



# **STEAM HUMIDIFIER OPERATING MANUAL for KUE TYPE HUMIDIFIERS**



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MANUFACTURER'S NOT RESPONSIBLE FOR HUMIDIFIER OPERATION AND PERFORMANCE BASED ON CONDITION OF WATER QUALITY.

(REFER TO PAGE 5)

## MOUNTING

Typically the humidifier option ordered with units will be installed, piped, and wired internally at the factory. In some instances the humidifier package may not physically fit internal to the unit. In this case a separate humidifier package will be provided to be mounted and wired in the field.

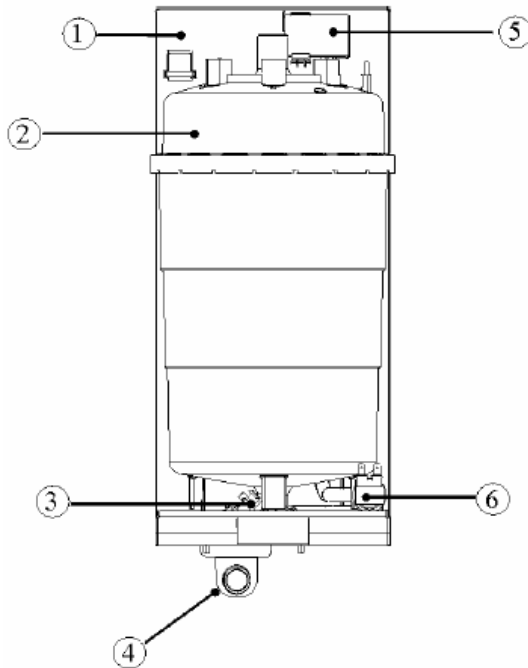
## FACTORY TESTING

All humidifiers are functionally run tested at the factory. This does not guarantee the humidifier will operate correctly at the site of installation due to water quality or applied voltage. The equipment installer must verify all piping and electrical connections are intact after shipment and before startup of the equipment.

## PRINCIPLE OF OPERATION

### Component Basics

Refer to Figure 1 – Steam Humidifier for the components that make up the humidifier.



**FIGURE 1 – STEAM HUMIDIFIER**

1. Humidifier Housing
2. Steam Cylinder
3. Fill Valve
4. Drain Connection
5. Fill Cup and Conductivity Sensor
6. Drain Valve

### Operation

Refer to Figure 2 – Humidifier Operation for details. On a call for humidification by the unit controller (A), the humidifier controller (B) will activate the humidifier contactor (C) to apply voltage to the electrodes in the steam cylinder (D). At the same time, the fill valve (E) will energize and open the valve to fill to admit water through the conductivity sensor (F). The conductivity is read through the conductivity sensor internal to the fill cup.

**FIGURE 2 – Humidifier Operation**

Water will continue to fill the cylinder until the water reaches the minimum position required for the minimum operating capacity.

Water is a conductor of electricity because it contains minerals (salt); so when the voltage is connected across the electrodes, it will start to conduct current through the water. This current will produce heat. Water will fill the bottle to the minimum point to allow the quickest response for the water in the cylinder to start boiling. Once enough heat is generated in the water by passing the current through it, the water will start to boil. At that point, low pressure steam will flow through the distribution pipe to the air stream.

As the water continues to boil, the water and current levels in the bottle will start to reduce. The fill valve will open slowly filling the bottle with water allowing the current to increase until the maximum humidification capacity is reached by the humidifier's control board.

Current level will vary based on conditions of supply water, applied voltage, and cylinder conditions. A new cylinder will have less current due to lower salt content. When the water evaporates creating steam, the salt will remain in the bottle which causes the conductivity to increase. An increase in conductivity causes an increase in operating current. When water is replenished to the bottle through the fill valve, it mixes with the existing water and salt content. Some of the freshly added water's salt content is converted to lime scale. This lime scale over time causes a rapid depletion in cylinder life. Since the conductivity sensor's function is to read the conductivity, the sensor will determine when the salt content is too high. At that point, the cylinder will perform a drain to flush the bottle of a large amount of water and salt content and then refill to bottle with a supply of fresh water.

## **WATER QUALITY**

- A. Inlet water pressure must be between 15 psi and 115 psi. Install a water pressure regulating valve for inlet water pressures higher than 115 psi.
- B. Use only potable water.
- C. Water conductivity should be between 300 and 1250 Micromhos. (Optimum humidifier performance is achieved between 300 and 500 Micromhos.)
- D. When water conductivity is consistently lower than 300 Micromhos, consider the use of a low conductivity steam cylinder. Inquire with the unit supplier about these lower conductivity cylinders.
- E. Never use a sole supply of de-mineralized water as there is no salt content to conduct current through the water. If water conductivity is high, de-mineralized water can be used to dilute the water supply.
- F. pH level of the water must be 7.0 to 8.5.

## **CYLINDER LIFE**

Normal life expectancy of the steam cylinder ranges from 500 to 4000 hours and depends on water quality, applied voltage and profiled usage.

Check the following conditions when the life of a cylinder is less than normal:

### **Cylinder Color**

Cylinder color is a good indicator of proper humidifier operation. The cylinder will appear to have a white to tan color when operating properly. When the cylinder color appears black with a presence of sludge internal to the cylinder, it is a good indication that there is an operational problem with the system. Disconnect power from the humidifier and the component controlling the humidifier and place a magnet internal to the cylinder. If iron filings are pulled from the sludge by the magnet, there is a water quality problem or problem with draining and filling.

### **Filling and Draining Conditions**

- A. Sagging or kinked steam hoses can cause condensate to collect internal to the steam hose. This creates an increased amount of back pressure on the cylinder and forces the fresh water filled to drain immediately.
- B. Constant cycling of the humidifier due to a non-standard set point/operating value.
- C. An increase amount of fill time (more than 5 minutes) due to a clogged or defective fill valve.
- D. A blocked drain screen or defective drain valve causing a real slow drain or not at all.

### **Optimum Water Conductivity**

Since optimum water conductivity for the humidifier is 150 to 350 Micromhos, a cylinder operating on conductivity higher

than this will have a shortened operating life. For example, a cylinder operating on water conductivity of 1700 Micromhos will have life of approximately 500 hours. The only solution to bring the water conductivity down is to dilute the main water supply with a mixture of de-mineralized water to bring the water supply closer to the optimum conductivity range.

### **Softened Water**

Softened water can be used only when the water conductivity is below 250 Micromhos. Even under 250 Micromhos, there are no guarantees the humidifier will operate properly and have a typical life expectancy. Softened water contains Sodium that tends to remain in the water longer and will not plate on the electrodes as quickly as normal salt content.

When the conductivity of softened water is above 250 Micromhos, the water pH level tends to become too basic becoming extremely corrosive to the electrodes. It will also cause an excessive amount of foaming promoting mineral traces in the bottle which leads to arcing internal to the cylinder. Long term arcing will damage not only the cylinder but also the contactor.

### **Extended Periods of Non-Use**

During extended period of non use due to vacations or holidays, the cylinder should be drained so that water does not stand in the cylinder without the humidifier operating. Water in contact with the electrodes for long periods of time without operating will cause premature deterioration and rusting of the electrodes. Algae growth internal to the cylinder may also cause odors on humidifier restart.

A field installed manual drain switch may be connected to a set of remote drain contacts on the humidifiers control boards. A field supplied mounted and wired 3 position switch (ON-OFF-ON) is required to make use of the manual

drain contacts. Refer to Figure 3 – Drain Switch for wiring instructions.

### **Water Analysis**

Water properties should be checked before startup and on an occasional basis. Checks should be made on the level of silica, nitrates, phosphates, iron, total dissolved solids, pH, solvents diluents, detergents and lubricants. Water contains high amounts of nitrates or iron in which the levels can be reduced by adding the proper filters containing activated charcoal (referred to as the taste and odor filter). Water with a large amount of silica content should be filtered with a 1-micron particulate filter.

Phosphates are used by municipalities and some buildings to coat and protect old piping (or lead pipes) to prevent corrosion. The protective coating actually works against the humidifier by coating the electrodes with a film which acts like an insulator. This film buildup prevents conduction of the electrical current through the electrodes and prevents steam generation. Water supply for the humidifier should be tapped before phosphate feeders in buildings that have their own phosphate feeders. If the phosphates are mixed in from the local water source, a charcoal filter may help remove a quantity of the phosphate content.

### **SUPPLY WATER CONNECTIONS**

A ¼" flare fitting is supplied on the unit for connection of the main water supply tubing to the humidifier.

**WARNING:** The fitting attached to the panel must be held with a wrench when tightening the field supplied flare connection.

Install 3/8" to 1/2" main supply water line to within 1 foot of the unit before reducing to ¼" OD tubing for the flare connection. An air gap is built in to the humidifier to satisfy U.L. and local

requirements where for backflow prevention.

The supply tube internal to the unit from the flare fitting to the humidifier is 1/4" copper tubing. It is attached to the humidifier fill valve using a plastic 3/4" MPS female connector.

**WARNING: The plastic fill fitting into the humidifier assembly must be hand tightened only. Never re-tighten this fitting using tools. This should be tightened by hand only.**

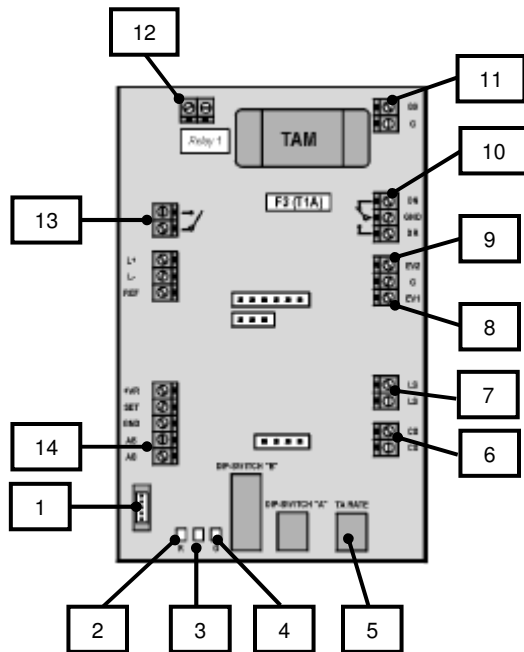
**HUMIDIFIER DRAIN CONNECTION**

The water from the humidifier cylinder is drained directly into the unit's condensate drain pan.

**DANGER: Drain water temperatures can exceed 200°F.**

**OPERATING THE HUMIDIFIER**

The humidifier control board is mounted internal to the electrical box section of the unit. See Figure 3 – Humidifier Control Board for reference.



**FIGURE 3 – Humidifier Control Board**

1. Connector for Remote Keypad.
2. Alarm Indicator (Red)
3. Humidifying Indicator (Amber)
4. Power Indicator (Green)
5. Current Transformer Dip Switches
  - a. Factory Set
6. Conductivity Sensor Input
7. Level Indicator Input
8. Fill Solenoid Valve Connection
9. Drain Solenoid Valve
10. Manual Drain Terminals
11. Control Voltage Terminals
12. Relay Contact for Contactor
13. Remote ON/OFF
14. Remote Alarm Contacts

**Humidity High Limit Safety**

In addition to the main control board, there is a humidity high limit switch located in the evaporator's air stream which acts as a safety to prevent high humidity within the unit's cabinet. Its main function is to prevent saturation internal to the cabinet. See Figure 4 – Humidity High Limit Switch for reference.

This device is not used to control the humidification activation point. Set it to 90 - 95%.

**NOTE:** On Marvel Microprocessor controlled units, no alarms will be displayed if this switch opens. The humidifier will automatically re-start the when the humidity level internal to the cabinet falls below the reset point.

**START UP CHECKLIST**

Check the main electrical supply to the unit to make sure it is in the off position.

**Checklist:**

- \_\_\_ 1. Verify the input power from the main supply matches the power required to operate the humidifier?
- \_\_\_ 2. Check all power block connections and control voltage termination points for tightness.

- \_\_\_ 3. Supply water connected and properly tightened?
- \_\_\_ 4. Verify the power wires attached to the electrodes on the top of the steam cylinder are tight?
- \_\_\_ 5. Steam hoses have no kinks and are properly supported to prevent sags?
- \_\_\_ 6. All clamps on steam hoses are tight?
- \_\_\_ 7. Bottle is securely fasten in the base of the humidifier?
- \_\_\_ 8. All sensors and limit switches are connected as shown in the electrical diagrams and mounting instructions?

**Startup:**

1. Turn water on to the humidifier at the main water supply.
2. Turn power on to the unit at the main power supply.
3. Set the humidity setting on the controller to about 65% for testing purposes.
4. The Amber indicator light should turn on indicating the system is calling for humidification.
5. After 10 seconds, the fill solenoid valve should energize and the steam cylinder should start to fill with water.
6. The water will fill to a minimum position and the water conductivity will be checked by the conductivity sensors in the fill cup.
7. Filling will stop at the minimum position until the proper electrical current is reached.
8. Once the proper current is achieved, the bottle will start to fill again until the maximum operating current is met.
9. The bottle will always maintain the water level at the proper level to maintain an air gap or if the water level is low, the proper electrical current is already met.

**Starting the humidifier with Water Conductivity Higher than 1000 Micromhos**

10. When starting the humidifier with water properties higher than 1000 Micromhos, the humidifier will fill with water and the electrical current and steam output before the steam cylinder fills completely. As the water begins to boil, the conductivity will increase and the humidifier control board will periodically open the drain solenoid valve while filling to reduce the conductivity so the system does not draw over full load current. Once the water reaches the full operating level, normal drain and fill will take over.

**Starting the Humidifier with Water Conductivity Lower than 1000 Micromhos**

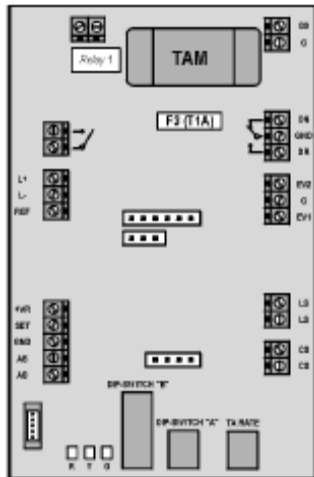
11. When starting the humidifier with the water properties lower than 1000 Micromhos, the steam cylinder will completely fill with water before electrical current draw is achieved. The water on the fill probes will boil off and at that point the system will start to search for minerals.

**Starting the Humidifier with Water Conductivity Lower than 100 Micromhos**

12. When starting the humidifier with water conductivity of less than 100 Micromhos, the steam output usually will not even reach the lowest output capacity. To temporarily start the humidifier, remove power form the unit and remove the steam hose outlet from the top of the humidifier. Add ½ teaspoon of salt to the steam cylinder. Re-attach the steam hose and re-apply power to the unit. If the humidifier starts, there is definitely a conductivity issue. Low Conductivity humidifier steam cylinders are available through the factory for these applications. Contact the local United CoolAir equipment distributor for details.

## Cylinder Foaming

13. If water in the cylinder starts to foam, the unit may deactivate the power condactor and activate the fill valve for a short period. If the foam collapses, the unit will then activate a drain cycle and refill. This can occur repeatedly until the foaming has been eliminated and is a normal routine.
14. Startup of the humidifier is complete. Set the humidity set point to the customer's desired humidity level setting.



## MAINTENANCE

### Steam Cylinder

Periodic cleaning of the cylinder may be required to prolong cylinder life.

Clean the Steam Cylinder as follows:

1. To drain the steam cylinder of all water, remove power from the unit. Next, remove the factory installed jumper from the ON and GND terminals. Place the jumper across the DR and GND terminals on the control board or by switching the field installed drain switch to the drain position to perform manual drain.

2. Reapply power with the jumper installed from the GND and DR terminals and allow the cylinder to drain completely.
3. Shut off power to the unit again.
4. Allow the steam cylinder to cool for a bit.
5. Loosen all hose clamps and electrode power leads.
6. Loosen the rubber strap that holds the steam cylinder into the humidifier housing.
7. Remove the humidifier steam cylinder.
8. Remove the cylinder's drain screen (if present).
9. Clean the cylinder by washing out all heavy mineral deposits with water.
10. Apply a cap to the steam outlet and add a 5% solution of phosphoric acid solution (humidifier cleaner) or a 50% solution of Lime Away®.

NOTE: If the electrodes look badly deteriorated, replace the steam cylinder.

11. Remove the cap from the steam cylinder outlet and re-install in the humidifier housing.
12. Replace the strap to secure the steam cylinder to the humidifier housing.
13. Replace the electrical power wires onto the electrodes making sure to tighten the connections fairly tight.
14. Reattach the steam hoses and clamps.
15. Restart the unit.

NOTE: The manufacturer assumes no liability for problems that occur related to cleaning and re-use of steam cylinders.

### Fill Valve and Drain Valve

The Fill Valve and Drain Valves may be cleaned at the same time as the steam cylinder. Shut the water valve off the supplies the water from the main water supply. Disconnect the plastic 3/4" MPS connector from the fill valve. Remove the Fill and Drain valves with a Phillips head screw driver. Remove the inlet strainer from the inlet of the Fill Valve with a pair of

needle nose pliers. Clean the Fill and Drain valves using a mixture of the same solution recommended to clean the steam cylinder.



**WARNING: DO NOT SOAK VALVES. Apply solution with a brush then rinse with clean tap water. Do not poke anything into the fill valve regulator area as it may destroy the fill valve.**

## **ALARMS AND FAULT CONDITIONS**

When an alarm appears, the Red LED indicator on the humidifiers control board will blink short or long blinks. As long as the Red LED indicator is blinking, an alarm condition is still present. To clear the alarm after removing the condition for alarm, remove power from the system for 5 seconds then re-apply. If the alarm is still present, the Red LED indicator will continue to blink.

Refer to the literature for the CP4 Control Board the appropriate amount of short and long blinks.

## ALARMS

Red LED Flashing	Cause	Resolution	Reset	Alarm Relay
2 Short	Electrode Over Current. <ol style="list-style-type: none"> <li>1. Water conductivity too high. Usually when starting after a short period.</li> <li>2. High water level due to failed drain valve.</li> <li>3. Water level high due to leaking drain valve.</li> <li>4. Defective Electrode(s).</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain a portion of the water and re-start the system.</li> <li>2. Verify the drain valve operation.</li> <li>3. Check for leaking drain valve.</li> <li>4. Replace steam cylinder.</li> </ol>	Manual	Closes On Alarm
3 Short	No Voltage across electrodes.	<ol style="list-style-type: none"> <li>1. Check function of Contactor CHU for operation.</li> <li>2. Check Voltage on both sides of CHU contactor.</li> <li>3. Check Remote ON/OFF contact.</li> </ol>	Manual	Closes On Alarm
4 Short	Internal memory error.	<ol style="list-style-type: none"> <li>1. Download the default program from factory.</li> </ol>	Manual	Closes On Alarm
5 Short	High Conductivity of the Supply Water.	<ol style="list-style-type: none"> <li>1. Clean conductivity Electrode Probes.</li> <li>2. Change water source.</li> <li>3. Install a water treatment system for partial demineralization.</li> </ol>	Manual	Close On Alarm
2 Long	Cylinder depleted.	<ol style="list-style-type: none"> <li>1. Replace Cylinder.</li> </ol>	Manual	Open On Alarm
3 Long	Lack of Supply Water	<ol style="list-style-type: none"> <li>1. Check for restriction in water lines.</li> <li>2. Check operation of fill valve.</li> <li>3. Check for Back Pressure on Steam Hose due to a restriction in hose.</li> </ol>	Manual	Closes On Alarm
4 Long	Excessive steam reduction.	<ol style="list-style-type: none"> <li>1. Cylinder depleted or excessive foam. Replace cylinder.</li> </ol>	Manual	Closes On Alarm
5 Long	Drain Malfunction	<ol style="list-style-type: none"> <li>1. Check operation of the drain valve.</li> </ol>	Manual	Closes On Alarm
6 Long	User parameter error	<ol style="list-style-type: none"> <li>1. Download the proper default program.</li> </ol>	Manual	Closes On Alarm
7 Long	Supply water conductivity pre-alarm	<ol style="list-style-type: none"> <li>1. Check the conductivity of the supply water.</li> <li>2. Install a water treatment system for partial demineralization.</li> </ol>	Automatic	Open On Alarm
8 Long	External Command not Connected Properly	<ol style="list-style-type: none"> <li>1. Check connection from the external voltage regulator.</li> </ol>	Automatic	Open On Alarm
9 Long	Cylinder Full with Production and No Output	<ol style="list-style-type: none"> <li>1. Check for leaks on fill valve.</li> <li>2. Turn off system and check and/or clean the electrodes.</li> </ol>	Manual	Closes On Alarm

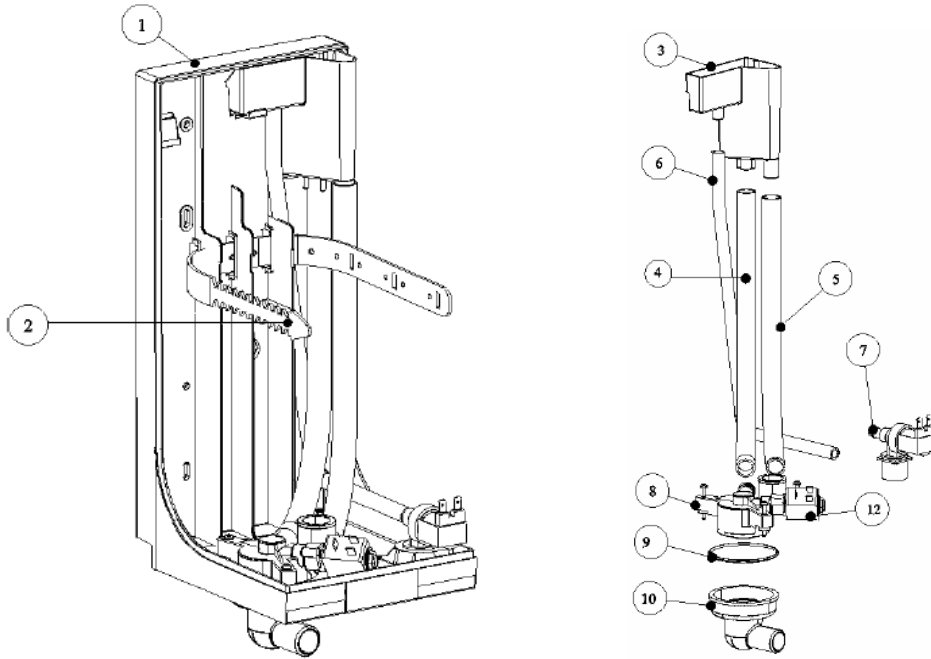
10 Long	Foam Inside the Cylinder.	<ol style="list-style-type: none"> <li>1. Foaming is caused by detergents or softeners or an excessive concentration of dissolved salt. Drain cylinder and check the water supply.</li> <li>2. Clean water lines and cylinder.</li> </ol>	Manual	Open On Alarm
11 Long	Cylinder depleted or corroded.	<ol style="list-style-type: none"> <li>1. Replace Cylinder</li> </ol>	Manual	Open On Alarm

## BASIC TROUBLESHOOTING

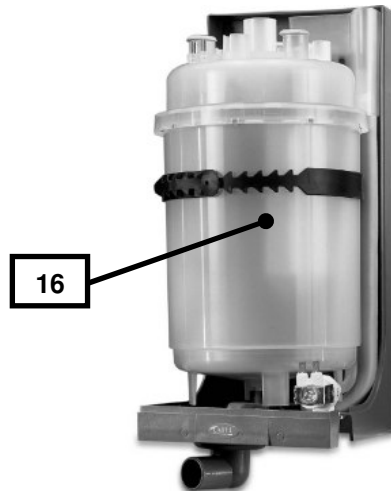
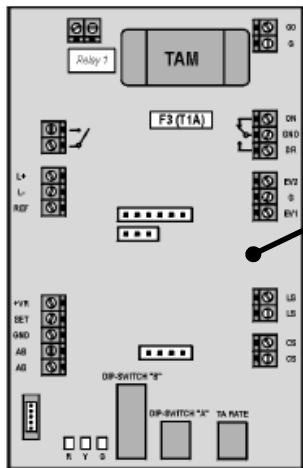
Problem	Cause	Resolution
Water in Steam Cylinder is Black	<ol style="list-style-type: none"> <li>1. This occurs when the minerals in the water are outside of the water quality range.</li> <li>2. Problem with filling and draining.</li> <li>3. Distribution steam hoses clogged or kinked.</li> </ol>	<ol style="list-style-type: none"> <li>1. Have a water sample checked by a local water treatment company and make changes to supply water based on their findings and recommendations.</li> <li>2. Check the fill and drain valve operation.</li> <li>3. Check distribution hoses for kinks and blockage.</li> </ol>
Arching Occurs in Steam Cylinder	<ol style="list-style-type: none"> <li>1. This is an indicator there may be lead or copper in the main supply water.</li> </ol>	<ol style="list-style-type: none"> <li>1. Have the water quality checked by a local water treatment company and make changes to the water supply based on their recommendations.</li> <li>2. Add appropriate filters and strainers to filter out the lead and copper.</li> </ol>
Continuous Filling and Draining of Steam Cylinder with NO Steam Output	<ol style="list-style-type: none"> <li>1. Mineral bridging has occurred across the electrodes.</li> <li>2. Lack of back pressure on steam hoses.</li> <li>3. The water fill valve's water regulator is broken.</li> <li>4. Excessive conductivity in the water.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean or replace the steam cylinder.</li> <li>2. Check the steam hose installation for kinks or low spots.</li> <li>3. Replace the fill valve.</li> <li>4. Use a mixture of de-mineralized water to dilute the main supply water bringing the conductivity down.</li> </ol>
Steam Output Does Not Meet Capacity	<ol style="list-style-type: none"> <li>1. Water conductivity is extremely low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Wait to see if the mineral content builds up over a few days.</li> <li>2. Add ½ teaspoon of table salt through the top of the steam cylinder.</li> </ol> <p>CAUTION: Turn off the unit when adding the salt and be careful as the cylinder and piping may be extremely hot.</p>
Water Continuously Drains From Steam Cylinder	<ol style="list-style-type: none"> <li>1. Defective or blocked drain valve.</li> <li>2. Fill valve is leaking.</li> <li>3. Fill and drain hoses are not connected correctly.</li> <li>4. Steam Cylinder is not positioned correctly in the bottom of the humidifier.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean or replace defective or blocked drain valve.</li> <li>2. Replace or repair fill valve.</li> <li>3. Re-connect fill and drain hoses.</li> <li>4. Reseat the Steam Cylinder into the Drain Connection.</li> </ol>

<p>Contactor for Humidifier Chatters</p>	<ol style="list-style-type: none"> <li>1. Dirt has gotten into the contactor.</li> <li>2. Transformer Secondary Voltage is too low.</li> </ol>	<ol style="list-style-type: none"> <li>5. Remove power from the unit. Remove Contactor and clean or replace the contactor.</li> <li>6. Check the primary input voltage to the transformer to make sure it is within the specified voltage threshold.</li> </ol>
<p>Humidifier Continuously Drains and Fills and Humidifier Contactor Constantly Deactivating and Re-activating</p>	<ol style="list-style-type: none"> <li>1. Water is foaming.</li> <li>2. Softened water is being used.</li> <li>3. Fill or drain valves are blocked.</li> </ol>	<ol style="list-style-type: none"> <li>7. Foaming will dissipate after a period of operation.</li> <li>8. Change water source.</li> <li>9. Clean or replace fill or drain valve.</li> </ol>

## REPLACEMENT PARTS



Item Number	Description	Part Number
1	Humidifier Housing	18CA1756
2	Steam Cylinder Locking Strap	18CA1757
3	Fill Cup / Conductivity Sensor	18CA1758
4	Overflow Tube	18CA1759
5	Steam Cylinder Fill Tube	18CA1760
6	Tank Fill Tube	18CA1761
7	Fill Solenoid Valve	18CA1762
7a.	Fill Connector Kit (not shown connects to 7)	18CA1763
8	Drain Outlet Assembly	18CA1764
9	Drain Gasket	18CA1765
10	Drain Connector (Elbow)	18CA1766
11	Drain Connector (Optional Straight – Not Shown)	18CA1767
12	Drain Valve Assembly	18CA1755
13	Steam Hose (22 mm)	18CA1753
14	Steam Hose (30 mm)	18CA1754



Item Number	Description				Part Number
15	Humidifier Control Board				18CA1751
15a Not Shown	Control Board Terminal Block Kit				18CA1752
Item Number	Description	Conductivity	Lbs/Hr	Volts/Phase/Hertz	Part Number
16	Steam Cylinder	Low	2.2 - 6.6	230/1/60	18CA1711
		Standard	2.2 - 6.6	230/1/60	18CA1712
		Low	2.2 - 11	230/1/60	18CA1713
		Standard	2.2 - 11	230/1/60	18CA1714
		Low	2.2 - 6.6	230/1/60	18CA1715
		Standard	2.2 - 6.6	230/1/60	18CA1716
		Standard	2.2 - 6.6	230/3/60	18CA1717
		Low	2.2 - 6.6	230/3/60	18CA1718
		Standard	2.2 - 6.6	230/3/60	18CA1719
		Low	2.2 - 6.6	460/3/60	18CA1720
		Standard	2.2 - 6.6	460/3/60	18CA1721
		Low	11 - 17.6	230/3/60	18CA1722
		Standard	11 - 17.6	230/3/60	18CA1723
		Low	11 - 17.6	460/3/60	18CA1724
		Standard	11 - 17.6	460/3/60	18CA1725
		Low	22 - 33	230/3/60	18CA1726
Standard	22 - 33	230/3/60	18CA1727		
Low	22 - 33	460/3/60	18CA1728		
Standard	22 - 33	460/3/60	18CA1729		

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