IMPORTANT! Read all instructions in this manual before operating pump. As a result of Crane Pumps & Systems, Inc., constant product improvement program, product changes may occur. As such Crane Pumps & Systems reserves the right to change product without prior written notification.
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SPECIAL TOOLS AND EQUIPMENT
INSULATION TESTER (MEGGER)
DIELECTRIC TESTER
SEAL TOOL KIT (see parts list)
PRESSURE GAUGE KIT (see parts list)
SAFETY FIRST!
PLEASE READ THIS BEFORE INSTALLING OR OPERATING PUMP.

GENERAL

1. Most accidents can be avoided by using COMMON SENSE.
2. Read this operation and maintenance instruction manual.
3. Do not wear loose clothing that may become entangled in the impeller or other moving parts.
4. Always wear appropriate safety gear, such as safety glasses, when working on the pump or piping.
5. Bronze/brass and bronze/brass fitted pumps may contain lead levels higher than considered safe for potable water systems. Various government agencies have determined that leaded copper alloys should not be used in potable water applications. For non-leaded copper alloy materials of construction, please contact factory.
6. Minimize the amount of cooking grease entering the system.
7. Do Not leave pump cover off the basin, except while servicing, to prevent entrance of foreign materials such as rocks, metal, soil, animals or humans.
8. Prevent large articles of clothing, large amounts of chemicals, other materials or substances such as are uncommon in domestic sewage from entering the system.
9. During power black-outs, discontinue water consumption at the home(s) to prevent sewage from backing up into the house.
10. Always keep the shut-off valve completely open when system is in operation (unless advised otherwise by the proper authorities).
11. Keep the control panel locked or confined to prevent unauthorized access to it.
12. This basin system is intended for use with water, sewage and effluent applications. This basin must be vented in accordance with local codes. This basin system is not to be installed in locations in which the basin interior would be classified as a hazardous location in accordance with NEC ANSI/NPFA 70.

PUMPS

17. Recommended no more than 10 starts per hour.
18. Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.
19. Only qualified personnel should install, operate and repair pump.
20. Keep clear of suction and discharge openings. DO NOT insert fingers in pump with power connected.
21. Do not block or restrict discharge hose, as discharge hose may whip under pressure.
22. Make sure lifting handles are securely fastened each time before lifting.
23. Do not lift pump by the power cord.
24. Do not exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.
25. Secure the pump in its operating position so it can not tip over, fall or slide.
26. Never operate a pump with a power cord that has frayed or brittle insulation.
27. Cable should be protected at all times to avoid punctures, cut, bruises and abrasions - inspect frequently.
28. Never handle connected power cords with wet hands.
29. Do not remove cord and strain relief. Do not connect conduit to pump.
30. To reduce risk of electrical shock, all wiring and junction connections should be made per the NEC and applicable state and local codes. Requirements may vary depending on usage and location. See wiring diagrams in manual.
31. To reduce risk of electrical shock, all wiring and junction connections should be made per the NEC and applicable state and local codes. Requirements may vary depending on usage and location. See wiring diagrams in manual.
32. Do Not operate the pump in the “HAND” control position and leave the pump unattended.
33. CAUTION - This unit may have more than one connection to the source of supply. To reduce the risk of electric shock, disconnect all such connections before servicing.
34. All connections inside this tank and/or junction box must be made with listed watertight connectors.

IMPORTANT! CRANE PUMPS & SYSTEMS IS NOT RESPONSIBLE FOR LOSSES, INJURY, OR DEATH RESULTING FROM A FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS, MISUSE OR ABUSE OF PUMPS OR EQUIPMENT.
SECTION A: GENERAL INFORMATION

A-1) To the Purchaser:
Within the manual you will find the necessary information to verify correct start-up and registration of your Barnes Pump system. This manual will also provide helpful information concerning proper maintenance and troubleshooting procedures.

A-2) Service Centers:
For the location of the nearest Barnes Pumps Service Center, check your catalog, your Crane Pumps & Systems representative or Crane Pumps & Systems Service Department in Piqua, Ohio, telephone 937-778-8947 or go to www.cranepumps.com.

SECTION B: START UP / WARRANTY REGISTRATION FORM

B-1) Start Up Form:
Included at the end of this manual is a start-up report sheet which should be completed as applicable. Return one copy to Barnes and store the second in the control panel or with the pump manual. It is important to record this data at initial start-up since it will be useful to refer to should servicing the pump be required in the future.

B-2) Sample Form:
We have also included a sample form (see Pages 11-12) that has been filled out, to help you better understand some of the information Barnes is asking for. Refer to the sample form as each section of the start up warranty registration is explained.

SECTION C: NECESSARY GENERAL INFORMATION

C-1) Owner Name & Address:
In most cases, this will be the party that will pay for and be responsible for service of the unit. This may be a municipal water or sewer district, or it may be individual home owners.

C-2) Location of Installation & Contact:
The address of where the basin is physically located and who is main contact.

As shown on the sample form, the owner if City of Piqua, but they have installed the basin at a house located at 234 Second Street.

C-3) Pump Model Number:
Pump model number will give Barnes information on your pump size and performance rating, it can be found on the pump nameplate attached to the pump.

Pump Model Number: 4SHVA30042

C-4) Pump Serial Number:
Like the basin serial number, the pump serial number will tell Barnes the plant location of where the pump was built, information specific to the pump, and date pump was built. This can also be found on the pump nameplate.

Pump Serial Number = C575824-0897
C = Covington Avenue Plant, T = Third Street Plant
575824 = Specific pump information
0897 = Built in August, 1997 (Date Code)
SECTION D: CONTROLS

D-1) Panel Model Number:
The panel model number will tell Barnes whether your control panel is a Simplex or Duplex and what options you may have. The panel model number can be usually found inside the control panel cover.

Control Panel Model Number = STEALTH-O-101-21
  STEALTH = Panel Series
  O = Pump Series
  101 = Panel Options
  2 = Horsepower
  1 = Voltage & Phase

D-2) Is Interior Dry:
Check YES or NO. The interior of the control panel must be clean and dry at startup. If moisture is present, determine cause and correct. Check to make sure that all conduit entries in the panel are sealed!

D-3) Are All Connections Tight:
Check YES or NO. It is recommended that all wire connections be checked for tightness in addition to the pump power, control wires, level sensor, and service wires. Check factory connections in the panel to assure that no connections were loosened during shipping.

SECTION E: JUNCTION BOX INFORMATION

CAUTION!
Check to be certain that all power is off.

E-1) Debris in Piping or Wet Well:
Indicate by checking YES or NO. Inspect the basin for anything that may have been inadvertently left in the bottom or rocks and excessive amounts of dirt that may have been dropped in the basin during installation.

E-2) Is Junction Box / Control Panel Dry:
Check YES or NO. The junction box must be dry to avoid power/control problems. If any moisture is present, wipe dry or use a blow dryer if necessary.

E-3) Are all Wire Connections Tight:
Check YES or NO. All wire nut connections in the junction box should be tight. In addition, look for wires that may be exposed beyond the end of the wire nut.

E-4) Are Pump Cords away from Pump:
Check YES or NO. Do not allow excess pump or control cords to hang any lower than the top of the pump.

SECTION F: ELECTRICAL CHECK

F-1) Single Phase:
Check and record incoming voltage to the control panel circuit breaker with the pump off, the reading is taken across L1 and L2 of the circuit breaker on the incoming side (see Figure 1). The voltage reading should be within ±10% of pump rated volts (pump rated volts can be found on the pump nameplate). If your pump is three phase, mark N/A.

F-2) Three Phase:
Check and record incoming voltage to the control panel circuit breaker with the pump off. Readings should be taken across L1 - L2, L2 - L3, and L3 - L1 on the incoming side of the circuit breaker, (see Figure 2). The voltage reading should be within ±10% of pump rated volts and should be balanced within ±1%. Pump rated volts can be found on the pump nameplate. If your pump is single phase, mark N/A.

If incorrect power supply readings are recorded, contact local power source.
**F-3) Resistance of Pump Power Connections:**
Record the ohms (resistance) reading of the motor windings at the pump power connections on the control panel terminal strip with power off. Readings should be taken between red/black, black/white, red/white, (see Figure 3). Compare your ohms readings to the electrical chart in the pump operations manual, you should be within ±5% of resistance listed on the chart.

**1 Phase**

<table>
<thead>
<tr>
<th>Connection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red - Black</td>
<td>Start + Run Resistance</td>
</tr>
<tr>
<td>Red - White</td>
<td>Start Resistance</td>
</tr>
<tr>
<td>Black - White</td>
<td>Run Resistance</td>
</tr>
</tbody>
</table>

**3 Phase**

<table>
<thead>
<tr>
<th>Connection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red - Black</td>
<td>All Three Resistance readings should be the same.</td>
</tr>
<tr>
<td>Red - White</td>
<td></td>
</tr>
<tr>
<td>Black - White</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**
If OHMS reading are not within range, disconnect wires at terminal strip and check again.

**F-4) Resistance Between Ground Lug and outside Pump Case/Rail:**
Record the ohms (resistance) reading between the control panel ground lug and the pump case or the stainless steel rail, if your basin has the rail system (see Figure 4). Resistance readings of less than 1 ohm indicate a good safe ground. (If basin is not located next to the panel, a temporary extension wire from the basin to the meter may be required to take this reading.)

**F-5) Insulation Check at Control Panel:** (MEG-OHM)
The insulation check of the pump power leads is taken at the control panel terminal strip between red/ground, black/ground, and white/ground with the power off, record your readings in meg-ohms (see Figure 5). Readings of 5 meg-ohm and higher are acceptable. Note “0” readings indicate a dead short. Correct the problem before proceeding. **THIS TEST MUST BE PERFORMED AFTER THE GROUND RESISTANCE CHECK IN SECTION F-4.**
SECTION G: PERFORMANCE CHECK

G-1) With discharge valve(s) closed, pull pump and rotate impeller by hand, replace pump.

IMPORTANT!
All power must be off

NOTE:
With the pump power off (circuit breaker) fill the wetwell with enough water to trip the high water alarm float. Open discharge valve in the wetwell and, if necessary, the discharge valve at the force main.

G-2) Is the High Water Alarm On:
Turn power on, is the high water alarm on (red light on top of control panel).

NOTE:
If your control panel is equipped with an alarm horn, push the button on the panel cover to silence.

Let the pump run until the alarm light turns “off”, and manually turn power off at the control panel circuit breaker.

G-3) Alarm Shut Off at Appropriate Level:
Measure the water depth (with pump off) when the alarm shuts off and record if desired.

G-4) Amperage Load at Line Connection:
Single Phase: Using a clamp on amp meter, clamp the amp meter to the L1 wire between the service drop and control panel circuit breaker. Turn pump power on at the control panel circuit breaker, (see Figure 6).

NOTE:
If pump does not come on, push the start button in the control panel. Record the amperage readings of L1 and L2, they should not exceed more than 10% over the pump nameplate amps. If your pump is a three phase, mark N/A.

G-5) Amperage Load at Line Connection:
Three Phase: Using a clamp on amp meter, clamp the amp meter to the L1 wire between the service drop and control panel circuit breaker, (see Figure 7).

NOTE:
If pump does not come on, push the start button in the control panel.

Record the amperage readings on L1, L2, and L3, they should not exceed 10% over the pump nameplate amps. If your pump is a single phase, mark N/A.

G-6) Did the Pump Shut Off at the Normal Off Point:
The pump should have pumped the water level down to the predetermined “Off” point and shut off automatically.

G-7) Visible Leaks:
Check YES or NO. Did you notice any visible leaks when pump was running. You should look for leaks around discharge fitting within the basin, and possible ground water entering the basin around the inlet pipe or cord entries.

G-8) Equipment Difficulties:
List any difficulties encountered during start up and note what, if any, corrective action was taken.

NOTE:
If you encounter any problems during start up, refer to the trouble shooting section of this manual.
SECTION H: FINAL CHECK

H-1) Has the End User Received All Manuals:

H-2) Has the End User been Briefed on Warranty:
A copy of the warranty is in the back of all manuals and should be pointed out to the end user.

H-3) Are the Operation / Maintenance Manuals Saved:
Advise end user to save all Installation/Operation Manuals and keep for future reference.

H-4) Received Above Information:
If possible, have those present at start up, sign and date the start up form if the system is operating properly.

NOTE:
If duplex system is being started, fill out duplicate forms, mark first set PUMP #1 or LEAD, mark second set PUMP #2 or LAG.
START-UP REPORT

General Information
Pump Owner's Name: JOHN SMITH - CITY OF PIONOA
Address: 123 FIRST ST.
Location of Installation: 234 SECOND ST.
Contact Person: JIM SMITH Phone: 333-4444
Purchased From: BARNES PUMPS & SERVICE

Nameplate Data
Pump Model #: YSHMA30042 Serial #: 0679837-0827
Part #: 127452 Impeller Diameter: 195 MM
Voltage: 460 Phase: 3 0 Hertz: 60 Horsepower: 30
Full Load Amps: 36.7 Service Factor Amps: 48.3
Motor Manufacturer: BARNES

Controls
Control panel manufacturer: BARNES
Model/Part number: VERSATROL 060062
Number of pumps operated by control panel:
Short circuit protection? YES X NO Type: CIRCUIT BREAKER
Number and size of short circuit device(s): 2 Amp rating: 50 AMP
Overload Type: HEATER Size: 26 Amp rating: 50 AMP
Do protection devices comply with pump and motor Amp rating? YES X NO
Are all electrical and panel entry connections tight? YES X NO
Is the interior of the panel dry? YES X NO
Liquid level Control Brand and Model: BARNES PN 124522-15

Pre-Start Up
All Pumps
Type of equipment: NEW X REBUILT USED
Condition of equipment at Start Up: DRY X WET NO MUDDY
Was Equipment Stored? YES X NO Length of Storage:
Liquid being pumped: WATER Liquid Temperature: ~75°F
Supply Voltage/Phase/Frequency matches nameplate? YES X NO
Shaft turns freely? YES X NO
Direction of rotation verified for 3D motors? YES X NO
Debris in piping or wet well? YES X NO
Debris removed in your presence? YES X NO
Pump case/wet well filled with liquid before startup? YES X NO
Is piping properly supported? YES X NO

Non-Submersible Pumps
Is base plate properly installed / grouted? YES X NO N/A
Coupling Alignment Verified per I&O Manual? YES X NO N/A
Grease Cup/Or Reservoir Level checked? YES X NO N/A
Submersible Pumps
Resistance of cable and pump motor (measured at pump control):
Red-Black: 0.35 Ohms(Ω)    Red-White: 0.36 Ohms(Ω)    White-Black: 0.36 Ohms(Ω)
Resistance of Ground Circuit between Control Panel and outside of pump: 0.0 Ω Ohms(Ω)
MEG Ohms check of insulation:
Red to Ground: >500    White to Ground: >500    Black to Ground: >500

Operational Checks
Is there noise or vibration present?  YES   NO   Source of noise/vibration: 
Does check valve operate properly?  YES   NO   N/A
Is system free of leaks?  YES   NO   Leaks at: 
Does system appear to operate at design flow rate?  YES   NO
Nominal Voltage: 460 Volt  Phase: 1Ø   (select one)
Voltage Reading at panel connection, Pump OFF: L1, L2 467 L2, L3 467 L1, L3 461
Voltage Reading at panel connection, Pump ON: L1, L2 453 L2, L3 454 L1, L3 457
Amperage Draw, Pump ON:  L1 28.4   L2 28.8   L3 28.9

Submersible Pumps
Are BAF and guide rails level / plumb?  YES   NO
Is pump seated on discharge properly?  YES   NO
Are level controls installed away from turbulence?  YES   NO
Is level control operating properly?  YES   NO
Is pump fully submerged during operation?  YES   NO

Follow up/Corrective Action Required
YES   NO

Additional Comments:
NO ISSUES TO REPORT

Startup performed by:  JOE RUMP       Date:  8-3-10

Present at Start-Up
( ) Engineer:  JIM Designer       ( ) Operator:  SAM USER
( ) Contact:  ( ) Other:

All parties should retain a copy of this report for future trouble shooting/reference

CRANE
A Crane Co. Company

PUMPS & SYSTEMS

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Aqua, Ohio 45356
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Fax: (937) 773-7157
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83 West Drive, Brampton
Ontario, Canada L6T 2J6
Phone: (905) 457-6223
Fax: (905) 457-2650
SECTION I: TROUBLE SHOOTING

I-1) Trouble Shooting Flow Charts:

How to read flow charts

1. Based on your observations and initial inspection of the system, select a Flow Chart I.1.1 through I.1.10.

2. All flow charts start at the top left hand corner, follow the chart in the direction of the arrows. Note the reference number at the top of each block.

ELECTRICAL SAFETY POINTS

Before attempting any repair be sure incoming power is OFF, double check with a volt meter.

1. Visually check power cable for signs of deterioration.
2. Visually check for water intrusion in control panel.
3. Check for low resistance between control panel and ground.
4. Make sure ground (green) in control panel is properly secure.
5. Pull fuses and keep in safe place.
6. Tag control panel with “CAUTION” tag.
7. Secure control panel with padlock.
8. ALWAYS disconnect the pump from the power source before handling or servicing.
9. NEVER handle connected power cords with wet hands.
10. NEVER operate a pump with power cord that is split, frayed, or has brittle insulation.

PROBLEM I.1.1 - Runs in Hand, Does not run in Auto (Float Switch) ................................................................. Page 12
PROBLEM I.1.2 - Seal Failure Light .................................................................................................................. Page 13
PROBLEM I.1.3 - Pump shuts off and turns on independent of switch, trips thermal overload ....................... Page 14
PROBLEM I.1.4 - Pump runs but does not pump down in Hand or Auto. Electrical ........................................ Page 15
PROBLEM I.1.5 - Pump runs but does not pump down in Hand or Auto. Mechanical ................................. Page 16
PROBLEM I.1.6 - Pump noise, Excessive vibration ...................................................................................... Page 17
PROBLEM I.1.7 - Pump will not shut off ........................................................................................................ Page 18
PROBLEM I.1.8 - Circuit breaker trips or fuse blows, pumps do not start .................................................. Page 19
PROBLEM I.1.9 - Pump cycles frequently ........................................................................................................ Page 20
PROBLEM I.1.10 - Failed start capacitor when pump turns on ..................................................................... Page 21
Problem I.1.1
Runs in Hand, Does Not Run in Auto
(Float Switch)

I-2.1
CHECK FOR CORRECT WIRING, LOOSE WIRES, CONTROL PANEL/JUNCTION BOX

BAD

CORRECT WIRING

GOOD

OK, RUNS IN HAND/AUTO

GOOD

BAD

I-2.2
IS THERE WATER TO TRIP FLOAT

NO

ADD WATER

YES

REPOSITION AND CLEAN FLOATS

GOOD

I-2.3
FLOAT HUNG UP

YES

REPOSITION AND CLEAN FLOATS

GOOD

NO

BAD

I-2.4
CONTINUITY CHECK AT CONTROL PANEL

CLOSED

CONSULT FACTORY

OPEN

I-2.5
CONTINUITY CHECK AT JUNCTION BOX

OPEN

REPLACE FLOAT SWITCH

GOOD

CLOSED

I-2.6
REPLACE DIRECT BURIAL CABLE FROM JUNCTION BOX TO CONTROL PANEL
Problem I.1.2
Seal Failure Light

NOTE:
The Seal Probe (Moisture Sensor) is a Normally Open (N/O) Detector. SH Series and explosion proof pumps have a 330K Ohm test resistor across the probes. If a 330K reading is obtained, this should be considered “Open”
Problem I.1.3
Pump Shuts Off and Turns on Independent of Switch
Trips Thermal Overload

I-2.10
EXCESSIVE WATER TEMPERATURE

YES

YES

I-2.1
CHECK FOR CORRECT WIRING, LOOSE WIRED, CONTROL PANEL/JUNCTION BOX

BAD

CORRECT WIRING

GOOD

GOOD

PUMP CYCLES ON HAND/AUTO AT CORRECT LEVEL

BAD

± 10% RATED AMPS

GOOD

GOOD

BAD

I-2.12
PULL PUMP, CHECK FOR JAMMED CUTTER/IMPELLER

CORRECT WIRING

WILL CAUSE HIGH AMPS BY RUNNING ON RIGHT HAND SIDE OF CURVE

CONSULT FACTORY
Problem I.1.4
Pump Runs but Does Not Pump Down in Hand or Auto.
Electrical

IF PROBLEM IS ELECTRICAL

I-2.14 CORRECT ROTATION 3 PHASE ONLY

NO

REVERSE ANY 2 POWER LEADS

PUMP DOWN IN HAND/AUTO

YES

GOOD

REF. (B) MECHANICAL

BAD

I-2.15 CHECK FOR CORRECT INCOMING VOLTAGE

GOOD

I-2.15 CORRECT INCOMING POWER SUPPLY

PUMP DOWN IN HAND/AUTO
Problem I.1.5
Pump Runs but Does Not Pump Down in Hand or Auto.
Mechanical

IF PROBLEM IS MECHANICAL

I-2.16 DISCHARGE VALVE NOT OPEN (WETWELL & MAIN)

OPEN VALVE

PUMP DOWN IN HAND/AUTO

I-2.17 PUMP AIRLOCK

CORRECT FOR AIRLOCK

I-2.18 EXCESSIVE INFLOW

CONSULT FACTORY

CORRECT LEAK

I-2.19 DISCHARGE LEAK

CORRECT LEAK

I-2.12 CUTTER/IMPELLER PLUGGED

PULL PUMP FOR SERVICE

GOOD

BAD

I-2.16 & I-2.29 CHECK VALVE STUCK, DISCHARGE FROM PUMP TO MAIN PLUGGED

REPAIR/REPLACE CLEAN

PUMP DOWN HAND/AUTO

I-2.21 DISCHARGE HEAD TO HIGH

CONSULT FACTORY

YES/NO
Problem I.1.6
Pump Noise
Excessive Vibration

I-2.22
DISCHARGE
PLUMBING OR RAIL
ASSEMBLY LOOSE

YES
TIGHTEN
ALL PLUMBING

NO

I-2.14
PULL PUMP,
CHECK ROTATION

ROTATION CORRECT

NO

I-2.14
PUMP RUNNING
BACKWARDS
3 PHASE ONLY

GOOD

PUMP WAS
RUNNING
BACKWARDS

BAD
CLEAN

GOOD

I-2.12
CLOGGED
IMPELLER/CUTTER

BAD
REPLACE

GOOD

TIGHTEN
ALL PLUMBING

BAD

REMOVE
PUMP FOR
SERVICE

GOOD
Problem I.1.7
Pump Will Not Shut Off

I-2.1
CHECK FOR CORRECT WIRING,
LOOSE WIRES, CONTROL
PANEL/JUNCTION BOX

CORRECT WIRING

GOOD

GOOD

BAD

BAD

SWITCH IN HAND
POSITION

TURN SWITCH TO
AUTO

GOOD

CONSULT
FACTORY

I-2.18
EXCESSIVE
INFLOW

YES

CONSULT
FACTORY

I-2.19
PUMP AIRLOCK

CORRECT FOR
AIRLOCK

GOOD

NO

BAD

I-2.3 & I-2.28
OFF SWITCH
STUCK

YES

I-2.4 & I-2.5
CONTINUITY TEST
FLOAT/SWITCH

GOOD

BAD

I-2.4, 1-2.5 & I-2.23
CONTINUITY TEST
FLOAT/SWITCH "ON"

GOOD

NO

BAD

I-2.24
CONTACT
STICKING

REPLACE
CONTACTOR

GOOD

BAD

CONSULT
FACTORY

I-2.21
PUMP IMPROPERLY
SIZED

YES

CONSULT
FACTORY

NO
Problem I.1.8
Circuit Breaker Trips or Fuse Blows, Pumps Do Not Start
Problem I.1.9
Pump Cycles Frequently

**DISCHARGE VALVE(S) NOT OPEN ALL THE WAY**

- **NO**
  - **OPEN VALVES**
  - **PUMP CYCLES CORRECTLY**

- **YES**
  - **I.2.1 CHECK FOR CORRECT WIRING, LOOSE WIRES, CONTROL PANEL, JUNCTION BOX**
    - **BAD**
      - **CORRECT WIRING**
      - **GOOD**
    - **GOOD**

- **BAD**
  - **POOR CONTROL CIRCUIT NEUTRAL**
    - **YES**
      - **CLEAN/TIGHTEN NEUTRAL WIRE**
      - **GOOD**
    - **NO**
      - **BAD**

- **I.2.19 LEAKING DISCHARGE/WATER INFILTRATION**
  - **YES**
    - **REPAIR OR REPLACE**
    - **GOOD**
  - **NO**
    - **BAD**

- **I.2.29 DEFECTIVE CHECK VALVE**
  - **YES**
    - **REPAIR OR REPLACE**
    - **GOOD**
  - **NO**
    - **BAD**

- **I.2.23 FLOATS SET TOO CLOSE, DEFECTIVE SWITCH**
  - **YES**
    - **REPOSITION FLOAT, REPLACES SWITCH**
    - **GOOD**
  - **NO**
    - **BAD**

- **I.2.12 PUMP CLOGGED**
  - **YES**
    - **REMOVE DEBRIS**
    - **GOOD**
  - **NO**
    - **BAD**

- **I.2.21 PUMP SIZED INCORRECTLY**
  - **YES**
    - **INSTALL LARGER PUMP**
  - **NO**

**CONSULT FACTORY**
Problem I.1.10
Failed Start Capacitor (Single Phase Units With Start Circuit in Panel) When Pump Turns On

1. CHECK FOR CORRECT PUMP POWER LEADS AT TERMINAL STRIP
   - GOOD
   - BAD

2. CHECK FOR CORRECT PUMP POWER CONNECTION AT JUNCTION BOX
   - GOOD
   - BAD

3. MEGGER CONTROL PANEL TO JUNCTION BOX
   - GOOD
   - BAD

4. REPLACE START CAPACITOR
   - GOOD
   - BAD

5. CHECK AMPS
   - OK
   - BAD

6. PUMPS RUN
   - OK
   - BAD

7. CHECK START RELAY
   - OK
   - BAD

8. CONSULT FACTORY
   - BAD

9. REPLACE
   - BAD
SECTION I: TROUBLE SHOOTING

I-2.1) Check for Correct Wiring:
Check all switch control leads for correct color coding or number marking. Trace all leads through junction box to correct terminal in the control panel. Refer to appropriate wiring diagrams in service manual, control panel, and junction box.

NOTE:
Pump power leads at control panel terminal strip must be red to R, black to B, and white to W.

When checking for correct wiring, look for moisture in the control panel or junction box, corrosion at wire connections, loose wire connections, and poorly stripped wires. All of the above can contribute to control problems.

I-2.2) Check Water Level:
Remove wetwell cover and check water level. If the water level is above the “On” float, this should be sufficient to close all switches.

I-2.3) Float Hang Up:
Visually check float movement while filling basin. If floats get hung up on pump or rail system, reposition floats and check again. Inspect floats for build-up of solids, clean, and check operation.

I-2.4) Continuity Check of Controls:
Turn off Main Circuit Breaker at control panel. Fill basin to a level above the alarm float, this will allow all switches to be closed. Referring to the wiring diagram supplied with panel, check for continuity at the control panel terminal strip. Off, On, and alarm switches should be closed (continuity), (see Figure 8).

Turn on the Main Circuit Breaker and manually pump the basin down to the bottom of the pump volute. Turn off the Main Breaker and repeat the continuity check. Off, On, alarm switch should be open (no continuity). If these conditions are not met, go to L.2.5.

I-2.5) Continuity Check of Controls:
AT JUNCTION BOX. Fill wetwell to a level above the discharge elbow, this will allow all switches to be closed. Refer to the wiring diagram supplied with the basin, turn off the main breaker, disconnect all switch control leads at the junction box, check for continuity from switch controls to junction box. Off, On, and alarm switches should be closed (continuity), (see Figure 9).

CAUTION!
When the breaker is turned on, the control leads may be energized with 120 V. Make sure they are safely tied off and isolated.

I-2.6) Replace Cable between Panel & Junction Box:
If it is necessary to replace the direct burial cable, note the following:

1. Is the cable the same size/type.
2. Reseal conduit entering control panel.
3. Are the cord grip grommets in the junction box the correct size.
4. Use “NEW” wire nuts in the junction box.
5. How did the cable get damaged?
I-2.7) Moisture in Control Panel/Junction Box:
The accumulation of moisture in the controls can lead to a number of electrical problems. If moisture is evident, turn power to the control panel off and thoroughly dry with a blow dryer. After drying, check for loose or corroded connections, determine cause of moisture, and correct.

I-2.8) Continuity Check Moisture Sensor, Control Panel:

NOTE:
The moisture sensor is a (N/O) normally open detector. SH Series and explosion proof pumps have a 330K Ohm test resistor across the probes. If a 330K reading is obtained, this should be considered “Open”.

In the event of a moisture detect, check the moisture sensor leads for continuity. Refer to wiring diagram supplied with panel. If resistance is detected, check for continuity in junction box, (see Figure 10).

I-2.9) Continuity Check Moisture Sensor, Junction Box:

NOTE:
The moisture sensor is a (N/O) normally open detector. SH Series and explosion proof pumps have a 330K Ohm test resistor across the probes. If a 330K reading is obtained, this should be considered “Open”.

If checking moisture sensor leads at the control panel for continuity indicates the presence of moisture, disconnect the moisture sensor leads in the junction box and check for continuity from junction box to pump, (see Figure 11).

I-2.10) Excessive Water Temperature:
Continuous water temperatures above 100°F (38°C) may cause the pump temperature sensor to open and trip the thermal overload. To determine if this is happening, turn power off and fill the basin with cold water (allowing time for the pump to dissipate heat). Turn power on and check for normal pump cycle. Continuous operation with the pump unsubmerged may result in the same symptoms. Consult pump manual for minimum submergence requirements.

NOTE:
Water temperature not to exceed 160°F (71°C) intermittent.
I-2.11) Check Motor Amperage:
With the power off, clamp the amp robe around the appropriate lead. Fill basin so pump will be under load and turn pump on. Record amperage readings on all necessary leads. Compare your recorded amperage with the nameplate rating and the amperage recorded on the system start-up sheets. (See Figures 12 and 13). Amps will drop as motor becomes warm.

NOTE:
Must not exceed ± 10% nameplate amps at nominal voltage.

I-2.12) Jammed Cutter/Impeller:
With the power off and the control panel locked, check the cutter/impeller for freedom of movement, you should be able to move the cutter by hand.

If clogged, clear the cutter/impeller cavity of any obstruction. If all the debris cannot be removed, it may be necessary to remove the volute to clean around the impeller, refer to pump Installation/Operation Manual.

I-2.13) Check Application:
Check for undersized pump or incorrect impeller installed for conditions. Recheck performance curve. It is possible the original pump selection is at fault or system head has changed.

I-2.14) Correct Pump Rotation:
All Barnes Submersible Pumps rotate “clockwise” looking down at the pump. To check rotation, suspend the pump freely, momentarily apply power, and observe the “kickback”. Kickback should always be in a counterclockwise direction as viewed from the top of the pump motor housing.

Incorrect rotation three phase: In the event that the rotation is incorrect for a three phase pump, interchange any two power cable leads at the control panel. Do not change power cable leads in the pump. Recheck the “kickback” rotation again by momentarily applying power.

Incorrect rotation single phase: In the unlikely event that the rotation is incorrect for a single phase pump, contact a Barnes Pump’s Service Center.

I-2.15) Check for correct incoming voltage:
Single Phase: Check incoming voltage on the line side of the control panel circuit breaker. Readings of ± 10% of published voltage (nameplate) are acceptable. A true check of the voltage supply to the motor must be taken with the pump operating under load, (see Figure 14).

Figure 12

Take voltage readings with the pump “off” and readings with the pump “on”, compare the two readings and note any difference.

Figure 13

If incorrect power supply readings are recorded, contact local power source.
Three Phase: Check incoming voltage on the pump side of the control panel circuit breaker. Readings of ± 10% of the published voltage (nameplate) are acceptable. A true check of the voltage supply to the motor must be taken with the pump operating under load, (see Figure 15).

Take voltage readings between all three legs with the pump “off” and readings with the pump “on”, compare the two readings and note any difference. Also note whether or not the voltages between all three legs are similar (balanced).

Figure 15

I-2.18) Excessive Inflow:
Inflow may be at a rate greater than pumping rate, compare inflow with pump curve.

Excessive inflow may also be due to ground water infiltration. With wetwell level pumped down as low as possible, check for ground water leaks around inlet and discharge lines. Check for leaks through damaged or cracked basin wall. Note the wetwell installation, if the top of the basin is below grade level, ground water may be entering around the lid or vent.

I-2.19) Discharge Leak:
Pump wetwell down (below discharge plumbing) observing discharge line, check for plumbing leaks while line is under pressure, repair fixtures, or discharge gasket as required.

I-2.20) Impeller/Cutter Damage:
If the impeller and or cutter is damaged or excessively worn, it must be replaced, see appropriate disassembly/assembly section in this Pump manual. NOTE: If the cutter on grinder pumps is excessively worn the shredding ring may be reversed.

I-2.21) Discharge Head Too High:
Check total head and pump performance curve and that the correct impeller has been installed or consult factory.

I-2.22) Discharge Plumbing or Rail Assembly Loose:
With pump running, check for loose pipe attachments and/or loose rail assembly. Make any necessary adjustments.

I-2.23) Adjust Float or Replace Switch:
If floats are used, you may have to reposition “on” float to get a longer pump down cycle. You may also have a float stuck in the open position.

I-2.24) Contactor Sticking:
The connector used in many control panels can be tripped on/off manually. With the liquid level above the “on” float, turn pump on, this will close the connector. Allow the system to pump down to the “off” level. If the pump does not shut off, manually turn it off. If the connector is still closed, it is sticking and should be replaced.

If incorrect power supply readings are recorded, contact local power source.

I-2.16) Discharge Valve Open:
Inspect discharge and check valves for correct installation. Are they installed backwards. (check valve). Is the valve at the basin and main open. Is the check valve stuck. Is discharge line from pump to main plugged.

I-2.17) Pump Air Locked:
If the pump has become air locked, it will not pump the basin down, air locked pumps may be corrected in one of the following manners.

- Shake pump up and down by the lifting rope, do not pull on the power or control cables.
- Close and open discharge valve a few times in quick succession.
- Start and stop pump a few times allowing 2 or 3 minutes between stop and restart.
- On small pumps, a ¼” bleed hole can be drilled in the discharge pipe just beyond the connection point to bleed off air.

I-2.19) Discharge Leak:
Pump wetwell down (below discharge plumbing) observing discharge line, check for plumbing leaks while line is under pressure, repair fixtures, or discharge gasket as required.
I-2.25) Check Circuit Breaker and Fuse Rating:

**NOTE:**
Control Panel Circuit Breaker (short circuit protection) should be rated at least 20% higher than pump full load amps, but no more than 3 times the full load amps. Current overloads should be sized in accordance with pump nameplate amps.

<table>
<thead>
<tr>
<th>Conditions of Motor and Leads</th>
<th>OHM Value</th>
<th>MEG-OHM Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A new motor (without Drop Cable).</td>
<td>20,000,000 (or More)</td>
<td>20.0</td>
</tr>
<tr>
<td>A used motor which can be reinstalled in the well.</td>
<td>10,000,000 (or More)</td>
<td>10.0</td>
</tr>
<tr>
<td>Motor in well. Ohm readings are for drop cable plus motor.</td>
<td>2,000,000 (or More)</td>
<td>5.0</td>
</tr>
<tr>
<td>A new motor in well.</td>
<td>500,000 - 2,000,000</td>
<td>0.5 - 5.0</td>
</tr>
<tr>
<td>A motor which may have been damaged by lighting or with damaged leads.</td>
<td>20,000 - 500,000</td>
<td>0.02 - 0.5</td>
</tr>
<tr>
<td><strong>DO NOT</strong> pull the pump for this reason.</td>
<td>10,000 - 20,000</td>
<td>0.01 - 0.02</td>
</tr>
<tr>
<td>A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will not fail for this reason alone, but it will probably not operate for long.</td>
<td>Less Than 10,000</td>
<td>0 - 0.01</td>
</tr>
<tr>
<td>A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I-2.26) Megger Control Panel to Pump:
With power “off” at the control panel, disconnect the pump power cable leads from the control panel.

![Figure 16](image1)

Connect one lead to ground (green) and check red, black, white power cord leads, (see Figure 16). A minimum insulation resistance readings of 5MΩ is considered acceptable. Readings of less than 5MΩ indicates a bad circuit between control panel and pump, (See Resistance Values on Page 30).

I-2.27) Megger Junction Box to Pump:
With power “off” at the control panel, disconnect the pump power cable leads at the junction box.

![Figure 17](image2)

Connect one lead to ground (green) and check red, black, white power cord leads, (see Figure 17). A minimum insulation resistance reading of 5MΩ is considered acceptable. Readings of less than 5MΩ indicates a bad circuit between junction box and pump, pull the pump for service.

I-2.28) Poor Neutral:
With power “off” check for “clean” tight neutral connection on control panel terminal strip, also check neutral connection at power supply. Refer to appropriate wiring diagram in service manual.

I-2.29) Defective Check Valve:
If the check valve is not installed properly or is defective, this will allow back flow at the end of the pump cycle. Remove and examine check valve for proper installation and freedom of movement, repair, or replace.

I-2.30) Faulty Relay or Start Capacitor:
Checking the start relay, (see Figure 18).

**CAUTION!**
Be sure to short out start capacitor and remove wires from relay terminals before making any resistance checks with ohmmeter. Always remove all power from circuits before making resistance measurements.

![Figure 18](image3)

Measure Between Terminals 1 and 2: Zero Ohms.
Measure Between Terminals 2 and 5: Actual coil resistance.

**Relay Check:** The terminals on the relay used in this check are numbered. The numbers are stamped on the backlight housing next to the terminals. With Ohmmeter set on the R x1 scale, the reading between Terminals number 1 and number 2 should be all the way to the right of the scale or zero. **On some occasions due to higher than expected amp draws through the relay, the contact may permanently “weld” together.** A relay with welded contacts will cause start capacitors to overheat and become defective. A relay with welded contacts will often measure good with an ohmmeter (O) even though it is defective.
If start capacitor is found faulty, it is suggested that the relay cover be removed (two screws) and the contact points physically checked for contact surface condition as well as freedom of movement.

The reading between Terminal number 2 and number 5 should show the resistance in the relay holding coil. If it shows open, then the coil has burned up. If it shows no resistance, it may have shorted out. Either way, replace the relay.

I-2.31) Checking Run and Start Capacitors:

CAUTION!

IF CAPACITORS ARE BEING CHECKED WHILE STILL IN THE CONTROL, PROCEED WITH STEPS 1 - 4.

1. Remove and lock “off” all power to control.

2. Using a screwdriver, with an insulated handle, short circuit each capacitor by placing the blade of the screwdriver across the two terminals of each capacitor. This will “discharge” the capacitor.

3. Remove all leads connected to capacitor terminals. (It is most important to make note of the position of leads so that they will be properly reconnected after testing.)

4. Remove any resistors found across the capacitor terminals (usually found on start capacitors).

CHECKING CAPACITORS: The following checks made with a Simpson Ohmmeter, Model Number 372, or equivalent, apply to both RUN and START CAPACITORS except for the range setting or scale used. (If a digital meter with a capable of measuring capacitance is used, verify the reading obtained matches the capacitance on the capacitor case)

Use scale R x 100K for Run Capacitors and R x 10K for Start Capacitors.

The following check can be taken with capacitors on the bench or in the control.

Check each capacitor by clipping an ohmmeter lead to one of the capacitor terminals and touching the other ohmmeter lead to the other terminal for a few seconds. NOTE: Results as follows:

- A good Run Capacitor is indicated by pointer of ohmmeter moving towards zero (the figure “0” on right-hand side of scale) and then slowly drifting back towards the left.
- When checking a Start Capacitor, you will note (depending on MFD rating), that some of them will not move the ohmmeter needle to complete zero before it is on its way back and that, unlike the Run Capacitors, the needle will not always move all the way to the left side of the scale. The reason for this is the much higher rating of Start Capacitors.
- If the pointer remains at infinity (00), capacitor is “open”.
- If the pointer remains at zero (0), capacitor is “shorted” A shorted or open capacitor must be replaced.

NOTE:
The above test builds up a small charge in the capacitor which it will store. Before repeating test or reconnecting capacitors, discharge capacitor by shortening terminals with an insulated screwdriver. A good capacitor will discharge a small spark.

Check each metal Run Capacitor for grounds by clipping one ohmmeter lead to capacitor case and the other ohmmeter lead, in turn, to each of the two capacitor terminals. With ohmmeter set at R x 100K, pointer should remains at infinity(00) on extreme left of scale. Start Capacitors often have backlight case and cannot be checked by this method for ground.
IMPORTANT!
WARRANTY REGISTRATION

Your product is covered by a warranty:
www.cranepumps.com/downloadables/CATALOGS_OIPMs/Warranty/24MonthWarranty.pdf

If you have a claim under the provisions of the warranty, contact your local Crane Pumps & Systems, Inc. Distributor.

RETURNED GOODS
RETURN OF MERCHANDISE REQUIRES A "RETURNED GOODS AUTHORIZATION".
CONTACT YOUR LOCAL CRANE PUMPS & SYSTEMS, INC. DISTRIBUTOR.

Products Returned Must Be Cleaned, Sanitized, Or Decontaminated As Necessary Prior To Shipment, To Insure That Employees Will Not Be Exposed To Health Hazards In Handling Said Material. All Applicable Laws And Regulations Shall Apply.