

ProMinent Fluid Controls

Boiler Sensor Test Procedure

WARNING: Any valve manipulation or work of any type on a boiler can be dangerous and should be performed by a licensed boiler operator.

NOTE: To invoke the controller to read a boiler sensor value, clear the alarm for the relay which controls the blowdown valve for that sensor, or clear all alarms. Either will start a captured sample cycle resulting in a new reading.

NOTE: Measured Level and Sensor Watch are ‘raw’ sensor values in millivolts (mV) and are present on the controllers at all times. ‘Readings’ refers to a calculated value in umhos, based on the raw sensor reading at a particular time in the sample cycle. Readings hold their value until replaced by the next reading.

OVERVIEW: Boiler conductivity measurement is different from condensate and cooling applications due to the high temperature sample. Because the sample temperature is relatively constant, (boilers, by design operate at a set temperature and pressure), a two wire sensor is often used and temperature compensation of the conductivity reading is negated. The expense and trouble of including temperature electronic components in the conductivity sensor are unnecessary.

Blowdown based on the conductivity is performed by sampling the boiler, comparing against a setpoint and then re-opening the valve for a predetermined length of time before re-testing. By adjusting the length of blowdown, the delay between samples and the physical valving, the conductivity in the vessel can easily be maintained.

Discharge too often or for too long and the conductivity will drop below setpoint levels.

Restrictive lines will cause the conductivity to ‘cycle up’, increasing the maligned impurities.

Timing and line size matter little if the sensor is providing incorrect information. While fouled or broken sensors, loose electrical connections or failing electronics will amount to poor control, improper plumbing is the most likely fault.

The best way to avoid errors due to faulty plumbing is to control where flashing takes place in the line.

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PROBLEM: Boiler conductivity readings are ‘bouncing’. Sequential readings are changing more than +/- 2% over a short period of time. (0 to 5,000 umhos x .002 = +/- 100 umhos)

PURPOSE: Determine if the sensor or controller has failed or if plumbing is incorrect.

PLUMBING: **Incorrect plumbing is the most frequent cause of faulty readings.** If a sensor is not completely submerged at the moment when the controller records the raw value, an incorrect reading will be realized. Correct plumbing is the most important factor in obtaining proper sensor readings.

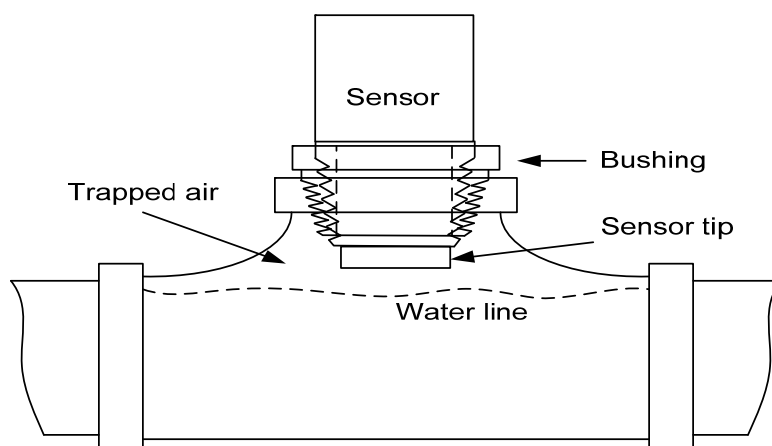
PLUMBING RULES:

- 1 The blowdown line should be taken from the highest portion of the boiler drum via a skimmer, without ejecting air.
- 2 The sensor should precede the automatic valve. Six to 12 inches nominal distance. See **FIGURE 2**.
- 3 Eliminate any restriction between the automatic valve and the boiler. All valves in this section should be 100% open. Gate or needle valves should not be used if possible as they offer resistance even when fully open.
- 4 A needle valve or restriction should follow the automatic valve. This restriction will be used to insure that flashing takes place at this point and nowhere else. Flashing at this point will insure that all upstream piping will be liquid filled!

NOTE: Flashing is the term for the rapid change of liquid to gas or steam. When the high pressure liquid in the boiler finds a path to atmospheric pressure, flashing takes place. In a pipe, the point where flashing happens can be controlled with a needle valve by restricting the exit flow. This restriction causes the pressure to build on the boiler side and drop on the atmosphere side.

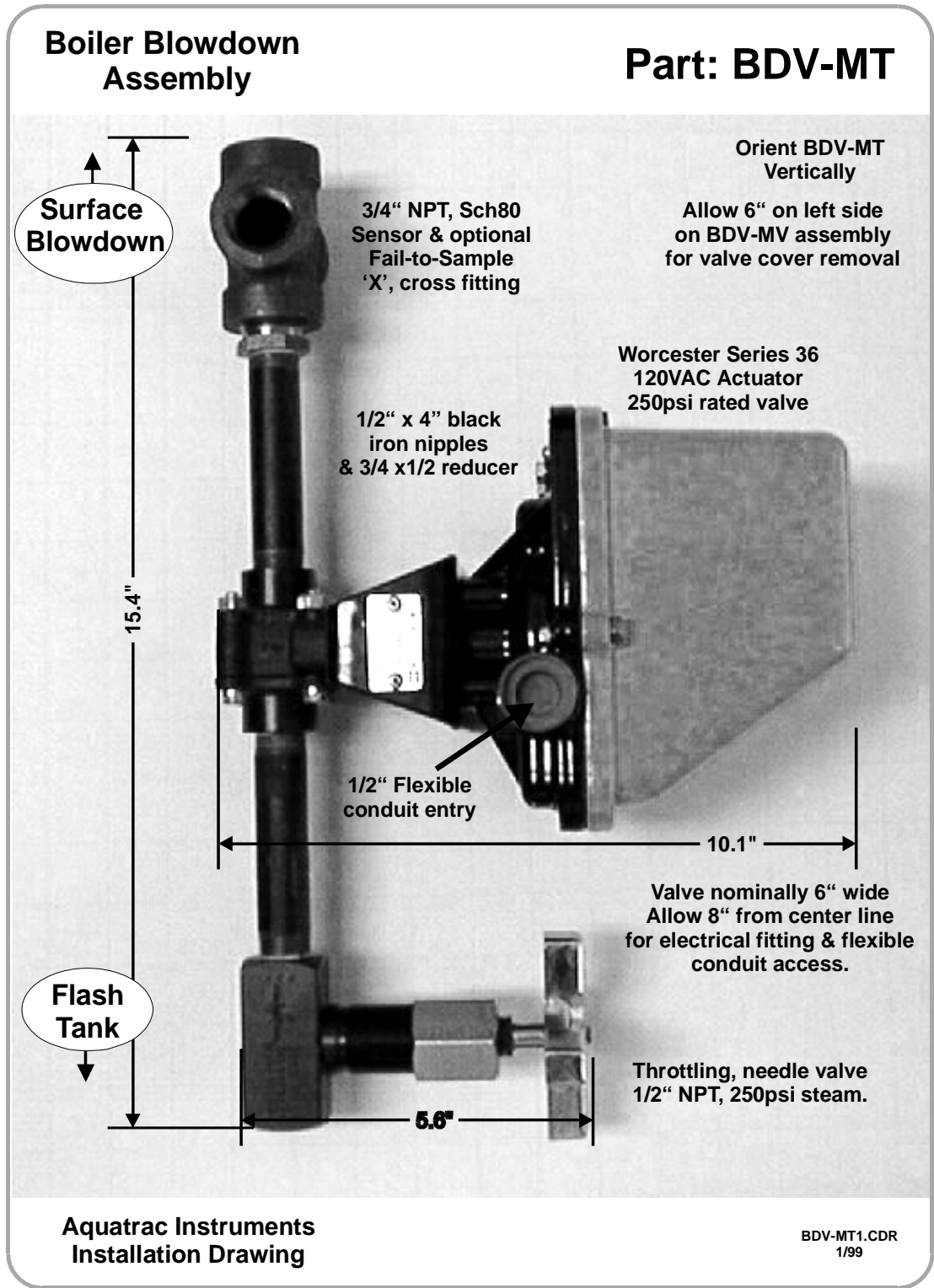
- 5 The 3/4" conductivity sensor should be inserted into a 3/4" pipe T. Larger Ts require bushings which hold the sensor farther from the sample. See **FIGURE 1**

FIGURE 1: Use of bushings raises sensor from sample



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FIGURE 2: Typical blowdown assembly layout:



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INITIAL TEST: - *Fill the blowdown line then read the sensor three times.*

- To fill the line;
- 1) cycle the blowdown valve. (See 'How To Start A Blowdown Cycle').
 - 2) When the automatic valve opens, close off the line manually at some point after the automatic valve.
 - 3) Wait for the sensor reading to update and repeat.

HOW TO START A BLOWDOWN CYCLE:

On the new controllers, (microFLEX, Aegis and MultiFLEX) clear the alarm for that relay or for SmartFlex and SmartAS controllers, clear all alarms to invoke a sample routine.

PROBLEM TYPE: *These readings can either be; unsteady, or steady and matches the wet test, or steady but does not match the wet test.*

- 1) If the reading is **unsteady** when all valves are closed, use the RESISTOR TEST below. If the input passes the resistor test, you may have air in the line. Bleed the air out of the sensor T or turn the T upside down. **WARNING: USE A QUALIFIED LICENSED BOILER OPERATOR TO PERFORM THESE FUNCTIONS!** If the readings are now steady but do not match the wet test, continue with step 2. If readings are steady and match the wet test, go to step 3.
- 2) If the reading is **steady, but does not match the wet test**, reset the calibration to factory default and re-read. If steady but does not match the wet test, clean or replace the sensor. If steady and matches the wet test, continue to step 3.
- 3) If the **reading matches and is steady**, we need to determine how far to open the needle valve.

To assist in step 3, the MultiFLEX, Aegis and microFLEX controllers, each have the ability to display current raw sensor values. On the MultiFLEX and Aegis controllers, enter the conductivity sensor menu, then select Diagnostic and scroll down to '**Measured Level**'. On a microFLEX, find '**Sensor Watch**' under the boiler sensor menu.

- a. Open the blowdown valve.
- b. Slightly open the previously closed valve and monitor the **Measured Level** or **Sensor Watch** values. Continue to slowly open the needle valve until the value starts to drop. Air in the line will cause the readings to drop. At this point, the valve is open too far.
- c. Close the valve slowly until the readings are steady.

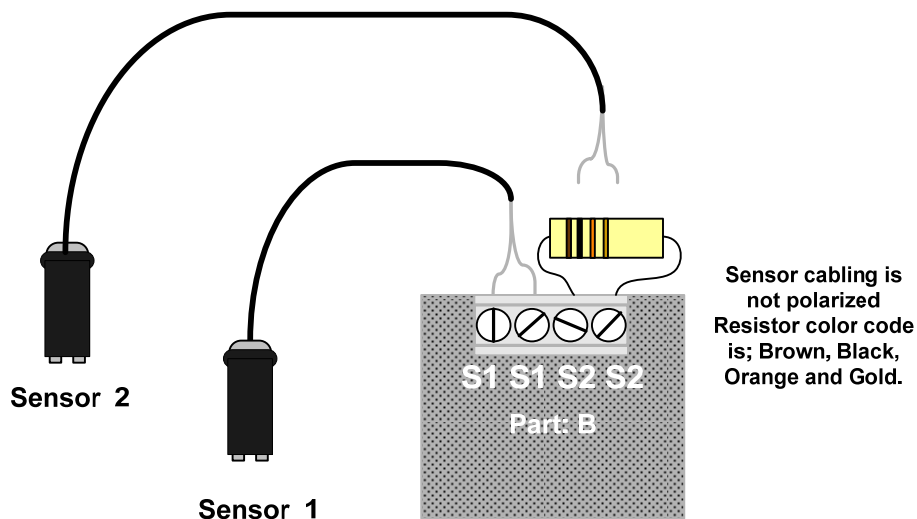
This is where the needle valve should remain. Flashing will occur after this valve and not affect the sensor readings.

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RESISTOR TEST: Using a 1,000 ohms resistor to replace the sensor. The expectation is a steady reading through several controller readings. If not, the controller or Driver B board is at fault.

1. Purchase 1K ohm Resistor pack at a local Radio Shack or Electronics Store. Wattage does not matter.
2. Power down the controller and remove the leads for the Boiler Conductivity probe.
3. Insert the resistor in place of the sensor. See **FIGURE 3**.

FIGURE 3: Replacing a boiler sensor with a 1K ohm resistor.



With a 1,000 ohm resistor in place of the sensor, and with the sensor input calibration set for factory default (Gain = 2 and Offset = -15), the reading after a sample cycle should read 450 to 500.

If after 3 samples, this value remains constant, the input driver board and controller are working properly. If not, call technical support for further troubleshooting tips; moving the driver to another input, replacing the driver and double checking your work.

The resistor can also be used to test the field wiring by replacing the sensor in at the boiler. Remove the wires from the sensor in the field and attach the resistor to the wires. Readings should be the same as when you attach the resistor directly to the driver board (as above) or input point.

NOTE: Boiler sensors will not read correctly when not in service. The temperature, pressure and proximity of the sensor in the T are all factors lost when the sensor is placed into a sample cup. However, holding the sensor in the air should net a near zero reading.

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CONTROLLER SPECIFIC INFORMATION

NOTE: All Aquatrac controllers have digital inputs that can be used as interlocks. These inputs inform the controller that the boiler or process is off-line and to close the blowdown valve or stop feeding chemical.

SMART AS AND SMARTFLEX CONTROLLERS

The SmartAS Controller uses conductivity input E+ and E-. The SmartFlex has two conductivity inputs; E and F. Boiler conductivity readings for a 1,000 ohm resistor should equal approximately 500 umhos.

MULTIFLEX CONTROLLERS

The boiler sensor terminates on a plug and play Driver B card. The terminals are labeled S1 and S1 for the first boiler and S2 and S2 for second. They are not polarity sensitive. A 1,000 ohm resistor will net a reading of approximately 250 umhos.

AEGIS CONTROLLERS

The boiler sensors are wired directly to the main board at S1, S2. Remove the sensor leads and install a resistor between S1 and S2. A 1,000 ohm resistor will net a reading of approximately 380 umhos. When more than one boiler is used, additional sensors are terminated on Driver B cards. See the MultiFLEX notes.

MicroFLEX CONTROLLERS

The boiler sensors are wired directly to the main board at S1, S2. Remove the sensor leads and install a resistor between S1 and S2. A 1,000 ohm resistor will net a reading of approximately 500 umhos.