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OPERATION AND MAINTENANCE MANUAL DUOPHASE AND STANDARD SYSTEMS

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I. System Start Up

Before proceeding with this checklist, confirm with a voltmeter that all power is off and be sure that water pressure can be isolated from the pumping system. Safety is of the utmost importance! If you have any concerns, STOP and call SyncroFlo Technical Service Department at 770-447-4443

A) Preparation – Vertical turbine pumps:

1. Be sure all piping has been properly flushed before attempting to operate the pumps.
2. Confirm that all drains plugs in the pump barrel and pressure regulating valves have been replaced.
3. Check to assure that the motors are adequately lubricated according to the specification in the maintenance section of the motor manual.
4. With motor shafts removed, check to assure proper motor rotation. This can be done by turning the "pump switch" to the "hand" position just for a split second and observing. Vertical hollow shaft motors should turn counterclockwise as viewed from the top. If rotation is incorrect reverse any two leads at the motor shaft.
5. With all valves closed bleed the seal chambers to relieve all pressure in the pump which may prevent impellers from resting on the bottom of the bowls. If necessary, install the motor headshafts and adjust the impellers according to the instruction found in the specific manual for vertical hollow shaft motors and vertical turbine pumps.
6. With the suction and discharge valves open, bleed the pump seal chambers, pressure regulating valves, all pressure gauges and switches of any air which may be trapped in equipment
7. Check for overall proper installation. Is system anchored? Is voltage correct?
8. Check overload settings against motor data plate.
9. For systems with hydrocumulator tank, check for the proper pre-charge as listed on the system data sheet. If a 'Type A" system, close the tank feed line gate valve until later in the start up.
11. Check inside the control panel. Ensure that all components are present and firmly installed. Re-tighten all control wires.

B) Start-up Procedure

1. Close the pumps discharge isolation valves. With the pump suction valves open, slowly open the suction manifold isolation valve (if supplied). Without valves, there should already be pressure on the suction manifold. Record this pressure before running any pumps _____ psi. Check the system for any leaks and correct now.
2. Check the incoming voltage with a voltmeter L1-L2 _____, L1-L3_____, L2-L3_____.
3. Confirm that all pump switches are in the "OFF" position. Turn on the panel power. The control power light should come on indicating 120VAC control power is present.
4. Check the amperage on all three legs with each pump running individually. The discharge valves should still be closed and the amperage quite low but balanced.
Vent each PRV until water runs clear and there is no air in the valve cover.
6. Check with the contractor or building engineer to be sure that they are ready to charge the building riser. All open pipes must be capped. Drain valves must be shut, etc. If the system is not equipped with automatic air vents, a fixture at the top of the building should be opened to allow air to escape.
7. With one pump in the "Hand" position, slowly open its discharge isolation valve partially until the riser is full and pressurized.

Check again for leaks on the system and building piping.
8. Check that the system pressure gauge reads correctly. A small amount of flow is required to properly confirm that the PRV is working correctly.
9. With a low flow, cycle through each pump and confirm proper operation. Record system pressure _____ psi. If incorrect, call SyncroFlo before proceeding!
10. With one pump still running, open the individual pump tank feed line isolation gate valves and the tank PRV isolation valves and allow the tank to pressurize. If the tank is roof mounted ("Type B" system), do not add water to the tank until all air in the building riser has been allowed to bleed off.
11. If all is correct, place all of the pump switches in" Auto".

C. Automatic Operation Tests

1. Low Suction Shutdown. Isolate the suction sensing line ball valve at the connection to the suction header. Loosen (but do not remove) the compression nut on the tube to reduce the pressure trapped in the sensing line to below the "Low Suction" setpoint listed on the Control Panel data sheet. After an 8-10 second delay the Alarm will sound and the system will shut down requiring a manual reset. Retighten the compression nut and open the isolation valve. The suction pressure will have to return to approximately 5 psi above its setpoint before the alarm can be reset. Press the reset once to silence the alarm. Wait 5 seconds and press reset again to clear the alarm.
2. Lead Pump Shutdown. (Type A and Type B systems). Stop all flow in the building, if possible. If not, a discharge manifold isolation valve (if provided) can be closed to simulate a "no flow" condition. If lag pumps are running, once their minimum run timers (MRTS) expire and there is not a 'Low System" condition, they will turn off. With no flow and only the one remaining pump running, the system pressure should rise above normal and close the "Lead Pump" switch. After a brief delay (15 seconds), and a continuous input from the "Lead Pump" switch, the remaining pump will shut down. Type C systems are not normally supplied with a lead pump shut down feature. The lead pump runs continuously unless the system is fitted with an "energy saving device".
3. Motor Amp Draw: Create flow demand equal to the rated capacity of each pump individually. Check the amperage draw of each leg of each motor while running at its rated capacity. Record the Amperage for future reference

P#1 L1 _____A, L2 _____A, L3_____A
P#2 L1 _____A, L2 _____A, L3_____A
P#3 L1 _____A, L2 _____A, L3_____A

4. System Voltage. At full flow, record the incoming voltage and compare it to the voltage recorded with all pumps off.
L1-L2____VAC
L1-L3 ___ VAC
L2-L3 ____VAC

II. Planned Shut Down

1. For short periods of time under normal conditions the system may be shut down by simply turning all pump control switches off as well as the control power switch. Before restarting, the motor shafts should be turned by hand to assure free rotation.
2. For long periods of inactivity or if freezing conditions are expected, the system should be isolated and completely drained. Refer to section I before attempting to restart.
3. The main incoming power to the control panel should be turned off to avoid restarting of the system by untrained personnel.

III. Troubleshooting:

The following troubleshooting information should be used as a guide in determining the cause of the most common problems you may encounter. It is not intended to be cure-all for problems. Should you be unable to correct a specific problem by use of this guide, contact your nearest SyncroFlo representative for assistance. SyncroFlo factory personnel are available to work with you and/or your representative in resolving exceptional problems not covered in this troubleshooting guide.

A) Motors:

1. Motor fails to run in "hand" position.
   a) Disconnect switch in the off position.
   b) Panel door interlock switch is "open" (see electrical schematic).
   c) One or more phases of the incoming power supply are lost.
   d) One or more fuses in the related motor circuit are blown.
   e) Control circuit primary or secondary fuse is blown.
   f) A loose power connection from the source to the motor on one or more phases.
   g) One or more overload is tripped.
   h) Failed motor starter coil – starter will not pull in.
   i) Improper motor wiring.
   j) Rotor is locked – check the pump for a locked pump shaft caused by foreign debris in the impeller or the binding of the impeller in the casing.

   NOTE: *See pump staging control section for motors that will not run in the "auto" position.*

2. Motor runs hot:
   a) Inadequate ventilation causing high ambient temperature.
   b) Overload on motor causing excessive amp. draw.
   c) Unbalanced power supply between phases.
   d) Over-greased bearings.

3. Excessive motor noise:
   a) Lack of bearing lubrication.
   b) Worn bearings requiring replacement.
   c) Loose or bent cooling fan.

4. Motor pulls excessive amperage (Overload tripping):
   a) Pump operating beyond rated capacity.
   b) Unbalanced power supply or improper voltage.
   c) Rotating elements binding internally.
   d) Rotating elements binding due to external mounting street.
   e) Motor running hot.

B. Pumps:

1. Pumps output pressure low:
   a) Motor speed incorrect – check incoming voltage.
   b) Rotating element binding.
   c) Clogged vane(s) on impeller(s).
   d) Suction isolation valve partially closed.
   e) Blockage in the suction supply line.
   f) Suction supply pressure lower than specified.
   g) Loss of prime (Suction lift applications only).
   h) Incorrect rotation direction.
   i) Pump is air bound.
   j) Pump operating beyond rated capacity.
   k) Incorrect impeller adjustment on vertical turbine pumps with semi-open (pump with an "O" in model number).
   l) Impeller(s) loose or binding.

2. Excessive pump noise:
   a) Pump operating beyond rated capacity causing cavitation.
   b) Impeller(s) loose or binding.

c) Foreign object loose in pump casing.
d) Suction lift too high causing cavitation.

3. Excessive pump vibration:
a) Bent pump or motor shaft.
b) Worn pump bearing(s).
c) Impeller out of balance.
d) Pump operating beyond rated capacity causing cavitation.
e) Misalignment between pump and motor.
f) Bad motor bearing.

C. **Pressure Regulating Valves:**

1. Pressure too high:
a) CRD set too high.
a) PRV diaphragm ruptured.
b) CRD diaphragm ruptured
c) Orifice elbow clogged.
d) Inlet side check valve (if applicable) stuck closed.
e) Inlet side strainer is clogged.
f) PRV stem sticking in upper or lower guide bearings.
g) PRV seat surface is worn or damaged.
h) CRD disc retainer worn or damaged.
i) Outlet side check valve (if applicable) stuck open or not seating tight. This could be caused by pipe nipple being threaded too far into the check valve preventing it from seating.
j) PRV stem nut not tight or entire diaphragm assembly is loose.

2. Pressure too low:
a) PRV stem sticking in upper or lower guide bearing.
b) PRV spring improperly aligned.
c) CRD disc retainer hole is clogged.
d) CRD disc retainer motion is obstructed.
e) CRD set too low.
f) Orifice elbow eroded allowing too high a volume of water in piloting.
g) Speed control improperly set.

3. Valve will not check (applies only if valves are piloted for check feature):
a) Inlet side check valve is stuck open or fails to seat.
b) Outlet side check valve is stuck closed.
c) Outlet side strainer is clogged.
d) PRV stem is sticking in upper or lower guide bearings.
e) PRV diaphragm is ruptured.
f) PRV seat is worn.

4. Modulation:
a) Air trapped under PRV cover.
b) Orifice elbow is too large or too small.
c) Inlet or outlet check valve (if applicable) malfunctioning.
d) Inlet or outlet side strainer partially clogged.
e) Speed control improperly set.

D. **Pump Sequencing (systems utilizing pressure switches):**

1. Pump fails to start automatically. *Note: Try to run in the "hand" position. If it fails to start refer to (Troubleshooting) Section III, A.1.*
a. Pressure switch improperly wired.
b. Pressure switch improperly adjusted.
c. Pressure switch sensing line closed or obstructed.

2. Pumps fails to stop automatically when not required :
a. Pressure switch improperly adjusted.
b. Pressure switch sensing line closed or obstructed.
c. Pump under control of minimum run timer.
d. Motor starter hung up in operating position – will not release.
e. Pump selector switch in "hand" position.

E. **Pump sequencing (systems utilizing Data Industrial paddle wheel flow sensors):**

1. Pump fails to start automatically: *Note: Try pump in "hand" position. If pump fails to start refer to section III, A.1 (Troubleshooting).*
   a) Paddle wheel flow sensor obstructed, broken or out of line with direction of flow.
   b) OIT improperly programmed.

2. Pump fails to stop automatically when not required:
   a) Pump under control of minimum run timer.
   b) Motor starter hung up in operating position will not release.
   c) Pump selector switch in "hand" position.
   d) OIT improperly programmed.

F. **HydroCumulator Tank Operation:**

1. Lead pump will not shut down :
   a) HydroCumulator feedline valve(s) closed.
   b) Maxi-store flow switch malfunctioning or hung-up. (If provided)
   c) HydroCumlator pressure switch misadjusted, usually too high. (If provided)
   d) Suction pressure lower than minimum design pressured. Refer to system data sheet.
   e) Pump selector switch in "hand" position.
   f) Pressure switch sensing line closed or obstructed.

2. Lead pump will not restart when required:
   a) HydroCumulator pressure switch misadjusted, usually too low. (if provided)
   b) Valve(s) feeding tank closed while tank is under pressure with pumps off.
   c) Pressure switch sensing line closed or obstructed.

3. Lead pump short cycles:
   a) High flow rate shut down (system not quipped with a maxi-store switch).
   b) Tank pre-charge pressure insufficient.
   c) Incorrect HydroCumulator pressure switch setting. (If provided)
   d) Pump check valves leaking back to suction.
   e) Bladder is ruptured.

4. Tank will not hold pre-charge:
   a) Air fill valve, pressure gauge or relief valve leaks.
   b) Any external fitting improperly sealed.
   c) Bladder is ruptured.

G. **Pressure Gauges**

1. Gauge provides incorrect pressure reading:
   a) Gauge cock partially closed.
   b) Gauge piloting partially blocked or damaged.
   c) Gauge improperly adjusted – switch gauge to a location where the exact pressure is known. *Caution: Pressure must not exceed the gauge rating. Remove the glass cover and adjust needle thumb screw until a correct reading is achieved.*

3. Gauge provides erratic pressure reading:
   a) Air in gauge piloting.
   b) Excessive system vibration.

H. Temperature Probes and Purge Valves

1. Valve purges continuously:
   a) Debris wedged in valve.
   b) Pump constantly running against little or no flow.
   c) Temperature probe failure – to check, disconnect power to temperature probe.
   d) Mechanical relief or purge valve clogged.

2. Valve does not purge at all:
   a) Temperature probe failure – check, electrically bypass temperature probe.
   b) Mechanical relief or purge valve clogged.

IV. Field Testing

A) Pumps:

1. Rotation: Turn the pump selector switch off and then back on to verify motor rotation. NOTE: A pump operating in reverse can still maintain pressure when operating at shut off or very low flow conditions.

2. Performance: Pump performance can be checked by testing pump shut off pressure. Put two pumps in the hand position, close the discharge valve on the pump to be checked and record pump discharge pressure. Subtract the suction pressure from the discharge pressure to obtain shut off pressure. Compare the actual shut off pressure to that which is on the system data sheet and/or pump curve.

3. Horsepower: Check amp. draw of motor with ampmeter while running at shut off and at design flows if possible. Compare against motor nameplate ratings.

B) **Temperature Protection System**:

1. Solenoid Purge Valve: The solenoid purge valve can be checked by electrically bypassing the temperature probe. This is done by jumpering terminals inn the control panel as indicated on the electrical schematic.

2. Temperature Probe and Purge Valve: The temperature probe and purge valve can be tested by operating the pump with the discharge valve closed until the water in the pump heats up enough to activate the purge valve. NOTE: Depending on the ambient temperature, water temperature and horsepower this could take some time.

3. Mechanical relief can be tested per step 2 above.

C) Flow Switch Sequencing

1. With system in automatic mode increase demand slowly to activate lag pump(s). (This may be difficult to do.)

2. The electrical circuit can be checked by jumpering the flow switch terminals in the panel or by removing the flow switch cover and manually tripping the mercury switch.

D) Pressure Switch Sequencing:

1. By closing the shut off cock from the discharge header to pump pressure switch and slowly relieving the sensing line pressure, a high flow condition can be simulated.

2. Once lag pump is started it will run until shut off cock is opened and minimum run timer completes it setting.

E) **Low System Alarm:**

1. To simulate a low system alarm condition. Place pump #3 (pump #2 on two pump system) in the hand position. Close shut off cock on system header and slowly bleed off pressure from low system switch until alarm trips. Immediately stop bleeding and read system pressure gauge to see where low system alarm is set. When activated low system alarm should start any and all pumps in the “auto” position. After testing open shut off cock and return to automatic operation.

F) Low Suction Alarm:

1. To test low suction alarm repeat procedures described in paragraph E above except close shut off in suction header and slowly bleed off pressure from low suction switch until alarm trips. Immediately stop bleeding and read suction pressure gauge. No pumps should be able to operate in any automatic position, after testing open shut off and return to automatic operation.

G) High System Alarm:

1. This alarm as are all others is factory set at the conditions indicated on the data sheet. Field testing should not be attempted unless a problem is present.

2. To test high system, place any pump in the hand position. Record system pressure and then slowly increase pump CRD setting on pressure regulating valve to raise system pressure to high system pressure setting. High system alarm should stop all pumps in the automatic position. Decrease system pressure to original condition and return to automatic operation.

H) HydroCumulator:

1. Proper HydroCumulator operation is dependent on a correct precharge pressure and no flow conditions. Before any field testing is done isolate receiver by closing shut off valve(s) and relieving water side pressure. A ¾" hose bibb is provided on prefabricated systems. Verify precharge and add if needed. If receiver can't be recharged, contact local representative or factory for assistance.

2. HydroCumulator on systems that have pressure regulating valves can be field tested by stopping all water usage in the building. If this is impractical during the day, simulated conditions can be created to test on/off operation. If system has maxi-store flow switch installed, jumper across the flow switch terminals to simulate no flow conditions. Place lag pump in hand position. With lead pump connected to tank, slowly close lead pump discharge diverting full pump pressure to the receiver. Once maximum pressure is obtained, pump #1 should shut off. If it does not, check to insure that a minimum run timer is not holding pump on. After lead pump shuts off, open discharge valve, and if HydroCumulator tank pressure is higher than system pressure, lag pump can be switched off. Building leak load requirements will be handled by the HydroCumulator tank until its water is depleted. The lead pump should come back on automatically. Remove jumper on flow switch and return all pumps to their respective auto position.

3. System with remote HydroCumulator tank can only be field tested during low and no flow conditions.

IV. Preventive Maintenance

A) Start-up – Two to three hours after starting the system clean all strainers in the suction line (if applicable). Clean the pencil strainers in the pilot lines of all pressure regulating valves. If there is any debris present a more thorough cleaning of the valve may be necessary.

B) Daily – Check and record all pressure gauge readings. Check for leaks in the mechanical seals and pilot tubing connections to the gauge board (if applicable).

C) Weekly – If lag pumps do not usually run, operate them in the "hand" position for approximately ten minutes each. Also, manually alternate equal capacity pumps if the system does not have automatic alternation.

D) Monthly – Check motor bearings and lubricate as necessary. Clean pencil strainers and all pressure regulating valves. Test all alarms. Check indicating light bulbs in panel.

E) Yearly – Check the system sequencing by generating sufficient flow in the building to automatically activate flow sensing devices. Clean and/or rebuild pressure regulating valves.

V. Spare Parts

A) Stocking Parts

The number and type of spare parts to be stocked will depend on anticipated maintenance, allowable downtime and water conditions in the area. SyncroFlo will supply a recommended spare parts list for your specific system upon request.

B) Ordering Parts

When ordering replacement parts, the following information must be provided: System production #, description of part and model number if available.

VI. Warranty Claims

Return material authorization (WCF#) must be obtained from SyncroFlo through your local representative prior to return shipment of any item for warranty consideration by the factory.