

Quick Reference Manual

Excerpts from Direct DriveHead Owners Manual

6/25/2007

Direct DriveHead, Inc.

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Direct DriveHead, Inc., personnel are available 24/7 to assist you with artificial lift planning, installation and provide training.

Actually, there is nothing really difficult about pumping a well with the Direct DriveHead; and once familiar with the installation process, we are certain, your field personnel will find it quite simple to install, operate, and maintain. Designed literally for “plug-in and pump” simplicity.

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Direct DriveHead Installation – Mechanical

Use at least a $\frac{3}{4}$ " Rod String to drive PCP. Determine fluid entry rate before ordering a PCP. Since flow rates are often a guess, error on the low side is suggested. You can always change gears from a 14:1 to a 9:1 to double the PCP pump potential. And if that is not enough, you can over-speed the electric motor by 150% to further increase the PCP output potential.

Utilize all of the features associated with the Direct DriveHead to maintain a steady fluid level above the pump to prevent “kicks” and “dry pumping”.

Progressive Cavity Pumps are the ideal pump for placement below the perforations because they can easily pump basic sediment to the surface. Basic sediment let in the wellbore will eventually cover the perforations.

1. Attach the pump stator with tag pin to the bottom of your tubing and lower into position.
2. Space tubing out of Well Head as low as possible and as close to the top plate of the well head as possible.
3. **At this point, attach 3” swedge to your tubing with hammer union provided to mount DriveHead and run rods. You can mount DriveHead first but you may find it easier to run rods first so go to Step 4 below.**

After the Direct DriveHead is mounted, remove top set of bolts located on back assembly behind bearing to allow the assembly to lay back and rest upon a stop. *(See Appendix Back Assembly)*

4. Attach the pump rotor to the rod string and lower through the hollow shaft of the bearing section into well. **Note rod weight just as the rotor enters stator at TD.**
5. Lower rotor through stator and “Tag Pin”. Rotate rod string with rod wrench to insure the rotor works itself completely through the stator to the pin. “Sense torque” as the pin will stop the rotation and prevent the rotor from passing beyond pin at the bottom of the pump.
6. After tag; pick up on the rod string until you regain rod weight seen in step 4.
7. After regaining rod weight, **“Lift Rod String” off of the pin.** The space between the pin and the bottom of the rotor in the Netzsch Pump design is 22 inches. Approx. 22” from the pin will be your targeted placement of the rotor in the stator for Netzsch pumps.
8. At this point, NOTE where the rod box is situated hanging in the derrick from the rod elevators and the targeted height you want for tying polish rod “LOVE JOY” connection to GEAR BOX LOVE JOY connection.

9. Space using pony rods as close to the bearing section as possible. Be mindful of spacing within a 12 inch area above bearing.
10. After Spacing Rods into position, Slide Direct DriveHead over and into place locking onto tubing with 3" hammer union. Also insert brass bushings around polish rod into top of bearing shaft to stabilize rotation of rod. **(See Appendix Brass Bushing)**
11. Lock Polish Rod into place with the brass bushings below by the Polish Rod Clamp. Tighten Clamp and position key-way into top of bearing shaft. **(See Appendix Brass Bushing)**
12. Reposition the back assembly up and over the polish rod. **(See Appendix Back Assembly)**
13. Lower Gearbox and Electric motor into the Love Joy Connection and tighten.
14. Connect electric cable provided into your electric starter box.
15. Open circuit and test rotation by "slowly" activating Variable Frequency Controller provided by Direct DriveHead. If rotation is to the left "STOP" and reverse polarity in your starter box and retest rotation. The unit is pre-wired and tested and will need no other wiring.
16. Install Packing.
17. Connect fittings, Test pump, and adjust packing to suit.

Direct DriveHead Installation – Electrical

The Direct DriveHead is pre-wired and tested before it leaves the assembly plant. A 5 HP 230/460 volt three phase motor is wired to a Variable Frequency Controller / Inverter. At the base of the VFD box you will find a Cat. 4 rig receptor pre-wired for quick connection to your field electric power breaker and starter box. A pre-wired Cat. 4 plug is also included with cable to make this installation as easy as possible. All your electrician

will need to do is wire the cable to the field power box and plug it in – as it is ready to go at that stage!

(If you only have single phase don't worry, our VFD will make 3 phase from single phase, simply follow the instruction contained within the VFD manual).

Field electric power breaker boxes that you provide should be equipped with standard heaters, coils and fuses to properly drive a 5 hp motor.

Breaker should not exceed 30 amps. Typical load during operations will be in the 3-6 amp range. Motor will pull up to 18 amps during high torque conditions without causing damage to the electronics.

This is a “soft start” system and does not require a “starter” in your breaker box.

Direct DriveHead VDF has low and high voltage protection; however, it would be a good idea to install same in your breaker box for added protection.

NOTE: ALWAYS CHECK DIRECTION OF ROTATION AFTER ELECTRICITY IS CONNECTED.

The VDF Controller provided will perform a self check upon applying power. After a few moments the self check is complete and the display will replace the presentation to show Hertz, RPM, Voltage and Current. At that time you are ready to operate the drive.

The rod string should rotate to the right as you look down the shaft. After you power up, press the FWD button and then bump the “up arrow” on the VFD until it begins to slowly turn. If incorrect, press STOP. Remove power and rewire YOUR CONNECTION IN THE POWER BOX to reverse polarity. Once turning the correct direction, you only need to use the FWD, “up arrow”, “down arrow” or STOP to control the pump. The controller has had safety and limit values preset before shipping. This includes slow ramp rates, hi and low hertz limits, etc. **(More options including plug in communications and web based pump manager available).**

Safety checks:

The VFD at 60 Hertz will cause the 230/460 motor to rotate at 1760 RPM. The VFD will vary frequency (Hertz) to vary motor speed. You may operate the motor 24/7 within a range of 150% to as slow as 30% without causing harm to the motor per manufacturers' specifications. The motor was built with a 3600 RPM housing and bearing set. (See Appendix for Gear Reducer RPM versus Hertz in your owner manual).

Operation Motor speed: Rated for 24/7 operation in the range of 20 to 105 Hertz.

Fluid pumping checks: With the pump operating at 100 rpm, a bubble tube will confirm flow coming up. It may take several hours for the actual flow to reach the surface. Time to surface depends upon pump rate, fluid level and tubing size. Loading the tubing will speed fluid to surface.

Pump rate: Daily volume pumped is linearly proportional to rpm of the rod string and hence the pump. The pump rpm is controlled by the frequency controller and the hertz that it sends to the motor. Progressive Cavity Pumps (regardless of manufacturer) are rated at a nominal daily volume at 100 rpm. Pump rpm of 150 would pump 150% of the rated daily volume, and a pump rpm of 50 would pump 50% of the rated daily volume. ***See Appendix Gear Reducer RPM versus hertz setting of the frequency controller.***

Safety checks:

- A. Avoid being damaged by the rotating rod and rotating rod clamp. Protect yourself and others further by installing the guard provided around the rod clamp.
- B. Avoid all electric circuitry and only service after the power supply to the Direct DriveHead is isolated or the unit is "unplugged" from the supply.
- C. After installing the Direct DriveHead, check to insure that all bolts associated with the back plate assembly are tight; (4) supporting the gear reducer and (4) which make up the hinge component.

- D. Check all valves attached to the Direct DriveHead pump system to insure that they are in the proper position to prevent spills and back pressure” on the pump. The positive displacement pump will build pressure against a closed valve and will either exceed the flow line burst pressure or exceed the pump rated limit and burn out.
- E. Insure Packing Cap is sufficiently tightened to prevent spills.
- F. Insure 3” hammer union is sufficiently tightened.
- G. Insure that the Key-Way tooth welded into the bottom of the rod clamp is securely fitted into the bearing section support shaft.

Maintenance-Free As Possible!

With no belts and pulleys or an internal bearing set to lubricate, the majority of the typical maintenance issues related to drive heads have been eliminated.

Bearing Set: Rated for a continuous load of 12,000#. The permanently sealed NTN bearings are packed with synthetic grease that does not require your attention. The Direct DriveHead bearing set bolts directly to the outside of the housing; Making replacement so simple that the pumper can change them on location. All other drive heads require the unit to be taken to a machine shop to press out bearings for repair.

Electric Motor: Note grease zerk and recommended lubrication found in motor manual.

Gear Box: Closed and sealed system with synthetic lubrication. No other attention required.

Packing: Any type of Standard 1 1/8” packing can be used. Determine the best type for your application and stick to it. Whilst installing packing use grease liberally. **Use packing wrench to tighten packing and periodically pump additional grease into packing housing to extend life.**

Routinely shoot fluid levels to match pump speed with fluid in-flow. Protect circuitry from high and low voltage spikes by installing protection in your field electric breaker box.

Spare/replacement parts:

All of the specific Direct DriveHead components are warranted for 6 months; Motor, GearBox, VFD, Bearing Section, and Housing.

Direct DriveHead maintains the following stock for its customers.

- Variable Frequency Controllers / Drives
- Gearboxes Reducers 14:1 and 9:1
- Bolt-On Bearing Sections
- Electric Motors
- Progressive Cavity Pumps
- Misc. Valves, Fittings, Polish Rods, Clamps, Wellheads and Gauges

Pumps:

The Direct DriveHead is for “every” PCP pump manufactured in the world, for “any kind of well” down to 6000 feet at production rates below 320 barrels per day.

PCP’s offered by Direct DriveHead cover the following range of operation; from 1 ½ barrels per day to 320 barrels per day at depths and rates shown in the pump table found at;

<http://www.directdrivehead.nteautomation.com/Progressive%20Cavity%20Pump%20Inventory.pdf>

To simplify warranty issues and/or to secure replacement parts, serial numbers for each component in your Direct DriveHead are on file at:

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