Mercury

App K

APEX INSTRUMENTS, INC.

Appendix K Automated Mercury Source Sampler – Model XC-6000EPC

Console Audit Manual

XC6000 Quarterly Audit Procedure

This procedure assumes the user is familiar with the basic operation of the Apex Instruments MercSampler XC-6000. If necessary please refer to the XC-6000 User Manual for additional information on connections and operations.

This document, and screen shots in this manual, is based on version 80711-94 software and firmware. If your unit has an earlier version please contact Apex Instruments, Inc. to obtain the latest version.

Equipment needed:

XC6000 System including: Console, Gas Sample Conditioner, Probe and Sample Lines
PC / Laptop running Apex XC6000 Console application
Printer or PDF Printer connected to the PC (PDF printer S/W located on the XC-6000 CD)
Communication cable (USB or Ethernet)

AK-6000 MercSampler Audit Kit
-or-
Barometer read in inches Hg. (NIST Traceable)
Thermometer read in deg. F (NIST Traceable)
Vacuum Gauge read in inches Hg.
Volumetric standard (wet test meter or dry gas meter) (NIST Traceable)
Thermocouple Pig Tail with male Type K connector
Ice / water bath (for verifying thermocouples)

AUTOMATED MERCURY SOURCE SAMPLER

The AK-6000 MercSampler Audit kit includes:

Volumetric standard (15 point calibrated DGM with built in temperature output) (NIST Traceable)
Barometer read in inches Hg. (NIST Traceable)
Thermocouple Simulator
Digital Thermometer read in deg. F (NIST Traceable)
Vacuum Gauge read in inches Hg.
Thermocouple Pig Tail with male Type K connector
Wide Mouth Vacuum Bottle for Ice / water bath (for verifying thermocouples)
Portable carrying case

Figure 4
Volumetric and Vacuum standard

Figure 2
Barometric Reference

Figure 5
Digital Thermometer

Figure 1
Thermocouple Simulator

Figure 3
Wide Mouth Vacuum Bottle

Figure 6
Type K Thermocouple Pig Tail

Audit Setup:

Depending on the type of enclosure the XC-6000 is mounted in it may be necessary to remove the XC-6000 from its enclosure.

Open the XC6000 console by removing the screws from the top of the chassis.

Users with XC6000 portable units (Hardigg Storm Case) gain access by turning the 2 release screws counter clockwise at the top of the front panel and swinging the panel down.

Connect the console, gas conditioner, and probe. Do not turn on the probe heater (switch on the front panel should be off) or the Heated sample line (the AUX switch on the Gas conditioner front panel should be off). Only connect the Stack thermocouple. Sample lines, pitot lines and other thermocouples do not need to be connected.

Power on the XC6000 console and start the XC6000 application on the PC.

Connect the PC to the console by pressing the "Connect" button on the XC-6000 Main screen.

Ensure that the XC6000 Time and Date are correct.

Figure 7
XC-6000 Main Screen

Enter the Config / Utilities screen by pressing the "Config / Utilities" button on the XC-6000 Main Screen.

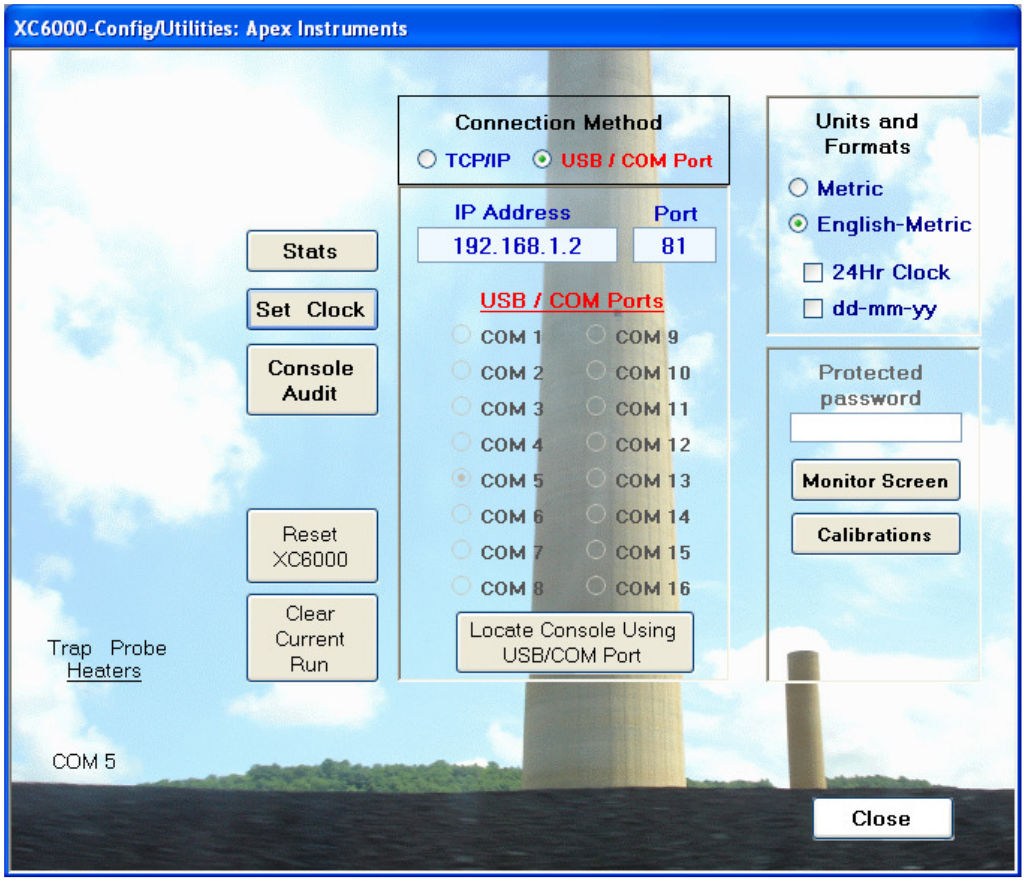


Figure 8
Config / Utilities Screen

To verify the internal operation of the XC-6000 open the Stats screen by pressing the "Stats" button on the left side of the Config / Utilities screen. Verify the correct date and time are displayed in the lower left corner and that the time is incrementing. If correct Press the “Close” button to return to the Config/Utils screen.

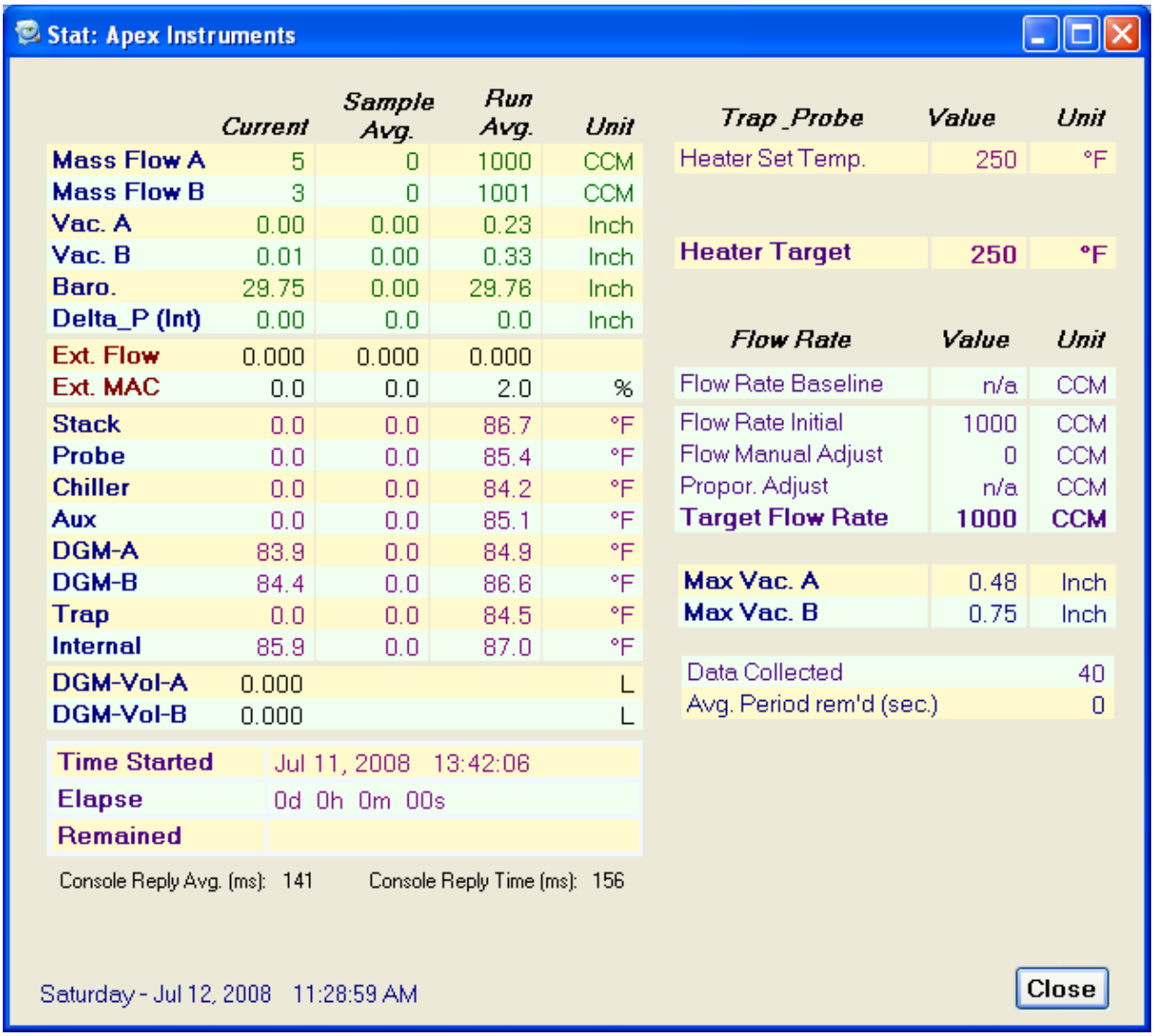


Figure 9
Stats Screen

If the date and time are not correct or there is an error displayed. Press the “Close” button, to return to the Config/Utils Screen and press the “Set Clock” button. The following message will be displayed.

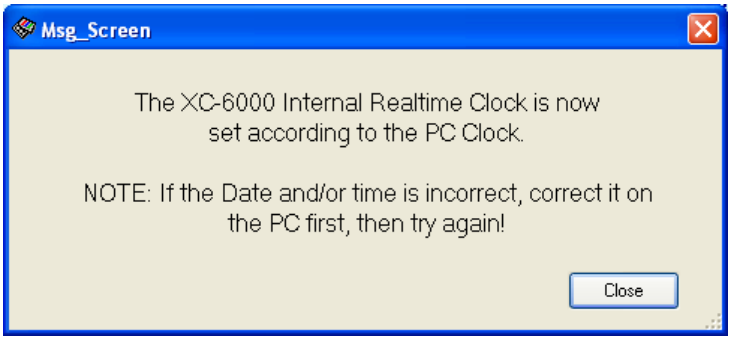


Figure 10
Set Clock Screen

Press the “Close” Button to return to the Config/Utils Screen. Press the “Reset XC-6000” button wait 30 seconds then press the “Stats” button and verify the time and date are correct and there is no error shown. Press the “Close” button on the Stats screen to return to the Config/Utilities screen.

Prior to beginning the Console Audit the XC-6000 and the Reference flow device should be warmed up. Connect the sample line of the AK-6000, or Reference Flow Device to the Sample A in line. Setup a test run for 30 minutes and let it complete. See the XC-6000 Operators Manual for test setup if needed.

Starting the Console Audit:

Open the Console Audit screen by pressing the "Console Audit" button on the left side of the Config / Utilities screen.

Enter the name of the auditor in the yellow text box.

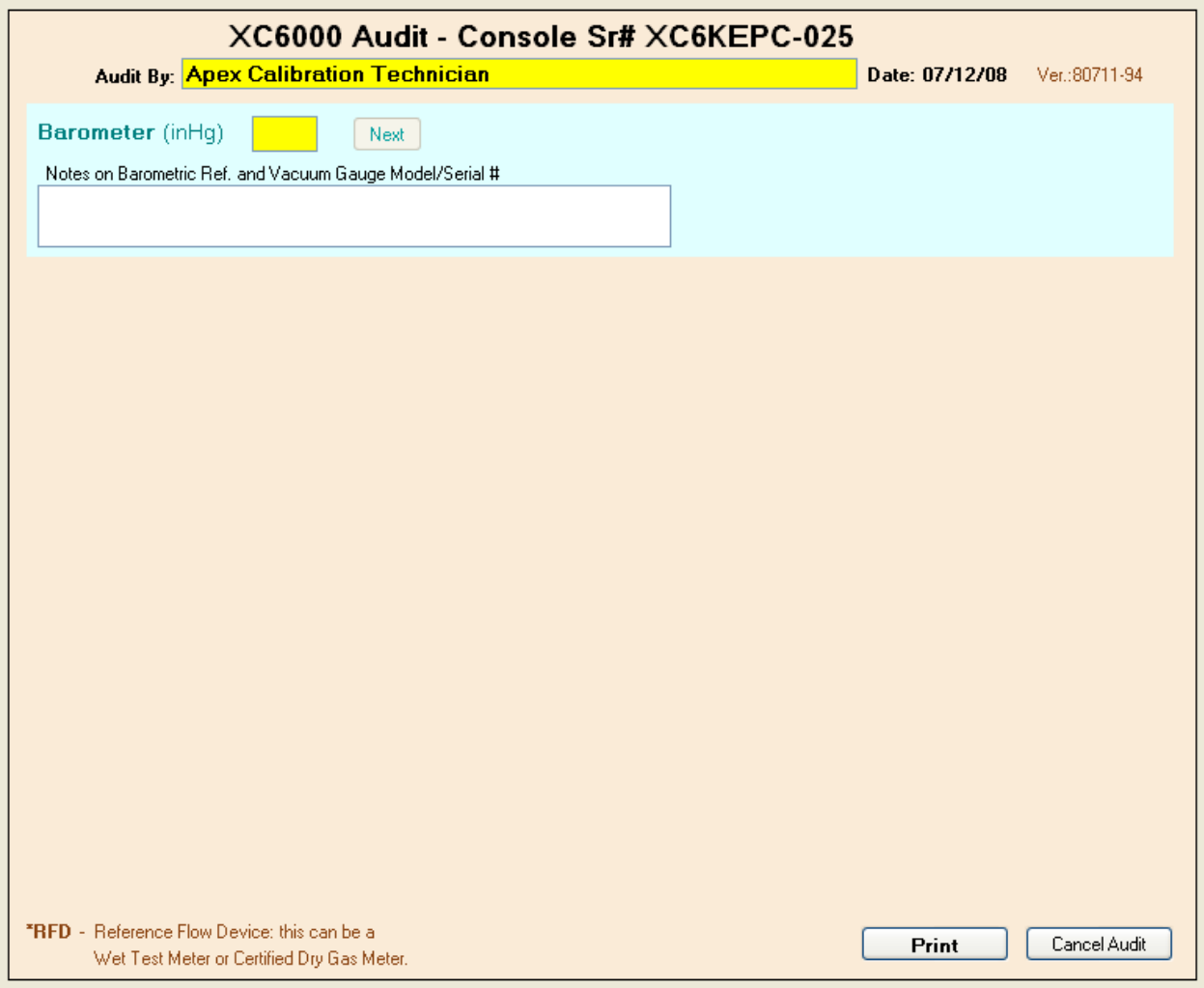


Figure 11
Console Audit Screen

Barometric Pressure Test:

If the Barometric test fails the Console Audit will fail and must be re-run.

Enter the Barometric pressure from your traceable barometer in inches Hg, xx.xx and press the "Next" button.

If the Barometric test passes the following screen is displayed. Enter the information for your reference barometric and vacuum device in the box provided.

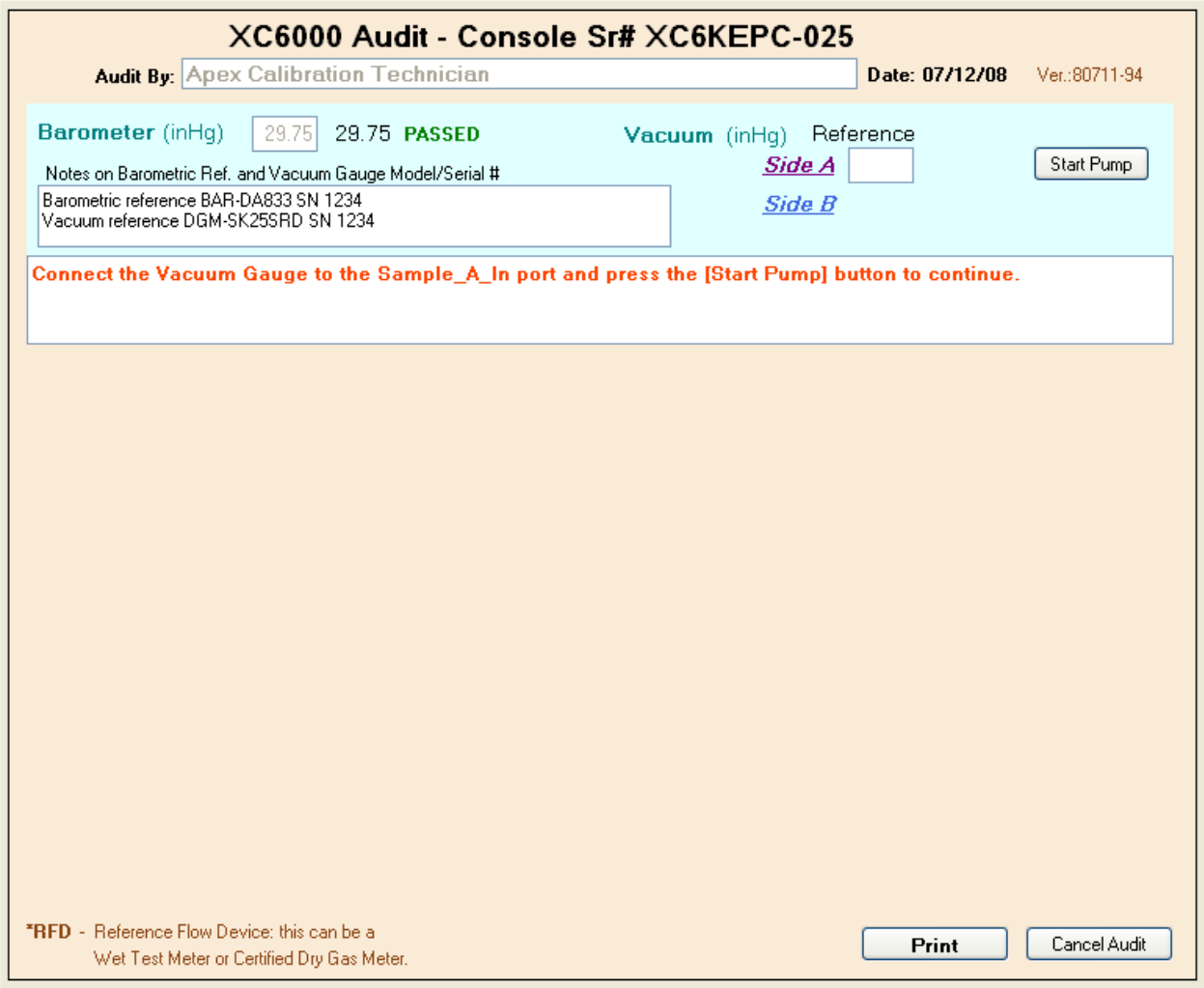


Figure 12
Barometric Test Pass

If the barometric test fails the following message will be displayed. You may continue the Console Audit to determine if there are any other areas out of calibration or end the Console Audit and correct each item as they are discovered. The Console Audit must be re-run if the Barometric Sensor Test fails.

See the section at the end of this document on how to resolve Out of Tolerance or Failed Console Audit items.

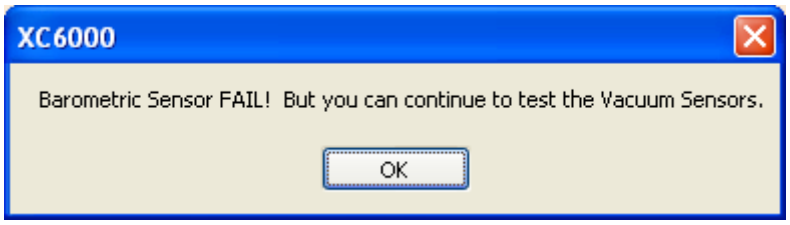


Figure 13
Barometric Sensor Failed

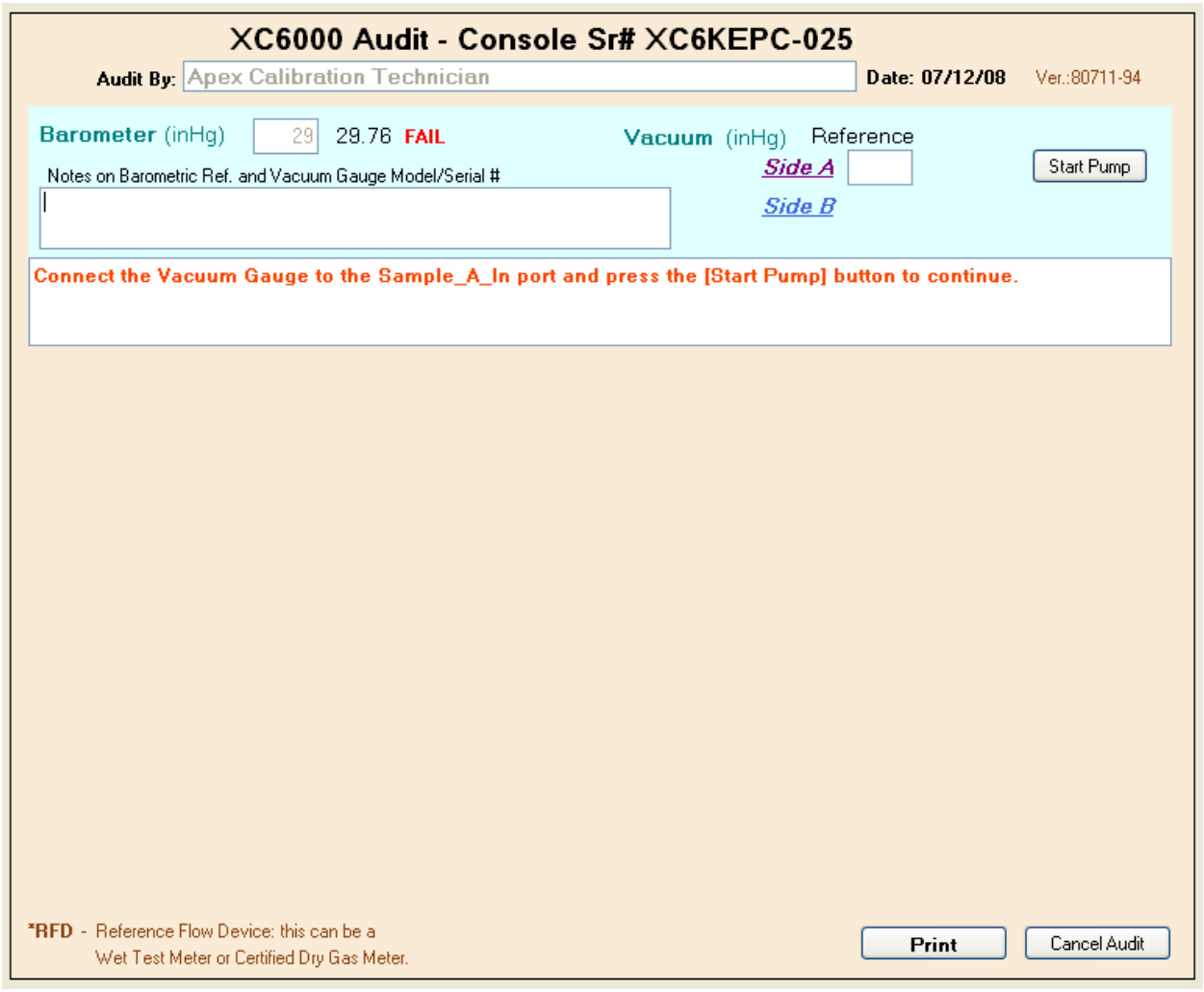


Figure 14
Barometric Sensor Test Failed

Vacuum Sensor Test:

The Vacuum Sensor Test will not cause the Console Audit to fail if out of tolerance.

Connect the AK-6000 Audit Kit sample line, or your vacuum gauge, to the A Sample In port on the back of the XC-6000 Console. Close the valve on the AK-6000 by turning clockwise. Do not connect the AK-6000 TC at this time.

Press the “Start Pump” button and wait for the vacuum gauge to stabilize. Enter the value into the Side A reference box and Press “Stop Pump”.

A message of PASSED or Out of Tolerance will be displayed. If Out of Tolerance you can continue the Console Audit. See the section at the end of this document on how to resolve Out of Tolerance or Failed Console Audit items.

Move the AK-6000 sample line, or vacuum gauge, to the B Sample In port on the back of the XC-6000 console.

Press the “Start Pump button” and wait for the vacuum gauge to stabilize. Enter the value into the Side B reference box and Press “Stop Pump”.

A message of PASSED or Out of Tolerance will be displayed. If Out of Tolerance you can continue the Console Audit. See the section at the end of this document on how to resolve Out of Tolerance or Failed Console Audit items.

Open the Flow Control on the front of the AK-6000 by turning counter-clockwise.

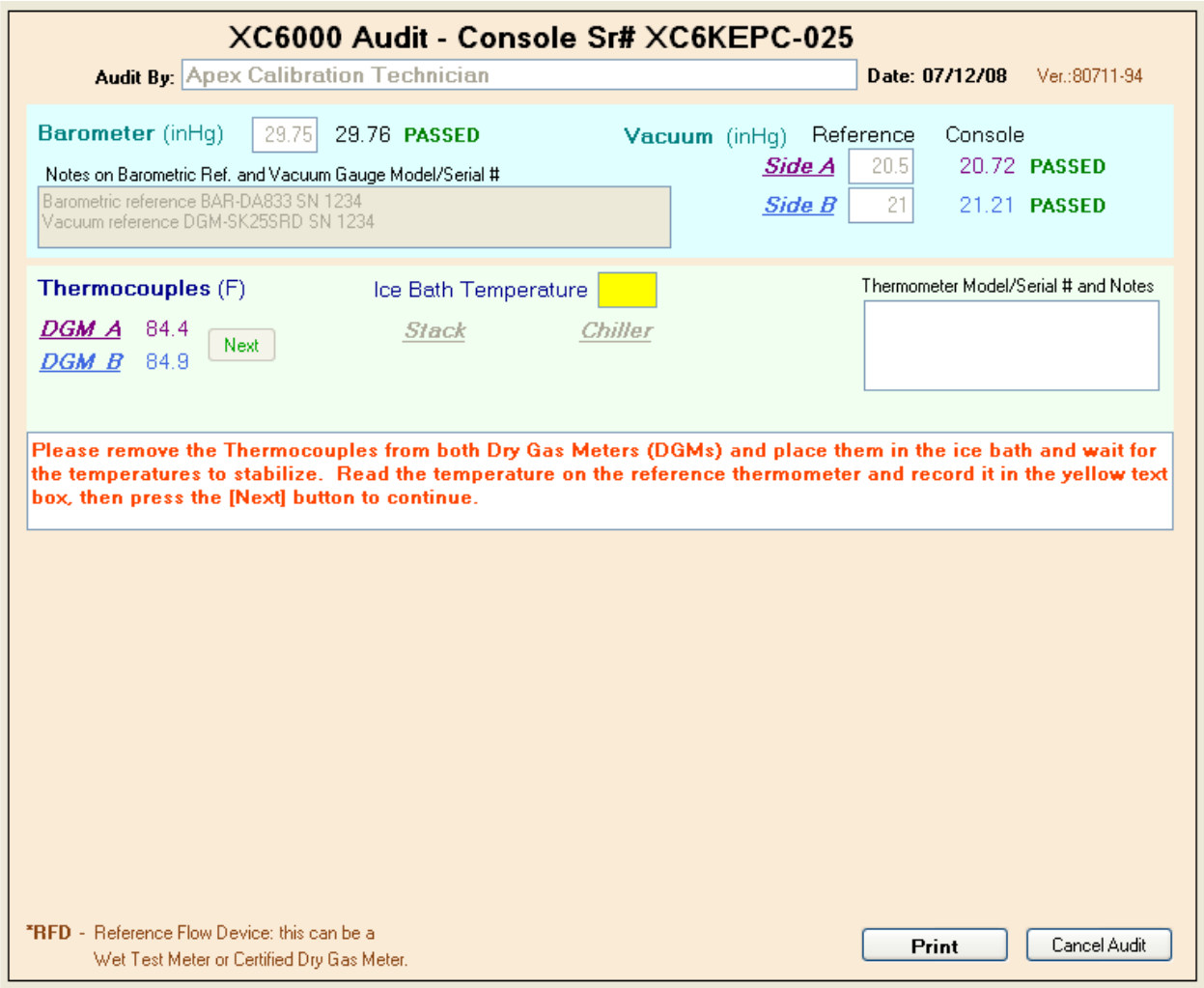


Figure 15
Vacuum Sensor Test Passed

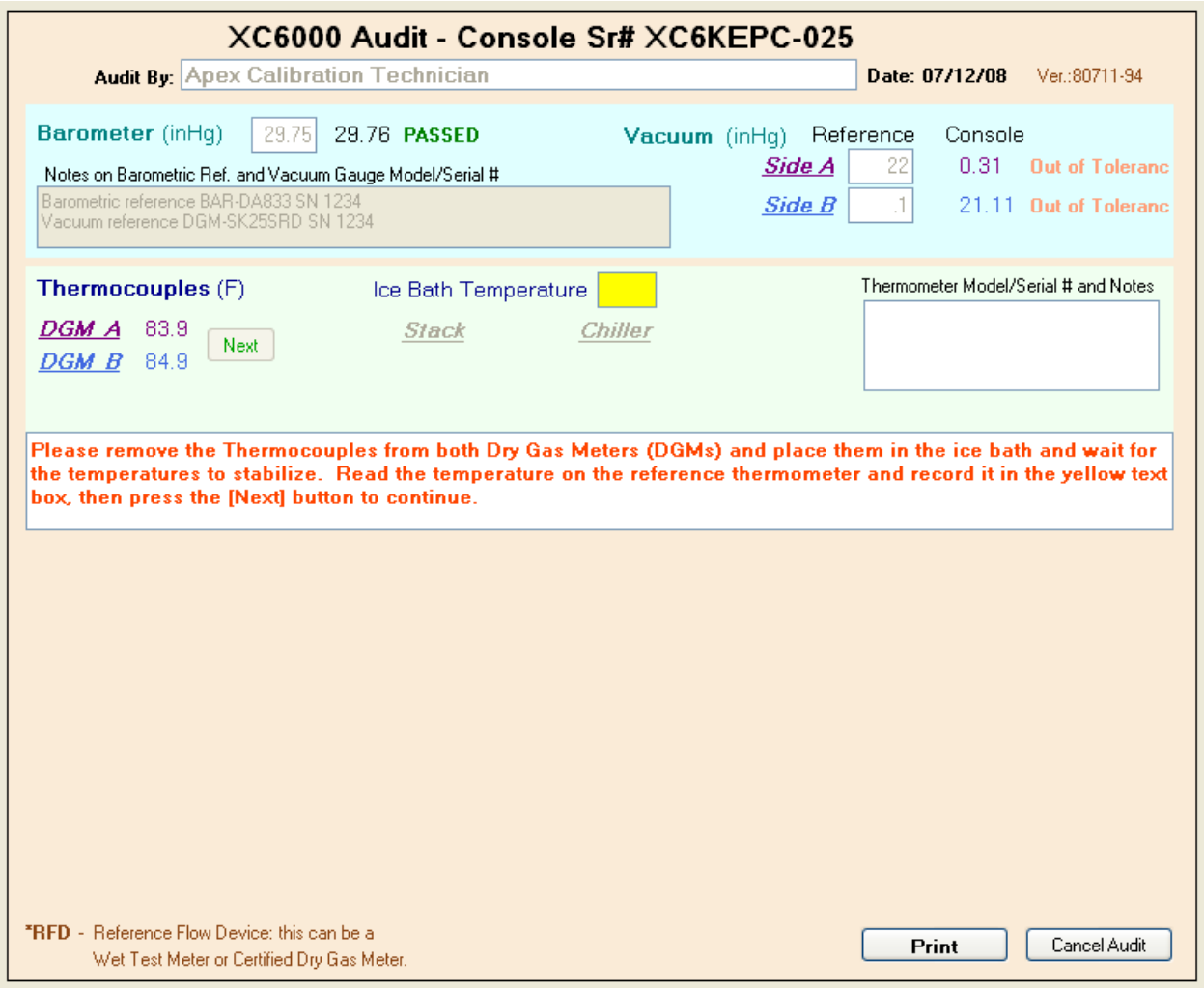


Figure 16
Vacuum Sensor Test Out of Tolerance

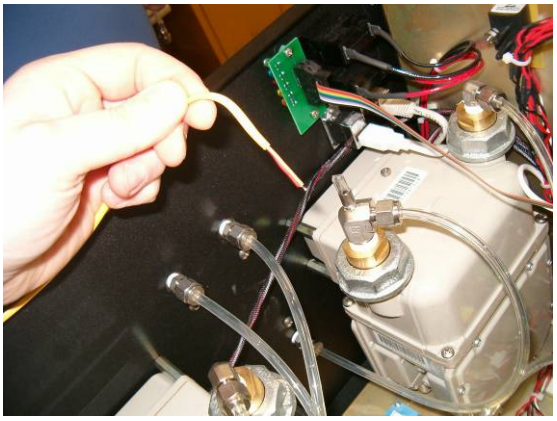
Thermocouple Test:

Enter the information for the traceable thermometer in the space provided.

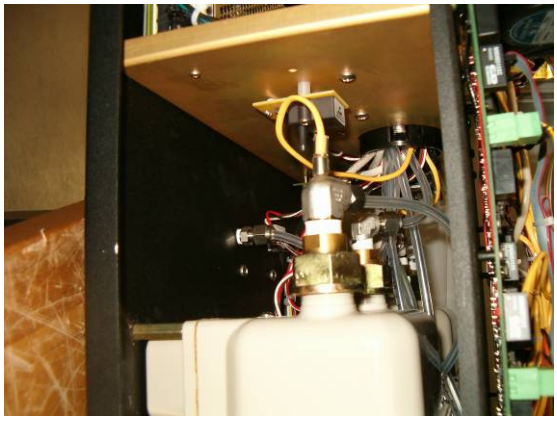
Prepare an Ice Water bath by filling the vacuum bottle with a mixture of ice and water. Use the traceable thermometer to measure the temperature of the ice bath and enter the value in the yellow box next to Ice Bath Temperature.

Remove the DGM thermocouples from the DGM fittings. Please note which thermocouple is removed from which meter. Users with XC6000 portable units (Hardigg Storm Case) must pull the DGM thermocouple wires out the top wire grommet.

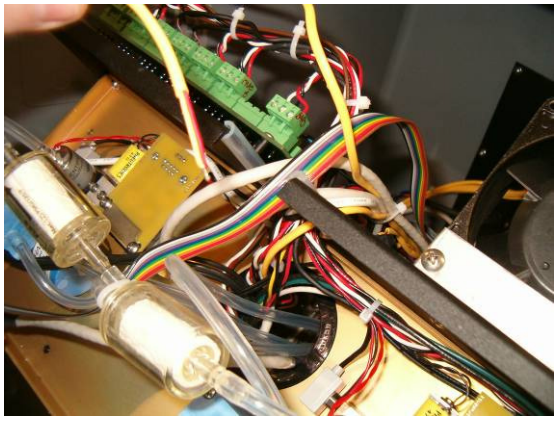
XC6000 DGM Thermocouple



XC6000 DGM Thermocouple Removed



XC6000 Portable Case DGM Thermocouple



Portable Case DGM Thermocouple Removed

Place the DGM thermocouples and the traceable thermometer in the ice bath. Watch the thermocouple readings on the audit screen until the DGM temperatures stabilize. When the DGM temperatures have stabilized press the "Next" button. If the XC6000 DGM thermocouples are within tolerance, the screen will show "PASSED". If the DGM thermocouples are out of tolerance a message box will be displayed and the screen will display "FAIL". Press the "OK" button to continue.

See the section at the end of this document on how to resolve Out of Tolerance or Failed Console Audit items.

Replace the DGM thermocouples into the DGMs taking care to place the A TC into DGM A and the B TC into DGM B.

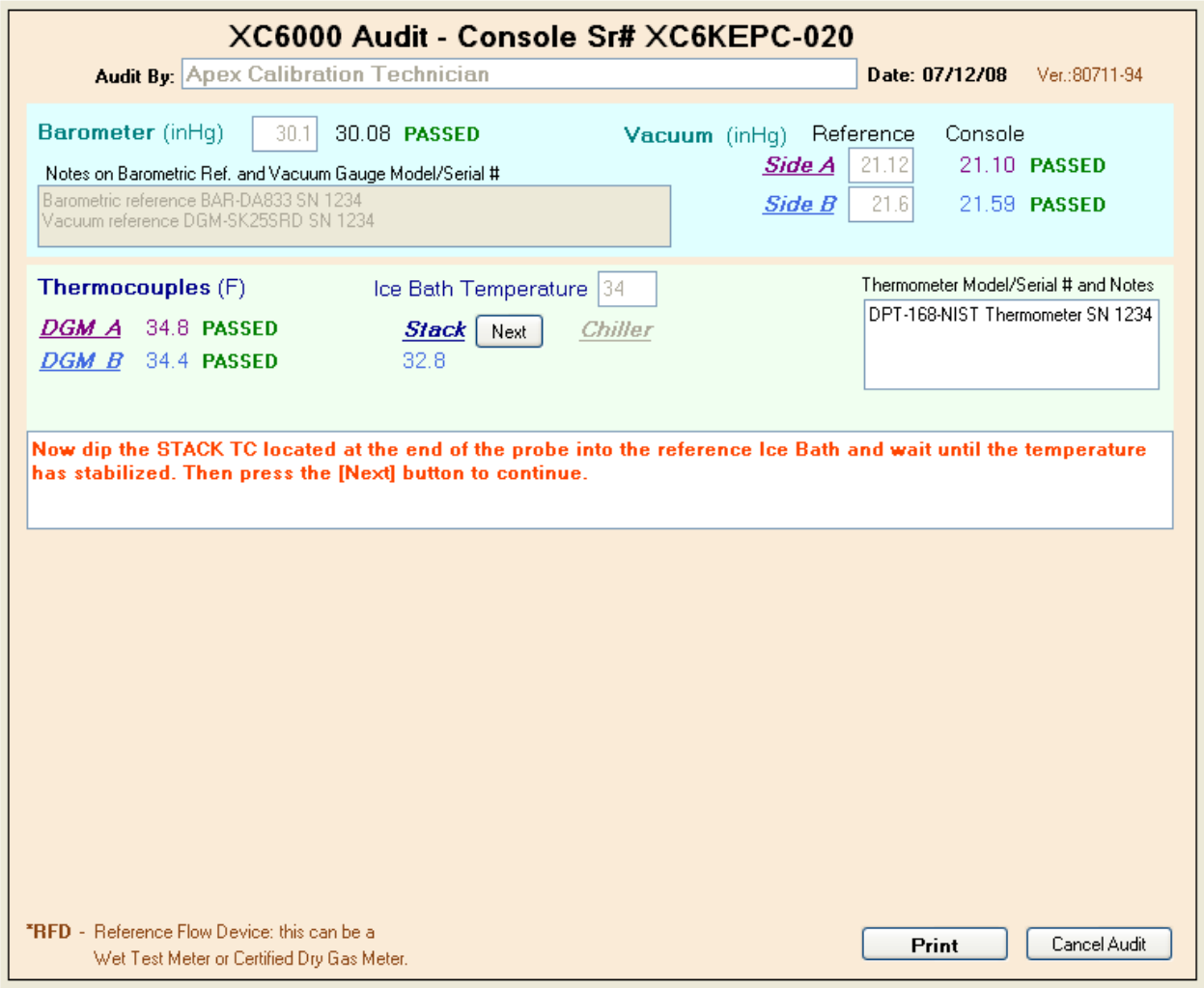


Figure 17
DGM Thermocouple Test PASSED

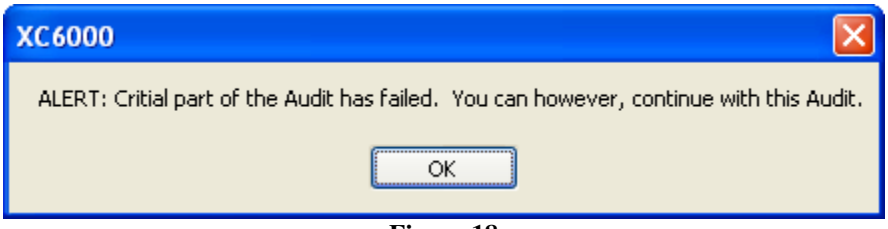


Figure 18
DGM Thermocouple Test FAILED Message Box

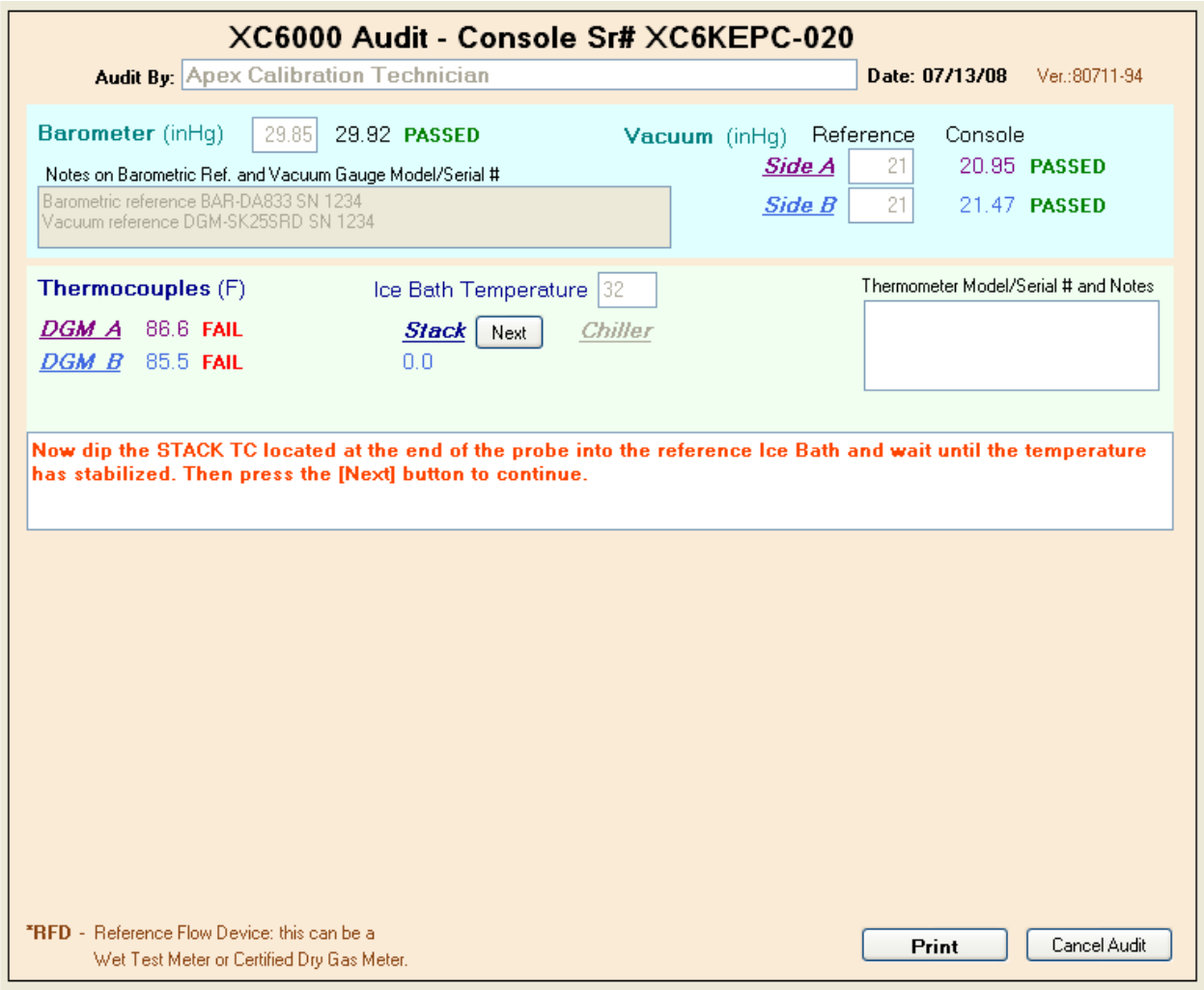


Figure 19
DGM Thermocouple Test FAILED

At the end of the probe is the Stack thermocouple. Now dip the end of the probe into the ice bath. When the temperature stabilizes Press "Next."

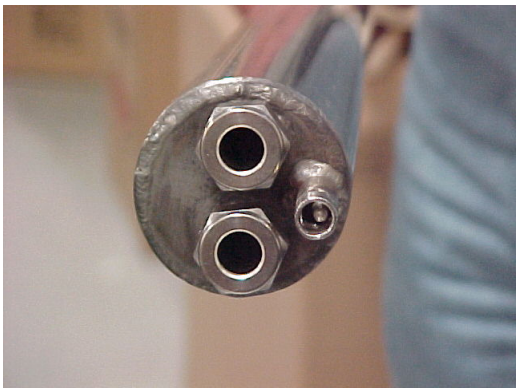


Figure 21
Stack Thermocouple

Figure 21
Stack Thermocouple in Ice Bath

A message box will be displayed providing information when using the AK-6000 Audit Kit. Press the "OK" button to continue.

Figure 22
Message Box

If the stack thermocouple is within tolerance the screen will show "PASSED" If the thermocouple is not in tolerance "Out of Tolerance" will be displayed. See the section at the end of this document on how to resolve Out of Tolerance or Failed Console Audit items.

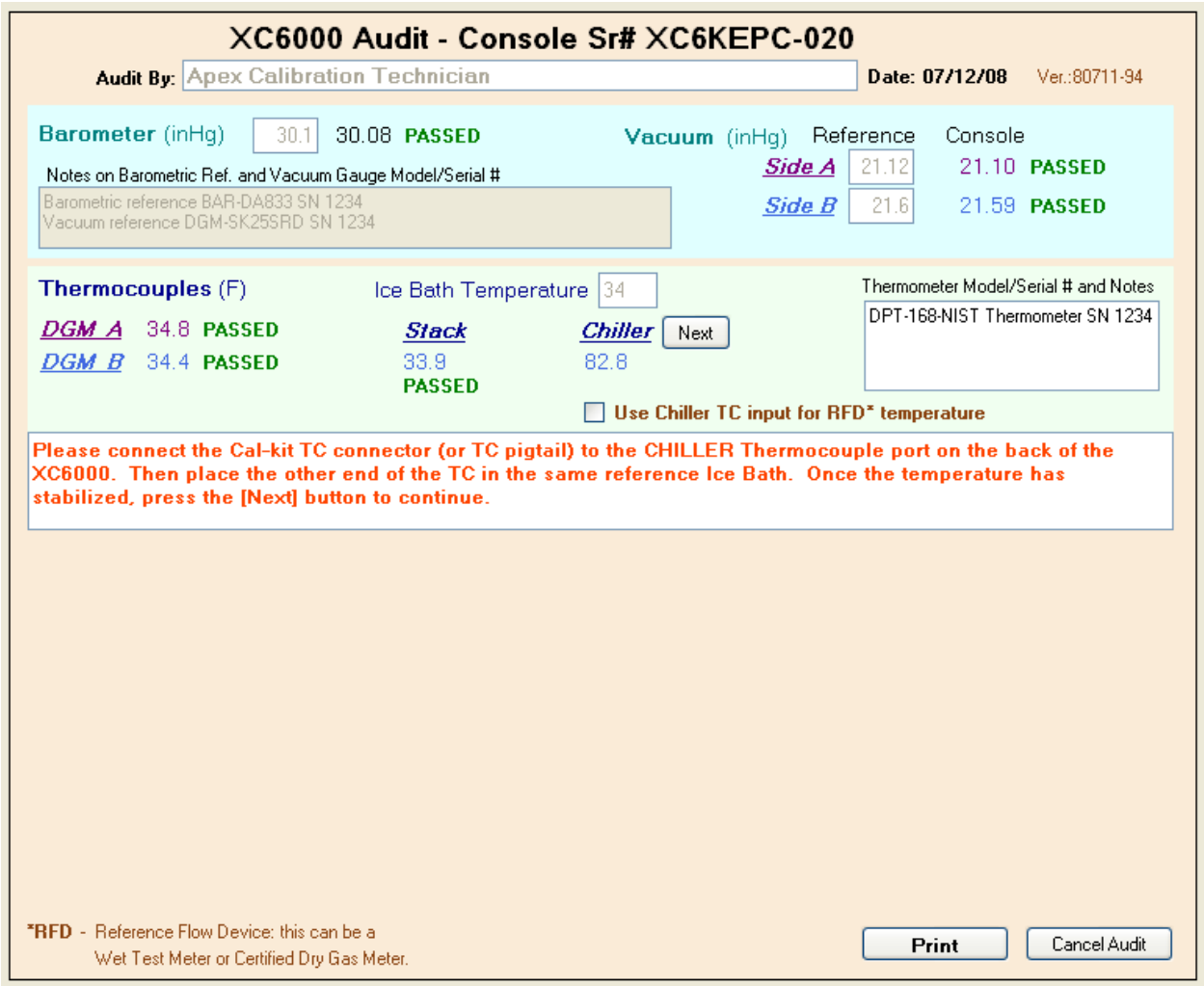


Figure 23
Stack Thermocouple Test PASSED

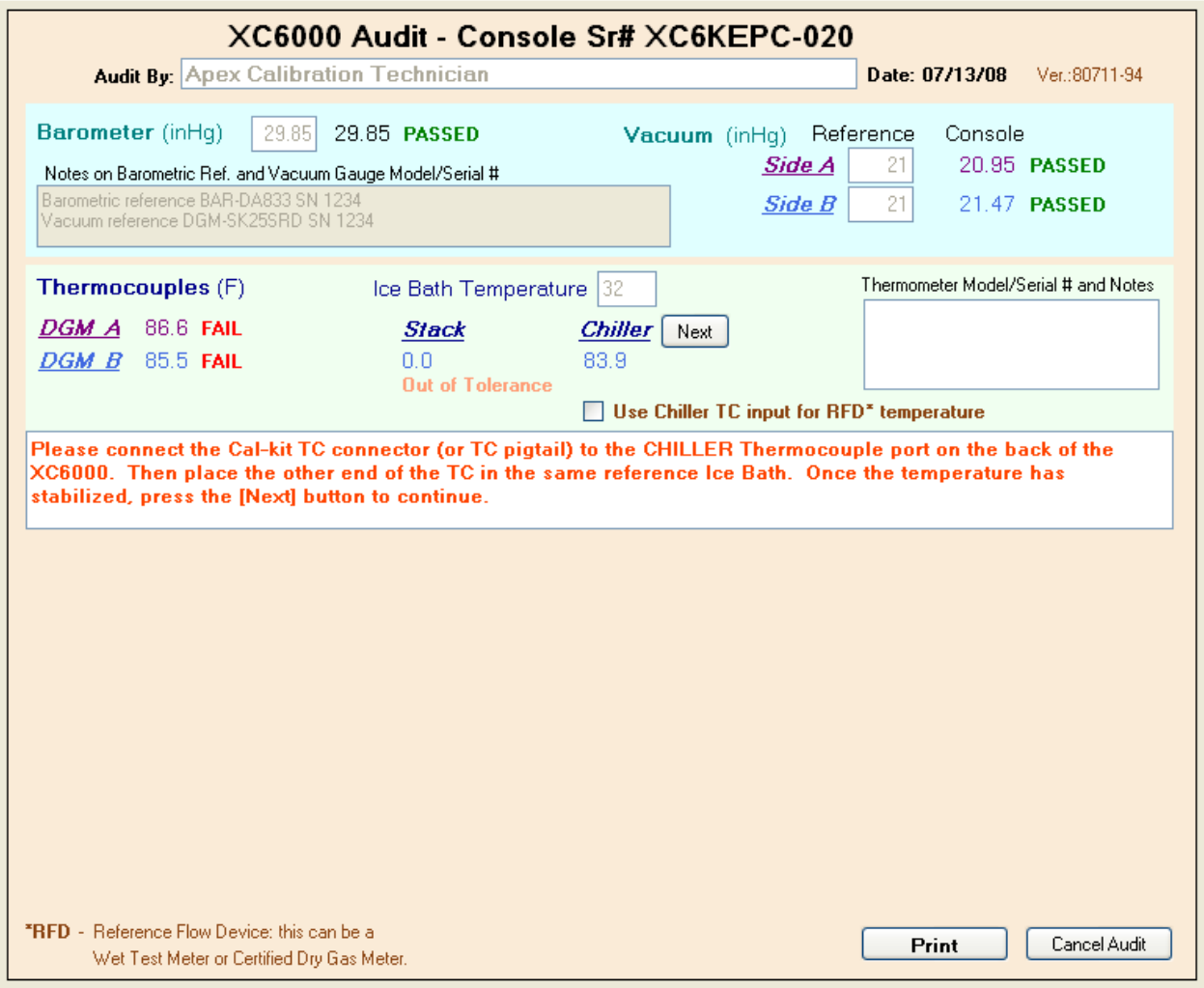


Figure 24
Stack Thermocouple Out of Tolerance

If the internal thermocouple of the AK-6000 Audit Kit is being used click the check box “Use Chiller TC Input for RFD Temperature.”

When using the Chiller TC for RFD temperature the Chiller TC Sensor test must pass.

Plug the Thermocouple Pig Tail into the Chiller port on the back of the XC-6000 and place the other end into the ice bath. When the temperature has stabilized press the "Next” button. If the chiller thermocouple is within tolerance the screen will show “PASSED” and a message box will be displayed with instructions to connect the RFD to the Sample A in port on the back panel of the XC-6000.

Unplug the Thermocouple Pig Tail when finished and plug the RFD Thermocouple into the Chiller jack and also connect the RFD to the Sample_A_IN port on the back of the XC-6000 console. Then press the “OK” button to continue.

Figure 25
Connect Sample Line Message

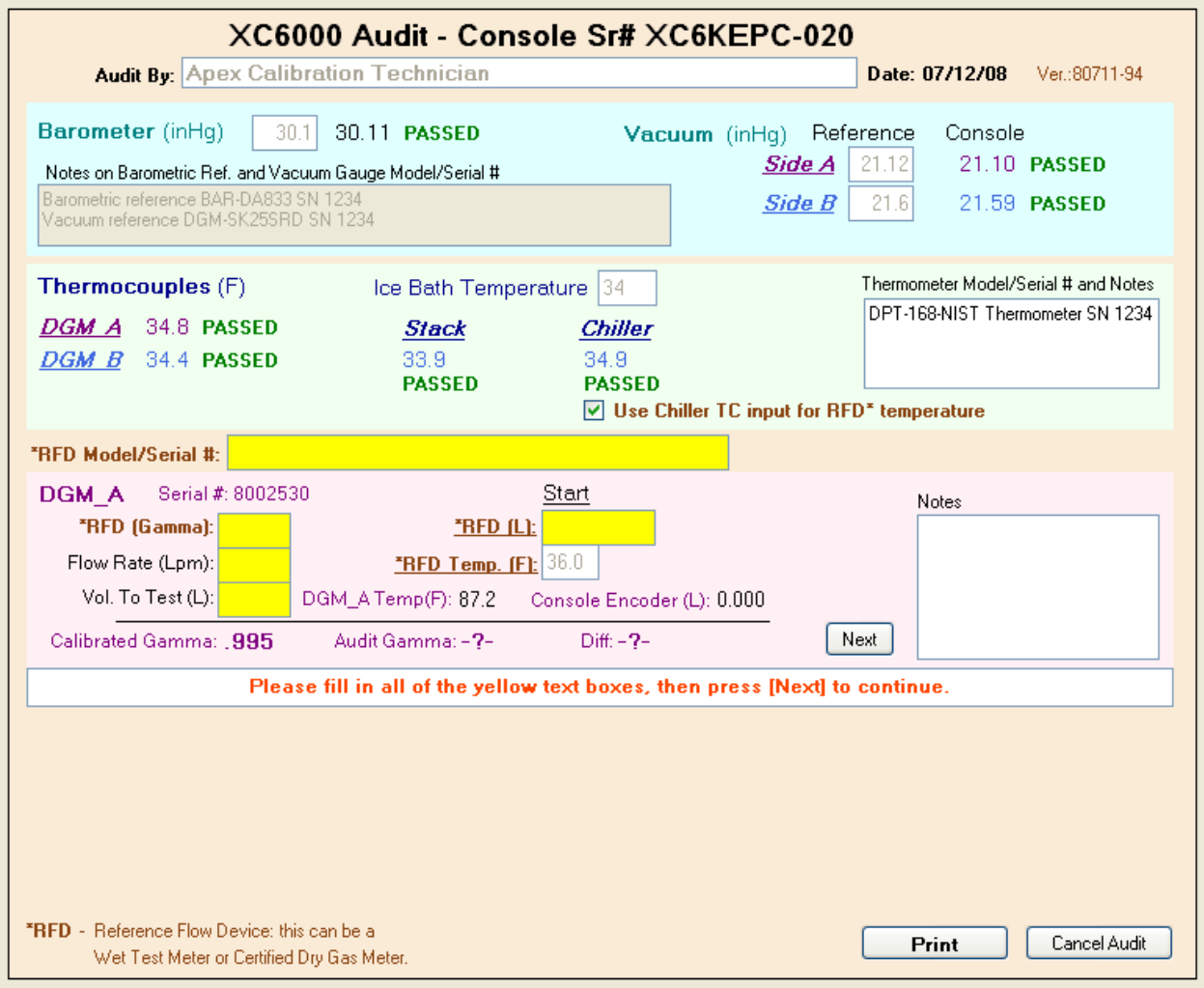


Figure 26
Chiller TC Sensor Test PASSED

If the thermocouple is not in tolerance “Out of Tolerance” or “FAIL will be displayed. See the section at the end of this document on how to resolve Out of Tolerance or Failed Console Audit items.

If the Chiller TC is being used for RFD temperature and the test FAILS the Console Audit will end. The user will have the opportunity to print the screen for reference.

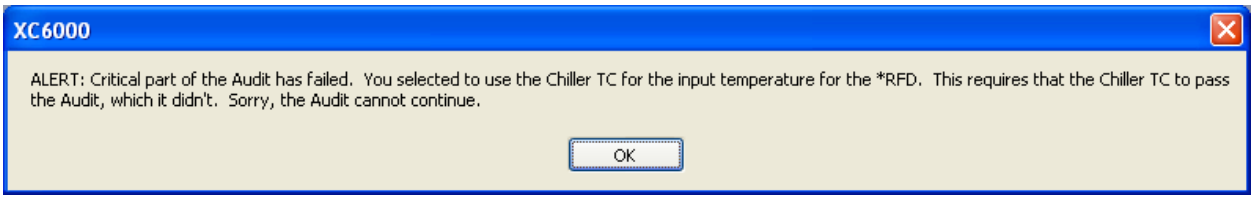


Figure 27
Chiller Thermocouple Sensor Test FAILED

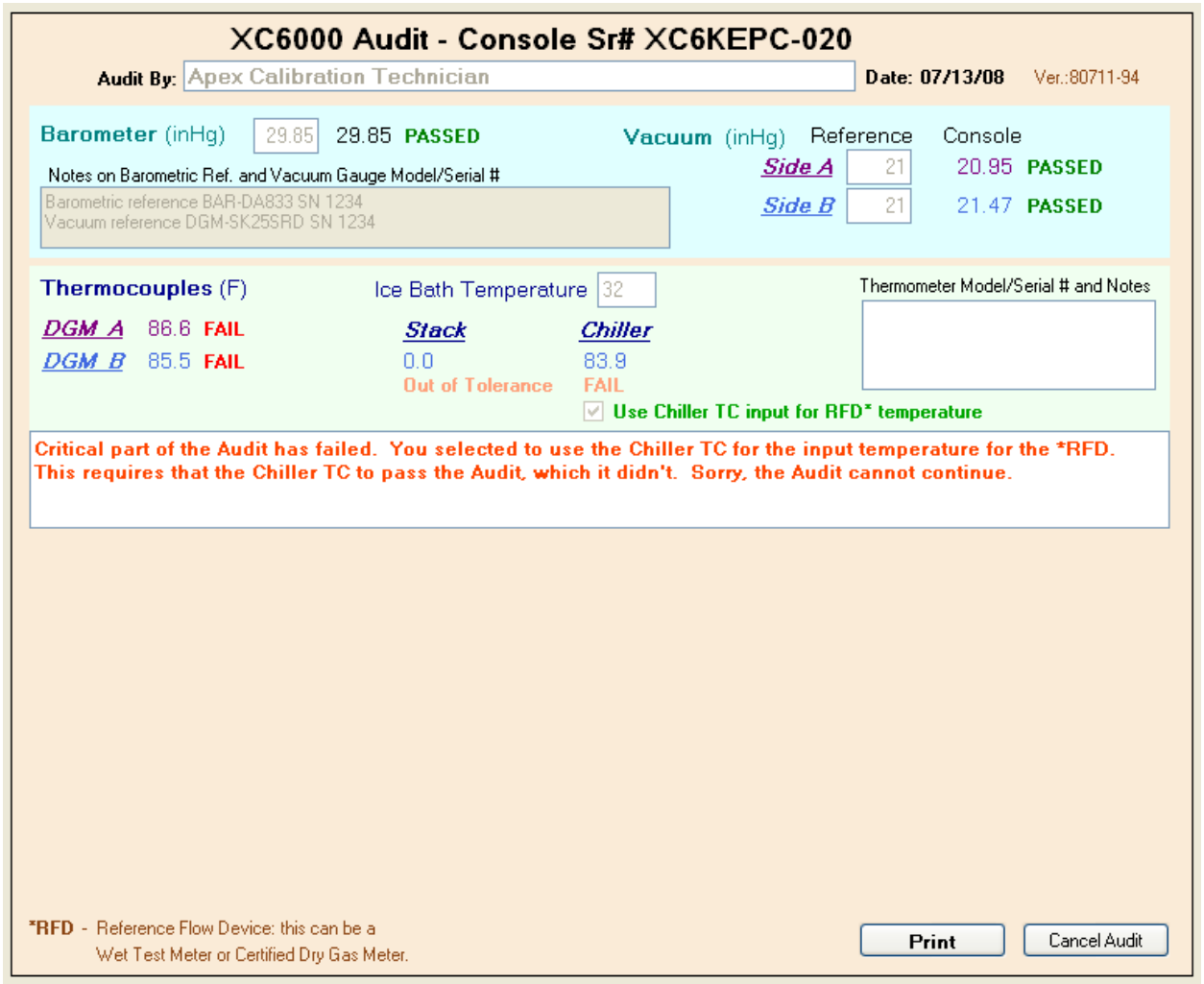


Figure 28
Chiller Thermocouple Sensor Test FAILED

Dry Gas Meter Audit:

Enter the model and serial number of the Reference Flow Device (RFD) into the space provided.

If using the AK-6000 connect the AK-6000 sample line to the Sample A In port and the AK-6000 thermocouple connector into the Chiller jack on the back of the console if not already done. If using a RFD connect the sample line to the Sample A In port on the back of the console.

Make sure the Flow Control on the AK-6000 is open by turning counter-clockwise.

Enter the AK-6000/RFD Gamma, test flow rate in L/min and test volume in L into the boxes provided. Apex Instruments recommends a minimum of 5L for test volume and a flow rate that is the average used in normal operation.

Press the reset on the totalizer on the AK-6000 to reset the counter to zero and enter the number 0 into the RFD start box. The AK-6000 will automatically enter the RFD starting temperature. If not using the AK-6000 enter the starting value, in liters, and the temperature, in °F of the RFD.

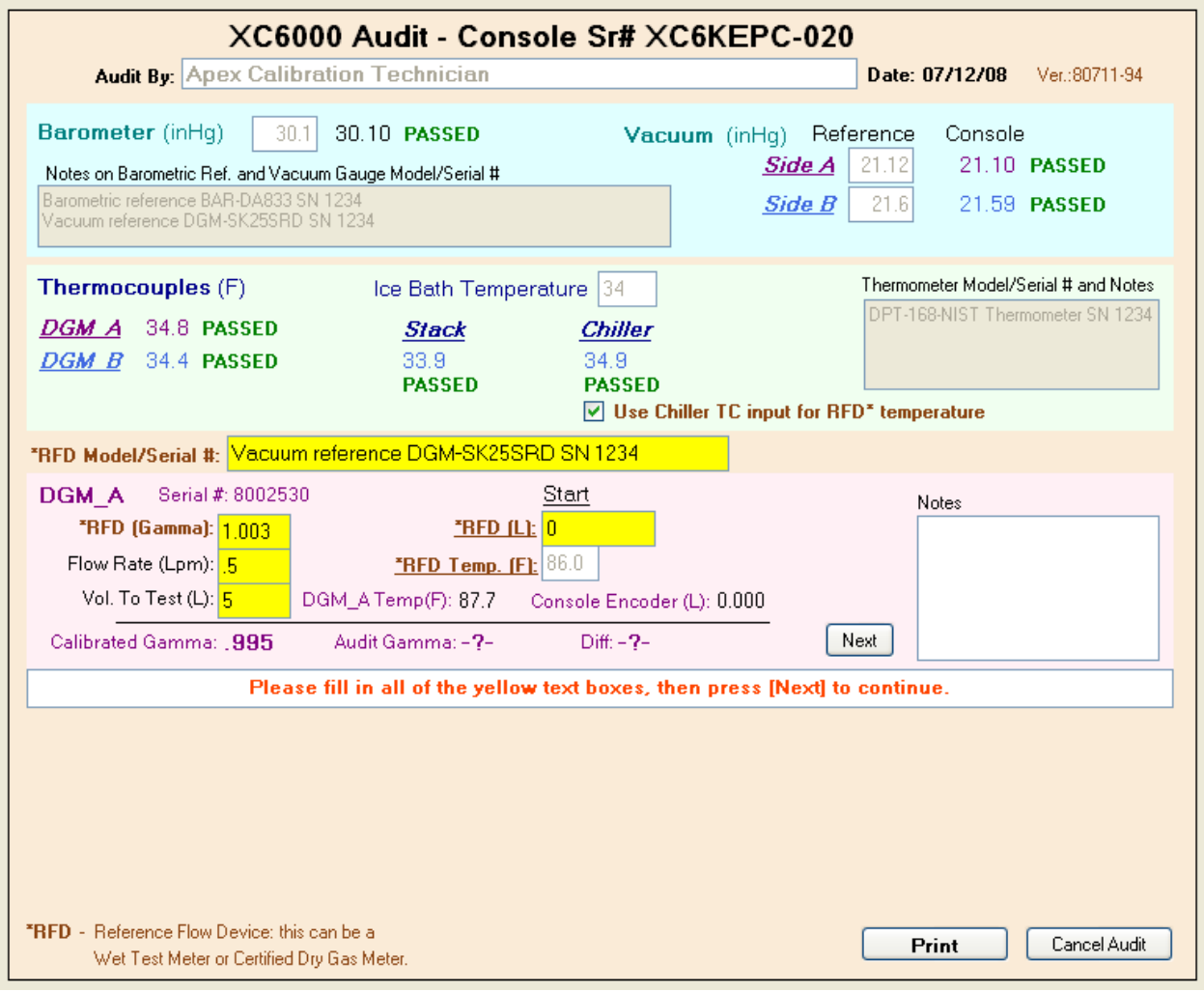


Figure 29
DGM A Test Setup

Press “Next” the XC-6000 pumps will start and the status of the test will be displayed. When the test volume has been reached the pumps will automatically stop.

When the test volume is reached enter the reading from the AK-6000 totalizer into the RFD End box and Press “Next” If not using the AK-6000 enter the ending value, in liters, and the temperature, in °F of the RFD and Press “Next”.

If the Calibrated Gamma and the Audited Gamma are within ±5% the test will pass and a message box will be displayed instructing the user to connect the AK-6000/RFD to the Sample_B_In port on the back of the XC-6000 console.

Connect the AK-6000/RFD to the Sample_B_In port on the back of the XC-6000 console. Press the “OK” button to continue.

Figure 30
DGM_A PASSED and Connect the RFD to Sample_B_In

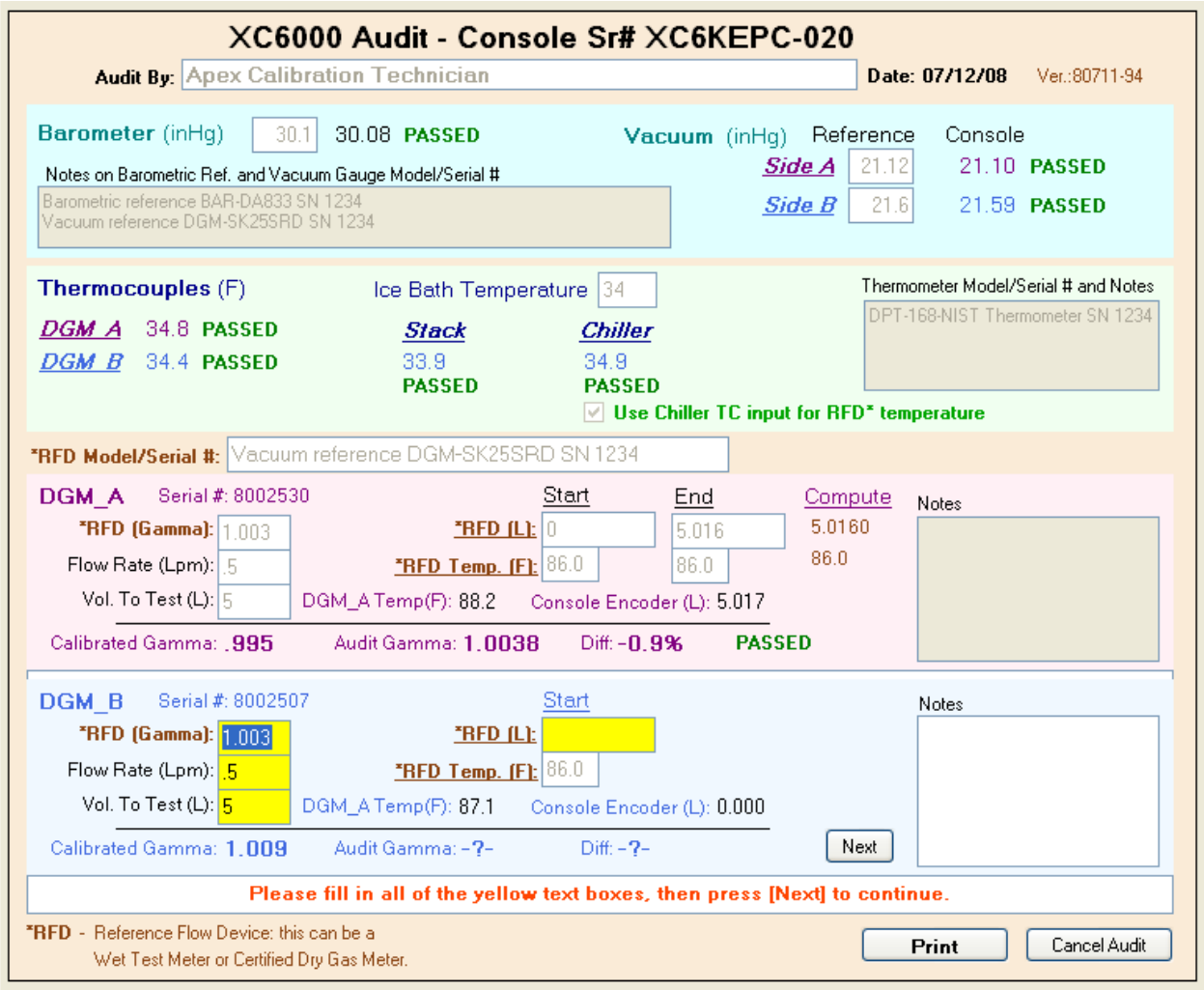


Figure 31
DGM A Audit PASSED

If the test exceeds the limit the test will fail. See the section at the end of this document on how to resolve Out of Tolerance or Failed Console Audit items.

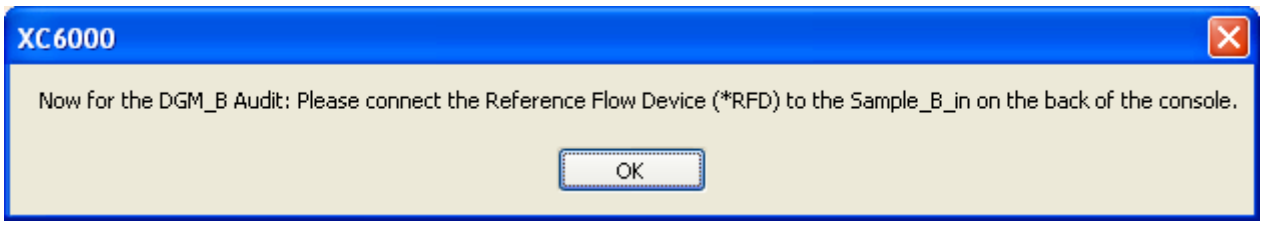


Figure 32
Connect Sample Line Message

DGM B

If using the AK-6000 connect the AK-6000 sample line to the Sample B In port. If using a RFD connect the sample line to the Sample B In port on the back of the console if not already done.

The AK-6000/RFD Gamma, test flow rate in L/min and test volume in L will be automatically filled in based on the information already entered. These values can be changed if desired.

Press the reset on the totalizer on the AK-6000 to reset the counter to zero and enter the number 0 into the RFD start box. The AK-6000 will automatically enter the RFD starting temperature.

If not using the AK-6000 enter the starting value, in liters, and the temperature, in F of the RFD.

Press “Next” and the XC-6000 pumps will start and the status of the test will be displayed. When the test volume has been reached the pumps will stop.

When the test volume is reached enter the reading from the AK-6000 totalizer into the RFD End box and press the “Next" button to continue. If not using the AK-6000 enter the ending value, in liters, and the temperature, in F of the RFD and press the “Next” button to continue.

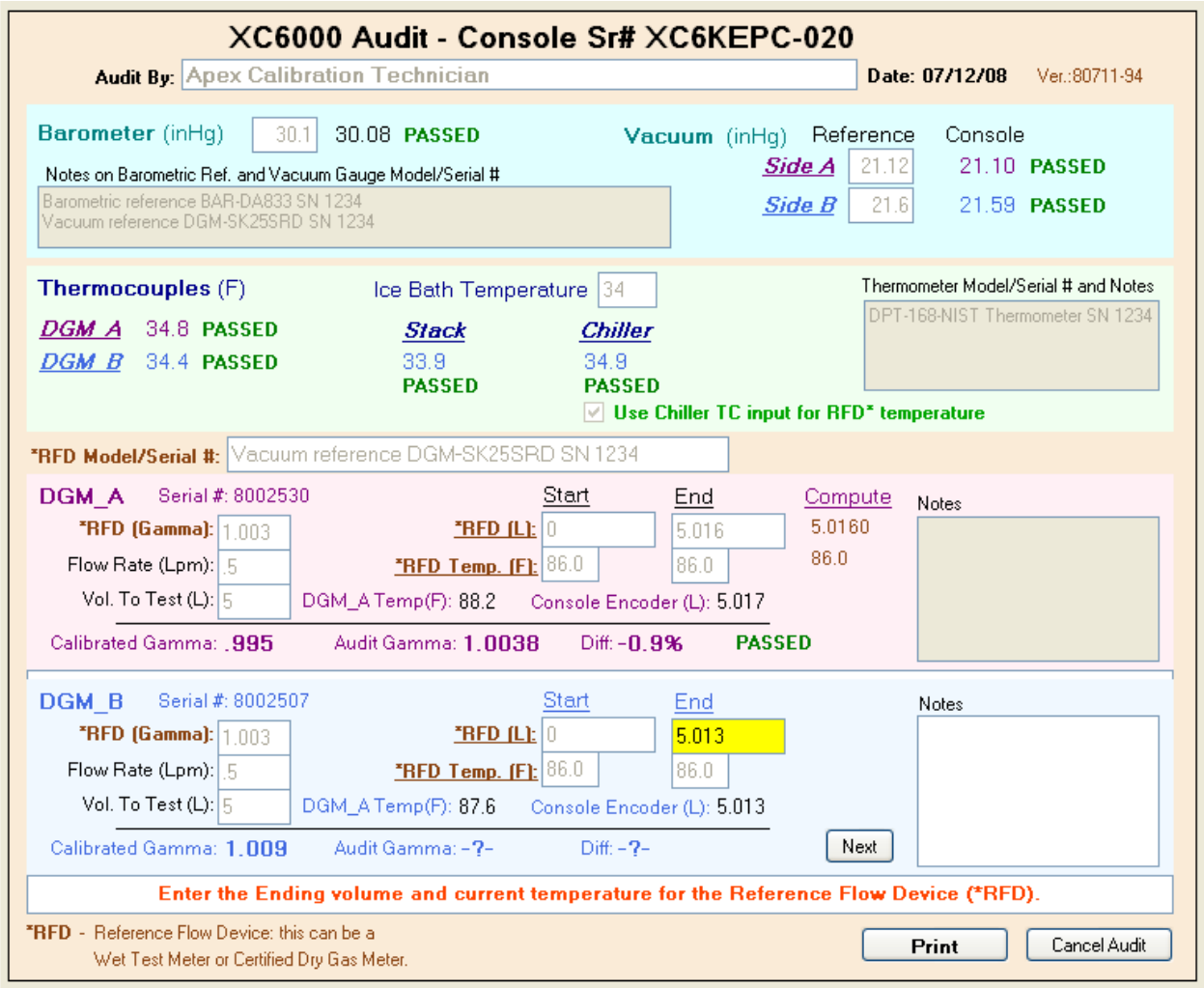


Figure 33
DGM B Enter Ending Values

If the Calibrated Gamma and the Audited Gamma are within ±5% the test will pass. If the test exceeds the limit the test will fail.

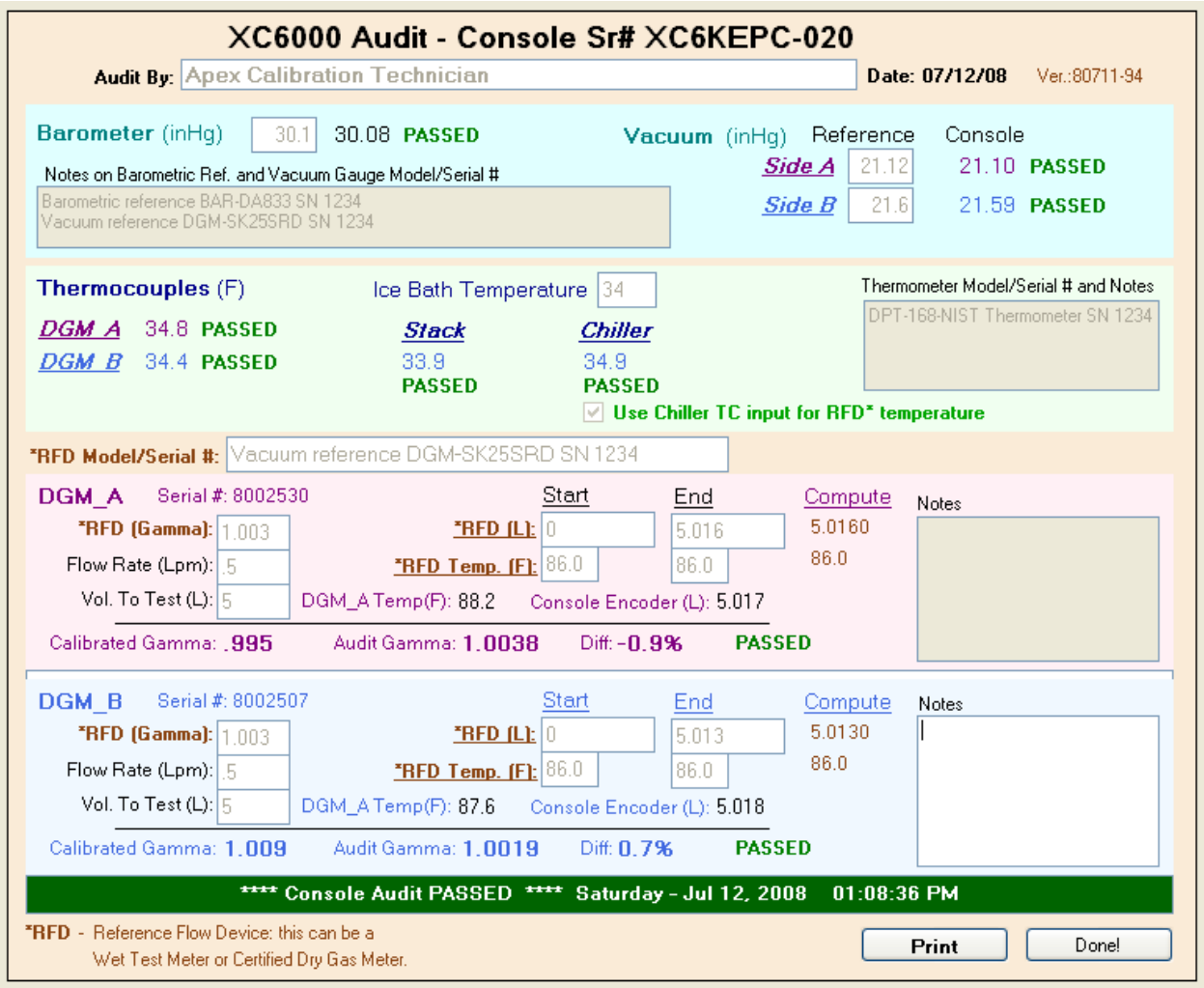
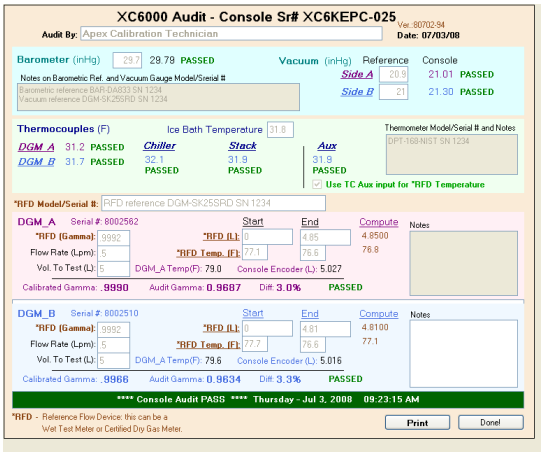


Figure 34
DGM B Audit Passed and Console Audit PASSED

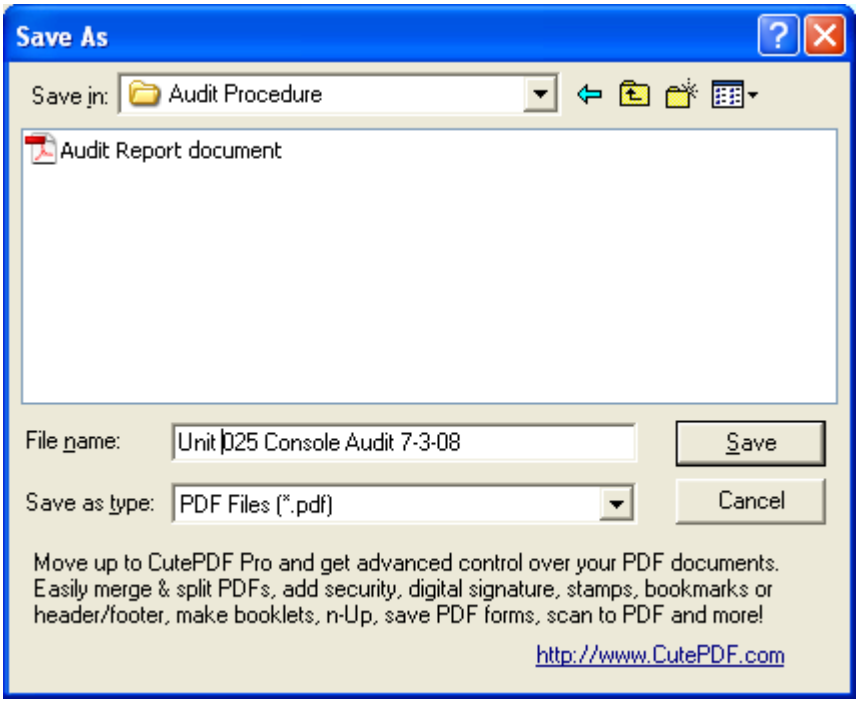
Printing the Console Audit:

When the Console Audit is complete a message at the bottom of the screen will display Console Audit Passed with the current date and time.

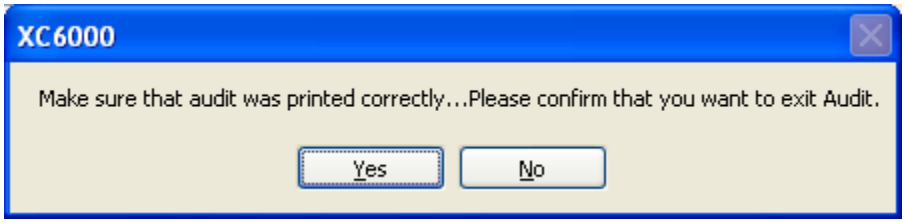
If the Console Audit failed the message Failed will be displayed.



Press the print button and the Console Audit will be printed to the Windows default printer. If you are using a PDF printer a dialog box will open. Enter a file name and select a location to save the Console Audit then Press Save.



Verify your Console Audit printed correctly. Press the “Done” button and a confirmation box will be displayed. Press the “Yes” button to exit or No to go back to the Console Audit screen to re-print the Console Audit Report.


XC6000
Make sure that audit was printed correctly...Please confirm that you want to exit Audit.
Yes
No

How to correct Out of Tolerance or Failed sections in the Console Audit:

If it is required to recalibrate the XC-6000 to factory specifications contact your Apex Instruments Account Representative or refer to the XC-6000 Calibration Manual.

Barometric Test: If the Barometric test fails the XC-6000 fails the Console Audit and should not be used until recalibrated to factory specifications.

DGM TC Test: If the DGM TC test fails the XC-6000 fails the Console Audit and should not be used until recalibrated to factory specifications.

DGM Volume: If the DGM Volumetric test fails the XC-6000 fails the Console Audit and should not be used until recalibrated to factory specifications.

Vacuum Test: If the Vacuum test results are Out of Tolerance the XC-6000 will pass the Console Audit and can continue to be used.

Chiller TC Test: If the Chiller TC test results are Out of Tolerance the XC-6000 will pass the Console Audit and can continue to be used.

Stack TC Test: If the Stack TC test results are Out of Tolerance the XC-6000 will pass the Console Audit and can continue to be used.