

Installation and Maintenance
SERIES 1140
Package Direct Coupled
Vertical Turbine Pumps

AURORA PUMP

A UNIT OF GENERAL SIGNAL

PO BOX 3801 • CITY OF INDUSTRY, CA • 91744

RECOMMENDATIONS FOR STORAGE AURORA VERTI-LINE PUMPS

Aurora Verti-Line Pumps are carefully prepared for shipment from the factory. Skids and boxes are intended to resist mechanical damage from normal handling and preservatives are used to protect critical surfaces from routine conditions of weather and corrosion in transit. Effective life of factory-applied protection, however, can vary widely under different circumstances and should be considered adequate only to secure the equipment during shipment and installation. If installation and operation cannot be effected within a reasonably short time after delivery to jobsite, the product is assumed to be in storage and subject to precautionary procedures as described below.

With common sense as the best guide, store the equipment off the ground in an indoor location where it will not be exposed to excess moisture or humidity, extreme weather conditions, blowing dust corrosive fumes, or other harmful factors. If storage must be outdoors, provide at least a roof shelter and cover all pieces securely with six mil polyethylene sheet or equivalent.

Inspect pump periodically to assure that factory-applied preventives remain intact. With the first sign of deterioration, renew the protective measure in question. If rust spots appear on machined surfaces, clean with fine emery cloth and apply approved rust preventive.

If pump is assembled, it should remain on skids just as delivered. Packing rings and/or mechanical seals if assembled in place should be removed from the pump and stored in a box. If pump is unassembled, inner column joints should be nested inside suction column pipe to save space as well as to provide greater protection. All threads must be covered with wrapping and tape or with suitable caps. Never stack anything on top of column joints.

Electric motors and right angle gear drives must be handled vertically at all times. See individual manufacturer's storage instructions for motors, gears, IC engines, universal shafts, other appurtenances and accessories.

For long term storage, but not to exceed 36 months, the following additional precautions should be observed:

- Air dry hydraulic portion of pump to remove any residual liquid.
- Cover and seal with pressure sensitive waterproof tape all openings into flowstream areas.
- Wrap shaft extension with pressure sensitive waterproof tape.
- Coat rabbet fit on driver and pump head with heavy grease, along with any other exposed machined surfaces.
- Completely cover upper part of motor and seal with tape. Consider providing space heaters for motors if stored under damp or humid conditions.
- Fill any external lubrication piping or flush lines with rust preventive.
- Store all parts in a clean dry area with ambient temperature reasonably constant between 40 and 100 degrees F.

Upon removing a pump from any type of storage, proceed as follows:

- Consider contracting with the pump manufacturer for the services of a factory trained field service engineer or technician.
- Remove all covers and tape from openings, drivers, and threads.
- Remove grease and rust preventive from mating fits and running surfaces.
- Clean all threads and mating fits thoroughly.
- Assemble packing and/or mechanical seal if applicable, using appropriate instructions.
- Flush any external lubrication piping to remove rust preventive.
- Follow individual manufacturer's instructions regarding driver and other appurtenances.
- Inspect all visible parts.
- Install pump and start up in accordance with applicable instruction manual.

Occasionally, a pump is stored in its installed position for protracted periods while related equipment is made ready or perhaps simply in seasonal shutdown. In this event, pump and driver shaft must be rotated manually once a week or the unit may be power run every two weeks, using proper startup procedures at each start.

These procedures are offered as a guide to assist users and may not be construed to amend, to extend, or to modify in any way the AURORA Pump warranty.

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SECTION 1

A WORD TO THE OWNER

Efficient performance. Satisfactory operation. Dependable service.

We know these are the things you want from your Aurora Verti-Line Package Pump and we've designed it accordingly. We've prepared this booklet to help you assure continuance of these features by implementing a careful and proper installation and maintenance program. Your Package Pump has been pre-engineered in module form and the standardized components as shipped to you are based on your pumping conditions as selected from our performance charts.

Because of variations in jobsite environments and installation requirements, we've had to be somewhat general. However, we have listed what we believe are the most important guidelines. Your installer must still use sound judgement to adapt the methods we've outlined to the specific site circumstances. It is in your interests that he does, since failure to comply with accepted and recommended procedures may void your warranty.

If any question should arise during the course of the work, we urge you to see your local Aurora representative immediately. Please be able to identify the unit by its serial number. We stamp the number on the nameplate, on the discharge head and on the bowl assembly.

Figure 1 will show you the relationship of most of the parts after installation is complete. The nomenclature we've used here will identify the items throughout the instructions. Before starting the installation, please read through the entire process we've described in this book. Study in detail the precautionary directions emphasized in Section 14.

Then, when you do start the work, refer to the instructions for each individual step. After the equipment is in operation, we suggest you keep a manual available at the site for future use in maintenance programs. It can be used in conjunction with the Aurora disassembly, assembly and troubleshooting manual.

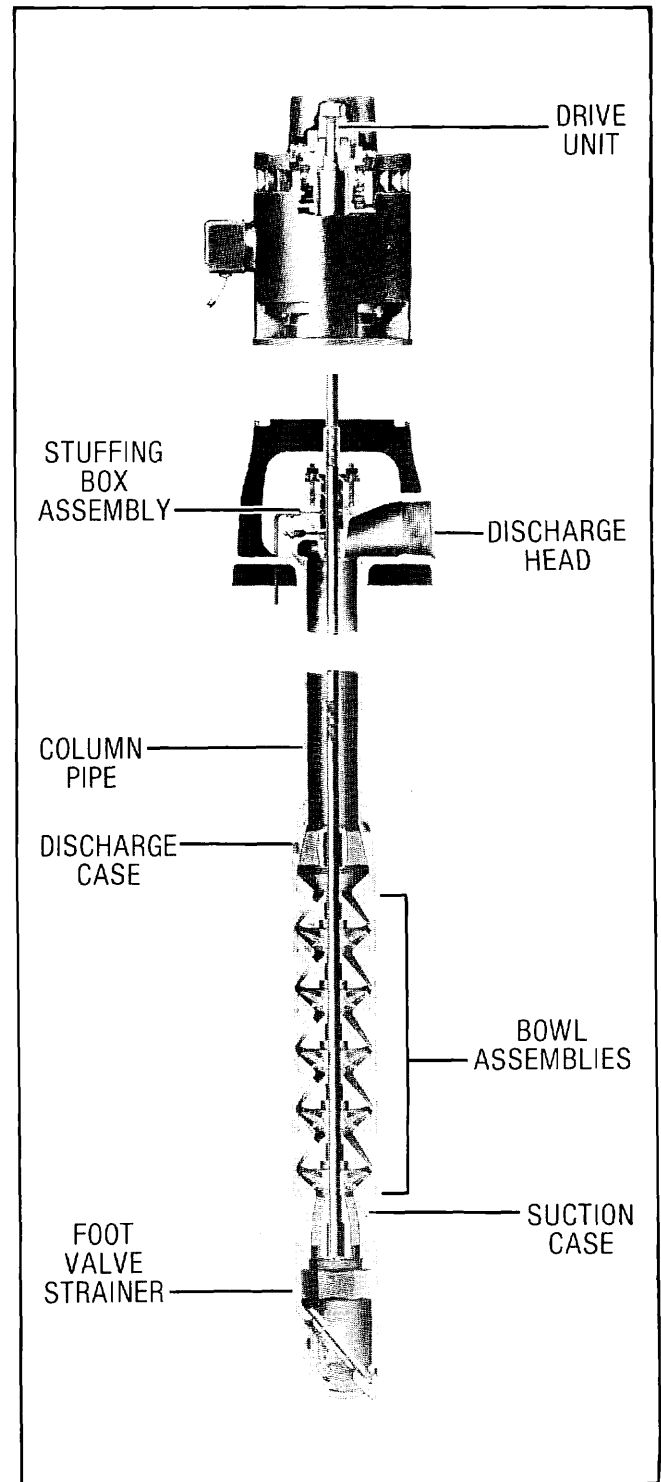


Figure 1. Package Turbine Pump

SECTION 2

THE WELL

Examine the well carefully before you start any installation procedures. Be sure sand hasn't covered any of the perforated sections. If you don't already know, now is the time to determine that your well is of ample diameter and depth, and is straight enough to receive your pump. Allow at least four feet from the footvalve/strainer to the bottom of the hole.

If you have any doubts at all about the straightness, we recommend caging and plotting. As an alternate procedure, you can lower a test section down the well to

the eventual setting of the pump bowls. The test piece is usually a pipe as big around as the largest diameter on the bowl assembly and 1-1/2 times the length of the bowl unit.

By the time you receive the pump at the jobsite, the well should have already been developed and tested. We cannot recommend the use of your new Aurora pump for this purpose since it can be classified as unusual abuse.

SECTION 3 THE FOUNDATION

Your pump requires a foundation suitable for the weight of the entire unit when full of water. While the preferred foundation material is solid concrete, you can use adequate beams or timbers within reason. Regardless of material, the foundation must be properly engineered, structurally sound and stable, and able to withstand and prevent objectionable vibration. It must not exceed allowable soil loading for your specific site.

If your well casing protrudes above the top of the foundation, check the bottom of the discharge head for interference. The head rests on a skirt to prevent interference with the foundation itself, but anything jutting upward from the mounting base might be in the way. The projection must either be cut off at the surface or the head must be blocked up accordingly.

We suggest anchor bolts on any installation, but there are a few instances where we must insist on them. These would include pumps furnished with belt drives, pumps with settings less than 50 feet, and pumps with discharge pressures exceeding 10 PSIG. We prefer the sleeve bolt design shown in Figure 2 but we've illustrated alternates for your consideration.

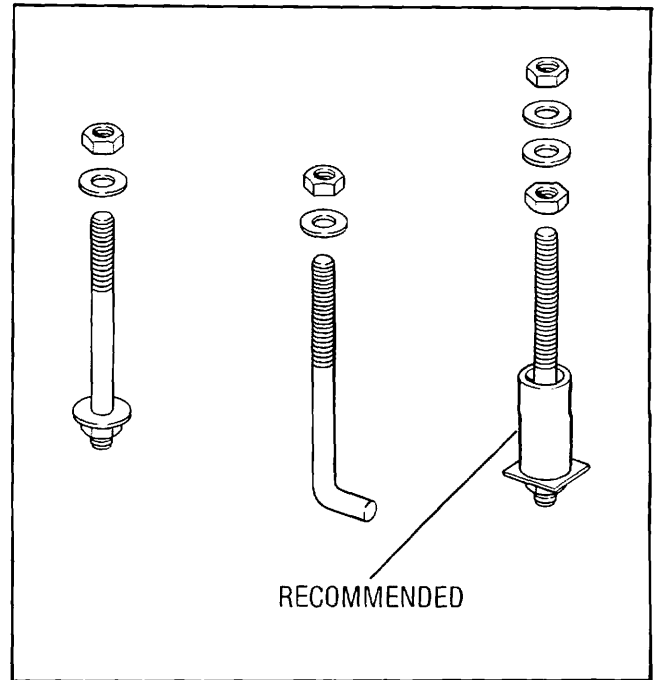


Figure 2. Foundation Anchor Bolt

SECTION 4 THE EQUIPMENT

The materials and equipment you'll need for installation may vary with the jobsite. We'll offer the following as a guide but you will want to remember the primary tool to be used at all times is **SAFETY FIRST**.

You can use a portable derrick or tripod, but we recommend a properly designed pump setting rig similar to that shown in Figure 3. With the rig in extended position, you must be able to erect the crown block so that the load hook will clear eighteen feet. The hoisting equipment will depend on the type of tripod or rig you select but it must be of sufficient strength and power to provide a minimum safety factor of 6.

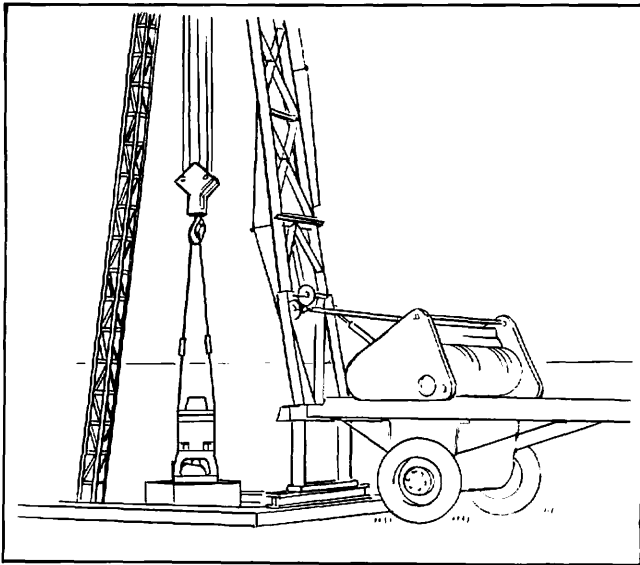


Figure 3. Pump Installation Rig

Your load hook should be of the safety type with an easy working swivel and should be truly centered over the axis of the well. If your well is slightly out of plumb, you may have to compensate by shifting the crown block as the assembly becomes progressively longer during installation and displaces laterally with respect to the well head.

We suggest the following miscellaneous tools and material but you may want to vary them to suit the peculiarities of your individual installation:

Lifting Equipment (See Figure 3)

Steel beam clamps (See Figure 4)

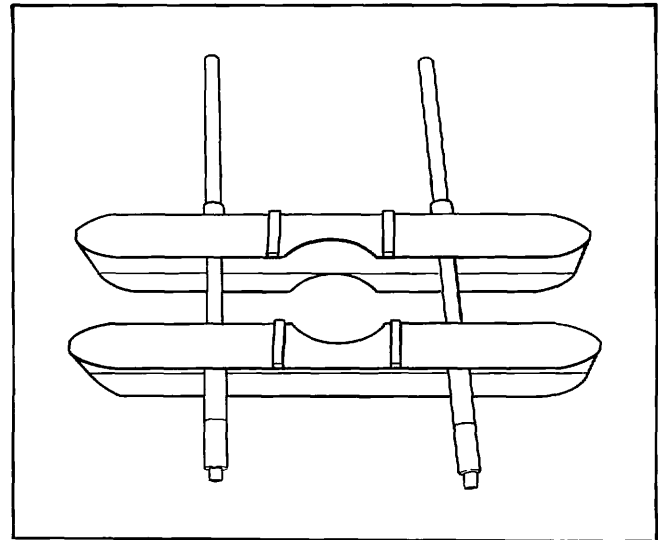


Figure 4. Steel Beam Clamps

*Steel lifting elevators of approved type and proper size (See Figure 5)

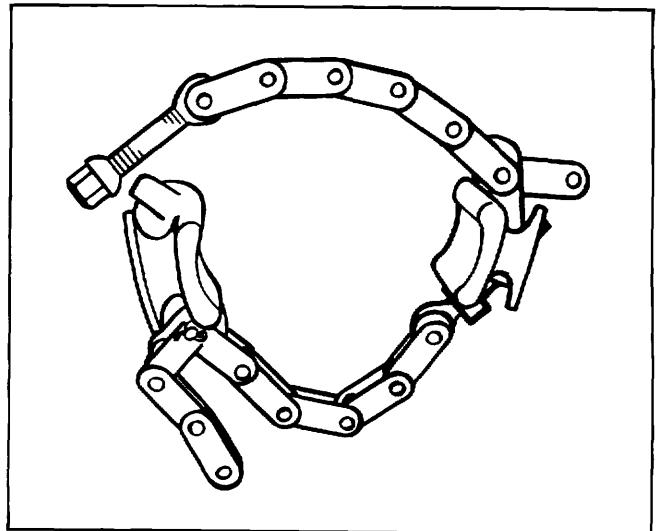


Figure 5. Lifting Elevators

Sling about 10 feet long of adequate size for loads (See Figure 6)

Small chain tongs

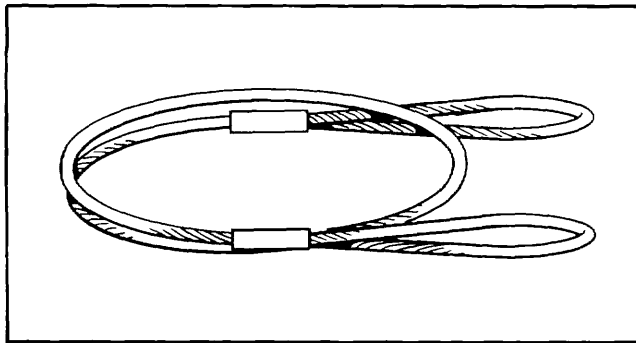


Figure 6. Cable Sling

Medium size pipe wrenches

Twelve foot length 1/2 inch rope

Ordinary set of mechanics tools (See Figure 7)

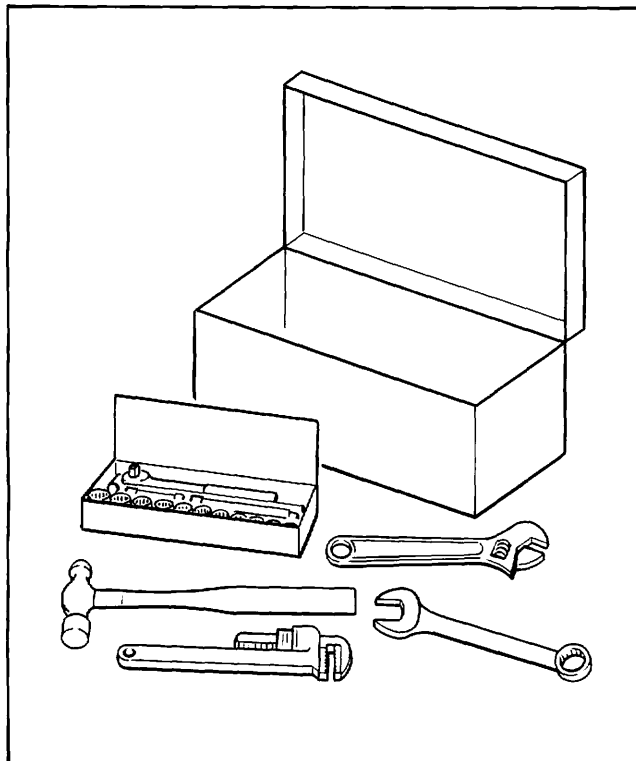


Figure 7. Ordinary Set of Mechanics Tools

Wire brush

Assortment of files

Pocket knife

Sacking or cover for bowl unit and column sections

Clean rags

Thread compound - approved anti-galling type for stainless steel shaft parts

Solvent - Gasoline, distillate, or kerosene in recommended containers.

Shims and wedges

Non-shrink grouting material

Note

All combustible materials must be kept in approved safety containers and handled carefully, away from any flame, sparks, exhaust, or any other source of ignition.

*As an alternate to one set of elevators, you may want to use a bail fitting, as shown in Figure 8, to lift these small column joints. The remaining set of elevators is then used to hold the load when changing the bail fitting. The instructions in this manual will describe only procedures with two sets of elevators.

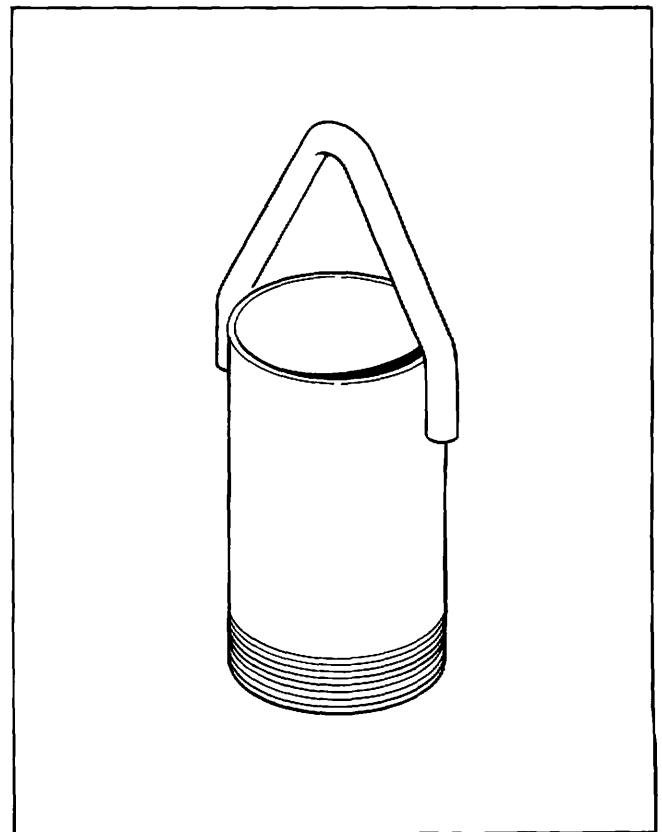


Figure 8. Bail Fitting

SECTION 5

RECEIVING THE PUMP

Your Aurora Verti-Line Package Pump was inspected on the carrier just prior to leaving the factory. When you receive it at your well site, look it over carefully for any visible damage to parts, skids, boxes, or dunnage. If shafting is crated, open the crate carefully to inspect and make a count but leave the shaft in the box for protection until each piece is ready for installation.

Take inventory on the truck or during the unloading process. We don't want you to sign for damaged or incomplete shipments unless you take the proper exceptions. Report such instances immediately to the Aurora sales office and to the transportation company involved giving full particulars and confirming all verbal understandings in writing.

SECTION 6

UNLOADING THE PUMP

We cannot urge you too strongly to exercise extreme care in handling and installing all parts, particularly the pipe and shaft. All items are precision machined for proper alignment and, if dropped, banged, sprung, or mistreated in any way, misalignment and malfunction will undoubtedly result. Parts should be lifted or skidded slowly and carefully from the transporting car or truck to the ground so as to prevent harm in handling. We ask you never to unload by dropping parts from the carrier to the ground. Never use crates in which parts are shipped for skids.

If your pump is short enough, say a hundred and fifty foot setting or so, you might be able to install directly from the truck that brought it to you. If the truck driver has the time and if he can back his vehicle in close to the well head, the parts can be handled directly from the truck bed by the pump rig as the installation progresses as shown in Figure 9.

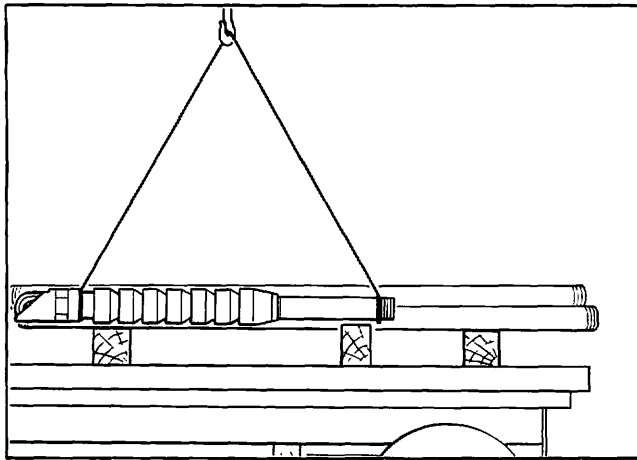


Figure 9. Unloading From Carrier

When not installing from the truck bed, lay out the column pipe and bowl assembly on suitable timbers or staging, to keep all material out of the dirt. Refer to Figure 10. Position the coupling ends toward the well

head. The column pipe is manufactured in five foot lengths but has been assembled at the factory into ten foot sections with a center bearing. Check these joints for tightness to be sure none have been loosened in transit. Check also for straightness as bent pipe may not be used. Examine all threads and butt faces of pipe and shaft.

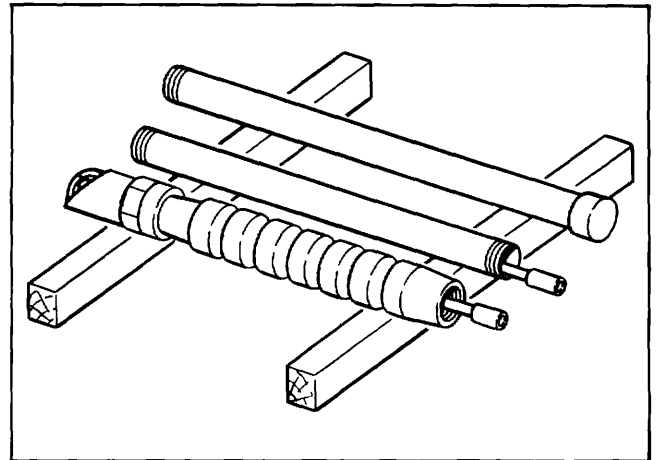


Figure 10. Readied for Installation

If the lineshaft was delivered in a crate, we suggest you handle it directly from the crate. If not, insert each length in its corresponding pipe section immediately after cleaning with solvent to remove rust preventive, oil, or slushing compound. Inspect each joint to make sure the faces are undamaged and that the piece is absolutely straight. Each was straightened before shipment from the factory and, if any were bent in transit, they cannot be used. Keep ends covered until ready for installation.

All other parts should be cleaned and laid out on a suitable surface in the order in which you'll want to use them. Again, check against your packing list to be sure none are missing. It's much better to find out now than during the actual installation.

SECTION 7

INSTALLING THE PUMP

You're now ready to start actual installation. Clear the work area at and around the mounting position so installers can move freely and with maximum safety. This will also decrease the chances for foreign material or objects to enter the pump as it is lowered into position and secured.

During the course of the work, you must never lose sight of the fact that you are handling precision components no matter how awkward they may be to manipulate. All threads should be engaged by hand and checked before tightening. Damage resulting from cross threading or dirt must be repaired with a file before applying force. If not repairable, the part must be replaced so it's clearly worth your while to use the utmost care.

Examine the bowl assembly and determine that the staging is correct. Push the shaft manually all the way into the bowls so the impellers are firmly seated and mark the shaft where it emerges from the top fitting. Pull the shaft out by hand as far as it will go and measure the distance your mark travelled. This is endplay or bowl lateral. Record it for later use and check the lateral requirement of your pump for compatibility. If you're unsure, your Aurora representative can assist you.

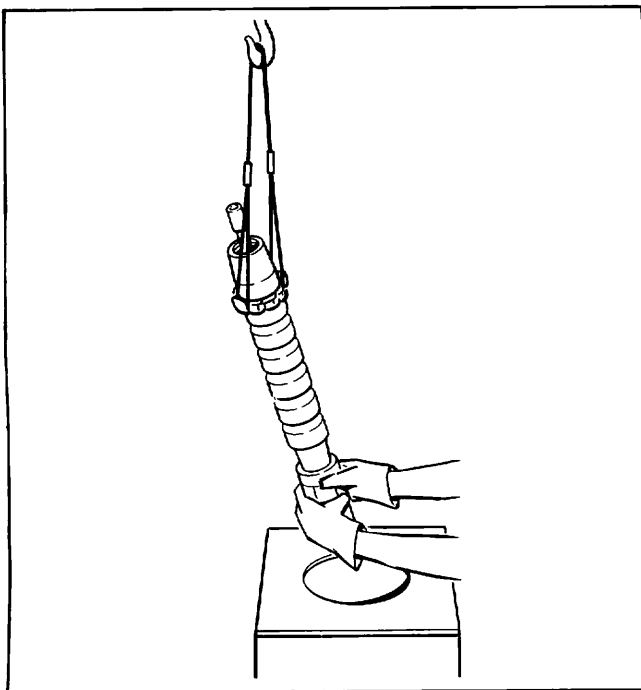


Figure 11. Raising Bowl Assembly Over Well

Using elevators, seize the bowl assembly near its top and raise as shown in Figure 11, guiding the bottom end by hand. Lower the bowl assembly into the well and support in place on the beam clamps. Examine and clean all exposed threads.

If something falls or is dropped into the pump at any point during the installation, it must be retrieved before going any farther. This could require returning everything to the surface. For this reason, we caution you to keep the open end of the pump covered at all times. Stuff sacking into the opening or use a cover designed specifically for the purpose, and stuff a clean rag into the top of the shaft coupling. Remember to remove all of this as the joint is made up.

The bottom column pipe should be marked as such. The bottom lineshaft is identified by the smaller thread on one end, turned to fit the bowl shaft. If not already done, insert the shaft into the pipe assembly. Secure elevators to the pipe immediately below the coupling. Refer to Figure 12. If you wish an alternative, you may

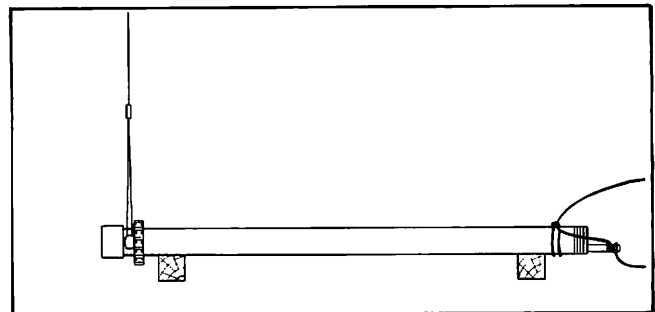


Figure 12. Secure Elevator to Column Pipe

make this lift using the bail fitting described in Section 4 Figure 8. Secure a timber hitch knot with your rope around the pipe about one foot from the thread end away from the well. Place a double reverse half hitch around the shaft on the threads as illustrated in Figure 13.

Hoist the column section into place over the well as shown in Figure 14. You must keep the free end of the tail rope taut at all times to avoid dropping the shaft. A soft board should be laid out for the end of the pipe to slide in on, restrained by the tail rope, or you can carry the end in by hand. In either case, the object is to prevent harm to the threads as the section is being raised. Clean all threads and inspect pipe and shaft ends once more to be sure there are no burrs, nicks, or dirt

adhering to the faces. Paint the threads with a thread lubricant, using only approved anti-galling compound on shaft parts.

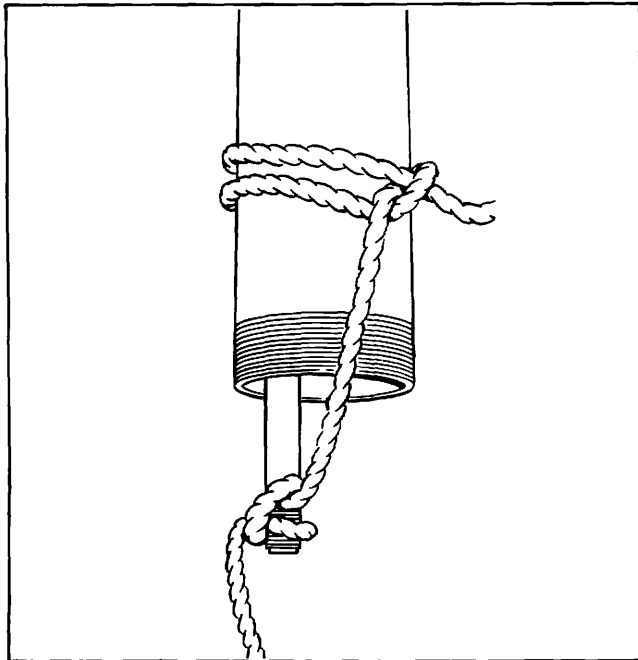


Figure 13. Securing Shaft Assembly

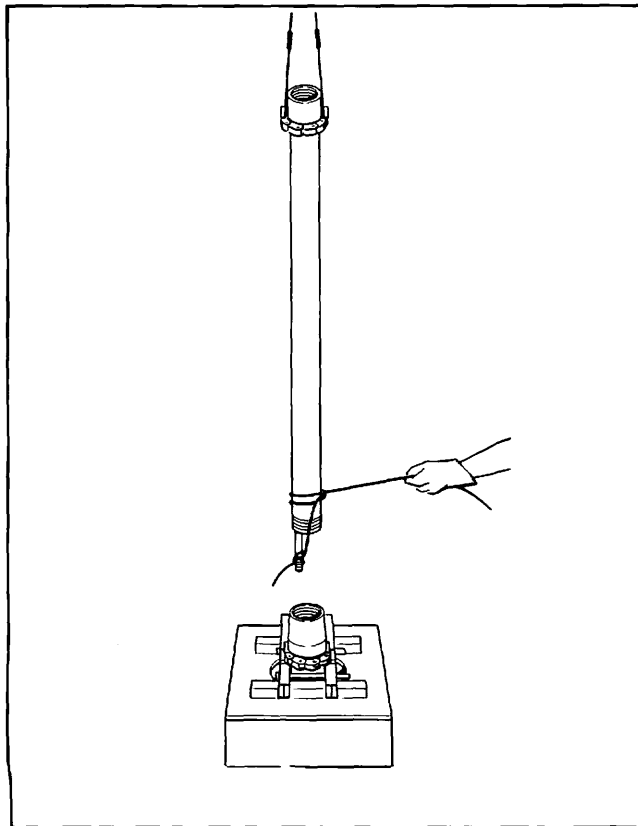


Figure 14. Column Pipe Hoisted into Place

Lower the assembly until the shaft sits firmly on its coupling. Start it in by hand, remembering it has left hand threads. Remove the rope, if you used it, and continue threading the shaft in until it butts solidly. Make sure the ends are together but do not use undue force. As in Figure 15, lock the shafts firmly with two small pipe wrenches, one on the coupling and the other on the shaft just above the thread, with the handles parallel to avoid pulling the shaft off center. A very slight force will do. An experienced installer can make this butt by hand on a pump of this size. Never apply wrench jaws to the threads or to any area of shafting that might run in a bearing or packing. Don't allow the coupling to ride up on the last scratch or an imperfect thread. Both shafts should expose an equal length of thread above and below the coupling, indicating that the shaft butt is in the exact center. If unusual power is required, stop and look for damaged or dirty threads since forcing may cause misalignment and eventual malfunction.

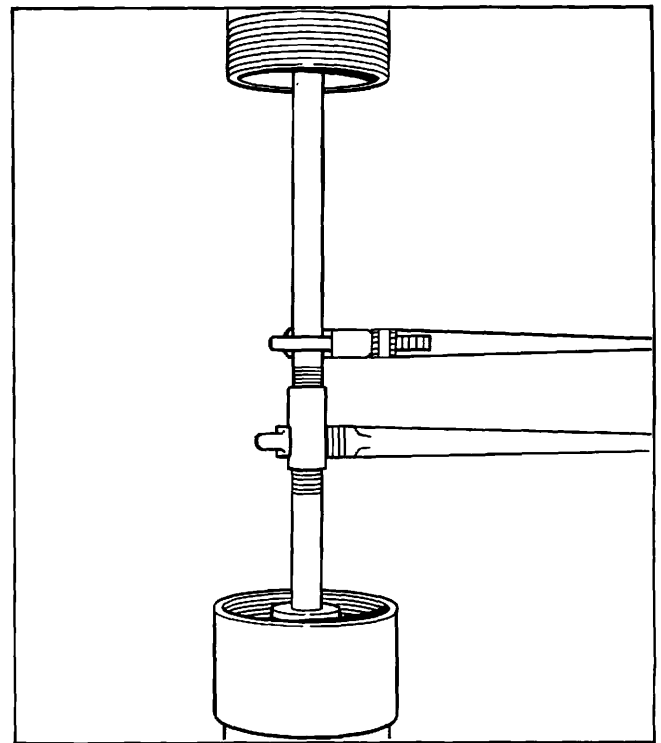


Figure 15. Connecting Shaft Ends

Now you can lower the column pipe. Carefully, start in by hand to prevent cross threading, remembering that these are right hand threads. In tightening the joints, place one set of chain tongs or a pipe wrench on the coupling and one set or one wrench on the pipe. Don't depend on the beam clamps to hold the lower section from turning. Make absolutely sure that the pipe ends butt solidly, metal to metal. Never strike the coupling with a hammer during these operations as this can set up localized stresses that may later produce a crack with disastrous results.

Raise the entire assembly far enough to allow access to release the holding clamp and remove the lower elevators. You may let the whole assembly down slowly until the upper elevators rest on the clamp, which may now be secured again. Wipe the upper end of the shaft clean of all oil to a point about a foot below the top end. After this point, on the way in, don't let oil run down the shaft or into the pipe as it will deteriorate the rubber lineshaft bearing.

Place a lineshaft bearing assembly over the projecting end of the shaft as illustrated in Figure 16. Slide the bearing down until the spider rim enters the pipe coupling and then on down until the rim rests solidly on the face of the pipe below. It should be possible to center the shaft so as to slide the retainer into the coupling without using any force whatsoever. If the shaft bears heavily to one side, investigate immediately for the cause. Never continue with the installation if the shaft does not center freely at the bearing retainer as this indicates a misaligned column pipe or bent shaft, either of which will eventually cause trouble.

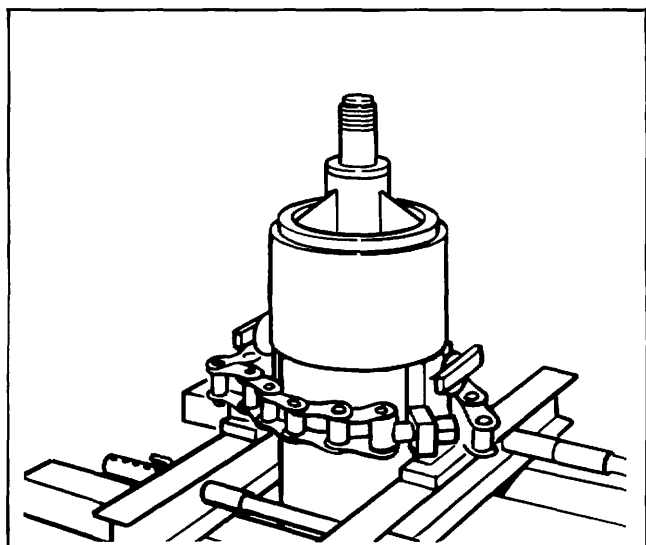


Figure 16. Installing Lineshaft Bearing

If all is centered properly at this time and the journal location is acceptable, cover the open pipe end and proceed with the installation of the next column section. Repeat this procedure with all subsequent sections, remembering that pipes and shafts must butt firmly at each joint. Note that the pipe ends must clamp the bearing retainer rim securely.

As each length goes in the well, measure and record the projection of the shaft from the rim of the bearing retainer. If the measurements start to accrue a total

deviation of one inch or more either way, stop and check for cause. If no cause is obvious, call your Aurora representative or the Aurora factory. As long as projections remain reasonably constant, continue installing.

The top column pipe may be assembled to the discharge head before installing in the well, as shown in Figure 17. To do this, screw the pipe into the threaded boss in the bottom of the head, butting it firmly against the shoulder. You may then loosen the packing gland and slide the top lineshaft carefully through the packing box and down into the pipe, passing through the center lineshaft bearing. The resulting assembly may then be made up the same as the other column joints already in the well.

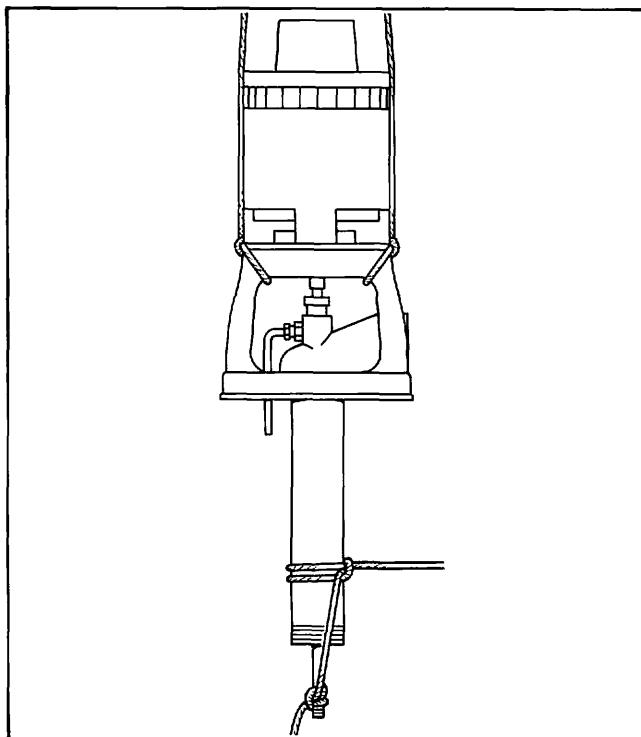


Figure 17. Discharge Head and Top Column Pipe Readied for Installation

Raise the unit a few inches to remove the beam clamp and elevators. Then let the pump down slowly and carefully, positioning the head with respect to the discharge piping, if used, engaging the anchor bolts if they are to be used. Continue to lower until the skirt contacts the foundation and the weight of the pump is transferred to the mounting base. Effect this transfer very gradually without a bump.

If you have anchor bolts, assemble the nuts loosely and proceed to Section 8 for driver installation.

SECTION 8

INSTALLING THE DRIVER

If you have a standard Aurora Verti-Line Package Pump, your driver is a vertical hollowshaft electric motor. Uncrate the driver but leave it attached to the bottom skid on which it arrived. Move it to a convenient location beside the pump head, keeping it vertical at all times. Set it down on firm and level footing.

Remove the canopy capscrews and the canopy itself. See Figure 18. Remove the drive coupling and any other parts packed in the top for shipment. Often, with these small motors, the drive coupling is secured, not of the self release type. If yours is of this description, don't remove it. Leave it in place but use caution later when it comes time to slide the headshaft through. This motor is shown in Figure 19.

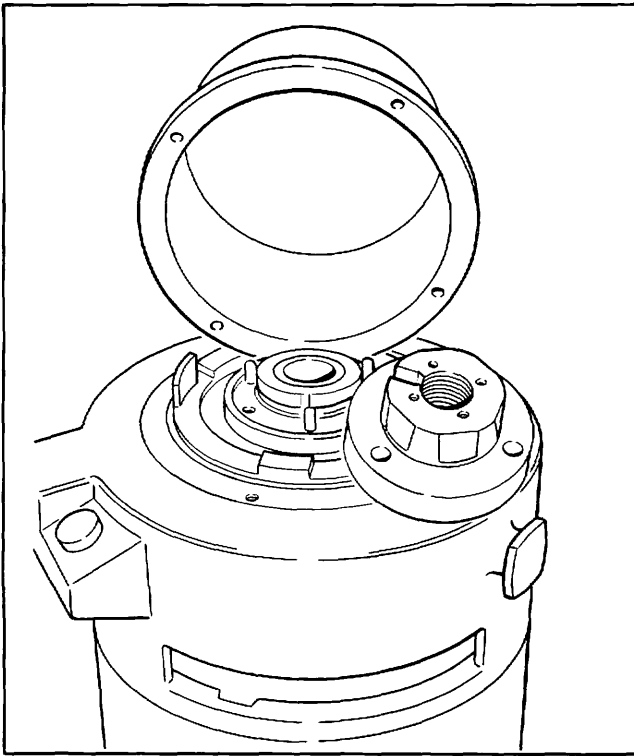


Figure 18. Removing Canopy

Cover all openings in the top to prevent anything from dropping into the motor. If this should happen, the object must be retrieved before you continue.

When ready for installation, raise the driver off its skid to a comfortable working height, liting with the lugs provided on the frame.

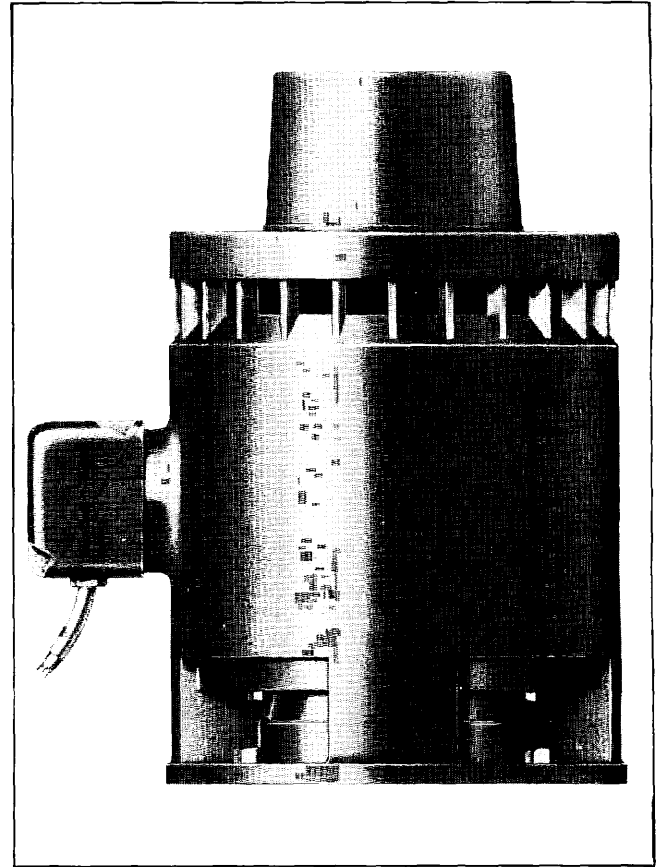


Figure 19. Electric Motor

WARNING

Stand beside the load as it hangs in the sling, never under it. Inspect and clean the mounting flange and register. If you find any burrs or nicks, set the motor on two beam supports and repair with a file.

WARNING

Don't work under the load while it's hanging from the hoist. Clean the top of the pump head and inspect it also, making any necessary repairs.

Clean the top of the discharge head and inspect it, making any necessary repairs. Raise the motor to a position over the pump and lower it slowly to the head until the register fit is engaged but with the weight still on the hoist. Position the junction box in the desired orientation. Align the mounting holes and start the capscrews in by hand. Transfer the weight gently from hoist to head and secure the capscrews, tightening them uniformly.

Please note the lifting lugs on the driver are for handling the driver only. Never attempt to use these lugs to handle the pump.

Now open the main breaker or pump disconnect switch and make a temporary connection between the motor terminals and the leads from the starter panel. Since many electric motors are built as dual voltage machines, it's important that proper connections be made to suit the voltage of your power source. Therefore you must check both power characteristic and motor rating for compatibility, then see the motor nameplate for correct wiring hookup.

You may now energize the starter panel and buzz start the motor by switching it very quickly on and off, observing for direction of rotation and watching to see that it spins freely and is in apparent balance. The hollowshaft must turn counterclockwise when viewed from the top. If rotation is clockwise on a three phase motor, kill the power to the starter panel and interchange any two leads. With single phase machines, follow manufacturer's instructions.

After re-connection, energize the starter and again buzz start the motor. When you're sure you have counterclockwise rotation, mark the motor terminals and the leads from the starter box to match. De-energize the starter at the breaker or pump disconnect and make the permanent power connections. Naturally, you'll make these connections in accordance with all applicable electrical codes and regulations.

Your headshaft was probably shipped to you in a separate box. Find it and clean it thoroughly throughout its length, threads, keyway, and end faces. Now slide it down through the driver hollowshaft without any bumping or scraping, keyway end up. Thread it carefully into the coupling on the top lineshaft, snapping the two shafts to a firm butt.

Looking down on the motor, check to see that the headshaft stands in the center of the hollowshaft and that the driver shaft rotates freely by hand. If the shaft stands to one side of the quill, rotate the shaft from below. If the top of the bar moves around the quill, you have a bent shaft or a bad coupling joint. If, however, the shaft remains in the same off center spot during rotation, you must align the pump.

When aligning your pump, you are attempting to line it up with the well. Don't use a plum line or a spirit level. Using wedges and/or shims under the corners of the discharge head, tilt the head slightly one way and then the other until the headshaft is concentric in the hollowshaft and doesn't drag anywhere in the quill. Secure the anchor bolt nuts firmly unless you're going to grout later, in which case you'll want to leave them loose for the time being.

If you can't align your pump successfully using the above method, call your Aurora representative before attempting any startup.

When all is well, retrieve the drive coupling and the other parts you set aside, together with the pump parts shown in Figure 20. Try the drive key, Item 3, in both headshaft and drive coupling keyways. In each case you should find a sliding fit. If necessary, dress the key until a free but not loose fit is obtained. Don't file the keyways. Slide the drive coupling if separate over the headshaft, Item 4, into proper position onto its register, firmly seated perfectly flat without cocking. It should slide easily and smoothly without tendency to drag or hang up when lowered or rotated.

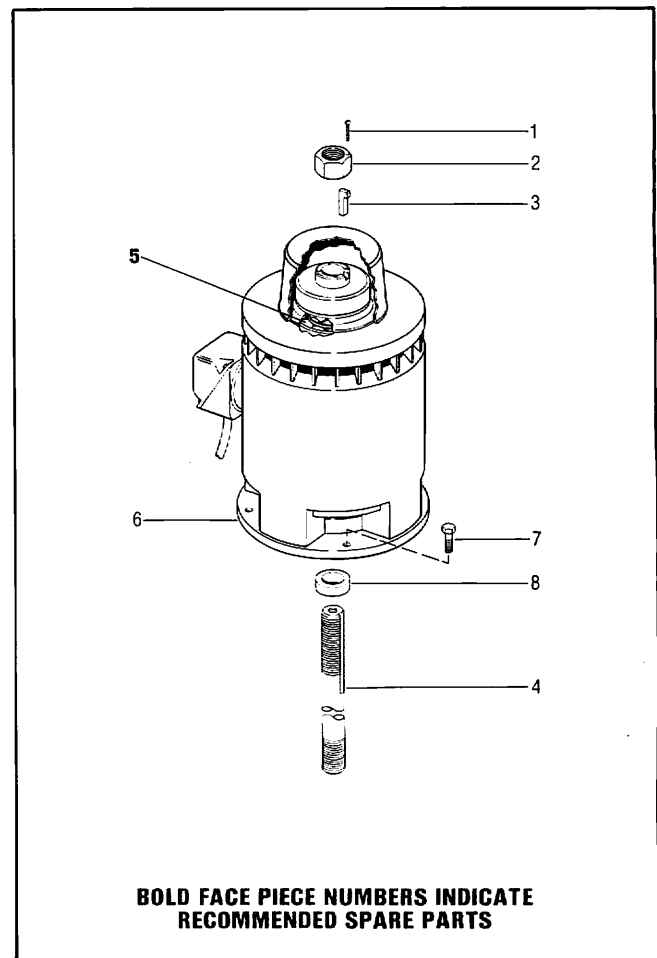


Figure 20. Vertical Hollow Shaft Electric Motor

Insert the drive key, Item 3. Again it should be a free, but not loose, fit. If necessary dress the key but never the keyways. The top of the key must be below the adjusting nut seat when in place.

Thread the adjusting nut, Item 2, onto headshaft keeping in mind the left hand threads, and raise the shaft until all its weight is on the nut. This is the break-free point. With a very slight lowering, the impeller vanes are felt to drag on the bowl. Mark the breakfree point, adjusting nut to driver coupling.

Now turn the nut counterclockwise to raise the shaft, counting the turns, until the top of the impeller hubs are felt to contact the bowl. Measure the distance the shaft moved out of the nut. This dimension should correspond with the endplay measurement you recorded

in Section 7. Now back the nut off clockwise until you are approximately two turns above the breakfree point. Assemble the lock screw, Item 1 Figure 20. The top of your motor now looks like Figure 21. Final impeller adjustment will be described in Section 13.

Replace the motor canopy and secure the capscrews. Keep it that way all the time you aren't actually working under the cover. Check your driver lubricant and follow the manufacturer's directions. Leave the power circuit open to the starter panel while performing the remaining work except when you require pump operation. Always practice SAFETY FIRST.

Your installation should now be at the point illustrated in Figure 22.

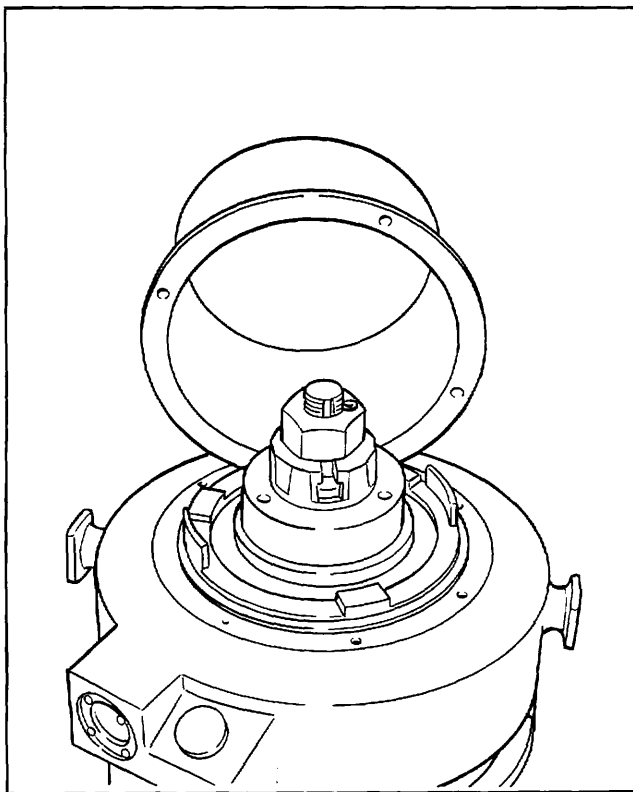


Figure 21. Vertical Hollow Shaft Driver Top

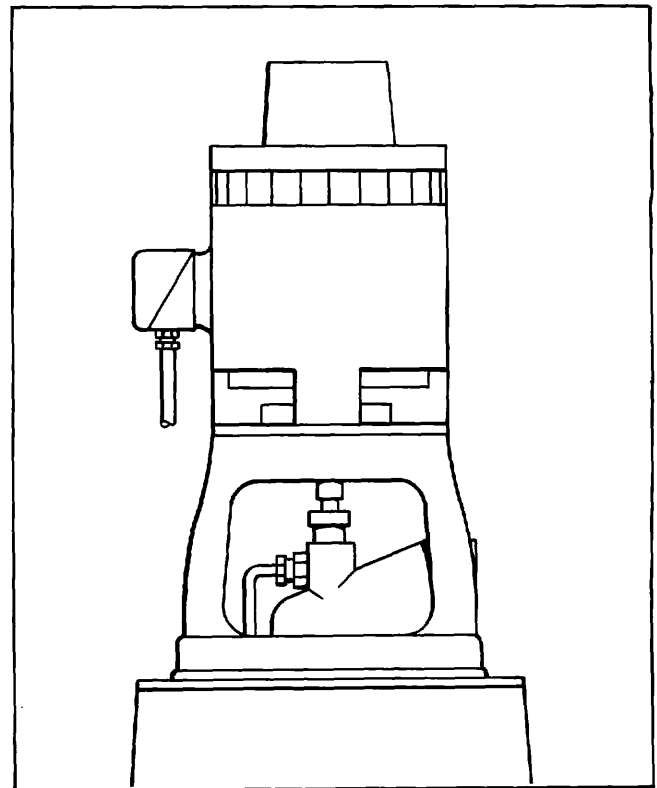


Figure 22. Complete Installation

SECTION 9

CONNECTING THE PIPING

Some form of discharge system is usually provided into which you want the pump to deliver flow. It may be a sophisticated grid or a simple piece of pipe to direct the water into a ditch, but it will be connected to the pump at the discharge head. Whatever your particular piping system is, it must be independently supported. It must not be allowed to impose stresses on the head due

to weight, misalignment, thermal expansion expansion, or any other condition.

If it is your intent to grout the pump base in place, this is the time to do it. After the grout has cured sufficiently, secure the anchor bolt nuts firmly.

SECTION 10

LUBRICATING THE PUMP

Your Aurora Verti-Line Package Pump is designed to be lubricated by the pumped liquid. There is very little for you to do in this regard since the pump is, in effect, self lubricating while operating. All it requires is an adequate supply of cool non-aerated water free from suspended solids or gases in solution.

Your only concern should be to assure that the unit is properly prelubricated for startup. The bowl assembly is equipped with a check valve, illustrated in Figure 23, at the bottom so that, once the pump has been operated and the column filled with water, the pipe should remain full and provide lubrication for subsequent startups. For your initial run, fill the column with water through the discharge pipe or through the prelube port, Figure 24. If the pump must sit idle for long periods of time, check it before starting to make sure the check

valve hasn't leaked and that you still have a full column of water.

This is something to remember if you ever find it necessary to pull the pump out of the well. In all likelihood, the column sections will come out filled with water and you should be prepared to deal with the situation.

Your discharge head has a grease fitting on the side adjacent to the packing box throttle bearing. Refer to Figure 24. It is really not often necessary to use this fitting and you can usually ignore it. If you do use it to lube the box bearing at all, apply the grease sparingly. Too much will interfere with cooling water flow through the box. We'll mention this feature again in Section 12.

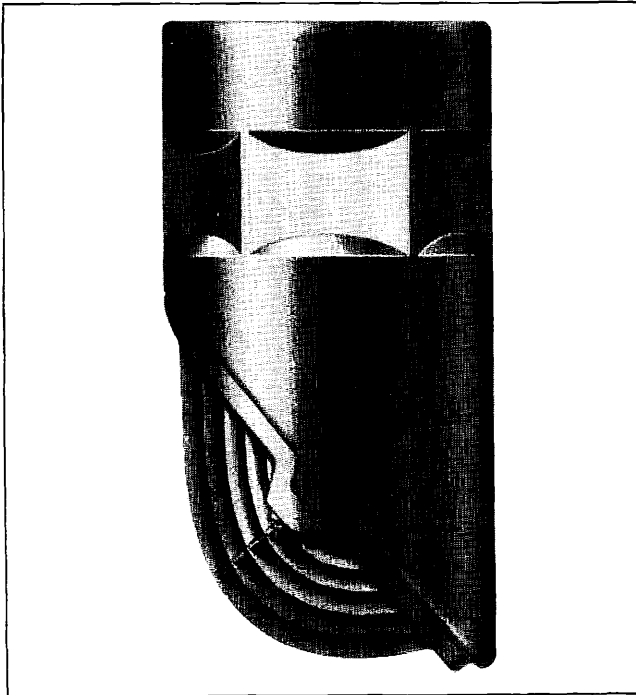


Figure 23. Foot Valve Strainer

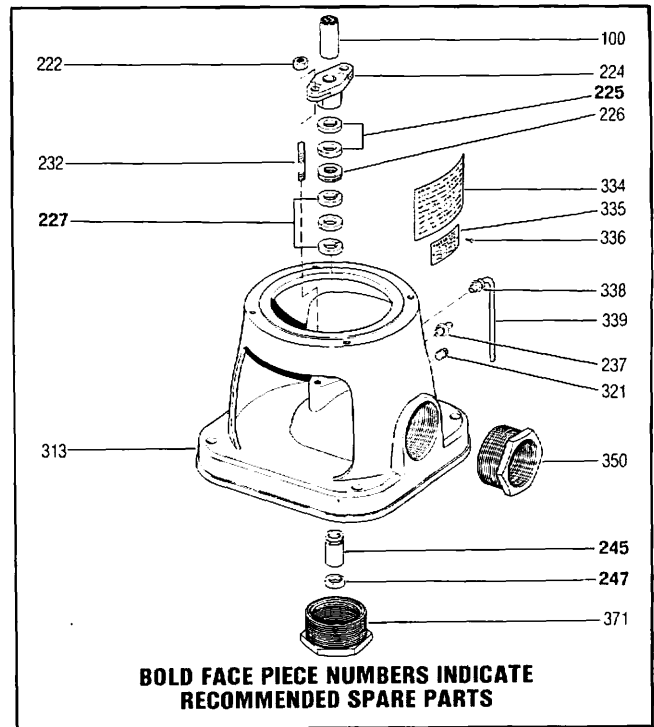


Figure 24. Discharge Head

SECTION 11

STARTING THE PUMP

Before starting a new pump for the first time, you must establish the status of the following items:

Driver lubrication levels must be adequate.

Driver wiring has been carefully checked.

Driver connection to power source is complete and adequately guarded.

Pump has been through a proper prelubrication cycle.

All accessible connections are tight.

Pump is properly adjusted according to Section 8.

Pump rotation is counterclockwise when viewed from top.

Bowl assembly is properly submerged.

Well and system are in condition to deliver and accept full flow.

All covers and guards are in place.

All personnel are clear of equipment.

When all these conditions are satisfied, start the pump and observe the operation closely. If there is excessive vibration, unusual or excessive noise, or if the driver draws noticeably more power than expected, stop the pump. Research the cause and correct the problem before attempting a restart.

Check the packing box illustrated in Figure 24. Let the pump run from ten to fifteen minutes while you allow the packing gland, Item 224, to leak at least 100 drops per minute. If the leakage rate slows during this period, loosen the gland nuts, Item 222, to maintain constant flow. Gland temperature should level off and then drop slightly toward the end of the run. You may then draw up the nuts about one sixth of a turn every five minutes until leakage is minimized. If, during this procedure, the gland heats up so it will vaporize water, back off the nuts and repeat until the temperature stays down after the gland is finally adjusted.

For further packing break in and final impeller adjustment, see Section 12 and 13 respectively.

If your pump has been repaired or if it has been shut down for several days or more, follow the same procedures for restarting as above. Refer to our Recommendations for Storage located on the inside front cover of this publication.

SECTION 12

ADJUSTING THE PACKING

During the first four hours of operation, you may find it necessary to tighten the packing gland gradually as the packing rings, Items 225 and 227, Figure 24 are broken in and formed to fill the chamber. You must always allow a small trickle to flow through the top of the gland. During this time, check frequently to see that the box is not overheating. Should this occur, slacking off on the gland nuts, Item 222, may be all you need do. If excess heat continues, inspect bypass line, Item 339, from the drain port and make sure there is substantial flow through it.

The grease fitting, Item 237, channels into the throttle bearing. A very small amount of standard water pump grease may be injected for startups only, otherwise not at all. Too much grease can actually interfere with heat transfer in the journal area, producing excessive temperature in the box. It's better to use no grease than too much.

As you repeatedly tighten the gland over long periods of operation, the packing rings will be compressed in the chamber, lowering the gland into the box. Additional rings are often added as required to compensate but you must never add more than two above the lantern ring, Item 226, since you will block the drain port, Item 338. After adding any packing, probe the drain port with a wire to see that it has not become plugged.

When you eventually find it necessary to repack the box, you must remove the remains of the old packing with packing hooks, cleaning the chamber thoroughly. The lantern cage, Item 226, is provided with #10-24 tapped holes in the face so that you can lift it out using appropriate machine screws or other means. You'll find the gland, Item 224, easy to remove because of its split design. You can secure the lantern ring up out of the way by tying a couple turns of string around the shaft.

At the time of repacking, always check the top shaft alignment and surface finish. The surface should be smooth without burrs, grooves, or scratches. Repair or replace any top shaft showing runout of 0.005 inch or more. You may use butt or diagonal cut rings for repacking, but we recommend the latter. We also urge you to use die cut rings of the same size and material as the original. If you cut and fit the rings at the jobsite, be sure to cut them so the ends just barely meet when formed around the shaft. The ring joints should be located 90° to 180° from the cut in rings immediately adjacent.

Periodic maintenance of the packing box is essential for long life and trouble free operation.

SECTION 13

ADJUSTING THE IMPELLERS

In Section 8, when connecting motor to pump shaft, you adjusted your impellers about two turns up off the bowl seats. The unit may be operated this way as long as it delivers water at the discharge but, since your impellers are of the semi-open variety, as shown in Figure 25, you'll want to achieve a precision adjustment if you intend to get the best out of your pump.

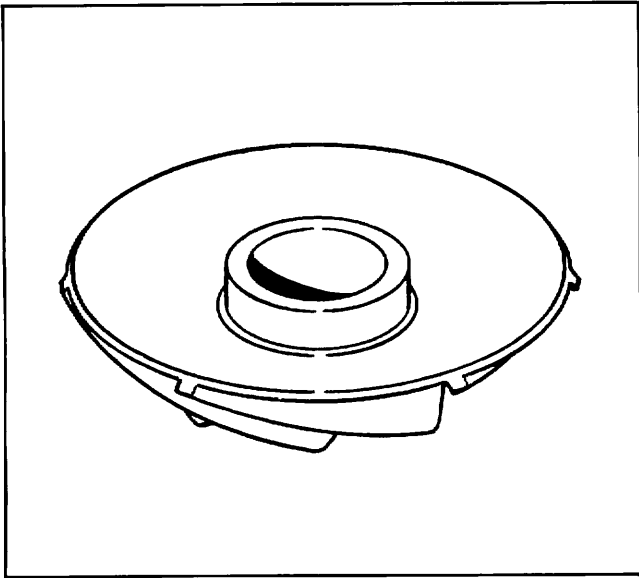


Figure 25. Semi-Open Impeller

You'll need an ammeter to indicate power behavior. Assuming your power readings were within reason during first operation, as discussed in Section 10, stop the pump, remove the adjusting nut lock screw, and back the adjusting nut down to the next lock screw hole by turning the nut clockwise. Secure the lock screw and start the pump, observing power behavior on the

ammeter. Repeat this, backing up one lock screw hole at a time until the ammeter first displays fluctuating power requirement. This tells you the impellers are in contact with the bowl seats.

If the fluctuations are very slight and the maximum power reading is acceptable, you've got the optimum setting. After short running time, the fluctuations should disappear as the impellers seat themselves.

If the power deviations are relatively wide and/or the power peaks too high, the impellers are dragging too heavily. Raise the shaft slightly by turning the adjusting nut counterclockwise one lock screw hole. Secure the lock screw and run the pump. This is your proper setting.

If the performance of your pump gradually falls off over a period of time and you're unable to find the explanation in the system, readjust the pump as described. If adjustment is the problem, you'll restore your original performance unless other changes have taken place.

If you really want to achieve an extremely fine adjustment, you may prefer to remove the lock screw and substitute a lock nut, such as a second adjusting nut. This will allow you to work through the intervals between lock screw holes to achieve an infinitely fine impeller setting if that's what you want. On a small pump like this, you may well find this method advantageous.

It's always a good idea to check the adjustment and readjust if necessary before running a performance test on the unit. Such a procedure will give you a standard of comparison for the life of the equipment.

If you have any questions, your Aurora representative will be glad to help you. We wish you the best of service from your Aurora Verti-Line Package Pump.

SECTION 14

PRECAUTIONARY INFORMATION

a. Responsibilities

There are certain areas in which Aurora Pump has no control and can therefore accept no liability. For instance, unless supervised by an Aurora Pump service engineer, responsibility for installation, start-up and maintenance rightfully belongs to the Owner and his authorized agents. Similarly, the following shall be the Owner's obligation and responsibility:

Suitability of foundation or mounting structure

Suitability of power characteristics

Security and safety of jobsite and site conditions

Placement and maintenance of all appropriate guards and safety devices

Suitability and performance of system to which pump is applied

Aurora Pump cannot be responsible for damages, lost time, or injury resulting from failure to comply with these instructions. Aurora Pump's obligations do not cover damage to the pump due to abrasives, gas, or corrosives in the water. They do not cover harm due to starting pump in a reverse rotation mode; neither do they cover performance when parts not furnished by Aurora are used in the pump.

If you have any question, please call your Aurora representative.

b. General Cautionary Notes

Your Aurora Verti-Line Package Pump is an engineered assembly of precision parts and must be treated accordingly even though sometimes the components are awkward to manipulate. Normal rules of safety and approved methods of practice as associated with the erection of heavy equipment must be observed in any activity related to your pump.

In addition to general acceptable industrial practice, we emphasize the following twenty precautions:

Don't work on pumps, wiring, or any pump or system components without opening energizing circuits such as at main breaker or pump disconnect switch. This will prevent damage or injury due to "surprise" starts actuated by automatic control systems. It will also help prevent other possibilities of injury.

Don't work under a suspended load. Rest the load on positive supports when it's necessary to be underneath.

Don't forget that this equipment contains rotating parts. Use CAUTION when working near such parts to avoid injury. Always replace all guards, covers, shields, and other safety devices before startup.

Don't permit smoking in the vicinity of petroleum base solvents. Store solvents in approved containers.

Don't use lubricants that can contaminate your system and cause damage or injury.

Don't start pump while it is still rotating in reverse direction after having shut down. You have some non-reverse protection from the check valve below the bowl assembly, but it's always best to check before starting.

Don't start your pump without making sure you have lubricating water in the column.

Don't start the pump without proper adjustment.

Don't start a pump in which the shaft appears frozen or locked up. Free the shaft and rotate by hand first.

Don't put heavier than recommended heaters in your starter if the pump load begins to trip those furnished originally. These are protective devices. Call your Aurora representative for assistance.

Don't add oil to driver while running; check levels only when idle. Don't add grease to grease lubricated driver without removing the relief plug.

Don't drop parts into pump during installation or disassembly. Don't drop parts into driver when canopy is off and top is open. Parts must be recovered immediately.

Don't run pump backward. Clockwise operation (looking down at top of pump) under power can unscrew threaded shaft joints. Power requirements of some designs increase when driven backward and can thus create undesirable overloads. In certain areas of the country prone to phase reversal problems, consider phase protection in your power circuit. Note: these problems do not apply to pumps coasting backward due to return flow from system; overspeed is the circumstance to question then.

Don't allow oil, grease, or thread lubricant to contact rubber bearings.

Don't pump anything but water unless your pump has been designed for it

Don't use your new pump to develop a new well.

Don't hang the weight of pipelines and fittings on the pump. Support pipe runs with blocking or saddles according the best piping practice. Use dresser type couplings with thrust ties if necessary whenever possible to eliminate piping strains imposed on your pump.

Don't throttle or obstruct the suction of any pump.

Don't tighten shaft packing except in increments. For example, take gland nuts up part of a turn and let pump run five or ten minutes before tightening further. If leakage water is too hot to put on your hand, back gland nuts off a little until water cools, then tighten again. Gland nuts must be adjusted evenly so as to prevent gland from cocking and forcing against shaft.

Don't change pump speed without first checking effect on power, internal pressure, and other conditions. Don't forget that your pump is guaranteed for design conditions only as purchased.

And let us add one more DON'T for the benefit of your pump and your peace of mind:

Don't hesitate to call your Aurora representative or the Aurora factory when you need help or have a question.

c. Operation at Shutoff Head

In the usual application of Aurora Verti-Line Package Pumps, no harm will result from operation at conditions of static flow head as long as you've prepared for that contingency. The following points should be checked and resolved before putting your equipment into operation at or near shutoff heads.

Impeller adjustment must be made at shutoff head.

Thrust bearing must be adequate.

If prolonged operation at no flow is contemplated, the problem of heat dissipation may become acute since most of the shutoff horsepower is converted to heat in the available liquid. This can be reduced with an adequate recirculation system.

You must remember that open lineshaft units depend upon pumped liquid for lubrication. Fluid temperatures, if raised excessively due to lack of flow, may impair lubrication efficiency even to the point of destroying the pump.

To summarize, normal designs will easily accommodate most of the considerations listed above. However, to obtain the best possible application, you must notify the factory at the time of purchase if operation at static flow heads will be a possibility. This precaution must be observed to validate any warranty.

d. Maintenance Hints

Always be sure all lubrication systems are in operating condition any time the pump is running.

Remove the old oil from your driver at least once a year or according to the driver manufacturer's instructions. Flush with kerosene and refill. Follow manufacturer's directions carefully as to method and type of lubricant. Replace self lubricated driver ball bearings in about five years. It is generally less expensive to replace these before they fail.

Replace all shaft packing on open lineshaft pumps after maintenance has required the addition of no more than two rings. Always let packing box leak slightly at top of gland to protect the shaft and add life to your packing.

Be aware of changing conditions in your system. Any change from the original condition or any variation in the system can create an undesirable reaction in the pump as the energizer of the system. If your system head has increased, for example, check your performance curve, your thrust bearing capacity, and other details for the new conditions.

We recommend you consult your Aurora representative before attempting to remove or repair your Package Pump. If it becomes necessary to work on your equipment, be sure to review all instructions for operation and maintenance. You may want to consider contracting for the services of a trained Aurora service engineer to guide you.

NOTES

TERMS AND CONDITIONS OF SALE

NOT INTENDED FOR SALE OR USE FOR PERSONAL, FAMILY, OR HOUSEHOLD PURPOSES.

1-79 Printed in U.S.A.

All orders shall be made out to Aurora Pump at North Aurora, Illinois, and shall be subject to acceptance by us at North Aurora.

1. CONSTRUCTION AND LEGAL EFFECT. Our sale to you will be solely upon the terms and conditions set forth herein. They supersede and reject conflicting terms and conditions of yours, any statement in yours to the contrary notwithstanding. Exceptions to any of our terms and conditions must be contained in a written or typed (not printed) statement received from you; we shall not be deemed to have waived any of our terms and conditions or to have assented to any modification or alteration of such terms and conditions unless such waiver or assent is in writing and signed by an authorized officer. No representation of any kind has been made by us except as set forth herein; this agreement conclusively supersedes all prior writings and negotiations with respect thereto and we will furnish only the quantities and items specifically listed on the face hereof; we assume no responsibility for furnishing other equipment or material shown in any plans and/or specifications for a project to which the goods ordered herein pertain. Any action for breach of contract must be commenced within one year after the cause of action has accrued. Our published or quoted prices, discounts, terms and conditions are subject to change without notice.

2. PRICES. Unless otherwise noted on the face hereof, prices are net F.O.B. our producing factory, and include standard catalogue literature only. Service time of a factory-trained service man is not included and may be charged extra. The amount of any applicable present or future tax or other government charge upon the production, sale, shipment or use of goods ordered or sold will be added to billing unless you provide us with an appropriate exemption certificate. We may adjust prices to our prices in effect at time of shipment. Purchased equipment such as motors, controls, gasoline engines, etc., will be invoiced at prices in effect at time of shipment in accordance with pricing policy of manufacturer.

3. DEFECTIVE EQUIPMENT. Providing Purchaser notifies us promptly, if within one year from date of shipment equipment or parts manufactured by us fail to function properly under normal, proper and rated use and service because of defects in material or workmanship demonstrated to our satisfaction to have existed at the time of delivery, the Company reserving the right to either inspect them in your hands or request their return to us will at our option repair or replace at our expense F.O.B. our producing factory, or give you proper credit for such equipment or parts determined by us to be defective, if returned transportation prepaid by Purchaser. The foregoing shall not apply to equipment that shall have been altered or repaired after shipment to you by anyone except our authorized employees, and the Company will not be liable in any event for alterations or repair except those made with its written consent. Purchaser shall be solely responsible for determining suitability for use and the Company shall in no event be liable in this respect. The equipment or parts manufactured by others but furnished by us will be repaired or replaced only to the extent of the original manufacturer's guarantee. Our obligations and liabilities hereunder shall not be enforceable until such equipment has been fully paid for. Purchaser agrees that if the products sold hereunder are resold by purchaser, he will include in the contract for resale, provisions which limit recoveries against us in accordance with this section. In case of our failure to fulfill any performance representation, it is agreed that we may at our option remove and reclaim the equipment covered by this agreement at our own expense and discharge all liability by repayment to the purchaser of all sums received on account of the purchase price. (THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESS OR IMPLIED BY FACT OR BY LAW, AND STATE OUR ENTIRE AND EXCLUSIVE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR ANY CLAIM OF DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION OR OPERATION.) WE WILL IN NO EVENT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR DELAY RESULTING FROM ANY DEFECT WHATSOEVER, AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED.

4. DELIVERY. Delivery, shipment and installation dates are estimated dates only, and unless otherwise specified, are figured from date of receipt of complete technical data and approved drawings as such may be necessary. In estimating such dates, no allowance has been made, nor shall we be liable directly or indirectly for, delays of carriers or delays from labor difficulties, shortages, strikes or stoppages of any sort, fires, accidents, failure or delay in obtaining materials or manufacturing facilities, acts of government affecting us directly or indirectly, bad weather, or any causes beyond our control or causes designated Acts of God or force majeure by any court of law, and the estimated delivery date shall be extended accordingly. We will not be liable for any damages or penalties whatsoever, whether direct, indirect, special or consequential, resulting from our failure to perform or delay in performing unless otherwise agreed in writing by an authorized officer.

5. OPERATING CONDITIONS AND ACCEPTANCE. Recommendations and quotations are made upon the basis of operating conditions specified by the Purchaser. If actual conditions are different than those specified and performance of the equipment is adversely affected thereby, Purchaser will be responsible for the cost of all changes in the equipment required to accommodate such conditions, and we reserve the right to cancel this order and Purchaser shall reimburse us for all costs and expenses incurred in, and reasonable profit for, performance hereunder. We reserve the right to refuse any order based upon a quotation containing an error. The provisions in any specification or chart are descriptive only and are not warranties or representations; we will certify to a rated capacity in any particular product upon request. Capacity, head and efficiency certifications are based on shop tests and when handling clear, fresh water at a temperature of not over 81°. Certifications are at this specified rating only and do not cover sustained performance over any period of time nor under conditions varying from these.

6. SHIPPING. Unless you specify otherwise in writing, (a) goods will be boxed or crated as we may deem proper for protection against normal handling, and extra charge will be made for preservation, waterproofing, export boxing and similar added protection of goods; (b) routing and manner of shipment will be at our discretion, and may be insured at your expense, value to be stated at order price. On all shipments F.O.B. our producing factory, delivery of goods to the initial carrier will constitute delivery to you and all goods will be shipped at your risk. A claim for loss or damage in transit must be entered with the carrier and prosecuted by you. Acceptance of material from a common carrier constitutes a waiver of any claims against us for delay or damage or loss.

7. PATENT INFRINGEMENT. We will not be liable for any claim of infringement unless due to infringement by goods manufactured by us in the form in which we supply such goods to you and without regard to their use by you. If you notify us promptly of any such claim of infringement and, if we so request, authorize us to defend or settle any suit or controversy involving such claim, we will indemnify you against the reasonable expenses of any such suit and will satisfy any judgment or settlement in which we acquiesce, but only to an amount not exceeding the price paid to us for the allegedly infringing goods. If an injunction is issued against the further use of allegedly infringing goods we shall have the option of procuring for you the right to use the goods, or replacing them with non-infringing goods, or modifying them so that they become non-infringing, or of removing them and refunding the purchase price. The foregoing expresses our entire and exclusive warranty and liability as to patents, and we will not be liable for any damages whatsoever, suffered by reason of any infringement claimed, except as provided herein. You will hold us harmless and indemnified against any and all claims, demands, liabilities, damages, costs and expenses resulting from or connected with any claim of patent infringement arising out of the manufacture by us of goods in accordance with a design or specifications which you furnish us.

8. CANCELLATION AND RETURNED EQUIPMENT. Orders may be cancelled only with our written consent and upon payment of reasonable and proper cancellation charges. Goods may be returned only when specifically authorized and you will be charged for placing returned goods in saleable condition, any sales expenses then incurred by us, plus a restocking charge and any outgoing and incoming transportation costs which we pay.

9. CREDIT AND PAYMENT. Payment for products shall be 30 days net. Pro-rata payments shall become due with partial shipments. A late charge of 1½ percent per month or the maximum permitted by law, whichever is less, will be imposed on all pastdue invoices. We reserve the right at any time to alter, suspend, credit, or to change credit terms provided herein, when in its sole opinion your financial condition so warrants. In such a case, in addition to any other remedies herein or by law provided, cash payment or satisfactory security from you may be required by us before shipment; or, the due date of payment by you under this contract may be accelerated by us. Failure to pay invoices at maturity date at our election makes all subsequent invoices immediately due and payable irrespective of terms, and we may withhold all subsequent deliveries until the full account is settled, and we may terminate this agreement. Acceptance by us of less than full payment shall not be a waiver of any of our rights. You represent by sending each purchase order to us that you are not insolvent as that term is defined in applicable state or federal statutes. In the event you become insolvent before delivery of any products purchased hereunder, you will notify us in writing. A failure to notify us of insolvency at the time of delivery shall be construed as a reaffirmation of your solvency at that time. Irrespective of whether the products purchased hereunder are delivered directly to you, or to a customer of yours, and irrespective of the size of the shipment, we shall have the right to stop delivery of the goods by a bailee if you become insolvent, repudiate, or fail to make a payment due before delivery, or if for any other reason we have a right to withhold or reclaim goods under the applicable state and federal statutes. Where you are responsible for any delay in shipment the date of completion of goods may be treated by us as the date of shipment for purposes of payment. Completed goods shall be held at your cost and risk and we shall have the right to bill you for reasonable storage and insurance expenses.

10. SPECIAL JIGS, FIXTURES AND PATTERNS. Any jigs, fixtures, patterns and like items which may be included in an order will remain our property without credit to you. We will assume the maintenance and replacement expenses of such items, but shall have the right to discard and scrap them after they have been inactive for one year without credit to you.

11. INSPECTION. Inspection of goods in our plant by you or your representative will be permitted insofar as this does not unduly interfere with our production workflow, provided that complete details of the inspection you desire are submitted to us in writing in advance.

12. RECORDS, AUDITS AND PROPRIETARY DATA. Unless otherwise specifically agreed in writing signed by an authorized officer, neither you nor any representative of yours, nor any other person, shall have any right to examine or audit our cost accounts, books or records of any kind or on any matter, or entitled to, or have control over, any engineering or production prints, drawings or technical data which we, in our sole discretion, may consider in whole or in part proprietary to ourselves.