

# HYDROSTAT

BREAK IN PROCEDURES



## **Proper Warm-up of Equipment with Submersible Pumps**

One of the common issues related to the longevity and reliability of the submersible pump used in Force Feed arrangements is sudden reduced or no performance. Many times, it's been observed that engines are started and warmed up before being operated at speed and it's assumed the submersible transmission system was as well. Although this may be the case in our tractors, it couldn't be further from the truth for transmission driven submersible pumps.

In the submersible pump application, an engine driven pump provides hydraulic power to a remotely located manure pump motor; usually connected with many feet of hydraulic plumbing of hose and/or piping. What we see happens is a large differential temperature between the hydraulic motor and the hydraulic pump. Because the pump is running, circulating oil, and the motor is stationary, the motor is not allowed any gradual warmup with the engine mounted pump and engine. Consequently, when we set our engine mounted pump, or hydrostat, to lift manure from containment, it is immediately required to get the liquid up the pipe to limit or prevent cavitation. As soon as this warm, or even hot, oil reaches the cooler motor, the resulting rapid heat rise causes some components in the motor to warm quicker than others. As a result, we find that these components become scored in the process due to interfering tolerances and result in damage that decreases, and in some cases, eliminates operational performance altogether. Many times, this is seen as a drop in charge pressure when turning on the hydrostat or, in less severe cases, it starts by seeing elevated operating temperatures followed by slowly decreasing charge pressure as operation goes on. Another common failure related to rapid thermal expansion during initial startup is case failure seen by a physically cracked submersible motor case. This is caused by heated loop oil entering the cold motor case at the moment the unit is turned on and operated.

To eliminate the possibility of these types of failures, it is required that upon starting the engine that the hydrostat transmission is also turned on to provide circulation to the submersible system. The submersible is only required to spin at relatively low speed. This speed can be found by turning on your hydrostat at 0% or lever in neutral and slowly increasing the output percentage or moving the cable until a system pressure of at least 500 psi is seen on the system pressure gauge or hydro PSI on your display. Once the operator is comfortable with the temperature of the engine, the submersible hydraulic system should be ready for operation as well. It is recommended that the temperature be allowed to warm up to at least 80 degrees Fahrenheit. If the engine is ready, but the submersible hydraulic system is not, gradually increase the speed of the submersible pump until the proper starting operating temperature is achieved. Be mindful that you do not accidentally lift liquid to your main pump unless you are intending to.



## **New Transmission Component or Replacement Installation Startup**

Due to the long plumbing routes and overhead configurations, it is very difficult to ensure that oil has filled the lines vs. just air. If for any reason, the submersible hydraulic system has been opened up by replacing any one of its components, including hoses or new hoses, the following procedure must be followed to ensure that as much air as possible has been released from the working circuit. This guidance is provided in the following step by step instructions.

### **Post Component Replacement:**

1. Ensure that any work done on any hydraulic system is done under no pressure and by qualified personnel. High pressure oil escaping generally cannot be seen and will cut or sever arms, fingers, and hands.
2. Upon completion of work: ensure all fasteners are properly torqued, reservoirs are topped off with clean oil of the correct viscosity, and any ball valves that had been closed are reopened
  - a. If you have replaced a pump or a motor, ensure that the case of that component has been completely filled with new, clean oil and that a new charge pressure filter has been installed on the hydrostatic pump.
3. Connect hydraulic hoses to submersible pump if necessary. The rest of this procedure must be completed with a submersible pump attached where the impeller can be easily seen.
4. While monitoring your charge pressure, start the engine. If charge pressure does not rise above 200 psi in 5 seconds, stop the engine. The following steps will need to be completed with the submersible pump out of any liquid.
  - a. Observe that if the charge pressure did not rise, that the oil level has dropped significantly in the reservoir sight glass. If it has not, check the rotation direction of the pump you have installed
5. Once charge pressure has stabilized (approx. 350 PSI on Danfoss and 255 PSI on Linde systems), ensure that the correct oil level in the reservoir. Top off as needed.
6. If you have done this work on a machine with a boom mounted submersible, you will want to ensure the boom is extended as far out and down as possible. This will ensure there is a minimal amount of places that air pockets can be trapped.
7. Begin the process by turning on the submersible pump and setting the rotational speed at something close to 60 RPM or 1 revolution per second. Monitor to ensure that your charge pressure remains stable at the stated pressures and the oil reservoir remains at an adequate level. Allow the system to run for at least 10 minutes.
8. After 10 minutes, increase the speed of the submersible pump to 50% output. Leave machine in this state for another 10 minutes while observing charge pressures and oil level.
9. If charge pressures are still stable and reservoir volume is adequate, set submersible to full speed for 5 minutes. Upon completion, most of the air will have been purged. If anything on the system is opened or added, then you will need to complete this process again.

## Pre-Pumping New Component Break-in

Now that components have been installed and ready for field running, they must be properly broken in. Regardless if a hose was changed or added or a completely new system, this process must be followed to ensure any remaining air is removed and that any new components are appropriately broken in

1. Deploy submersible pump and connect all hoses if necessary
2. Depending on the type of submersible arrangement you are using, the following will be different
  - a. If connected to a lagoon feeder type submersible, close the inlet gate of the pump trailer. If there is no inlet gate, disconnect the inlet hose and allow circulation back to the lagoon.
  - b. If utilizing a boom, open the agitation gate at the end of the boom. If no agitation boom is installed, ensure that the inlet gate on the boom is closed to prevent liquid being sent to the main pump
3. Start engine and follow proper warm up procedure highlighted above
4. Upon completion of the warmup, elevate engine speed to 1100 RPM
5. Begin the breaking procedure by adjusting the output of the submersed pump to achieve 1000 PSI. Observe charge pressure and reservoir level to ensure they are stable and not dropping.
6. Once the 1000 PSI has been achieved for 10 minutes, increase the output of the submersible 1000 PSI every 5 minutes until maximum output has been achieved and remain at maximum output for 5 minutes.
7. Reconnect submersible to system if it was disconnected.
8. Begin pumping operation at low speeds. Gradually work up to normal working speed over the course of the first 15 minutes of operation. Doing so will ensure that the submersible hydraulic system has been given ample amount of time to purge air, flush any break in contamination, and complete a proper break in.

It is important to follow these steps when starting up or making changes to your submersible hydraulic system. Units within the warranty period that show signs of premature failure due to contamination (including air) or rapid thermal expansion will be denied any available warranty coverage. Using hydraulic motors or attachments not approved by Puck Enterprises will also void any available warranty on the engine mounted hydrostat.

## Handling of Detached Submersible Pumps

In order to properly store a submersible pump that has been disconnected from a pump trailer or agitation trailer, it must be ensured that the oil remaining in the hoses has the ability to expand and contract to accommodate varying storage temperatures. For units with hydraulic couplers, a storage kit should be applied immediately to one of the high-pressure hoses following its disconnect from the machine in order to allow expanding oil to escape. Failure to do so will result in submersible pump hydraulic motor case failures including blown gaskets and split housings. These failures are not warrantable events. If you do not have a storage kit, please contact your Puck sales representative to acquire them.

