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APR-XL-CALKIT

Description

The APR-XL-CALKIT includes the instrumentation and fixtures necessary to set top and bottom airflow and perform thermal calibration procedures to factory standards for the APR-5000-XL(S) rework machine.

Packaging

1	Carrying Case
1	Airflow Velocity Meter, Vane
1	Thermocouple (TC) Calibrator / Simulator, K-Type
1	Thermal Probe and Handle (APR-5000-XL)
1	APR-5000-XL Thermal / Airflow Calibration Fixture with Stand-offs
1	NZA-490-490 Reflow Nozzle
1	Bottom Metal Airflow Fixture

For procedures and more information, please contact APR Customer Service at Service@APR-Rework.com

APR-5000-XL Thermal Calibration

Thermal Calibration for the APR-5000-XL serves two main purposes: for all machines to be set to factory standards, and for multiple machines to have the capability of running the same thermal profiles with similar results.

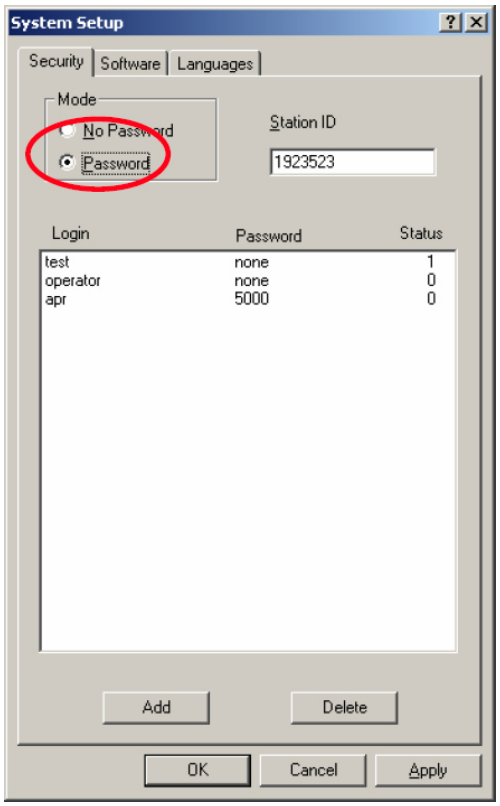
The steps for APR-5000-XL thermal calibration are performed in the following order:

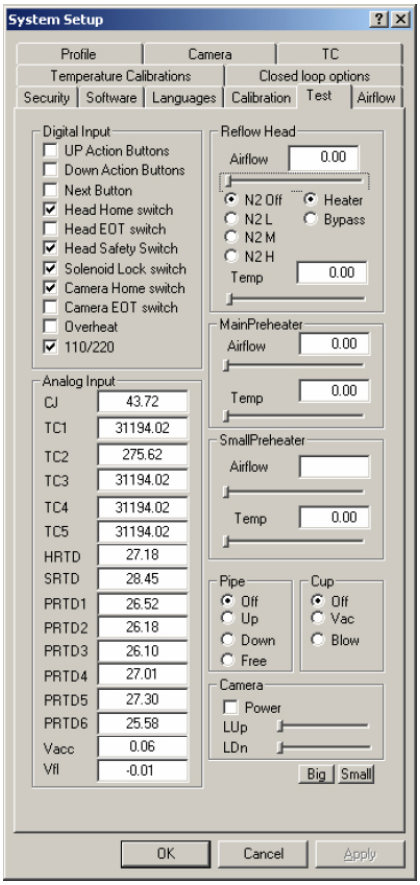
1. Thermocouple (TC) calibration
2. Reflow head (top heater) airflow setting
3. Large bottom pre-heater airflow setting
4. Small bottom pre-heater airflow setting
5. Small bottom pre-heater thermal calibration
6. Large bottom pre-heater thermal calibration
7. Reflow head (top heater) thermal calibration

Note: Airflow setting can be done in any order, but all should be set before performing thermal calibrations. Thermal calibrations can be done in any order.

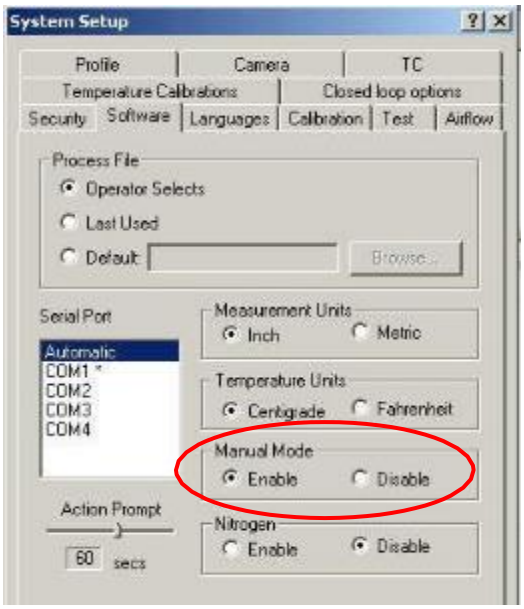
Section 1: Enabling the Required System Setup Tabs

1. Click the System Setup button.
2. Select Password.
3. If a Login/Password has not previously been created it will be necessary to create one. This can be done with any name or password. (i.e. Login=Test; Password=password; Status=operator).
4. Click OK to save. Exit and Restart the software.
5. Administrator login/password: In the Login Window type **OKInt** for the Login and **1923523** for the Password. NOTE: The Login is case sensitive.
6. Now when the System Setup window is opened, all eleven setup tabs will be accessible until the software is exited.





1. Click the software tab and enable the manual mode, which will be used in several of the following procedures.

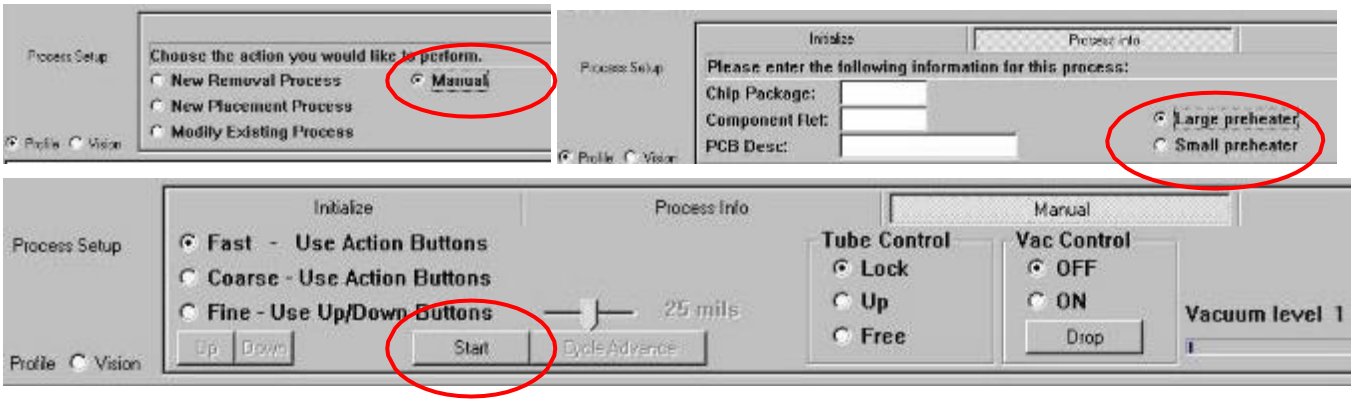


Section 2: APR-5000-XL Thermocouple Calibration

***Required Equipment*:**
Altek or Omega Thermocouple (TC) simulator/calibrator, K-type

SYSTEM WARM-UP

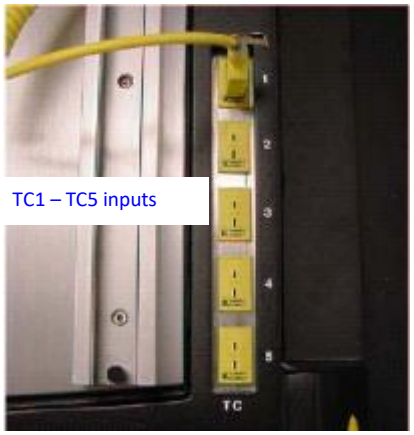
1. Power on the APR-5000-XL. Start the APR XL software.
2. In Process Setup select manual mode. Leave large pre-heater selected and continue the command window. Click start to run the default thermal profile and warm up the machine. The default profile is the one that is loaded when the software is first started.
3. After the machine has finished the cycle, click <next> to exit the manual mode and return to main screen.



TC INPUT CALIBRATIONS

4. Click System Setup and enter engineer's password 1923523 in the bottom space of the Station ID. Click OK. Enter System Setup again.
5. Click on TC tab to enter thermocouple calibration window.
6. Connect the thermocouple simulator/calibrator to TC1 input.

TC simulator/calibrator

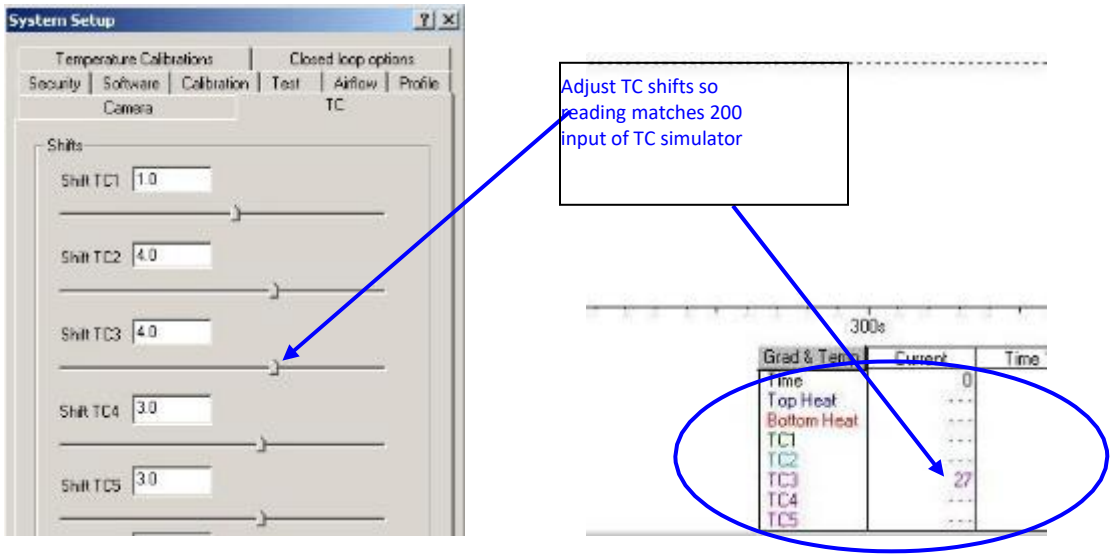


TC1 – TC5 inputs

7. Switch TC simulator to ON position for the outer dark band.
8. Turn knob to 200°C.
9. Observe TC1 reading at the bottom of the screen. Adjust TC1 shifts in the setup window to adjust software reading to match 200°C simulator input. Example: If TC1 in software reads 198 adjust TC1 shift slide bar up +2°. If TC1 reads 203 adjust TC1 shift slide bar -3°. Tolerance is ± 2°.
10. Connect TC simulator set at 200 to TC2 thru TC5 and adjust TC shifts to match 200°C as needed.
11. When complete, click APPLY and OK.

Note: TC readings will not update until APPLY and OK buttons are clicked.

12. Review updated TC1 – TC5 readings. If further adjustment needed, repeat previous steps.



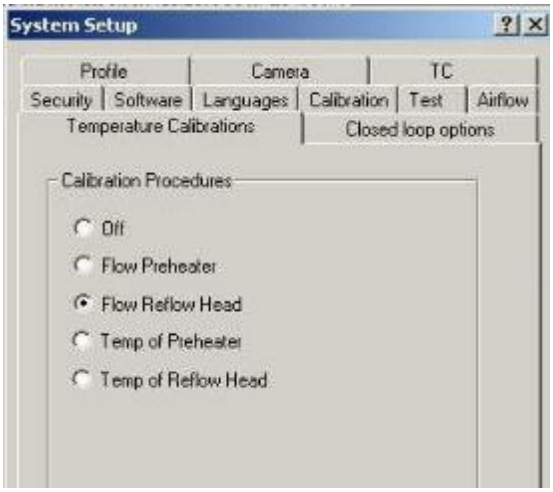
Section 3: APR-5000-XL Reflow Head Airflow Settings

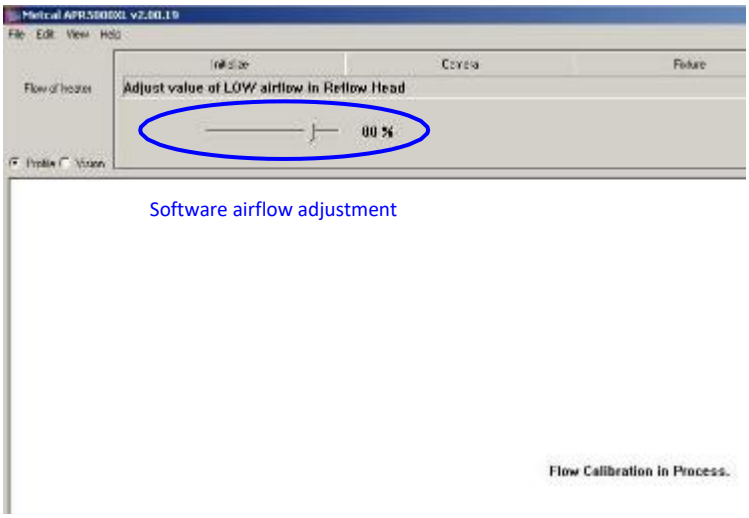
***Required Equipment*:**
NZA-490-490 reflow box nozzle
In-line airflow meter (mounted on the APR-5000-XL)

1. Power on APR XL unit and open the software.
2. Attach NZA-490-490 nozzle to the reflow head.
3. Click System Setup and enter engineer's password 1923523 in the bottom space of the Station ID. Click OK and re-enter System Setup.
4. Click on Temperature Calibrations tab. Select Flow Reflow Head. Click OK. Follow the software prompts.
5. The in-line airflow meter is either mounted in the rear of the APR XL (older models) or on the back of the head assembly (newer models).
6. The factory reflow airflow settings for Low, Medium and High are as follows:

Reflow Head Airflow	Factory Setting
Low	8 liters
Medium	16 liters
High	24 liters

7. Read the meter by looking at the ball position and adjust Low, Medium and High airflow bars in the software to set airflow to the factory settings.
8. Click FINISH to save settings and exit calibration window.



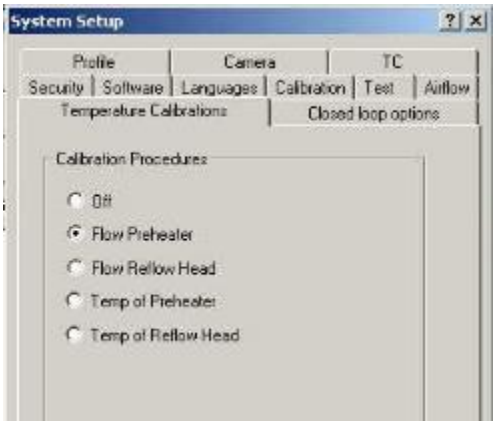


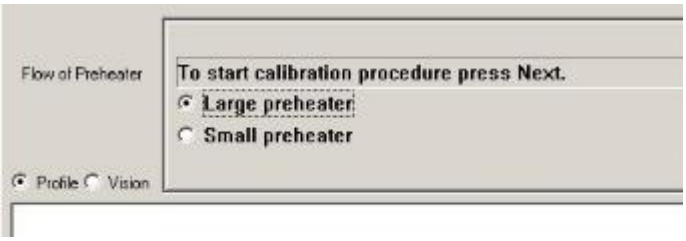
Software airflow adjustment

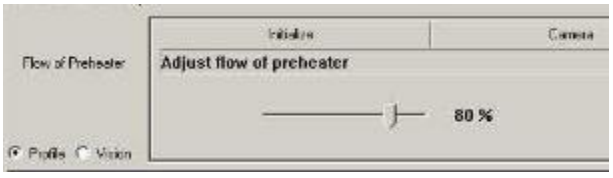
Section 4: APR-5000-XL Large Pre-heater Airflow Setting

***Required Tools/Equipment*:**
APR XL thermal/airflow calibration box fixture Turbo airflow meter
5/64" hex key

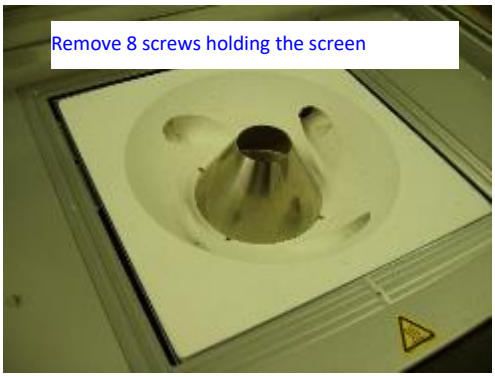
1. Large and small pre-heater airflow is set separately.
2. Power on APR XL and open software.
3. Click System Setup and enter engineer's password 1923523 in the bottom space of the Station ID. Click OK and re-enter System Setup.
4. Click on Temperature Calibrations tab. Select Flow Preheater. Click OK.
5. Select LARGE pre-heater.







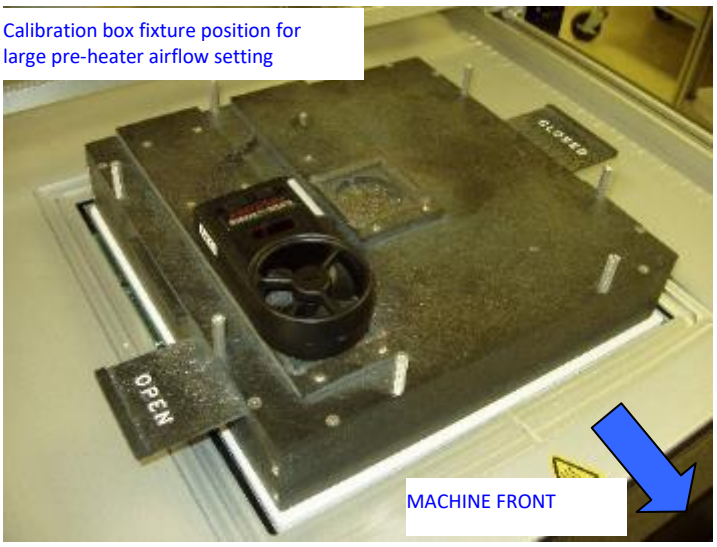
6. With a 5/64" hex key, remove the APR XL pre-heater grill screen.
7. Use the small metal disc from the cal kit to cover the small pre-heater cone opening.



8. Place the calibration box fixture onto the heater bowl as shown with the open side down on the grill and the center window centered over the small pre-heater cone. Facing the machine, the corner window of the fixture will be in the front left section of the heater bowl.
9. The center window should be CLOSED and the corner window should be OPEN for large pre-heater airflow setting.
10. Set the Turbo airflow meter to read knots.
11. Place the airflow meter in the corner window of the box fixture and center the propeller of the meter in the box window.
12. The airflow specification for the larger pre-heater is:

APR XL Large Bowl Pre-heater Airflow Setting	
Air Flow Meter Reading	= 5 knots (500 ft/min)

9. Use the adjust bar to adjust the airflow until the meter reads 5 knots.
10. Select <finish> to complete large pre-heater airflow setting.
11. Refer to next section to set small pre-heater airflow.



Section 5: APR-5000-XL Small Pre-heater Airflow Setting

1. Large and small pre-heater airflow is set separately.
2. Power on APR XL and open software.
3. Click System Setup and enter engineer's password 1923523 into the bottom space of Station ID.
   Click OK and re-enter System Setup.
4. Click on Temperature Calibrations tab. Select Flow Pre-heater. Click OK. Follow the software prompts.
5. Select SMALL pre-heater.
6. Remove the APR XL pre-heater grill screen.
7. Set the Turbo airflow meter to read knots.
8. Place the propeller of the turbo meter over the center of the small pre-heater cone opening as shown.
9. The airflow specification for the larger pre-heater is:

APR XL Small Bowl Pre-heater Airflow Setting	
Air Flow Meter Reading	= 5 knots (500 ft/min)

10. Use the adjust bar to adjust the airflow until the meter reads 5 knots.
11. Select <finish> to complete small pre-heater airflow setting.
12. Remove the box fixture and install the pre-heater grill screen.

Section 6: APR-5000-XL Small Pre-heater Thermal Calibration

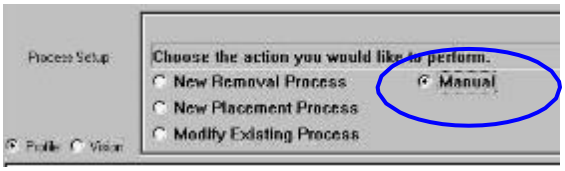
***Required Equipment*:**
APR XL thermal/airflow calibration box fixture APR XL thermal probe
NZA-490-490 reflow nozzle

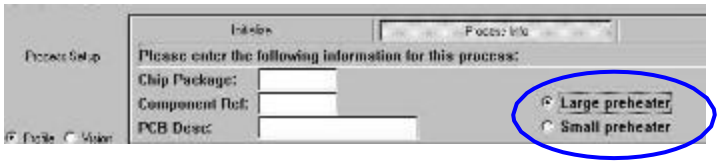
NOTE: It is important to have consistent ambient conditions when running thermal calibrations. Conditions such as an air conditioner blowing downward directly onto the machine can cause inconsistent results; the machine should be located out of the influence of these areas.

The thermal calibration process consists of running the auto-calibration in system setup first; then running a verification profile in the manual mode. If additional offset adjustments are needed, these will be done in system setup and will be followed by a verification run in the manual mode.

SYSTEM WARM-UP

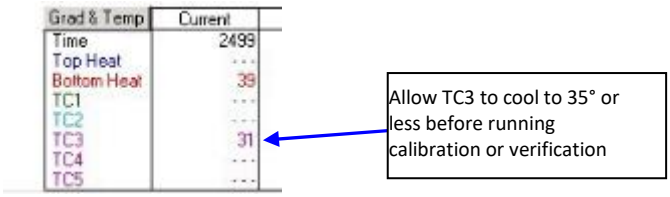
1. Power on APR XL and open the software.
2. If the APR has not been run recently, run the default thermal profile to warm up the machine. Click Process Setup and go to manual mode. Leave large pre-heater selected and continue to manual mode command window. Click start to run the default thermal profile and warm up the machine.
3. After the machine has finished the cycle, click <next> to exit the manual mode and return to main screen.



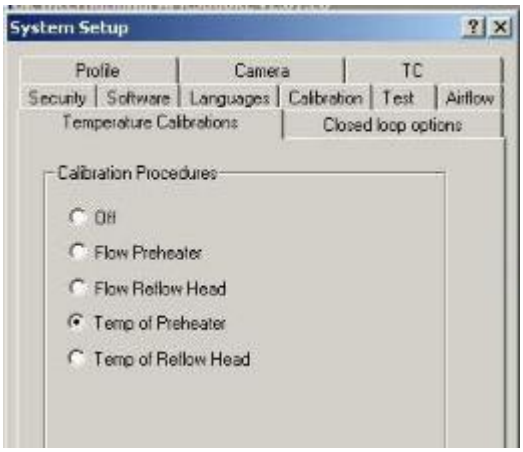


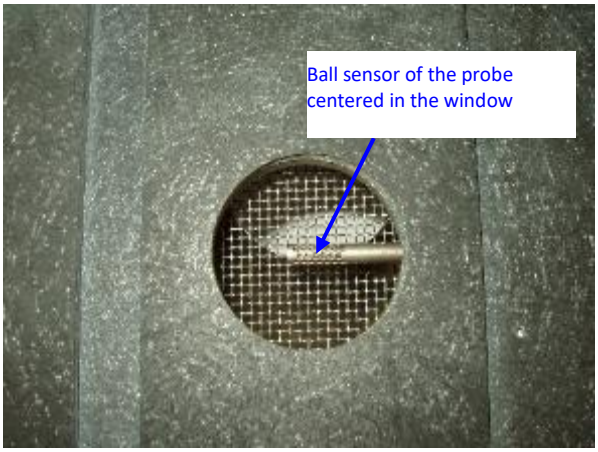
AUTO-CALIBRATION

NOTE: before running any thermal auto-calibration or verification, the TC reading from the probe should be ≤ 35° C. An external fan blowing on the TC probe/box fixture can be used to help cool down the system.

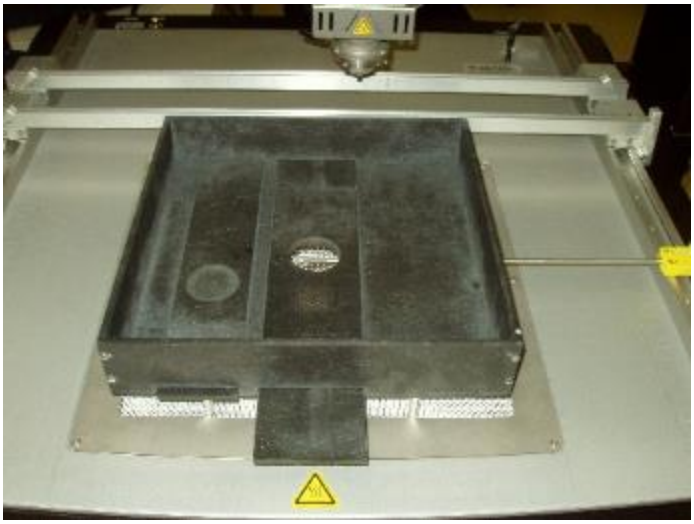


4. Click System Setup and enter engineer's password 1923523 into the bottom space of Station ID. Click OK and re-enter System Setup.
5. Click on Temperature Calibrations tab. Select Temp Pre-heater. Click OK.
6. Select SMALL pre-heater.





7. Insert the NZA-490-490 nozzle into the reflow head an use the y-axis control to move the head to the rear and out of the way of the pre-heater area.
8. Insert the thermal probe into the calibration box fixture so that the ball sensor on the end of the probe is centered in the center window. Note that the ball sensor not at the very end of the probe but seen thru the small openings near the end of the probe. Use the small screw to hold the probe in place. Do not over- tighten.
9. Insert the 8 standoffs into the calibration box fixture. For pre-heater thermal calibration the box will be sitting on the standoffs with the open end UP.
10. For the small pre-heater thermal calibration, the box fixture center window is OPEN and the corner window CLOSED.
11. Align the box fixture, with the thermal probe on the right side, over the APR XL heater box so that the ball sensor of the probe is aligned with the front edge of the small pre-heater cone.
12. Connect the thermal probe to the TC 3 input. TC3 is the only input that is used by the auto-calibration for feedback.



13. Click <Start> and run the auto-calibration for one full cycle.

NOTE: while running the auto-calibration cycle, the profile plot will be changing continuously as the machine makes adjustments. This auto-calibration plot is NOT used to verify final thermal calibration.

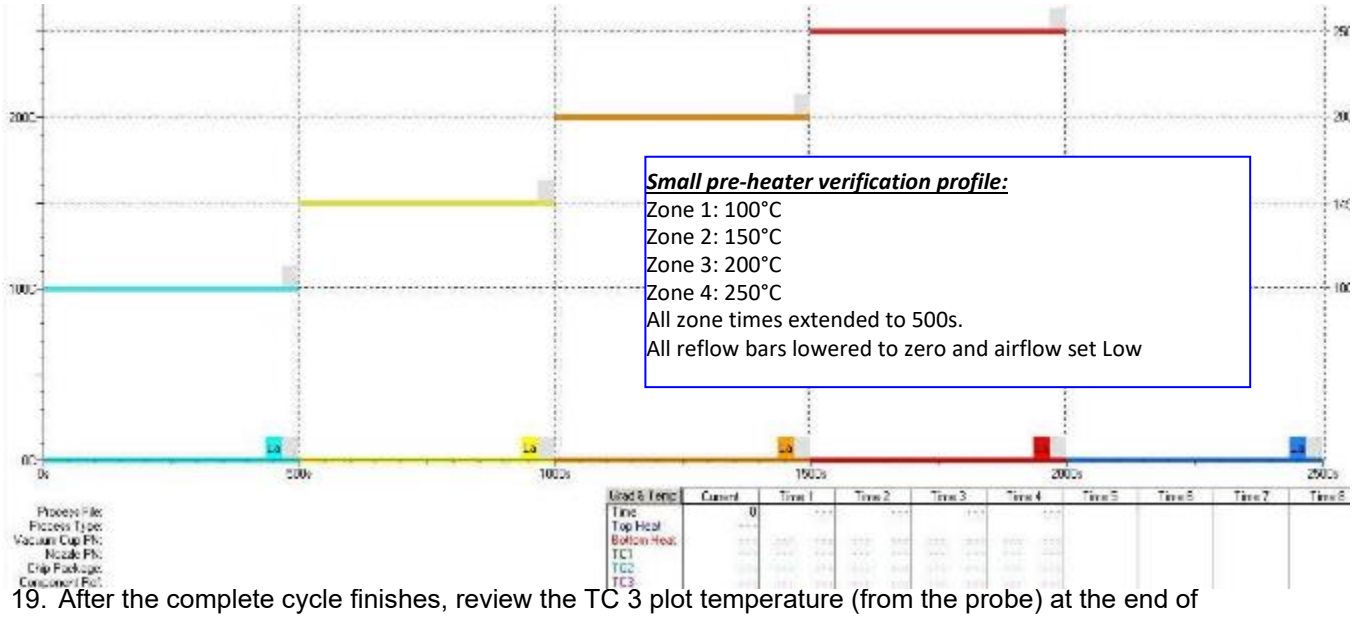
14. Select <Finish> to save and exit the software calibration window.

THERMAL VERIFICATION

15. To verify the thermal calibration, click <Process Setup> and select the manual mode. Keep the thermal fixture and probe in the same position.
16. Select SMALL pre-heater. Continue to manual mode command window.
17. Keep the default pre-heater thermal profile settings: the 4 heat zone temperature bars set at 100º; 150º; 200º; 250º C. Lower all reflow (top) heater temperature bars to zero and set airflow to low. Extend the time interval for all zones to 500s.

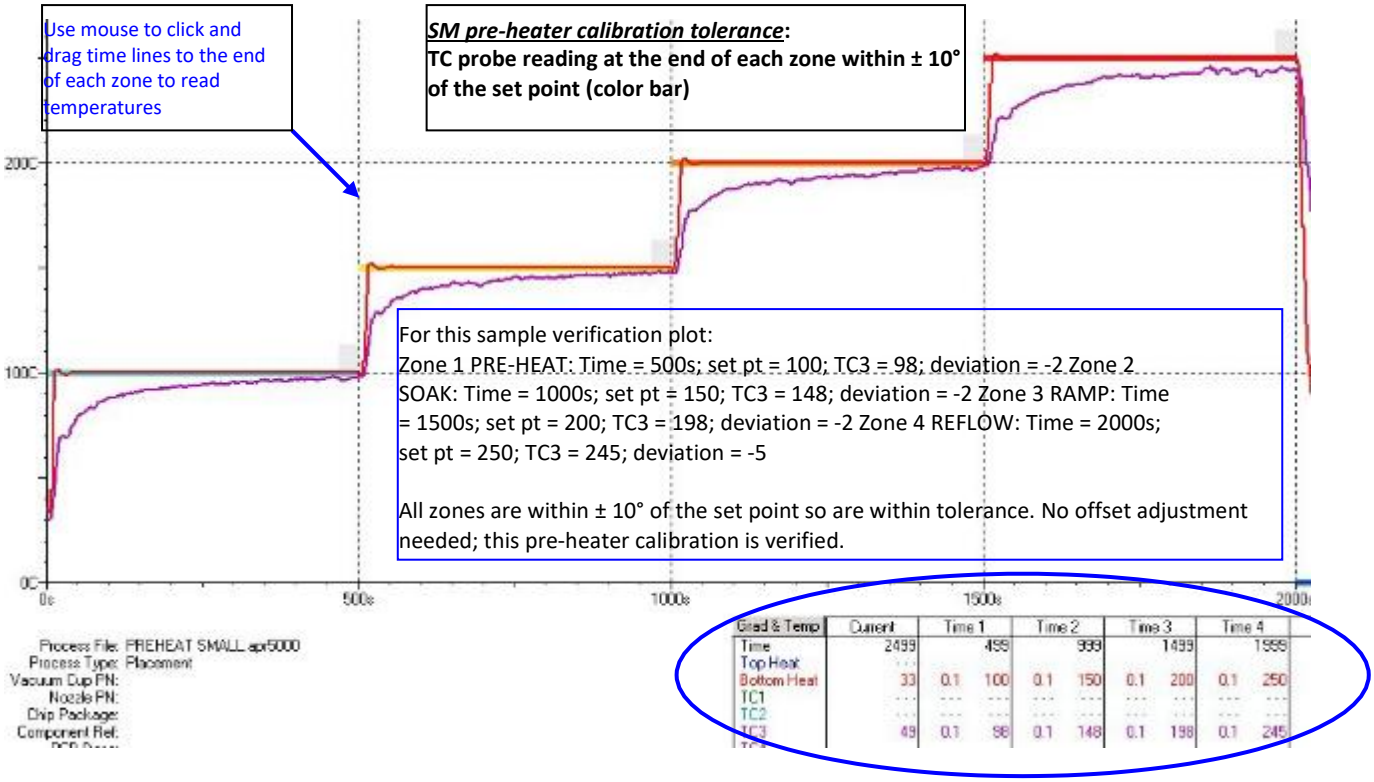
NOTE: before running any thermal auto-calibration or verification, the TC reading from the probe should be ≤ 35º C. An external fan blowing on the TC probe/box fixture can be used to help cool down the system.

18. Click <start> to run verification profile.



19. After the complete cycle finishes, review the TC 3 plot temperature (from the probe) at the end of each zone. Position the time lines at the end of each zone so that the exact TC 3 temperature can be reviewed.
20. For all 4 heat zones, record the temperature deviation from the set points (pre-heater color bars). Example: The 1st zone is set at 100º C. if the TC plot at the end of this zone is 85º C, record the 1st zone deviation as - 15º C. If the TC plot at the end of the zone is 137º C, the deviation is + 37ºC.

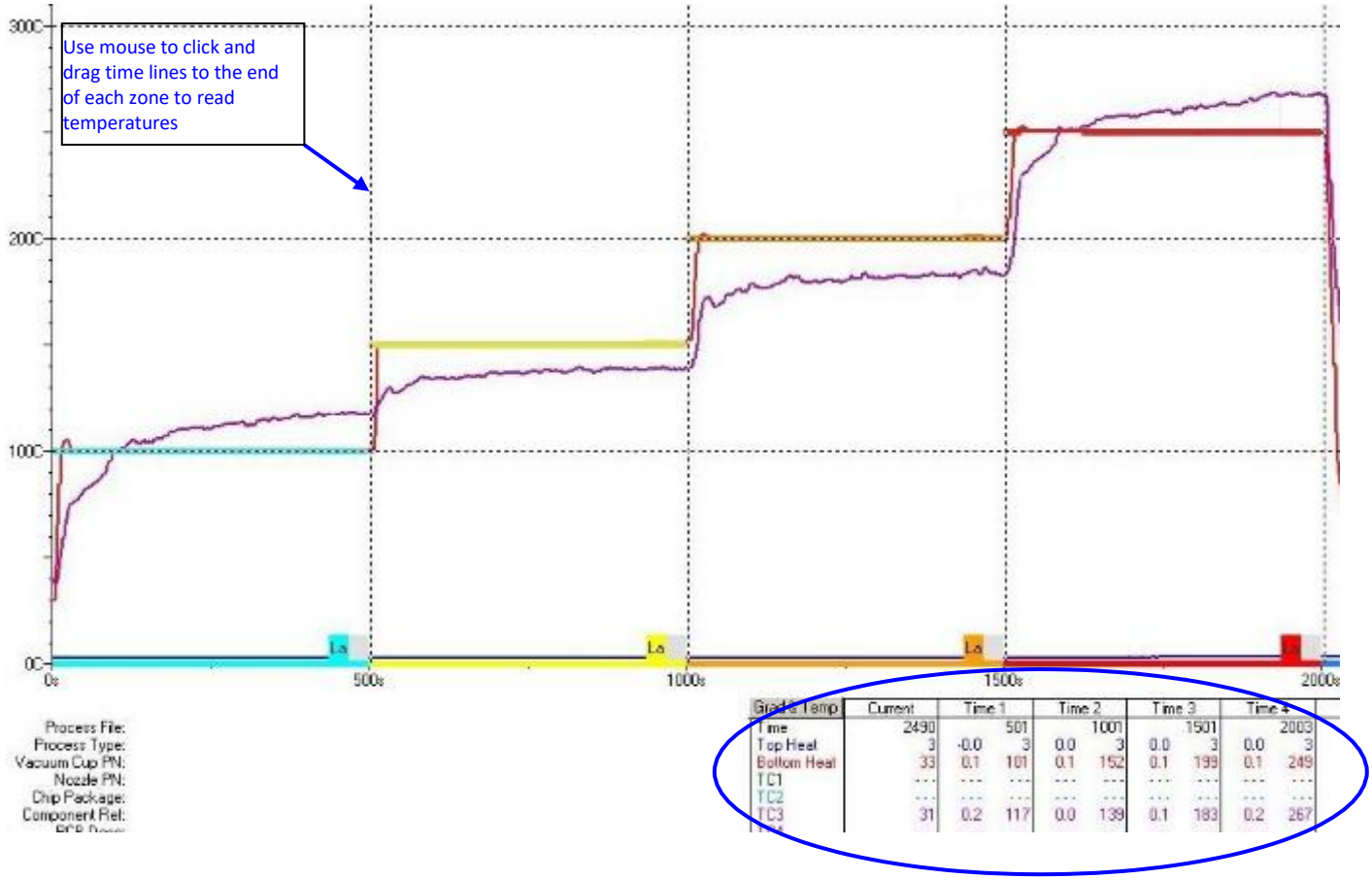
21. If the TC readings at the end of each zone are all within ± 10º C of the set point, the calibration is verified. Follow steps 22-29 to adjust thermal offsets only if any of the zones are outside of this tolerance.



OFFSET ADJUSTMENT

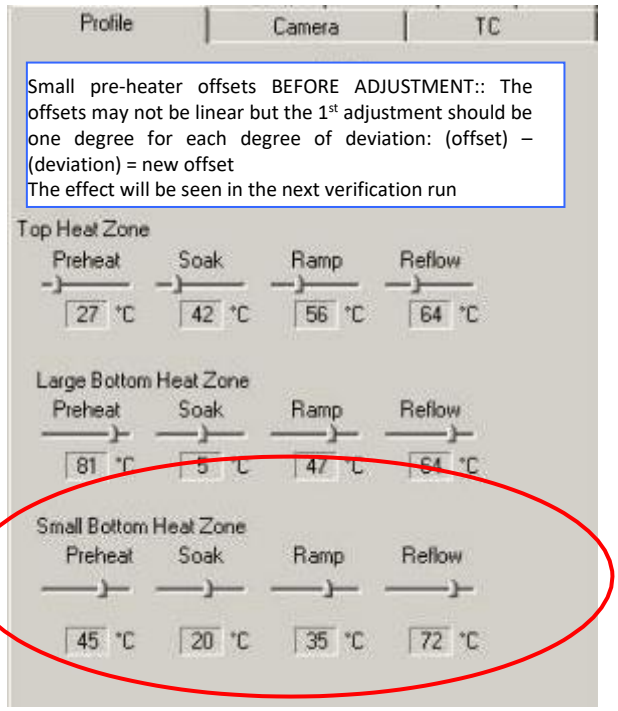
22. If the TC probe plots for any of the 4 zones do not fall within ± 10° of the pre-heater set points then the thermal offsets are adjusted. The offset adjustments are based on the TC3 deviations from the setpoints.
23. Exit the manual mode, click System Setup and enter engineer's password 1923523 into the bottom space of Station ID. Click OK and re-enter System Setup.
24. Select the <Profile> tab. The thermal offsets for each for the 4 zones for the small pre-heater are the 4 settings under Small Bottom Heat Zone.
25. It is optional to adjust the offset when the particular zone meets the ± 10° tolerance from the set point.
26. Using the recorded TC deviations, adjust the offsets in each zone as needed. The offsets are not necessarily linear, but the first adjustment should keep a one-to-one relationship between the offset and the TC deviation. The actual effect will be seen in the next thermal verification run and the offsets can then be adjusted accordingly in the next round, if necessary. Example: If the zone 4 (reflow) set point is 250° and the 1st verification run TC plot at the end of the zone is 270°, then the deviation is + 20 °.

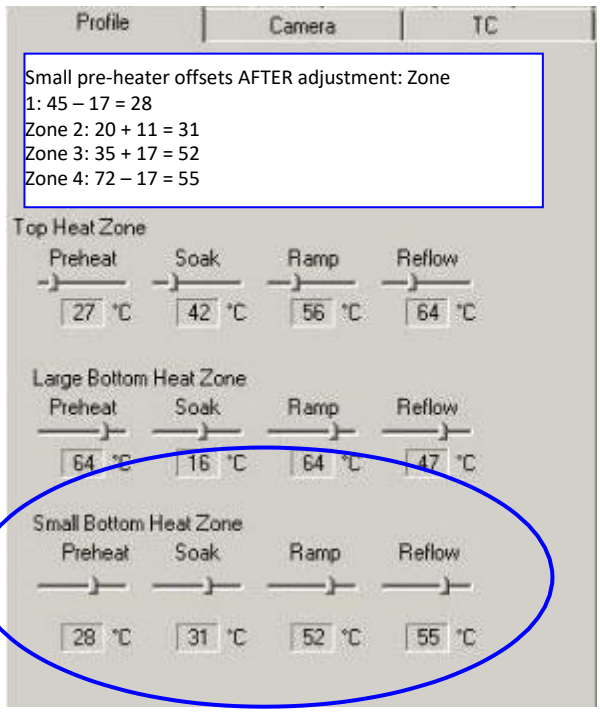
If the reflow zone offset is 43°, the 1st adjustment should be to reduced by 25 so the new reflow offset is 43–20= 23. It may be that the next verification run shows that the TC plot is now 240°, or reduced 10° more than expected. This shows that each degree of offset in the settings is slightly larger than 1 degree in reality. In this case, if we wish to for TC3 to be closer to the set point at 250°, then we may now choose to adjust the offset up 7 degrees instead of 10 for the 3rd run, knowing that each offset degree results in more than 1 degree of actual increase in the TC plot.



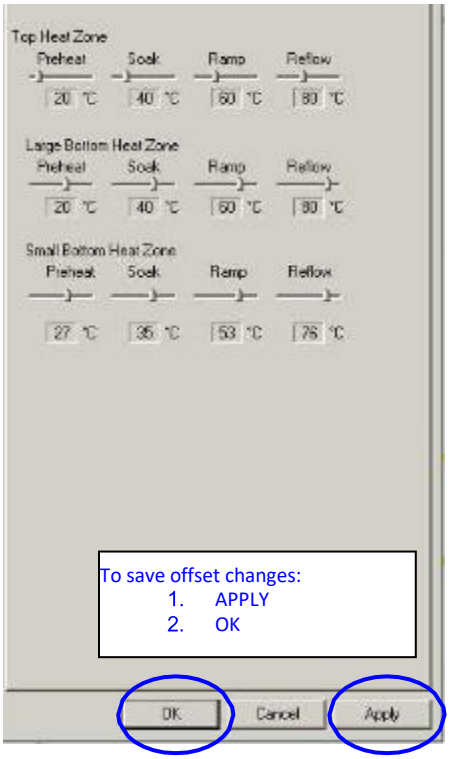
For this sample verification plot
Zone 1 PRE-HEAT: Time = 500s; set pt = 100; TC3 = 117; deviation = +17 Zone 2 SOAK: Time = 1000s; set pt = 150; TC3 = 139; deviation = - 11 Zone 3 RAMP: Time = 1500s; set pt = 200; TC3 = 183; deviation = - 17 Zone 4 REFLOW: Time = 2000s; set pt = 250; TC3 = 267; deviation = +17

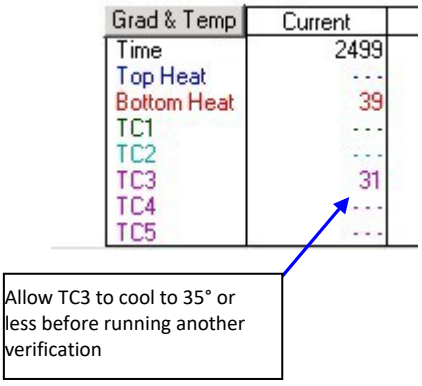
TC3 at the end of all zones is outside of the ± 10° of the set points so the offsets for all zones will need adjustment and the verification profile run again





27. After making the offset adjustments, click <APPLY>, then <OK>. The changes to the offsets will not be saved unless both of these buttons are used.





28. In manual mode, run the small pre-heater verification again. Make sure the TC3 reading is cooled down to

≤ 35º C before starting the cycle again.

29. Review the new thermal plot to see if the TC3 reading is within ± 10º C of the set point at the end of all 4 heat zones. If further offset adjustment is necessary, repeat steps 22-28 until the calibration is verified to standard.

Section 7: APR-5000-XL Large Pre-heater Thermal Calibration

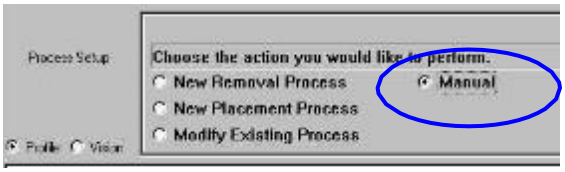
***Required Equipment*:**
APR XL thermal/airflow calibration box fixture APR XL thermal probe
NZA-490-490 reflow nozzle

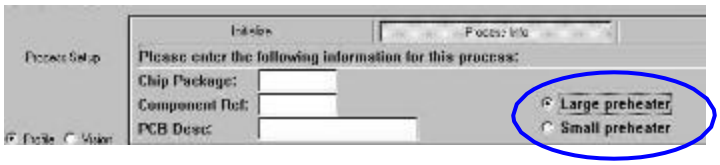
NOTE: It is important to have consistent ambient conditions when running thermal calibrations. Conditions such as an air conditioner blowing downward directly onto the machine can cause inconsistent results; the machine should be located out of the influence of these areas.

The thermal calibration process consists of running the auto-calibration in system setup first; then running a verification profile in the manual mode. If additional offset adjustments are needed, these will be done in system setup and will be followed by a verification run in the manual mode.

SYSTEM WARM-UP

1. Power on APR XL and open the software.
2. If the APR has not been run recently, run the default thermal profile to warm up the machine. Click Process Setup and go to manual mode. Leave large pre-heater selected and continue to manual mode command window. Click start to run the default thermal profile and warm up the machine.
3. After the machine has finished the cycle, click <next> to exit the manual mode and return to main



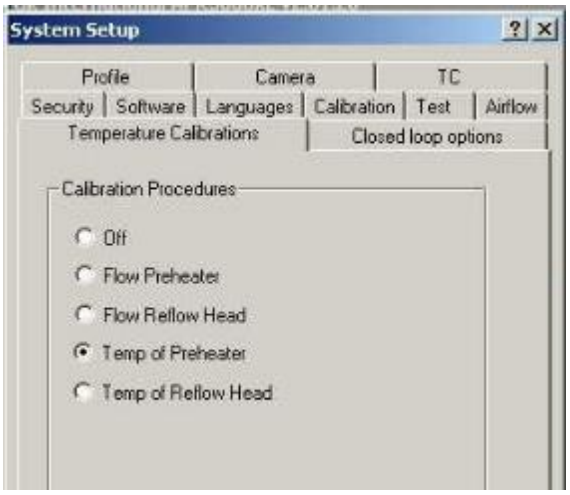


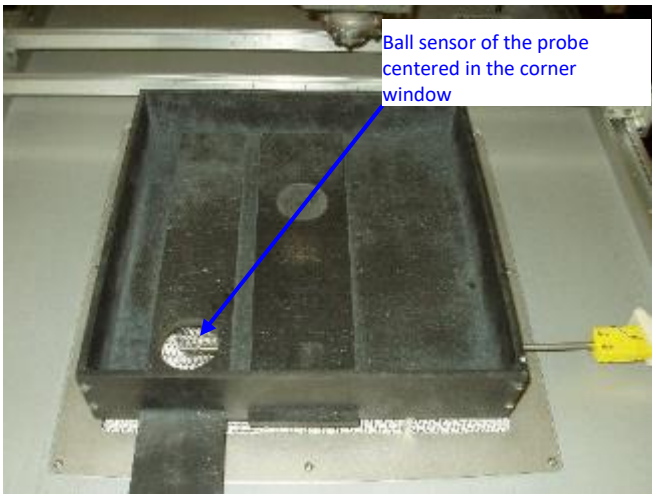
screen.

AUTO-CALIBRATION

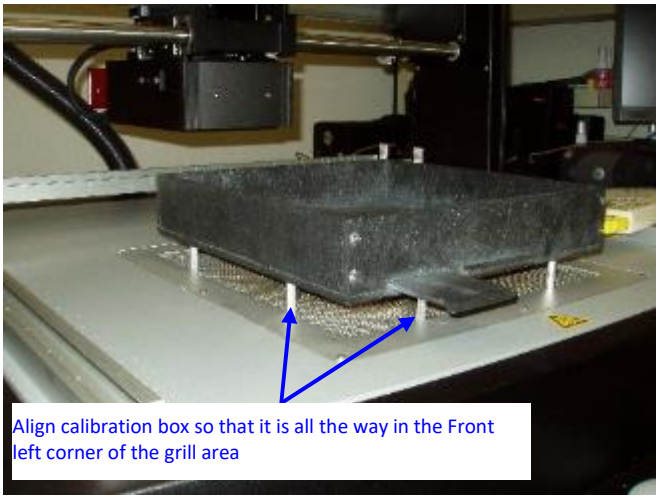
NOTE: before running any thermal auto-calibration or verification, the TC reading from the probe should be ≤ 35º C. An external fan blowing on the TC probe/box fixture can be used to help cool down the system.

4. Click System Setup and enter engineer's password 1923523 into the bottom space of Station ID. Click OK and re-enter System Setup.
5. Click on Temperature Calibrations tab. Select Temp Pre-heater. Click OK.
6. Select LARGE pre-heater.





7. Insert the NZA-490-490 nozzle into the reflow head and use the y-axis control to move the head to the rear and out of the way of the pre-heater area.
8. Insert the thermal probe into the calibration box fixture so that the ball sensor on the end of the probe is centered in the corner window. Note that the ball sensor not at the very end of the probe but seen thru the small openings near the end of the probe. Use the small screw to hold the probe in place. Do not over- tighten.
9. Insert the 8 standoffs into the calibration box fixture. For pre-heater thermal calibration the box will be sitting on the standoffs with the open end UP.
10. For the large pre-heater thermal calibration, the box fixture center window is OPEN and the corner window CLOSED.
11. Align the box fixture, with the thermal probe on the right side, over the APR XL heater box so that it is all the way in the front left corner of the grill area.



12. Connect the thermal probe to the TC 3 input. TC3 is the only input that is used for the auto-calibration as feedback.
13. Click <Start> and run the auto-calibration for one full cycle.

NOTE: while running the auto-calibration cycle, the profile plot will be changing continuously as the machine makes adjustments. This auto-calibration plot is NOT used to verify final thermal calibration.

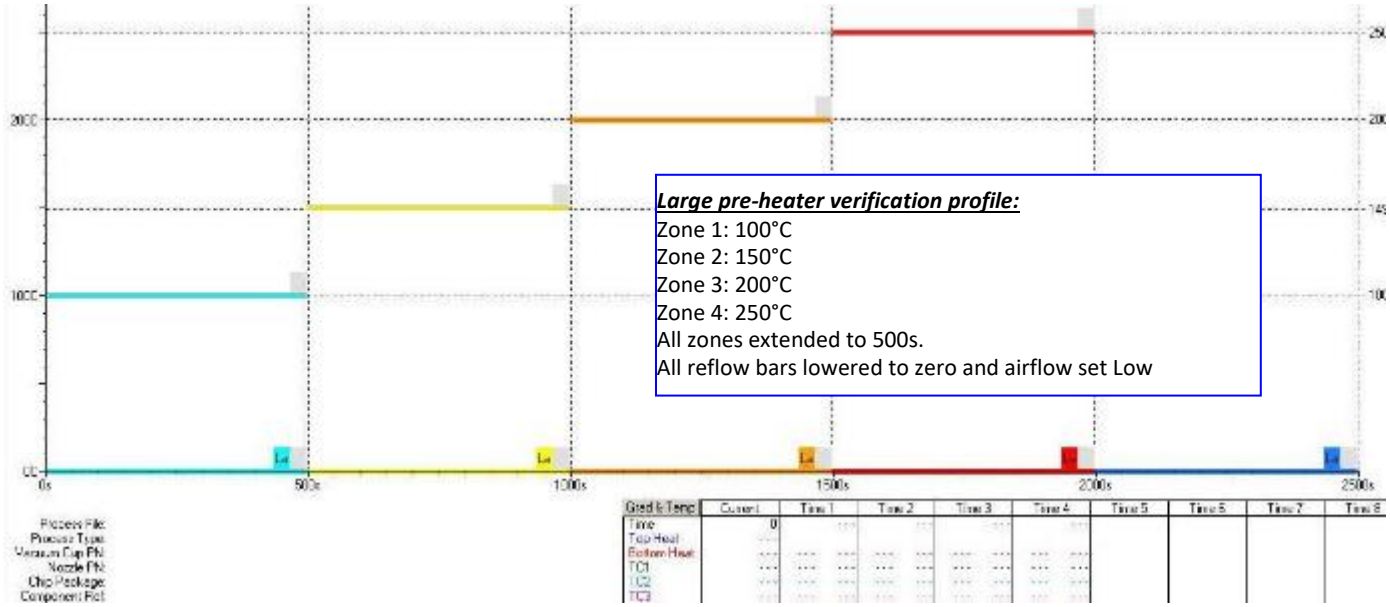
14. Select <Finish> to save and exit the software calibration window.

THERMAL VERIFICATION

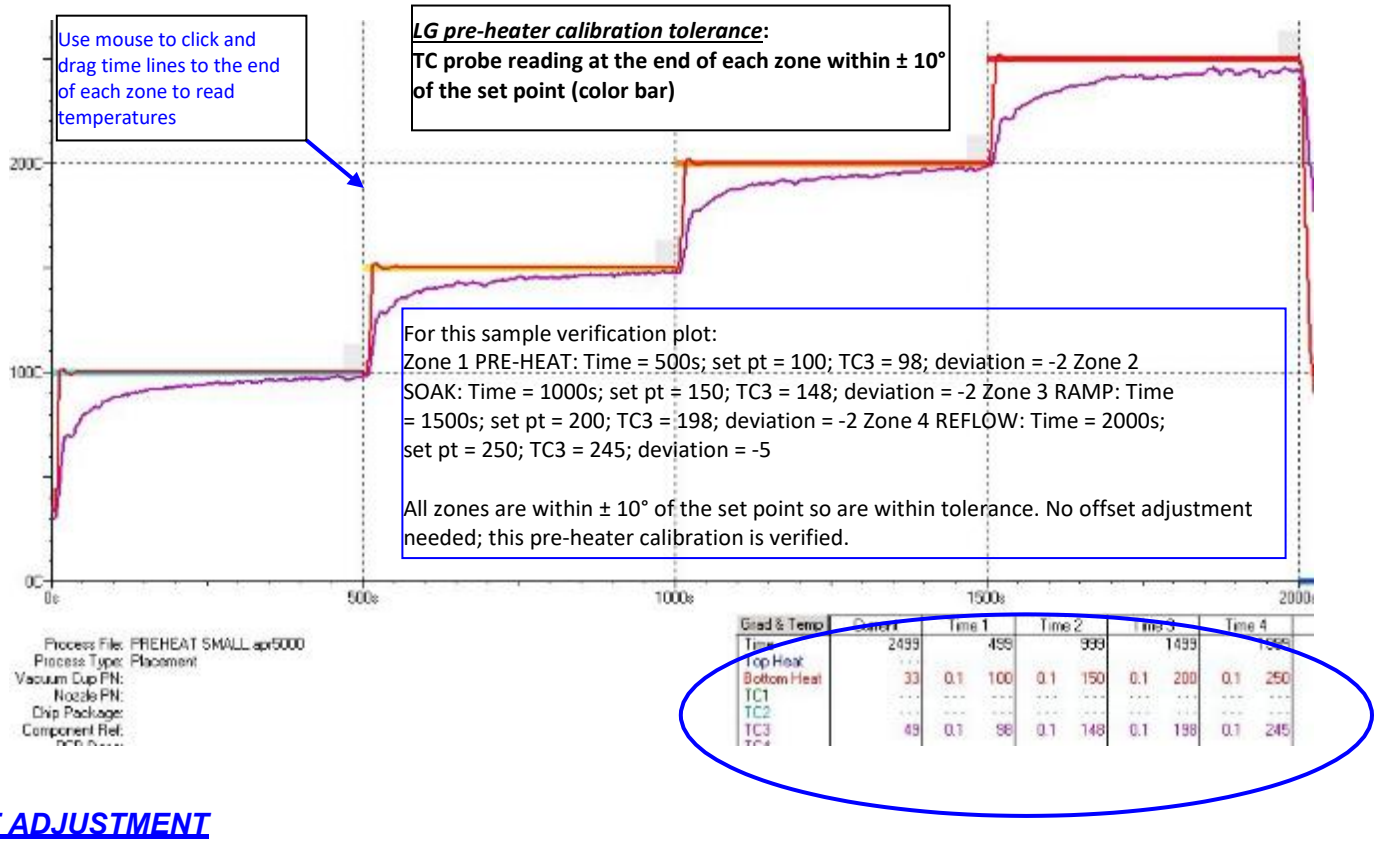
15. To verify the thermal calibration, click <Process Setup> and select the manual mode. Keep the thermal fixture and probe in the same position.
16. Select LARGE pre-heater. Continue to manual mode command window.
17. Keep the default pre-heater thermal profile settings: the 4 heat zone temperature bars set at 100º; 150º; 200º; 250º C. Lower all reflow (top) heater temperature bars to zero and set airflow to low. Extend the time interval for all zones to 500s.

NOTE: before running any thermal auto-calibration or verification, the TC reading from the probe should be ≤ 35º C. An external fan blowing on the TC probe/box fixture can be used to help cool down the system.

18. Click <start> to run verification profile.
19. After the complete cycle, review the verification profile, particularly the TC 3 plot temperature (from the probe) at the end of each zone. Position the time lines at the end of each zone so that the exact TC 3 temperature can be reviewed.



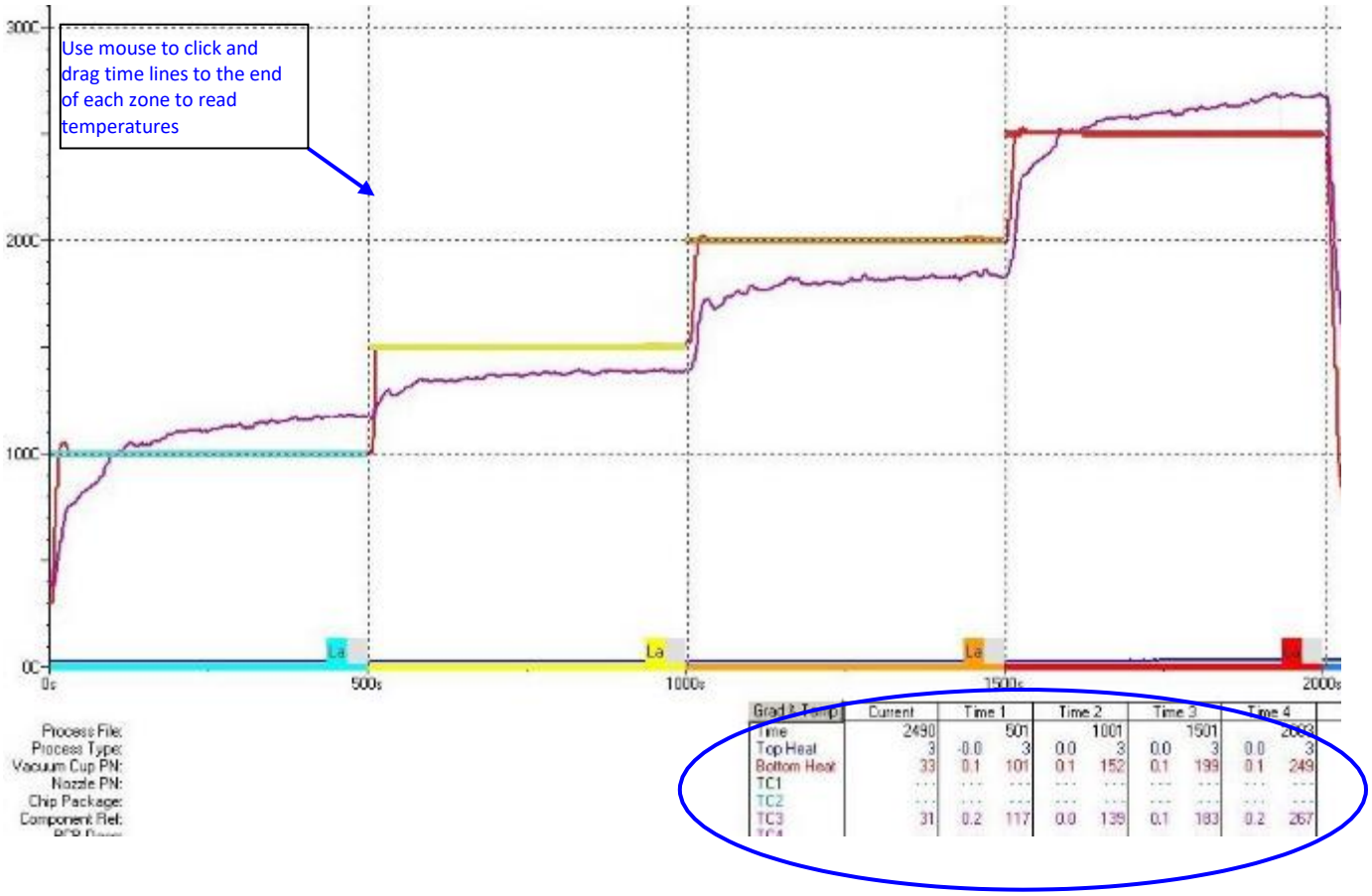
20. For all 4 heat zones, record the temperature deviation from the set points (pre-heater color bars). Example: The 1st zone is set at 100º C. if the TC plot at the end of this zone is 85º C, record the 1st zone deviation as - 15º C. If the TC plot at the end of the zone is 137º C, the deviation is + 37ºC.
21. If the TC readings at the end of each zone are all within ± 10º C of the set point, the calibration is verified. Follow steps 22-29 to adjust thermal offsets only if any of the zones are outside of this tolerance.



OFFSET ADJUSTMENT

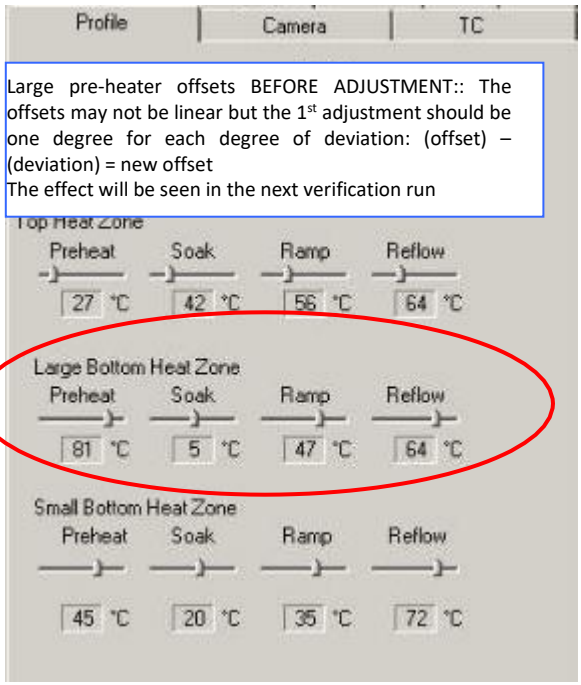
22. If the TC probe plots for any of the 4 zones do not fall within ± 10° of the pre-heater set points then the thermal offsets are adjusted. The offset adjustments are based on the TC3 deviations from the set points.
23. Exit the manual mode, click System Setup and enter engineer's password 1923523 into the bottom space of Station ID. Click OK and re-enter System Setup.
24. Select the <Profile> tab. The thermal offsets for each for the 4 zones for the small pre-heater are the 4 settings under Large Bottom Heat Zone.
25. It is optional to adjust the offset when the particular zone meets the ± 10° tolerance from the set point.
26. Using the recorded TC deviations, adjust the offsets in each zone as needed. The offsets are not necessarily linear, but the first adjustment should keep a one-to-one relationship between the offset and the TC deviation. The actual effect will be seen in the next thermal verification run and the offsets can then be adjusted accordingly in the next round, if necessary. Example: If the zone 4 (reflow) set point is 250° and the 1st verification run TC plot at the end of the zone is 270°, then the deviation is + 20 °.

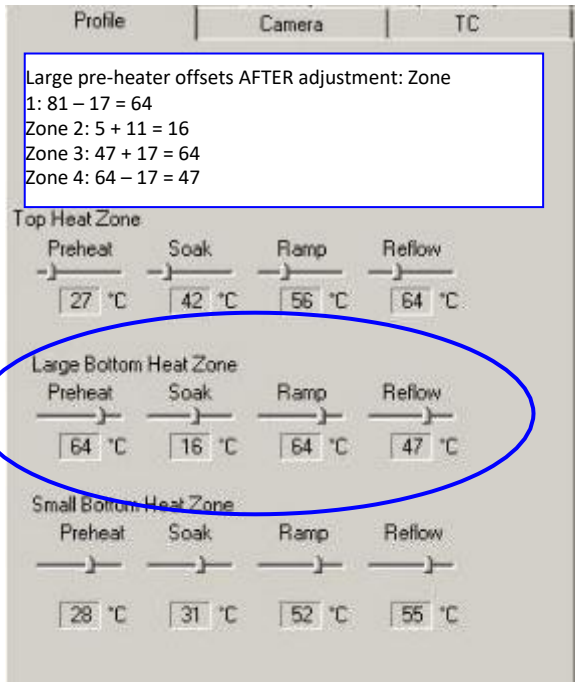
If the reflow zone offset is 43°, the 1st adjustment should be to reduced by 25 so the new reflow offset is 43–20= 23. It may be that the next verification run shows that the TC plot is now 240°, or reduced 10° more than expected. This shows that each degree of offset in the settings is slightly larger than 1 degree in reality. In this case, if we wish to for TC3 to be closer to the set point at 250°, then we may now choose to adjust the offset up 7 degrees instead of 10 for the 3rd run, knowing that each offset degree results in more than 1 degree of actual increase in the TC plot.



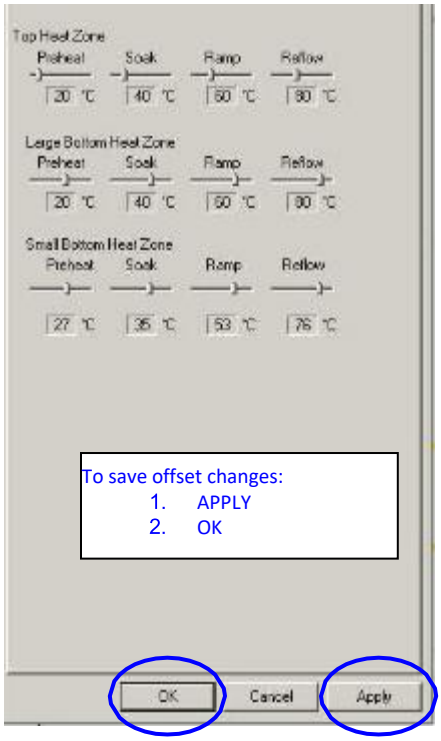
For this sample verification plot
Zone 1 PRE-HEAT: Time = 500s; set pt = 100; TC3 = 117; deviation = +17 Zone 2 SOAK: Time = 1000s; set pt = 150; TC3 = 139; deviation = - 11 Zone 3 RAMP: Time = 1500s; set pt = 200; TC3 = 183; deviation = - 17 Zone 4 REFLOW: Time = 2000s; set pt = 250; TC3 = 267; deviation = +17

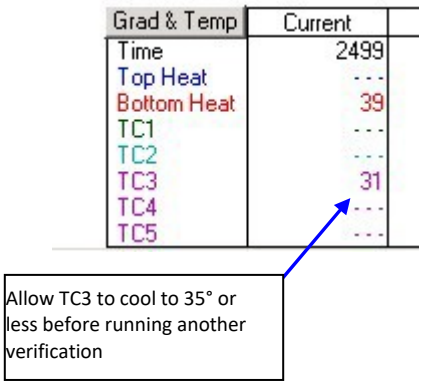
TC3 at the end of all zones is outside of the ± 10° of the set points so the offsets for all zones will need adjustment and the verification profile run again





27. After making the offset adjustments, click <APPLY>, then <OK>. The changes to the offsets will not be saved unless both of these buttons are used.
28. In manual mode, run the large pre-heater verification again. Make sure the TC3 reading is cooled down to ≤ 35° C before starting the cycle again.





29. Review the thermal plot to see if the TC3 reading is within ± 10º C of the set point at the end of all 4 heat zones. If further offset adjustment is necessary, repeat steps 22-28 until the calibration is verified to standard.

Section 8: APR-5000-XL Reflow Head (Top Heater) Thermal Calibration

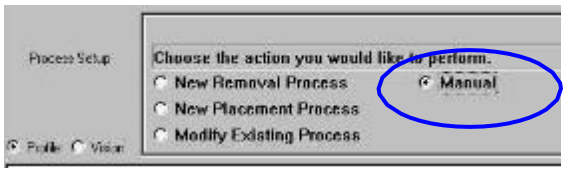
***Required Equipment*:**
APR XL thermal/airflow calibration box fixture APR XL thermal probe
NZA-490-490 reflow nozzle

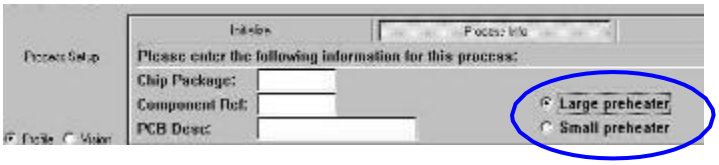
NOTE: It is important to have consistent ambient conditions when running thermal calibrations. Conditions such as an air conditioner blowing downward directly onto the machine can cause inconsistent results; the machine should be located out of the influence of these areas.

The thermal calibration process consists of running the auto-calibration in system setup first; then running a verification profile in the manual mode. If additional offset adjustments are needed, these will be done in system setup and will be followed by a verification run in the manual mode.

SYSTEM WARM-UP

1. Power on APR XL and open the software.
2. If the APR has not been run recently, run the default thermal profile to warm up the machine. Click Process Setup and go to manual mode. Leave large pre-heater selected and continue to manual mode command window. Click start to run the default thermal profile and warm up the machine.
3. After the machine has finished the cycle, click <next> to exit the manual mode and return to main screen.

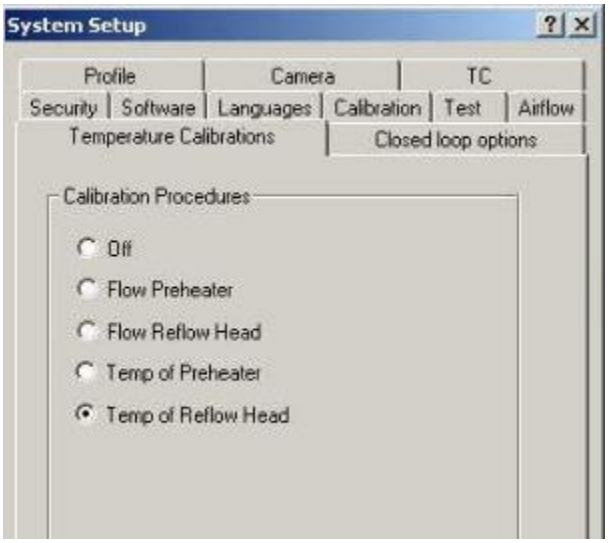


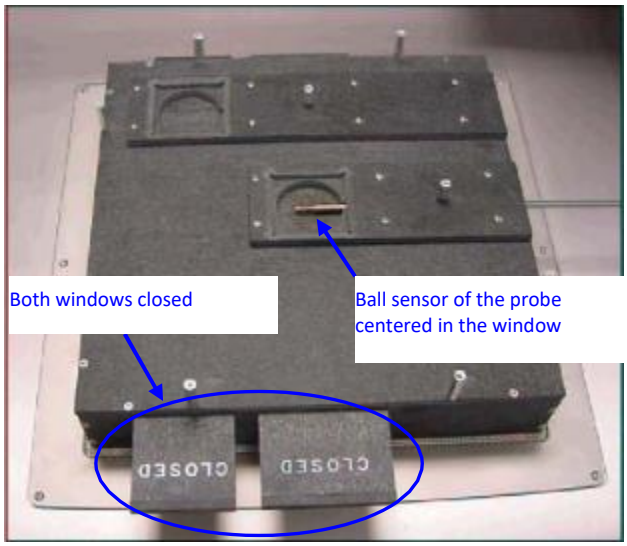


AUTO-CALIBRATION

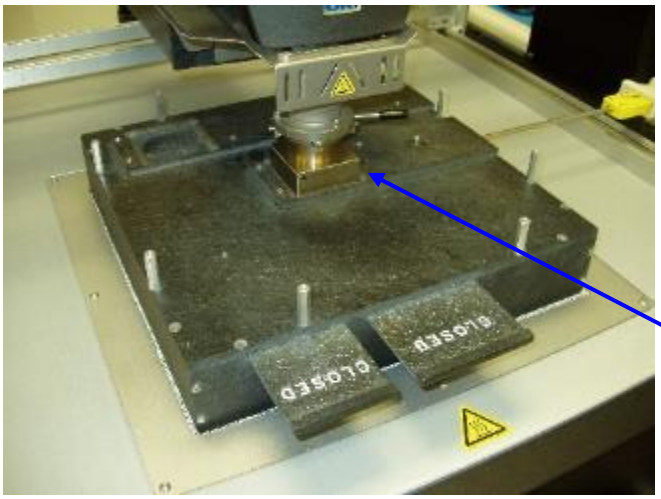
NOTE: before running any thermal auto-calibration or verification, the TC reading from the probe should be ≤ 35º C. An external fan blowing on the TC probe/box fixture can be used to help cool down the system.

4. Click System Setup and enter engineer's password 1923523 into the bottom space of Station ID. Click OK and re-enter System Setup.
5. Click on Temperature Calibrations tab. Select Temp of Reflow Head. Click OK. Select large or small pre- heater; it does not matter which as this should not factor in the reflow head calibration.





6. Insert the thermal probe into the calibration box fixture so that the ball sensor on the end of the probe is centered in the center window. Note that the ball sensor not at the very end of the probe but seen thru the small openings near the end of the probe. Use the small screw to hold the probe in place. Do not over- tighten.
7. For reflow head thermal calibration the open end of the box will be DOWN on the grille.
8. Center the box fixture on the pre-heater grille. The center box window should be centered on the cone.
9. For reflow head thermal calibration, both of the box fixture windows are CLOSED.
10. Connect the thermal probe to the TC 3 input. TC3 is the only input that is used as feedback for the auto- calibration.
11. Viewing the camera image of the nozzle and the center of the box fixture, use the joystick to align the nozzle edge with the opening in the calibration fixture.
12. Bring head down and align NZA-490-490 nozzle so that it drops down into the opening on top of the box fixture. Use the fine adjustment until the bottom edges of the nozzle touch the fixture.



13. Click <Start> and run the auto-calibration for one full cycle.

NOTE: while running the auto-calibration cycle, the profile plot will be changing continuously as the machine makes adjustments. This auto-calibration plot is NOT used to verify final thermal calibration.

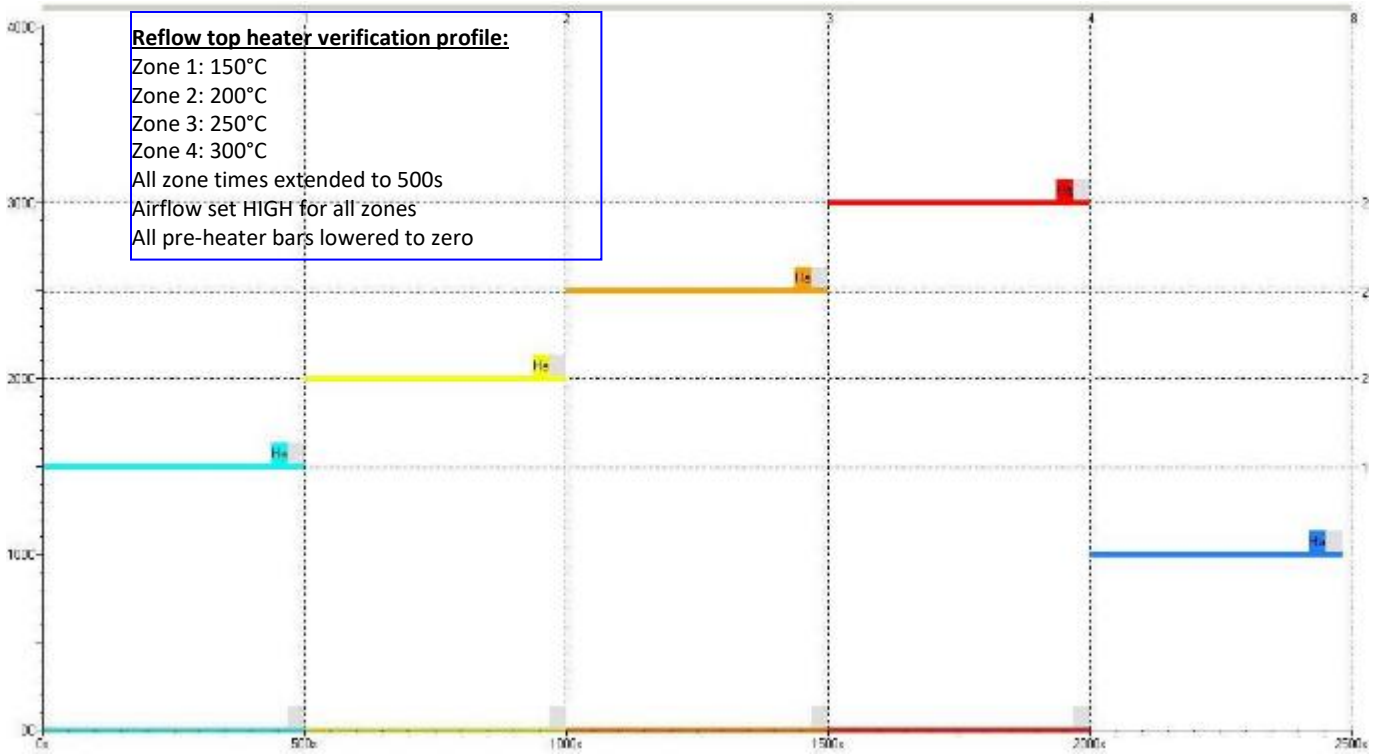
14. Select <Finish> to save and exit the software calibration window.

THERMAL VERIFICATION

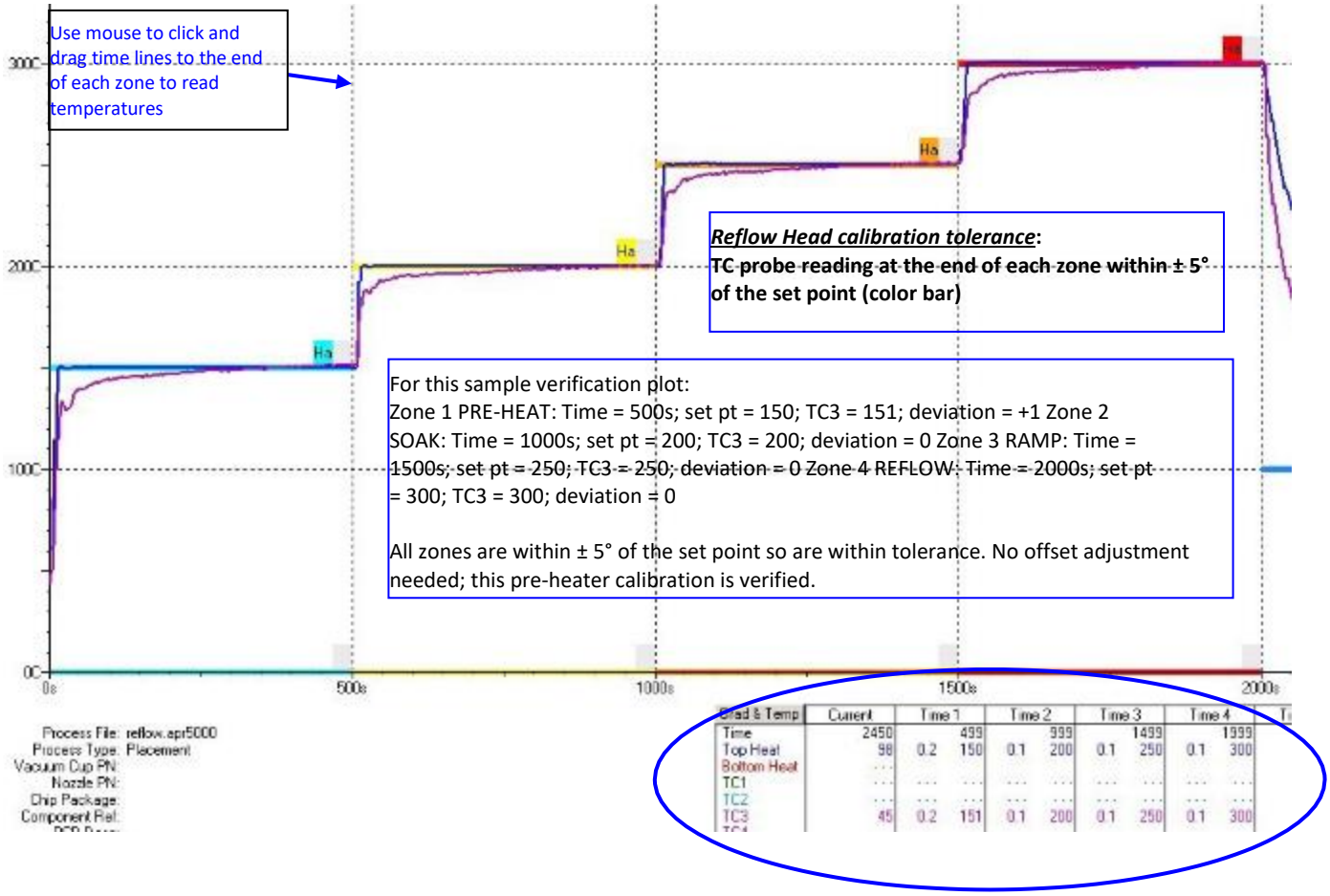
15. To verify the thermal calibration, click <Process Setup> and select the manual mode. Keep the thermal fixture and probe in the same position.
16. Select large or small pre-heater, it does not matter which. Continue to manual mode command window.
17. Use the head up/down controls to drop the NZA nozzle into the opening on top of the box fixture.
18. Keep the default pre-heater thermal profile settings: the 4 heat zone temperature bars set at 150º; 200º; 250º; 300º C. Lower all pre-heater (bottom) temperature bars to zero and set airflow to low. Extend the time interval for all zones to 500s.

NOTE: before running any thermal auto-calibration or verification, the TC reading from the probe should be ≤ 35º C. An external fan blowing on the TC probe/box fixture can be used to help cool down the system.

19. Click <start> to run verification profile.



20. After the complete cycle finishes, review the TC 3 plot temperature (from the probe) at the end of each zone. Position the time lines at the end of each zone so that the exact TC 3 temperature can be reviewed.
21. For all 4 heat zones, record the temperature deviation from the set points (top heater color bars). Example: The 1st zone is set at 150º C. if the TC plot at the end of this zone is 120º C, record the 1st zone deviation as - 30º C. If the TC plot at the end of the zone is 175º C, the deviation is + 25ºC.
22. If the TC readings at the end of each zone are all within ± 5º C of the set point, the calibration is verified. Follow steps 23-30 to adjust thermal offsets only if any of the zones are outside of this tolerance.

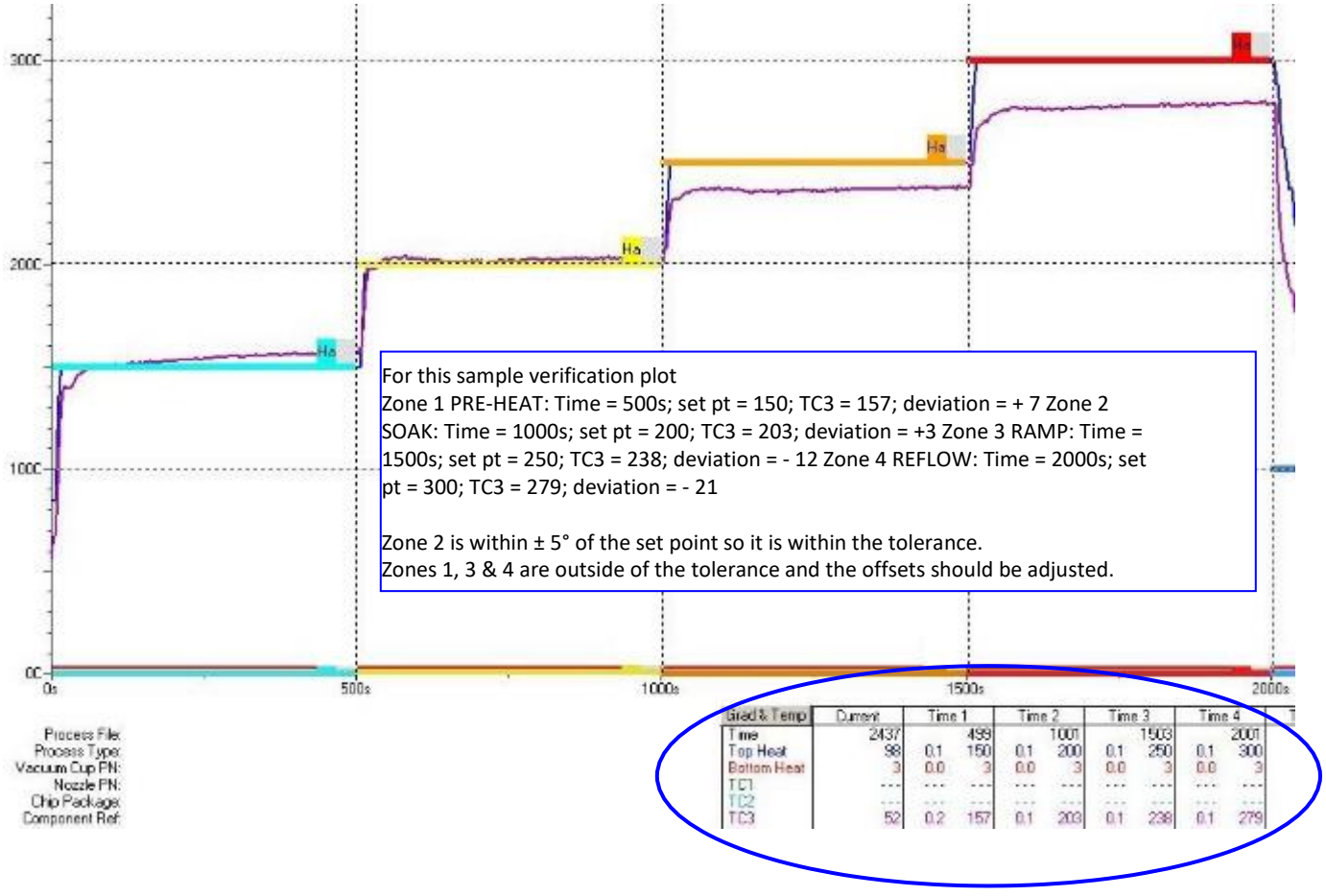


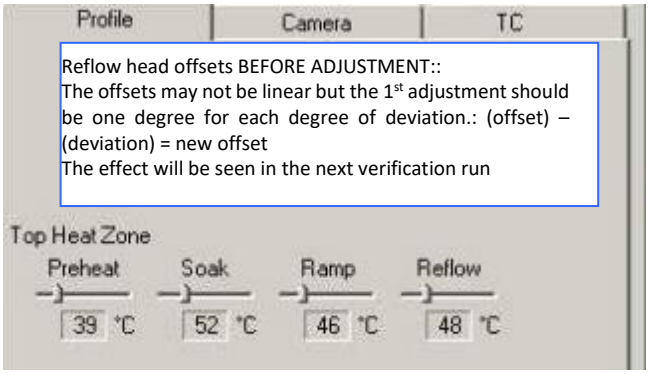
OFFSET ADJUSTMENT

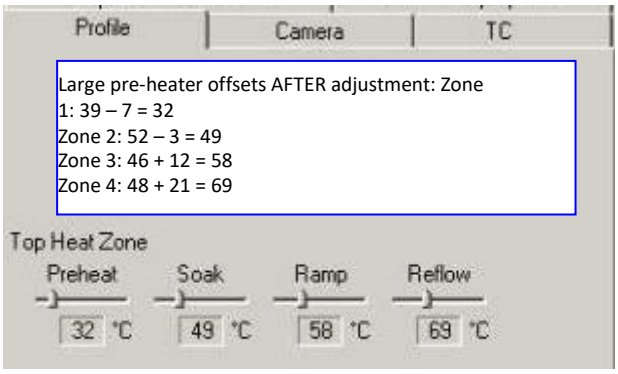
23. If the TC probe plots for any of the 4 zones do not fall within ± 5° of the reflow heater set points then the thermal offsets are adjusted. The offset adjustments are based on the TC3 deviations from the setpoints.
24. Exit the manual mode, click System Setup and enter engineer's password 1923523 into the bottom space of Station ID. Click OK and re-enter System Setup.
25. Select the <Profile> tab. The thermal offsets for each for the 4 zones for the reflow head are the 4 settings under Top Heat Zone.
26. It is optional to adjust the offset when the particular zone meets the ± 5° tolerance from the set point.

27. Using the recorded TC deviations, adjust the offsets in each zone as needed. The offsets are not necessarily linear, but the first adjustment should keep a one-to-one relationship between the offset and the TC deviation. The actual effect will be seen in the next thermal verification run and the offsets can then be adjusted accordingly in the next round, if necessary. Example: If the zone 3 (ramp) set point is 250° and the 1st verification run TC plot at the end of the zone is 270°, then the deviation is + 20 °.

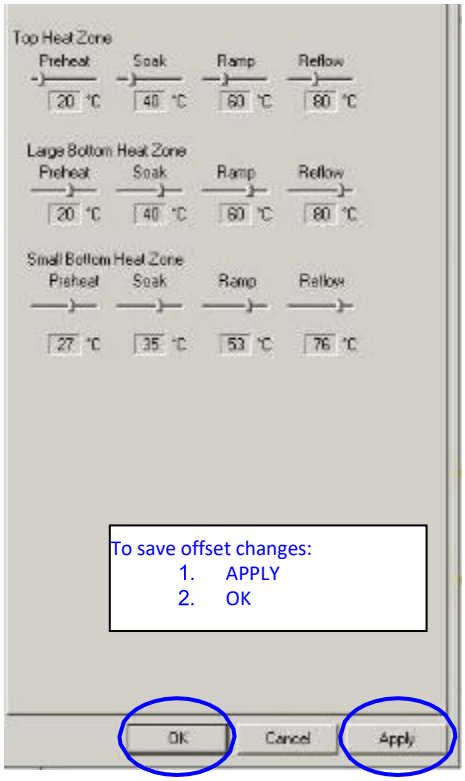
If the ramp zone offset is 43°, the 1st adjustment should be to reduced by 25 so the new offset is 43–20= 23. It may be that the next verification run shows that the TC plot is now 240°, or reduced 10° more than expected. This shows that each degree of offset in the settings is slightly larger than 1 degree in reality. In this case, if we wish to for TC3 to be closer to the set point at 250°, then we may now choose to adjust the offset up 7 degrees instead of 10 for the 3rd run, knowing that each offset degree results in more than 1 degree of actual increase in the TC plot.

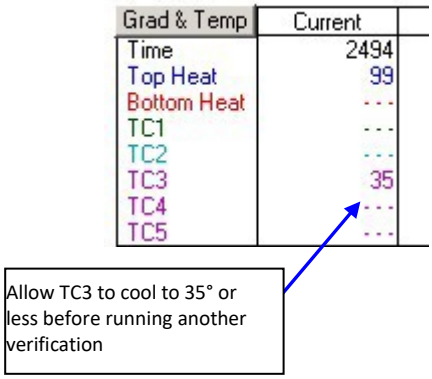






28. After making the offset adjustments, click <APPLY>, then <OK>. The changes to the offsets will not be saved unless both of these buttons are used.





29. In manual mode, run the large pre-heater verification again. Make sure the TC3 reading is cooled down to

≤ 35º C before starting the cycle again.

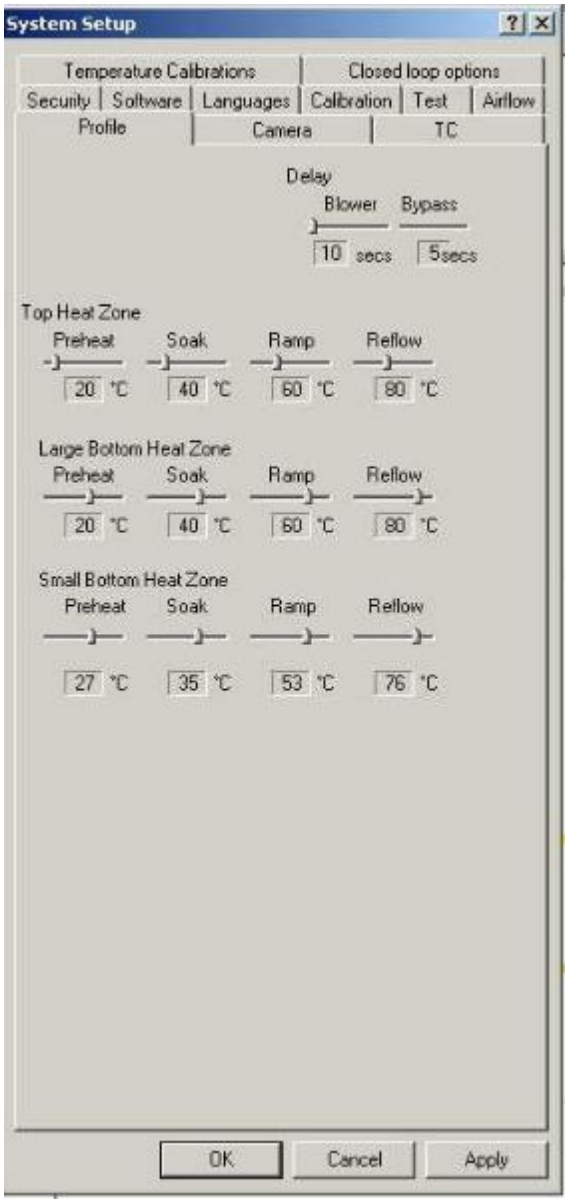
30. Review the thermal plot to see if TC3 reading is within ± 10º C of the set point at the end of all 4 heat zones. If further offset adjustment is necessary, repeat steps 23-29 until the calibration is verified to standard.

Summary:

The machine has now been calibrated to factory standards.

The thermal offsets are saved in memory on the machine's control PCBA and not the software.

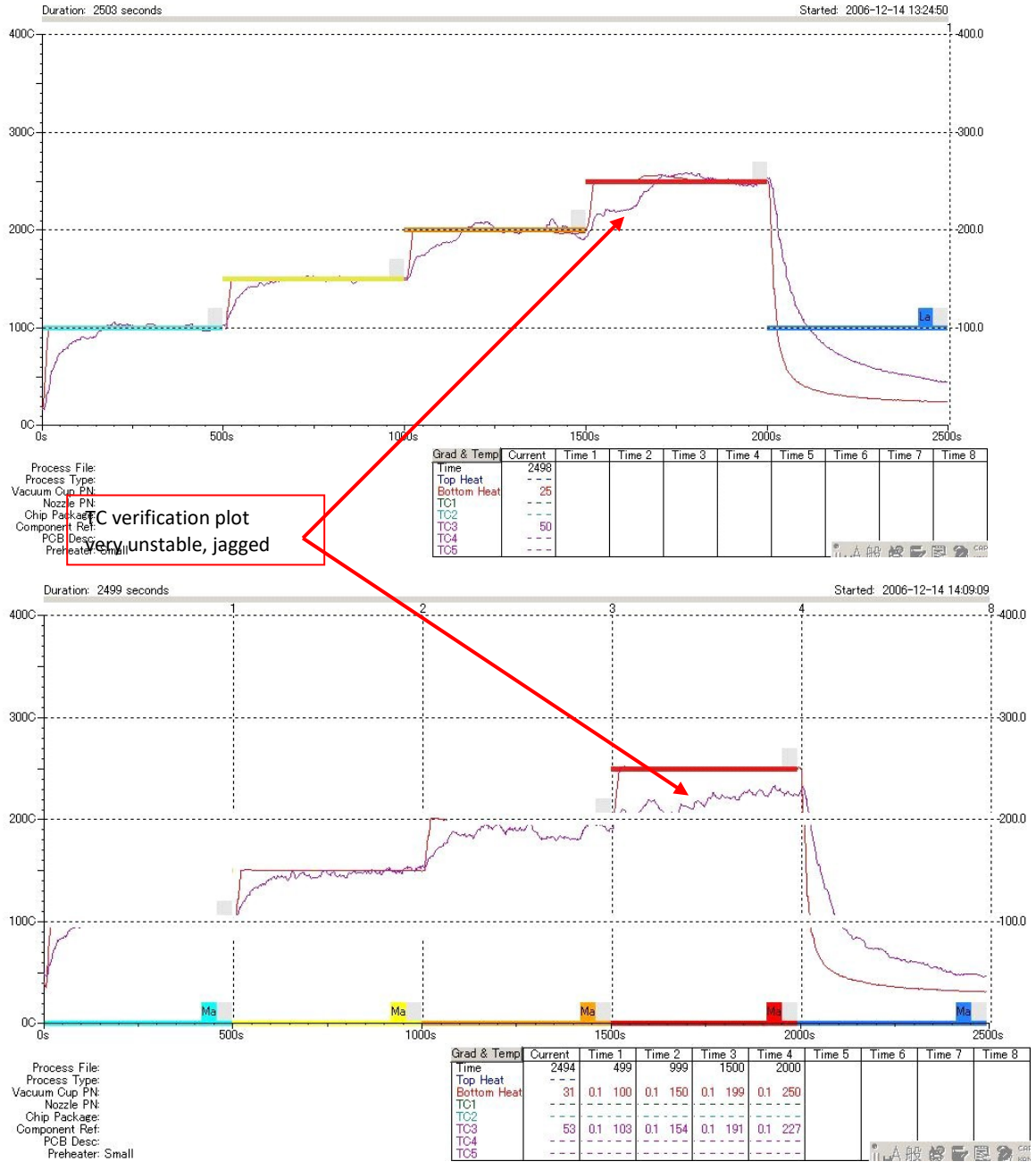
A record of all the thermal offsets should be saved by doing a print screen and pasting into a new picture or Wordpad document.

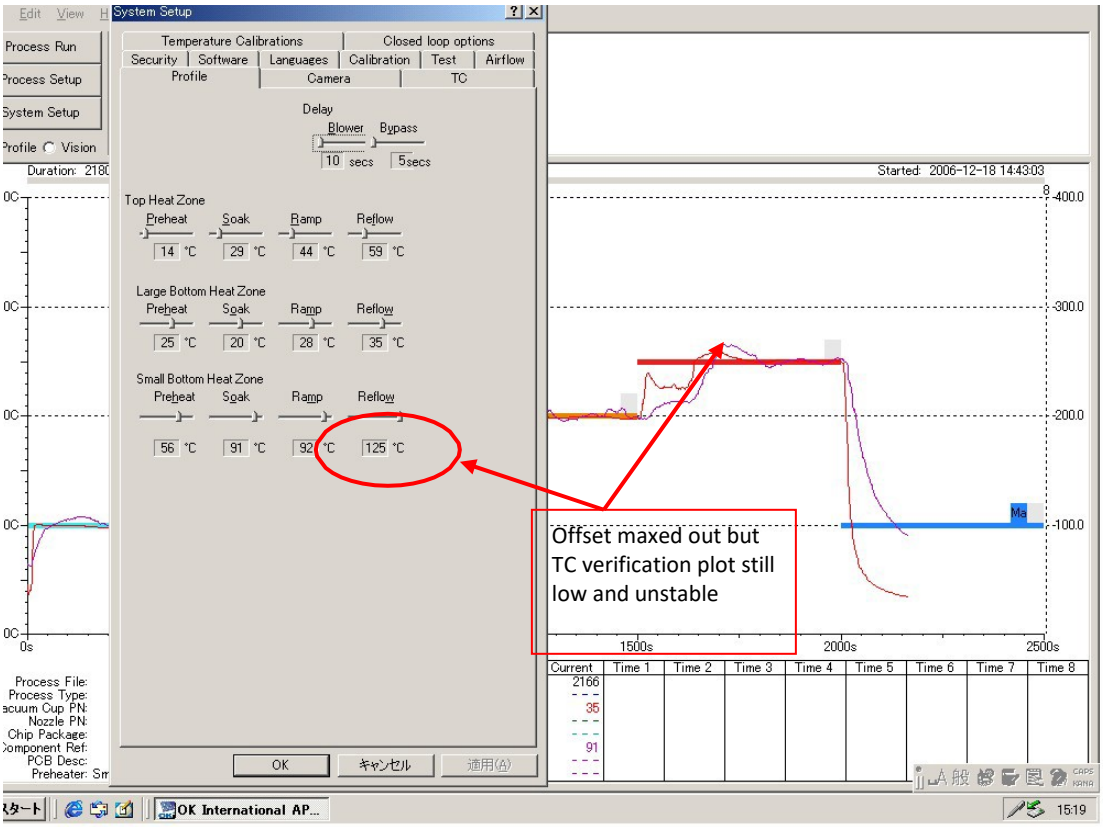


APPENDIX 1:

APR-5000-XL PRE-HEATER THERMAL CALIBRATION – STABILITY AND HEATER POSITION

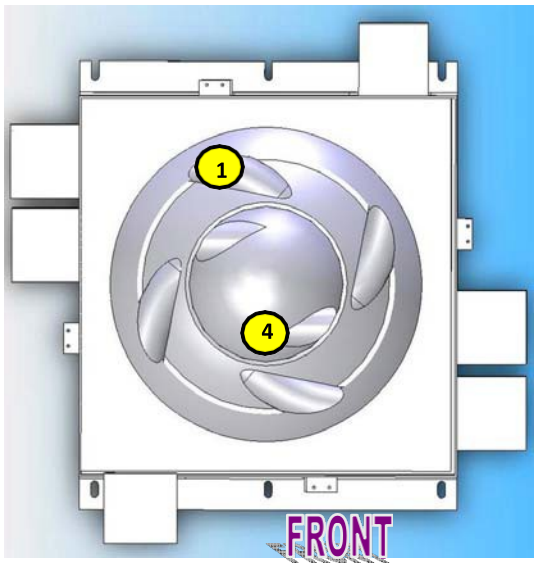
1. There may be cases where pre-heater thermal verification shows either an unstable, very jagged thermocouple (TC) plot, or where the offset adjust is maxed out and still TC plot does not reach set point, or both conditions during same profile run.



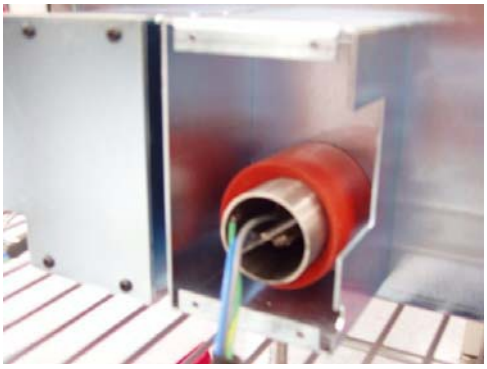


2. These conditions are most often related to heater/RTD position, and can be corrected or improved by making small adjustments to the position of the heater.

3. Remove top cover of APR XL. Locate the heater tube that is in the same location as the **sensing** RTD. For small pre-heater this is RTD # 4 (front). For large pre-heater this is RTD # 1 (rear).



4. Whether large or small pre-heater, remove the backplate for the particular heater that is behind the **sensing** RTD.



5. Typically, this heater will be in “X” position with regard to rotational position. The procedure will be to make very small rotational adjustments to the heater and check effect with a verification plot.

IMPORTANT: *these adjustments should only be done to the heater that is behind the* ***sensing*** *RTD. Remaining heaters will have minimal or no effect on plot.*

6. Refer to the steps below:

    a. Leave all PH thermal offset adjustments as they are. Do not change.
    b. Refer to the heater position diagram and make small adjustment to the rotational position of the heater behind the sensing RTD.
    c. Replace back cover and top cover and run a verification plot. It should only be necessary to view the 1st and 2nd zones, 100s each to see effect. If the TC plot is unstable we are looking to smooth it out. If TC plot is low and offset adjust is maxed out we will be looking for a rise in temperature, it may be 50 to 100 degrees, whatever is needed.
    d. If 1st2 zones display desired effect after heater position change, go to step f. If effect not seen in 1st and 2nd zones, cycle advance and go to step e.
    e. If there is not sufficient desired effect for either TC stabilization or rise in temperature, repeat steps b,c,e; make another rotational adjustment to the heater and run another verification. Repeat these steps until plot has either stabilized and/or raised in temperature sufficiently (we do not want offset maxed out, so temp should be sufficient enough so that offset can be reduced). Refer to heater position diagram. Do at least 4 small adjustments in the clockwise direction. If no effect, go back to reference and do at least 4 small adjustments in the counter-clockwise direction.
    DO NOT leave heater in “+” or cross position.
    f. Once desired effect achieved with TC, reduce all PH offsets to zero and run an auto-calibration in system setup.
    g. Run PH thermal verification in manual mode and make any necessary minor offset adjustments.

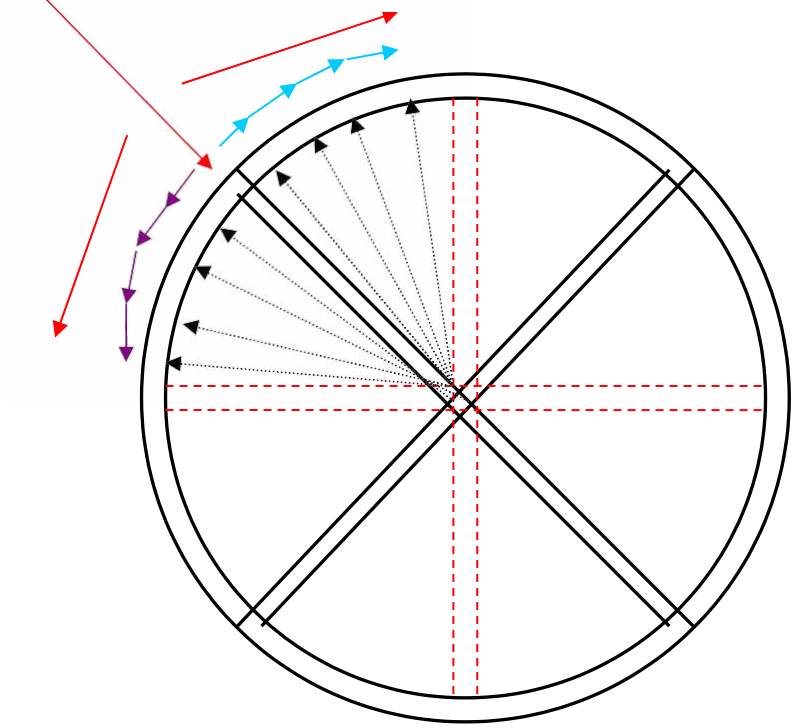
NEXT PAGE FOR HEATER POSITION DIAGRAM

HEATER POSITION DIAGRAM – REAR HEATER VIEW

Note original position of heater tube to be used as reference point for rotational adjustments

Rotational adjustment direction #1: rotate heater clockwise; should have enough for 4 small increments. DO NOT leave heater in "+" or cross position

Rotational adjustment direction #2: rotate heater counter-clockwise; should have enough for 4 small increments. DO NOT leave heater in "+" or cross position



APR

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APR-5000-XL Calibration Data Log

BLOWER AIRFLOW READINGS

Function / Range	As Found	Result	As Left	Result	Units
REFLOW HEATER BLOWER					
8 ± 1					Liters
16 ± 1					Liters
24 ± 1					Liters
SMALL PREHEATER BLOWER					
5.0 ± 0.5					Knots
LARGE PREHEATER BLOWER					
5.0 ± 0.5					Knots

EXTERNAL THERMOCOUPLE READINGS

Function / Range	As Found	Result	As Left	Result	Units
TC1					
250 ± 1					°C
TC2					
250 ± 1					°C
TC3					
250 ± 1					°C
TC4					
250 ± 1					°C
TC5					
250 ± 1					

INTERNAL THERMOCOUPLE / HEATER READINGS

Function / Range	Offset Before Calibration	Offset After Calibration	As Found	As Left	Result	Units
REFLOW HEATER						
150 ± 5						°C
200 ± 5						°C
250 ± 5						°C
300 ± 5						°C
SMALL PREHEATER						
100 ± 10						°C
150 ± 10						°C
200 ± 10						°C
250 ± 10						°C
LARGE PREHEATER						
100 ± 10						°C
150 ± 10						°C
200 ± 10						°C
250 ± 10						°C