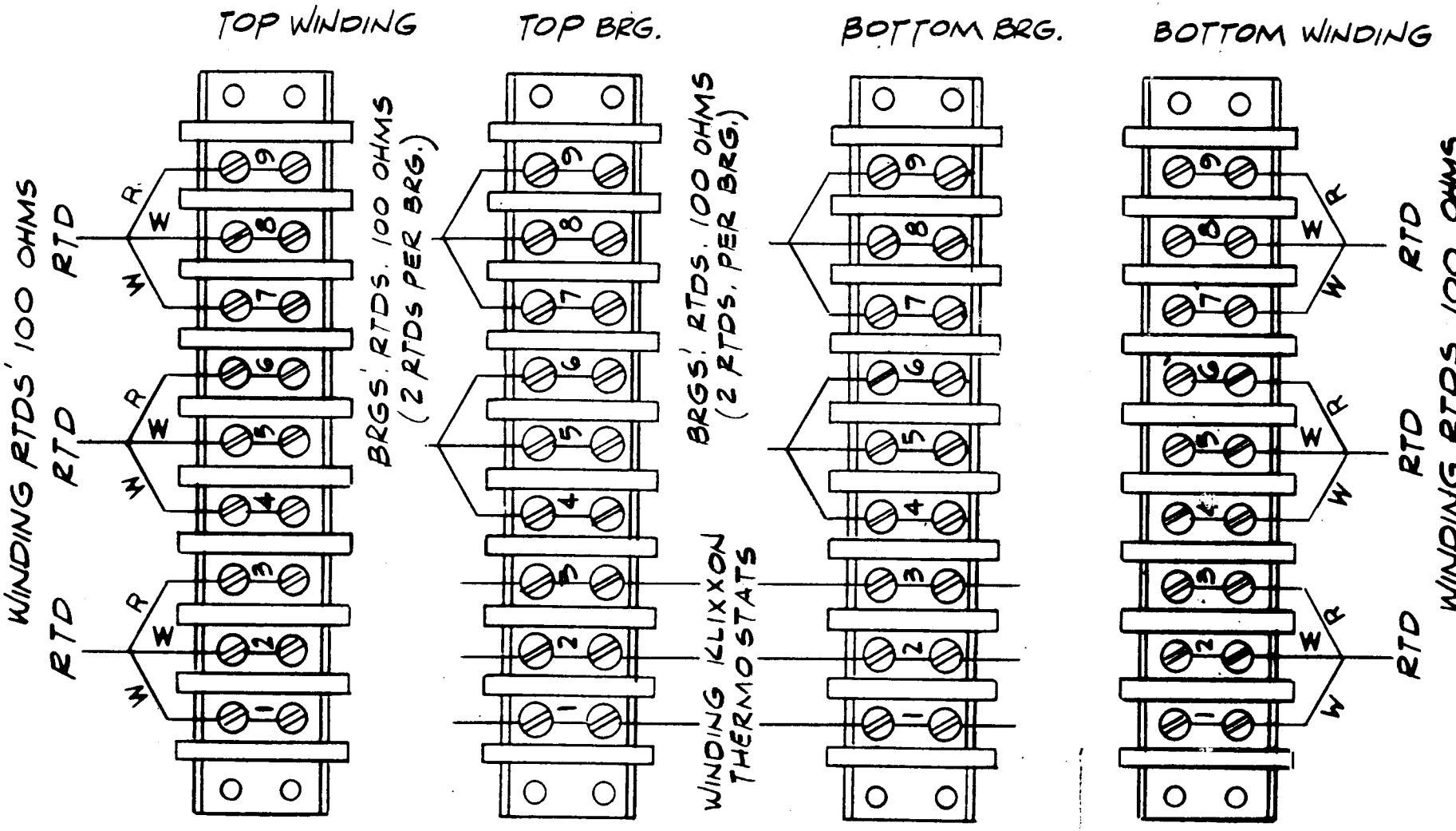
SNV 686 HSP 300 HP 460 V 60 Hz 3 Ph 600 RPM

LOAD of F.L	CURRENT A	EFFICIENCY %	POWER FACTOR %	SPEED R.P.M.
100	372	92.0	82.0	585
75	298	91.0	77.5	
50	229	89.0	69.0	

STARTING TORQUE 1750 LbFt or 65 % of F.L.T WITH SLIPRINGS.
STARTING CURRENT 1700 A @ 100 % VOLTAGE SHORTED

40 38-3

C-84,04



CERTIFIED CORRECT
CONTINENTAL ELEC. CO., Inc.

Engineering Dept.

RATINGS

S/N I-6210

WINDING RTDS. 100 Ω
BEARING RTDS. (2/BRG.) 100 Ω
KLIXXON 1822-L2-11-1, 150°C N/C

	AUXILIARY WIRING CONNECTION DIAGRAM
	CONTINENTAL ELECTRIC CO., INC. NEWARK, N. J.
REF. C81586	DRN. BY: JT 3-25-99
MS. 88691 FOI6210	CHK'D BY:
	APP'D BY:
	C-88704

Continental Electric Co., Inc.
Manufacturers of Electric Power Apparatus
325 FERRY STREET, NEWARK, N.J. 07105
PHONE: 973-344-4050 • FAX: 973-344-3214

GENERAL OPERATING INSTRUCTIONS FOR VERTICAL HOLLOW SHAFT WOUND ROTOR MOTORS, WITH OIL BATH LUBRICATED HI-THRUST BALL OR ROLLER BEARING ON TOP WITH NON-REVERSE RATCHET AND GREASE LUBRICATED BALL BEARING IN BOTTOM.

RECEIVING:

Continental alternating current slip ring motors are completely inspected, tested and ready for successful operation when they leave the plant. Each machine should be carefully inspected to see that no damage has occurred during shipment. Be sure no foreign material is on the slip rings. Turn shaft by hand if possible to see that it turns freely in its bearings.

INSTALLATION:

Motors which cannot be installed when they are received or if motor will stand idle for prolonged periods of time should be kept clean and dry. Space heater should be energized.

Install the motor on a solid base and securely bolt in position before operating. With the motor at standstill, fill the top oil reservoir with a turbine quality lubricating oil with a viscosity accordingly to the nameplate on the motor, to the correct oil level marked on the sight gauge.

The bottom ball bearing is grease lubricated and sufficiently lubricated to operate under normal condition.

The motor shaft should be accurately aligned with the connected load. Follow the instructions of the coupling manufacture for correct method of coupling installation.

Before connecting power supply to motor be sure power supply and motor nameplate rating agree. Do not try to run motor on any other current, voltage or frequency than that for which motor is designed. Connect motor through a starting switch which is properly fused.

NON-REVERSE RATCHET:

Non-reverse ratchets are the pin type designed that prevent the motor from being driven in the opposite direction by the pump when it is shut down. Caution should be observed when applying non-reverse ratchets due to pump head conditions and should NOT be subjected to abnormal use, including frequent stopping and starting of the motor.

Continental Electric Co., Inc.
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SLIP RINGS:

Slip rings must be kept clean and free from grease, oil and dust. If necessary to clean the rings, use a fine grade of sandpaper to polish rings and wipe clean with a lint-free dry cloth. Never use emery cloth to clean the rings. A brown oxide color indicates good brush and slip rings life.

BRUSHES:

Brushholders should be kept clean and dust free to prevent brushes from sticking in their holders. The spring tension on the brushes should be kept as light as possible commensurate with good ring contact to prevent excessive wear of brush. As brushes become worn, they should be replaced by purchasing the proper size and grade of brush from manufacturer.

Sparking at the brushes is a sign of improper ring contact and can be corrected by cleaning the rings, re-adjusting the spring or replacing with a new brush. This should be done as quickly as possible in order to avoid pitting the rings or causing more serious electrical damage to the machine.

MAINTENANCE:

The top bearing oil reservoir should be kept filled to the oil level marked on the sight gauge. The oil level may change slightly when the motor is running because of the circulation of the oil.

Check the oil periodically for contamination. Bottom ball bearing is grease lubricated to operate under normal condition for approximately one year. A relubrication schedule will vary widely with the motor size, type of service and environment. When lubrication becomes necessary use a good grade of clean mineral grease (Non-Fluid Oil S-58 or equivalent) for normal operating temperatures. Never fill the bearing housing more than 1/3 to 1/2 full of grease as overgreasing will cause excessive heat in the bearing.

No other maintenance or servicing required on Continental motors to permit many years of efficient trouble-free operation.

CAUTION: Do not lay motor on its side as this will damage the thrust bearing. Install coupling with motor in a vertical position.

Continental Electric Co., Inc.

Manufacturers of Electric Power Apparatus

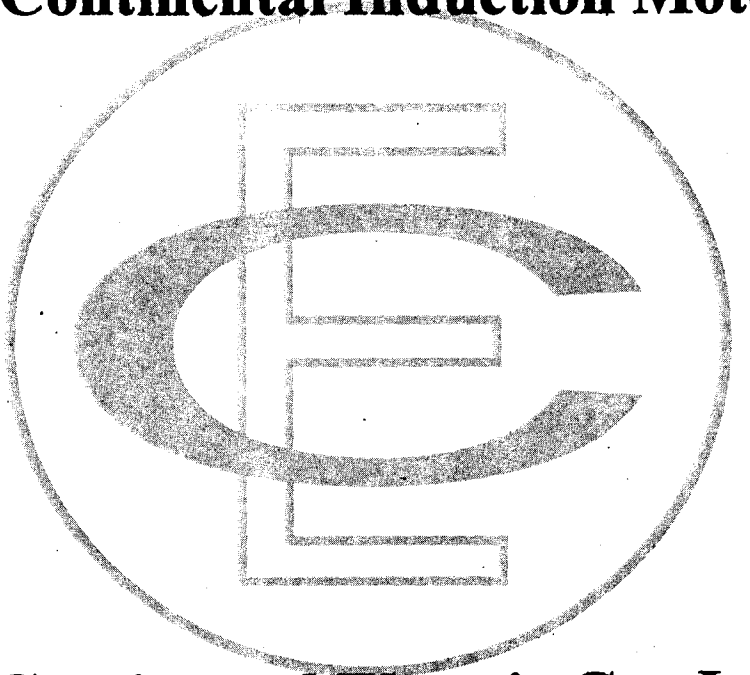
325 FERRY STREET, NEWARK, N.J. 07105

PHONE: 201-344-4050 • FAX: 344-3214

Service Manual

for

Continental Induction Motor



Continental Electric Co., Inc.

Newark, Nj 07105 U.S.A.

MAINTENANCE

Electric motors and generators are among the most efficient machines known today, and will operate with a minimum of attention. To keep the equipment operating at a high level of efficiency, however, a good maintenance program must be set up. Systematic inspections of the equipment should be scheduled, and records should be kept of the findings of these inspections. Examination of these records will indicate any sign of potential trouble. Periodically, at planned intervals, the equipment should be completely disassembled and overhauled
Figures 400-1 and 400-2 show typical forms recommended by the National Electric Manufacturers Association (NEMA) for recording inspection data and Figures 400-3 and 400-4 depict typical service record forms.

Dirt, dust and oil are the greatest enemies of electrical equipment. When dirt or dust settles on a machine, it may prevent heat dissipation and restrict ventilating passages. This in turn may lead to overheating and insulation breakdown. Some types of dust are electrically conductive and can also cause insulation breakdown.

Dust and dirt also have a harmful effect in that they tend to soak up oil or grease, forming a gum which is not easily cleaned off. Oil is particularly damaging since it tends to deteriorate insulating varnish. Once a motor or generator has become oil soaked, it is in serious danger of burning out.

Note:
The best indication of the condition of the insulation is a record of the insulation resistance taken at regular intervals when the machine is hot. A sudden decrease in the insulation resistance may indicate an approaching breakdown, which may be avoided if the causes is located and corrected

Insulation Resistance
Insulation resistance is useful in determining the presence of moisture in the winding. It is suggested that insulation resistance readings be taken every three months.

Any sudden downward trend of the insulation resistance values will indicate that special maintenance steps need be taken. See sections on cleaning and insulation renewal.

MEASUREMENT OF INSULATION RESISTANCE
The method of taking insulation resistance should be definitely controlled and the following routine is suggested:
A. Adopt a definite time of application for taking readings, preferably after 1 minute of voltage application. Make tests immediately after a shutdown when machine is relatively free from moisture.
B. Always use the same voltage instrument.
C. Keep a complete record of date, temperature of winding and ambient temperature, relative humidity and condition of winding. Insulation resistance will vary inversely with the temperature. That is, the insulation will decrease with increase in temperature. Roughly the resistance will be doubled for each 15° drop in temperature. For example, if a certain insulation has a known resistance at 75° C, then at 60° C the resistance should be approximately doubled and at 25° C it should be in the neighborhood of 10 times as great. It
must be emphasized that these figures are only approximations and that the rate for individual machines will usually vary.
D. Take readings at machine terminals, be sure other cables, switches, etc. are isolated.

E. When ever motor driven or electronic instruments are used to take readings over a period of time longer than 1 minute, as in the case of dielectric absorption curves, it is essential that, before a repeat reading of the same part is taking that the winding be discharged to ground for a time at least equal to the total time of voltage application when readings were first taken.

CLEANING

Oil or grease covered machines should be cleaned thoroughly and a fresh coating of insulating varnish applied. Usually most of the oil or grease can be removed with a cloth moistened with a solvent such as VM & P Naptha. A brush should be used for surfaces difficult to reach by hand. Use a spray gun to clean inaccessible slots and passages. After using the solvent, be sure to dry the windings with dry compressed air.
Warning: Do not use a solvent which has toxic effects or which has a deteriorating effect on varnish.
No amount of cleaning will repair insulation which has been badly oil soaked. The motor will probably have to be rewound.

CLEANING METHODS

Compressed Air - This is the most important convenient method if there is not an excessive amount of dirt or oil present. Air pressure should be less than 50 psi, excessive pressure is capable of injuring the insulation.
A. Use dry air andallow any accumulation of water in the pipes to be blown out before turning the air blast on the machine. In blowing dust out of machines, the adjacent machine should be protected from flying dust by a suitable cover or shield.
B. Suction-Cleaning by a vacuum cleaning system is the preferred method as all dirt is carried away from the machines and the danger of blowing dirt into adjacent cent machines is completely avoided.
C. Wiping-All accessible insulated parts, subject to copper or carbon dust, should be wiped clean with a dry cloth in addition to cleaning by suction or compressed air.
When wiping, do not neglect such parts as inner surface of end windings, strip ring insulation, etc.
D. Solvents - The use of solvents should be avoided in so far as practical and only used whenever it is necessary to remove hard or pasty deposits of grease oil and other foreign matter.
Before using any solvent, use a clean, dry rag to wipe off as much dirt as possible as mentioned in paragraph C. Then use a rag moistened (not dripping) with a petroleum solvent of the "safety type" such as Stoddard Solvent No. 1609-2 or equivalent. If a petroleum solvent has little effect on the dirt, trichloroethane may be used. However, precautions must be taken as trichloroethane is an active solvent and somewhat corrosive in it's action. Do not use on leads or other rubber insulation because it has a deteriorating effect on these items. Thorough drying after wards is essential to avoid damage to the insulation.

INSULATION RENEWAL

The best way to renew an insulation is to apply one or more varnish treatments, each followed by baking. Prior to varnish treatments the motor should be thoroughly cleaned. Those motors employing a splash lubricated bearing on the drive and have an oil seal to present entrance of oil into the motor. The screened openings at the bottom of the motor near the shaft extension end should be checked frequently for the presence of oil, indicating a leaking seal.

INSTALLATION OF OIL SEALS

The importance of properly installing an oil seal cannot be over emphasized. Failure to observe correct installation procedures probably accounts for mare cases of the improper functioning of oil seals than any other single cause. To secure the ultimate in satisfactory service, it is recommended that the following precautions be observed.

A. Fluid Contact

The seal should be assembled with the toe or wiping edge of the seal of the element pointing toward the fluid to be retained. (See Figure 43)

B. Bore

The bore should be checked for adequate chamfer (30 degrees angle to a minimum depth of 1/16 of an inch). The bore should be inspected for scratches and all sharp edges be removed. The seal outside diameter should be correct for the bore in the assembly.

When a leak at the outer edge of either metal or rubber covered seals is caused by abrasion of the oil seal, it may be directly related to improper chamfer on the bore or the use of improper insulation tools.

C. SHAFT

The surface of the shaft should be uniform and free from burrs, nicks, scratches and grooves. The surface finish should be between 10 and 20 -micro inches and on a repair ion should be buffed to this finish with crocus cloth.

D. Lubrication

In all cases a lubricant should be applied to the shaft or to the sealing element of the oil seal. This aids installation and reduces heat build-up during the first few minutes of run. The application of a lubricant to the outer periphery of a synthetic rubber-covered seal will reduce the possibility of shearing or brushing. Some bearings used on the shaft extension end of flare mounted motors are splash lubricated by oil in the gear case of the driven equipment. This type of bearing can be denoted by the absence of greasing facilities and when the motor is not mounted, by observing that the bearing is open. An oil seal is used on the inboard side of this bearing to prevent lubricant from entering the motor.

GREASE LUBRICATED BEARINGS

Partial charge of grease should be made at intervals after 6 months of operation. At intervals of approximately one year the bearing should be cleaned thoroughly and replaced with grease.

Dirt is the biggest foe of anti-friction bearings, and one of the most common ways for it to get into the bearings is with the grease at the time the bearing is relubricated. It is imperative to keep grease free of foreign matter, both in handling and in storage Cover the bearings and interior of the housing with clean wrapping material if they are to be left dismantled or exposed. Never open the bear ng housing under the conditions which would permit entrance of dirt into the bearing.

The following steps should be followed when greasing the motor:

A.) Clean the exterior of the motor.

B.) Re move the relief plug.

C.) if grease hardened, remove the hardened lubricant which has accumulated in the area around the relief plug with a wooden or plastic stick. In severe conditions, run the motor until the hearina chamber is warmed to the temperature which wilt allow the grease to flow more easily.

D.) Regrease motor with a "low pressure" grease gun, never fill the bearing housing wish more than 1/3 to 1/2 full of grease as over greasing will cause excessive heat in the bearing.

E) Replace the relief plug.

Recommended Grease:

It is recommended that these greases or their equivalents be used:

A.) Normal conditions Non-Fluid Oil - New York & New Jersey S58
Alternate- STD. OIL Co. "ANDOK C"- shell cyfrina #3..
B.) Temperatures below -30C Humble Oil Co. #325

REGREASING OF HORIZONTAL AND VERTICAL SQUIREL CAGE INDUCTION MOTORS

The ball bearings Continental motors are lubricated with Non Fluid Oils and or greaae which is a sodium base neutral grease semi-channeling and NLGI grease #3. The amount initially placed in each bearing was approximately 1/3 to 1/2 of the space within the bearing housing. This grease should be sufficient of a period of one to two years under normal operating conditions, and provided the grease does not become contaminated from some outside source. The frequency of regreasing should be determined by the speed and operating conditions. Excessive greasing contributes toward bearing overheating and motor failure.
On horizontal motors the shielded side of the bearing is ,placed toward the inside of the motor. On vertical motors the shield is on the bottom side of each bearing in order to keep the grease contact with the bearing.
When regreasing horizontal motors clean the area around the inlet and grease drain and remove plugs. If grease has hardened in the area around the drain plug use a wooden stick to remove the hardened grease. Removal of the drain plug serves a pressure relief when regreasing. It is preferable to stop the motor and add grease slowly with a hand operated grease gun. Run motor for about ten minutes with the drain plug removed to allow excess grease to drain out.
When regreasing vertical motors the drive end bearing cap may have two 1/8" pipe plugs, 180° apart which may also be removed to serve as grease drains and pressure relieves. Follow same procedure for regreasing horizontal motors.

During major overhaul remove all dirt from around the drive end and bearing cap, opposite drive end bearing cap and inspect condition of grease. It should look and smell clean with no objectionable odors. If grease deterioration has taken place, the bearing housing parts of both ends of the motor should be thoroughly cleaned, bearings should be repacked and housings filled approximately 1/3 full of fresh grease.

The following chart is a guide to the amount of grease to be added using a low pressure hand held grease gun.

Shaft Extension Diameter	Weight of grease to be added-oz.
3/4" to 1-1/4"	3/4
l-1/4" to 1-7/8"	1
1-7/8" to 2-3/8"	2
2-3/8" to 3"	3

BALL BEARING REPLACEMENT

GENERAL

The repeated stressing of the balls and races as a bearing rotates ultimately causes fatigue of the metal. The higher the load, the higher the stress and the shorter the time until the bearing fails. Bearings are rated by their probability of fatigue failure.
Bearing rnanufacturers have tested many groups of identical bearings under heavy loads to the point of fatigue failure. Bearings in a group have been, found to have different lives even though they are under the same load. For this reason bearings are rated for either minimum life or for average life. Minimum bearing life is a period of time, based on continuous operation at designed load, after which 30C6 of the bearings will still be operating. A grease bearing life is five times minimum bearing life.
When removing or replacing a ball bearing there are rules which always should bc observed.

Following these rules closely will prevent damage to the bearing or motor and will result in longer bearing life.
A.) When removing a bearing, always use an approved bearing puller.
B) Never operate the protective cover on new bearings where the bearings will be exposed to dust or dirt. Always open the package in a clean place and do not remove bearing from package until ready to install.
C.) Never try to clean a new ball bearing. The slushing oil on new bearings should not be removed
D.) Fill bearing chamber one-third to one-half full of clean grease. Do not pack bearing full of grease as this will cause over heating of the bearing.
E.) Do not force a bearing onto a shaft by means of the outer race Do not attempt to force the bearing on a badly from shaft or a shaft which is too large for the bearing.

METHODS OF REPLACEMENT

A .) Pressing Procedure

Clean shafts and bearing housing thoroughly.

Clean dirt out of threads and grooves. Remove burrs and slivers.

Clean and oil bearing seats.

Press bearings on straight and square.

Press only on the ring which takes the tight fit.

Press bearings until they are seated against the shaft or housing shoulder.

Use an arbor press if available and press the shaft into the bearing supporting the inner ring on blocks. Be sure the blocks don't scrape the shaft or threads.

If the distance between the end of the shaft and the bearing seat is fairly short, hold the shaft in a vise and press the bearing onto the shaft with a clean tube. This can be done either in an arbor press or by tapping with a hammer evenly around the tube.

See figures 45-1 and 45-2 for removal and installation of -bearings.

B.) Heating Procedure:

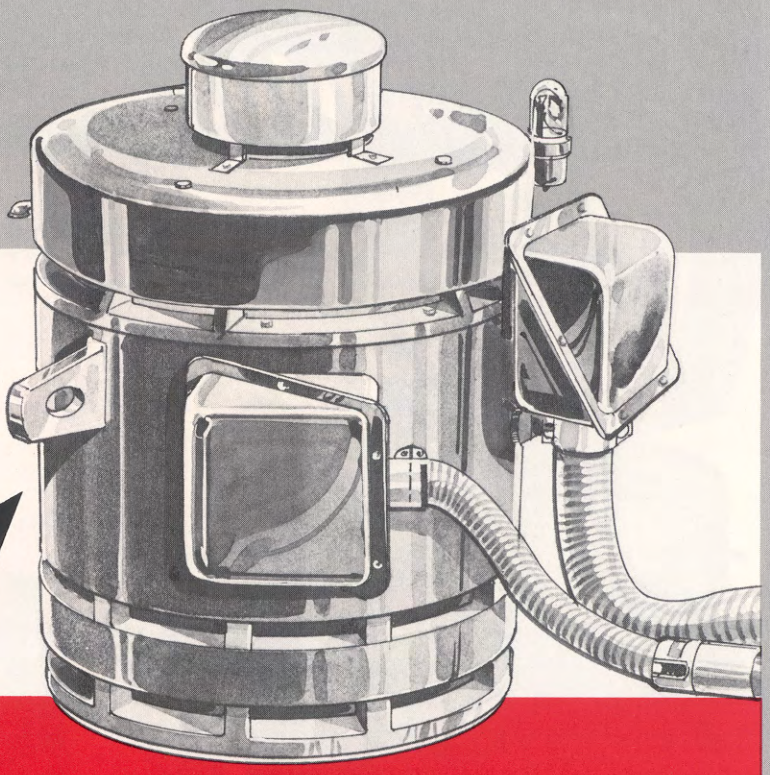
Another method of installing ball bearings is to heat the bearing in an oven or oil bath so that it will slide onto the shaft. Use a temperature of approximately 225°F. Too high a temperature will damage the bearing and too low a temperature will cause the bearing to seize the shaft.

General Storage Considerations for Motors

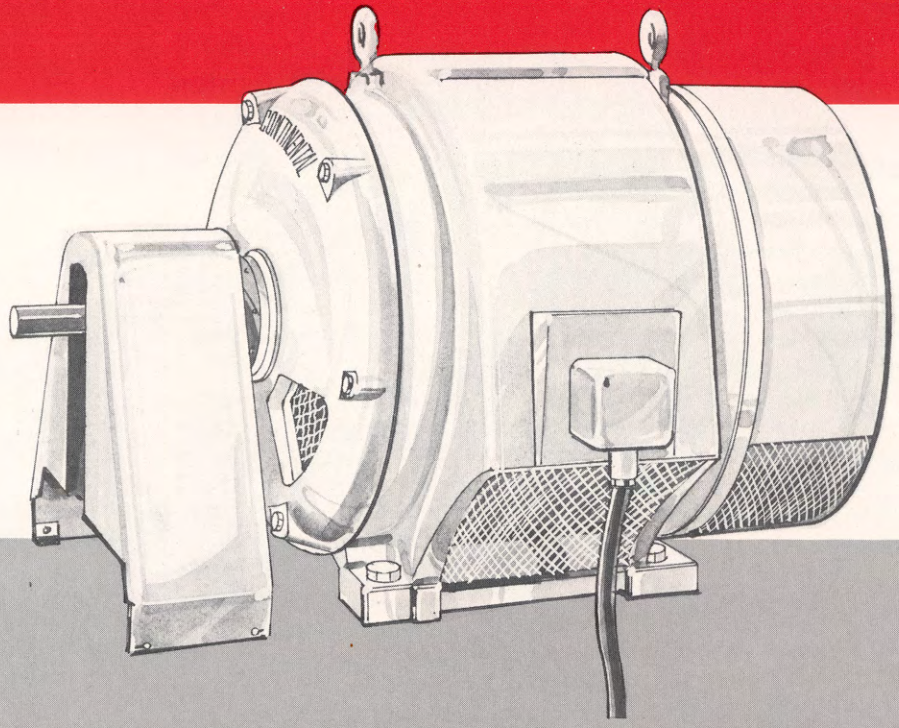
If the motor is to be stored before installation it should be in its normal operating position and protected against moisture, dirt, corrosion or other damaging conditions in a well ventilated dry area. Coat shaft extension with a good rust preventive compound. For long term storage cover machine loosely with a tarp that extends to the ground but must not tightly wrap the motor so that motor may properly breathe. Energize the space heaters to keep the temperature of the winding a few degrees above the surroundings air. If the motor does not have space heaters auxiliary heat should be used to keep the windings warm and free of condensation. The shaft should be rotated by hand every month to keep the bearings lubricated.

At the end of the storage period the insulation of the motor should be meggered before connecting on line. The reading should be approximately 2 megohms per each 1000 volts of operating voltage plus 1 megohm, corrected to 40c (Ref. IEEE #43).

Continental



HORIZONTAL & VERTICAL WOUND ROTOR MOTORS

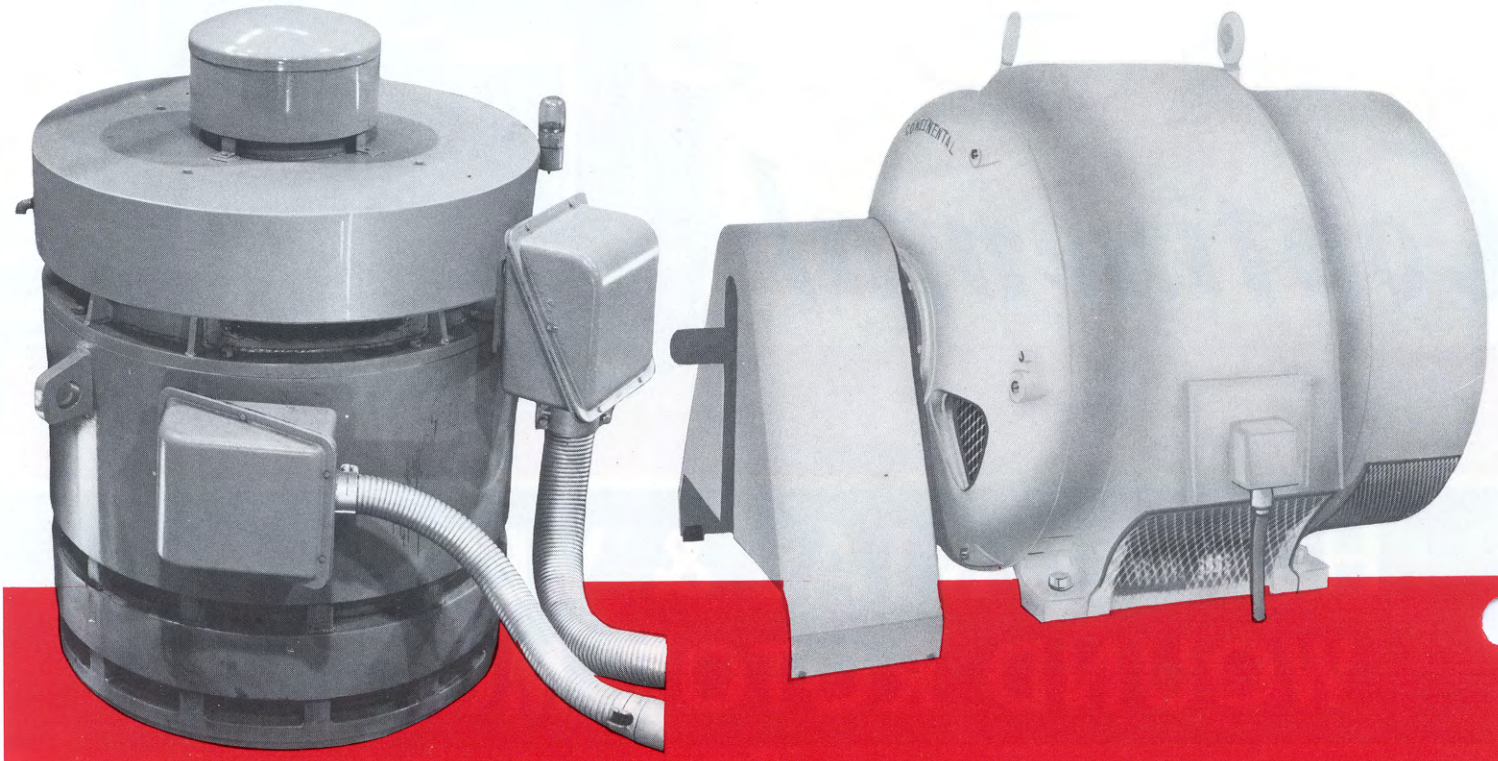


CONTINENTAL ELECTRIC CO., INC.

Manufacturers of Premium Quality Motors for over Fifty Years

Continental WOUND ROTOR MOTORS

THE OPERATING CHARACTERISTICS of the Wound Rotor or Slip Ring Motor make it especially applicable on drives requiring High Torque, Low Starting Current, Adjustable Varying and /or Constant Speed. The range of controlled speed depends on characteristics of motor load and resistance in rotor circuit.



APPLICATIONS AND RATINGS WOUND ROTOR MOTORS

are ideally suited for Sewage and Water Waste treatment plant applications, and as prime movers for heavy inertia loads and to assure smooth starting of compressors, beaters, hoists, crushers, cranes, elevators, displacement pumps, turntables, stokers, etc., and where speed control is required as for fans, centrifugal pumps and other special applications. They are also used where Line disturbance at starting must be minimized. Continental Wound Rotor Motors are available in a range from 50 to 1500 H.P. and Voltages up to 6600 Volts in open, drip-proof, splash-proof, and totally enclosed fan-cooled enclosures. Frames with separately enclosed slip rings can also be supplied. Special mechanical or electrical modifications to the above motors can be furnished to suit each individual application.

GENERAL CONSTRUCTION CONTINENTAL WOUND ROTOR MOTORS

are built to meet National Electrical Manufacturers Association Standards.

Construction – cast iron and rugged fabricated steel frame and brackets are used for rigidity, long life and true concentricity

Windings – random and form wound coils placed into already insulated slots in silicon steel cores. Coils are insulated as dictated by the voltage of the motor. Form Wound Coil extensions are tied with glass tape to rolled and welded Steel Surge rings preventing movement of the coils by line surges.

Rotor Assembly – built for long life and quiet operation. Shafts are oversized and made from selected high grade steel. Ample cooling is provided by conservatively sized fans. Bronze collector rings are shrunk on heavy mica insulated steel bushings. The complete collector ring assembly is then pressed on motor shaft. The entire rotor is dynamically balanced.

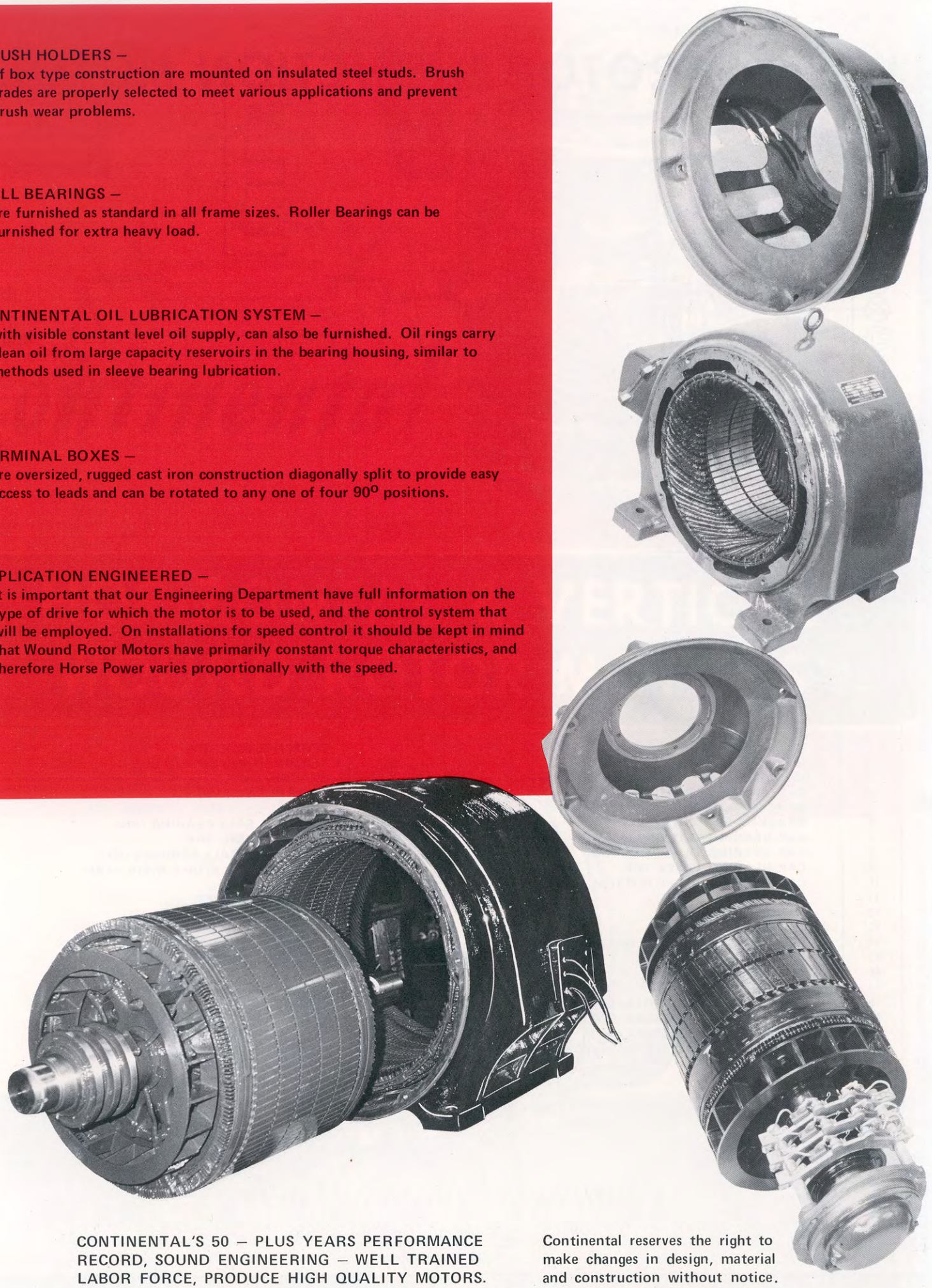
BRUSH HOLDERS –
of box type construction are mounted on insulated steel studs. Brush grades are properly selected to meet various applications and prevent brush wear problems.

BALL BEARINGS –
are furnished as standard in all frame sizes. Roller Bearings can be furnished for extra heavy load.

CONTINENTAL OIL LUBRICATION SYSTEM –
with visible constant level oil supply, can also be furnished. Oil rings carry clean oil from large capacity reservoirs in the bearing housing, similar to methods used in sleeve bearing lubrication.

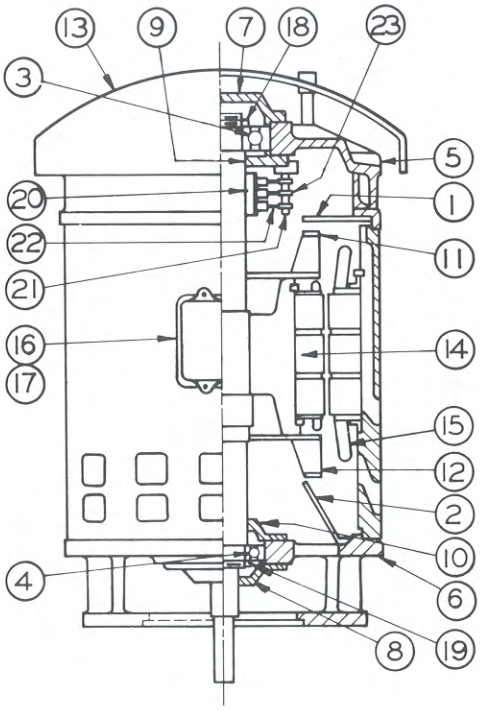
TERMINAL BOXES –
are oversized, rugged cast iron construction diagonally split to provide easy access to leads and can be rotated to any one of four 90° positions.

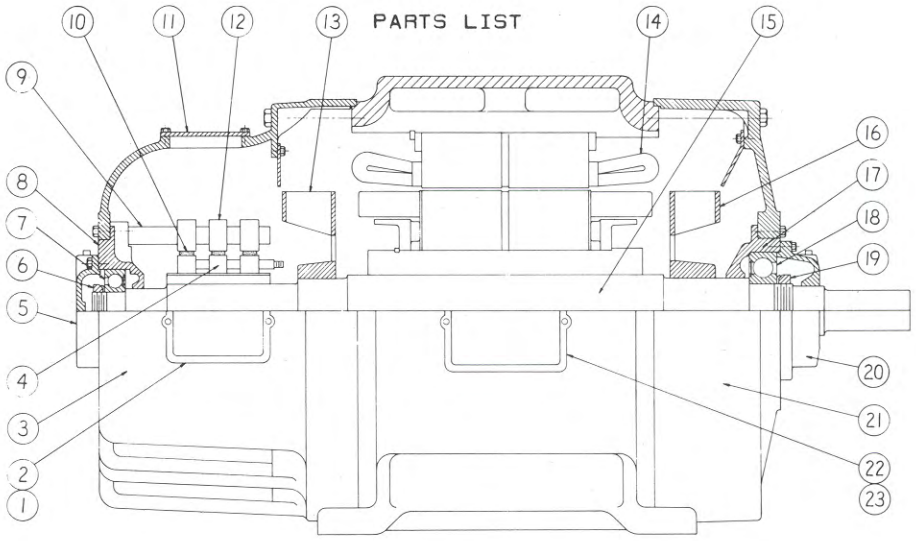
APPLICATION ENGINEERED –
it is important that our Engineering Department have full information on the type of drive for which the motor is to be used, and the control system that will be employed. On installations for speed control it should be kept in mind that Wound Rotor Motors have primarily constant torque characteristics, and therefore Horse Power varies proportionally with the speed.



CONTINENTAL'S 50 – PLUS YEARS PERFORMANCE RECORD, SOUND ENGINEERING – WELL TRAINED LABOR FORCE, PRODUCE HIGH QUALITY MOTORS.

WOUND ROTOR INDUCTION MOTORS





PARTS LIST

VERTICAL

ITEM	PART NAME
1	AIR GUIDE
2	AIR GUIDE
3	*BALL BEARING, TOP
4	*BALL BEARING, BOTTOM
5	BRACKET, TOP
6	BRACKET, BOTTOM
7	CAP, BEARING, OUTER TOP
8	CAP, BEARING, OUTER BOTTOM
9	CAP, BEARING, INNER TOP
10	CAP, BEARING, INNER BOTTOM
11	FAN, TOP
12	FAN, BOTTOM
13	MUSHROOM COVER
14	ROTOR COMPLETE WITH SHAFT
15	STATOR WINDING
16	TERMINAL BOX
17	TERMINAL BOX COVER
18	LOCKNUT & LOCKWASHER, TOP
19	LOCKNUT & LOCKWASHER, BOTTOM
20	SLIP RING ASSEMBLY
21	BRUSH HOLDER STUD & INSULATION
22	*BRUSH
23	BRUSH HOLDER

* RECOMMENDED SPARES

HORIZONTAL

ITEM	PART NAME
1	TERMINAL BOX - SRE
2	TERMINAL BOX COVER - SRE
3	BRACKET - SRE
4	SLIP RING ASSEMBLY
5	CAP, BALL BEARING, OUTSIDE - SRE
6	LOCKNUT, BALL BEARING - SRE
7	*BALL BEARING - SRE
8	CARTRIDGE, BALL BEARING - SRE
9	BRUSHHOLDER STUD & INSULATION
10	*BRUSH
11	HAND HOLE COVER
12	BRUSHHOLDER
13	FAN - SRE
14	STATOR COILS
15	ROTOR COMPLETE
16	FAN - PE
17	CARTRIDGE, BALL BEARING - PE
18	BALL BEARING - PE
19	LOCKNUT, BALL BEARING - PE
20	CAP, BALL BEARING, OUTSIDE - PE
21	BRACKET - PE
22	TERMINAL BOX
23	TERMINAL BOX COVER

* RECOMMENDED SPARES

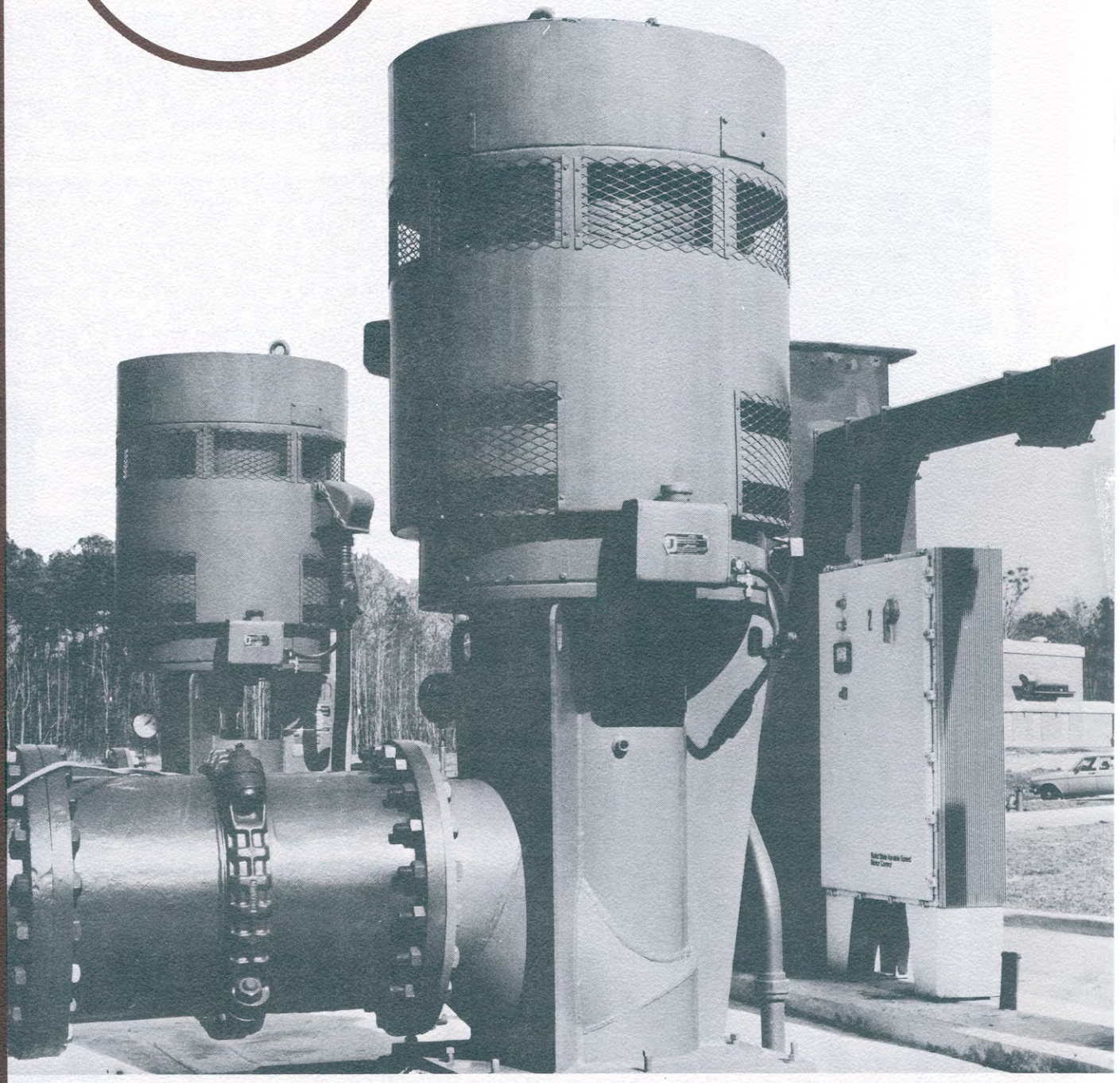
Continental Electric Co., Inc.

325 Ferry Street, Newark, New Jersey 07105

(201) 344-4050

VERTICAL MOTORS

Continental



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