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COMMERCIAL SYSTEM OPERATION AND MAINTENANCE

CONTENTS

I. SYSTEM START UP

A. Preparation – Close Coupled Pumps:

1. Be sure all piping has been properly flushed before attempting to operate the pumps.
2. With the suction and discharge valves open, bleed all pressure regulating valves, pressure gauges and pressure switches of any air which may be trapped in equipment.
3. Check to assure proper motor rotation. This can be done by turning the "pump run switch" to the "hand" position just for a split second to observe the motor rotation. Close coupled pumps should turn clockwise when viewed from the top of the motor. If rotation is incorrect, reverse any two leads at the motor starter.

B. Start-Up Procedure:

1. Open all pump suction valves and close all discharge valves.
2. With panel doors latched shut and "pump run switches" off, turn the control panel on. Silence all alarms.
3. Start the #1 pump in the "hand" position making sure that the discharge valves are *closed*. Partially open the discharge valve and allow pressure in the distribution system to reach system design pressure so as not to shock the system. After the building piping system is pressurized, open the discharge valve completely.
4. With the building pressurized and discharge valves open try the remaining pumps in the "hand" position to assure proper operation.
5. Rebleed all pressure gauges and pressure regulating valves. *Note: Bleeding of pressure switches on systems in operation may cause alarm conditions. Reset all alarms.*
6. Switch each pump to the proper automatic position. Refer to the sequence of operation supplied in this manual. *Note: Never leave system unattended with pumps operating in the "hand" position.*
7. Isolate all pump pressure gauges from line pressure by closing each individual cock to each gauge. Pump pressure gauges should only be used for testing.

II. PLANNED SHUT DOWN

1. For a short period 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 that they rotate freely. Always follow steps as noted in Section I.B), for restarting system.
2. For long period 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. 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 a cure-all for problems you may encounter with your system. 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 basic troubleshooting guide.

A. Motors:

1. Motor fails to run in "hand" position.
   a. Disconnect in the off position.
   b. Panel door interlock switch is "open" (see electrical schematic)
   c. One or more phases of the incoming power supply is lost.
   d. One or more fuses in the related motor circuit is 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 overloads is tripped.
h. Failed motor starter coil-starter will not pull in.
i. Improper motor wiring.
j. Rotor is locked-check the pump for 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 stress.
   e. Motor running hot.

A. Pumps:

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

B. Pressure Regulating Valves:

1. Pressure too high:
   a. CRD set too high.
   b. PRV diaphragm ruptured.
   c. CRD diaphragm ruptured.
   d. Orifice elbow clogged.
   e. Inlet side check valve (if applicable) stuck closed.
   f. Inlet side strainer is clogged.
   g. PRV stem sticking in upper or lower guide bearings.
   h. PRV seat surface is worn or damaged.
   i. CRD disc retainer worn or damaged.
   j. 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.
   k. 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.

3. Valve will not check (applies only if valves are piloted or check featured):
   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.

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. Pump fails to stop automatically when not required:
   a. Pressure switch is 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.

F. Pump sequencing (system utilizing 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. Flow sensor improperly wired.
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.

G. HydroCumulator Tank Operation:

1. Lead pump will not shut down:
   a. HydroCumulator feedline valve(s) closed.
   b. Lead pump pressure switch misadjusted (too high).
   c. Suction pressure lower than minimum design pressure. Refer to system data sheet.
   d. Pressure switch sensing line closed or obstructed.
2. Lead pump will not restart when required:
   a. HydroCumulator pressure switch misadjusted (too low).
   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. Tank pre-charge pressure insufficient.
   b. Incorrect low system or lead pump pressure switch setting.
   c. Pump check valves leaking back to suction.
   d. Bladder is ruptured.
4. Tank will not hold pre-charge:
   a. Air fill valve, pressure gauge or relief valve leaks.
   b. Any external fittings 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.

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

H. Temperature Probes, Purge and Thermal Relief 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. Temperature probe is adjusted (adjustable type only).
2. Valve does not purge at all:
   a. Temperature probe failure-to check electrical bypass temperature probe.
   b. Solenoid coil burned out or not wired correctly.

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 in 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. Thermal relief valve:
   Close pump discharge valve until water temperature reaches approximately 130° F.
4. The electrical circuit can be checked by jumping the flow terminals in the panel or by removing the flow sensor and manually spinning the paddle wheel.

D. Pressure Switch Sequencing:

1. By closing the shut off cock from the discharge header to the 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 has expired.

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 stop pump #1 and start pump #3 (pump #2 on two pump system) in the auto position. (On two pump system lead pump should not run in auto 1 but should run in auto 2during low system alarm condition). 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 other are factory set at conditions indicated on the data sheet. Field testing should not be attempted unless a problem is present.
2. To test high system place pump #3 in the hand position (pump #2 if two pump system). Record system pressure and then slowly increase pump #3 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 pre-charge 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 bib is provided on prefabricated systems. Verify pre-charge and add air if needed. If receiver can't be pre-charged, contact local representative or factory for assistance.
2. HydroCumulators 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. Place any pump in hand position. With lead pump connected to HydroCumulator slowly close pump discharge valve diverting full pump pressure to the receiver. Once maximum pressure is obtained pump #1 should shut off. If it doesn't, a minimum run timer may be holding the pump on. After lead pump shuts off open lead pump discharge valve and if HydroCumulator pressure is higher than system pressure, the pump can be switched off and building requirements will be handled by the HydroCumulator until its water is depleted. The lead pump should come back on automatically. Return all pumps to their respective auto positions.
3. System with remove HydroCumulators can only be field-tested during low and no flow conditions.

V. PREVENTIVE MAINTENANCE

A. Startup-two to three hours after starting the system, clean all strainers in the suction line (if applicable).

Clean the pencil strainers in the pilot l 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.

D. Monthly-Check motor bearings and lubricate if 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.

F. Lubrication-Some small motors have pregreased bearings and require no maintenance.

Note: Refer to specific component bulletins for motor lubrication instructions.

VI. SPARE PARTS

A. Stocking spare parts:
The number and type of spare parts to be stocked will depend on maintenance anticipated, allowable down time and on water conditions in your 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 number, description or part and model identification number(s) if available.

VII. WARRANTY CLAIMS

A warranty claim form must be obtained from SyncroFlo, Inc. through your local representative prior to returning any item for warranty consideration by the factory.