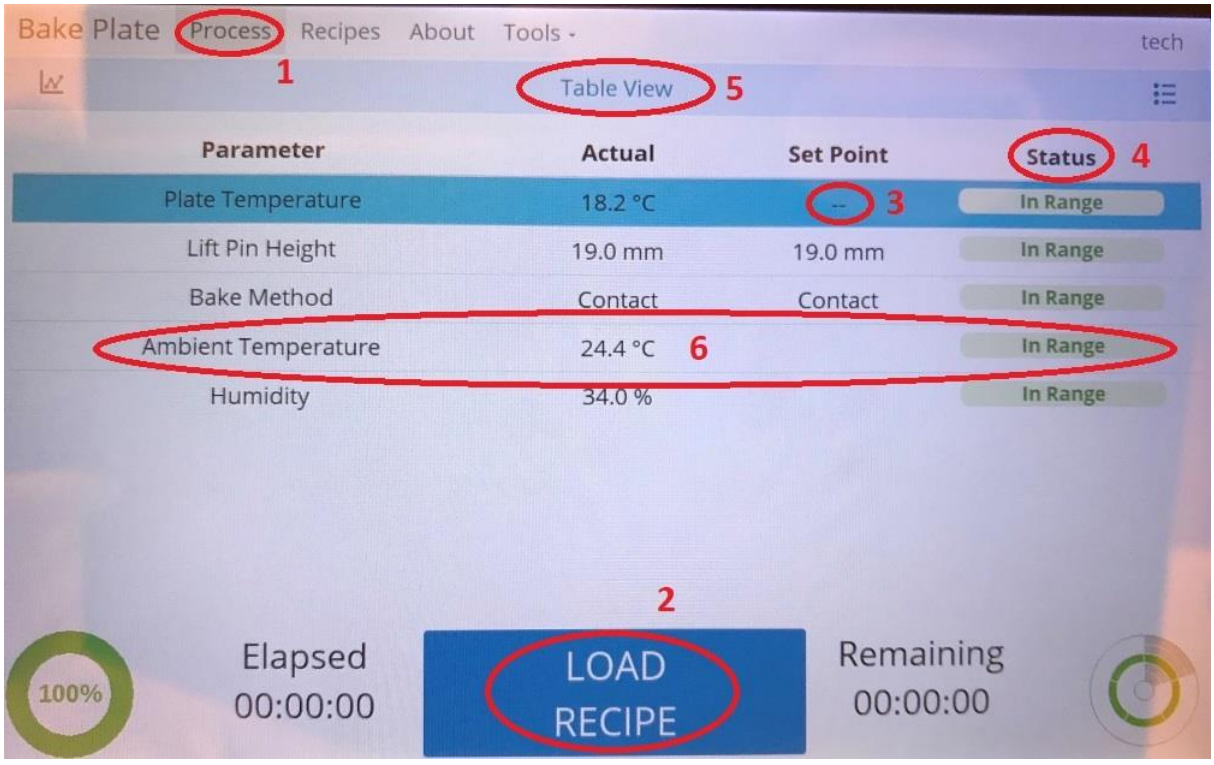
Operational Procedure for Apogee Hot Plate

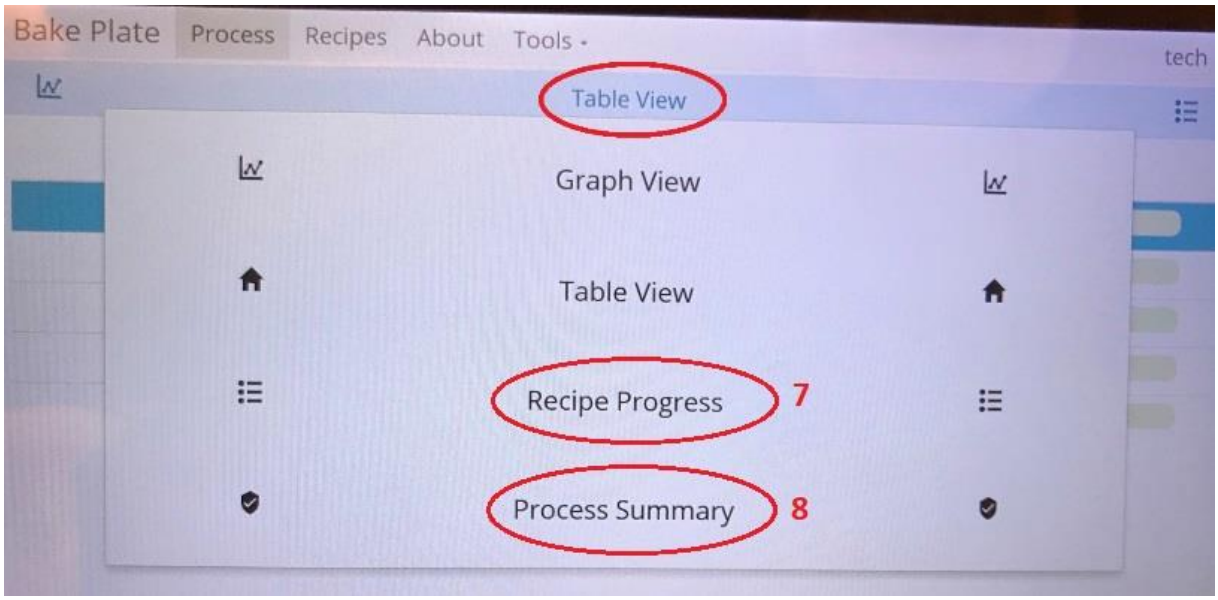
User Login

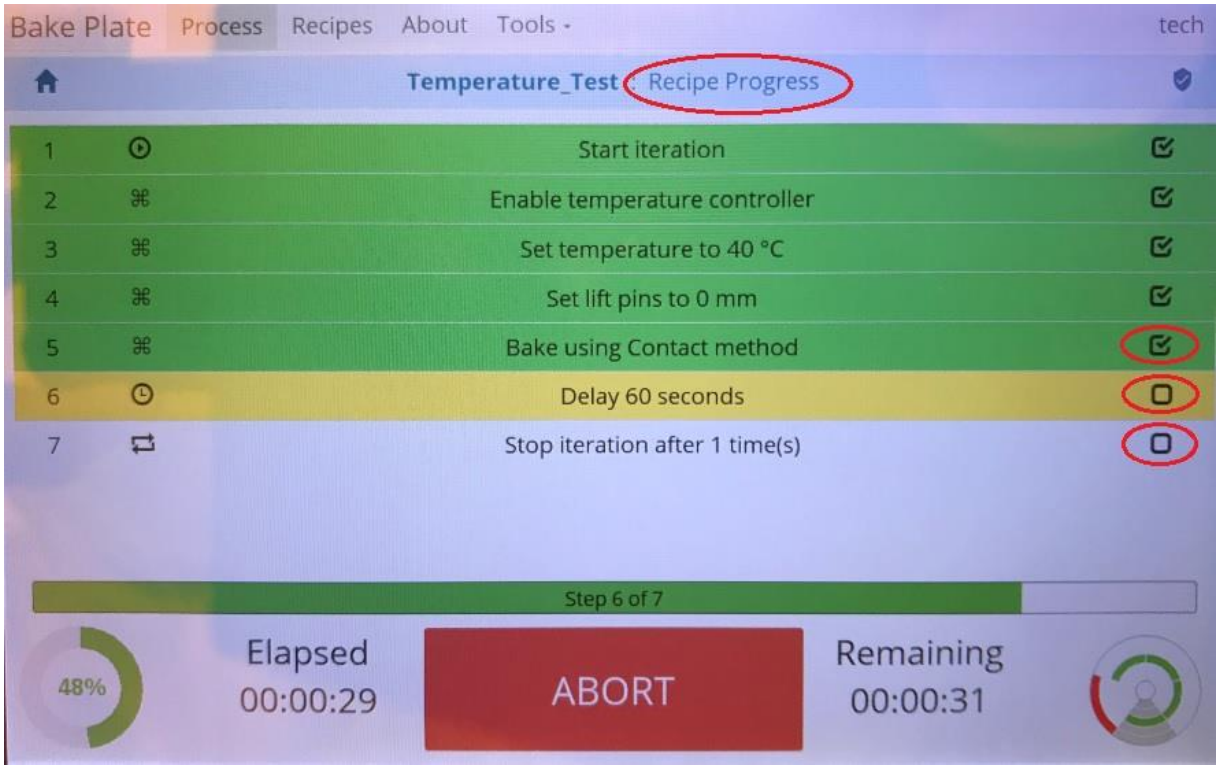
1) Logging in as "tech" will enable users to run, create, or edit Basic Recipes.
2) **Enter username**: tech
3) **Enter password**: tech1

Overview



1) The screen will initially be in the **Process Tab** and contain information about system parameters.
2) Users will be able to **Load** a recipe on this screen.
3) Some parameters, such as **Plate Temperature**, can be manually disabled and will display "--" as **Set Point** when disabled.
4) **Status** column will indicate whether each parameter falls within range of preconditions which are pre-defined in basic recipes or edited in advanced recipes. The recipe will not start until all preconditions are met.
5) A **Table View** will display the status of parameters. Users can click on **Table View** to display a dropdown menu of different views.
6) Users can also click on a parameter's row in **Table View** to display a **Graph view** of selected parameter. **Graph View** displays previous 30 seconds of the selected parameter.
7) Select **Recipe Progress View** to display lists of steps of the active recipe. The status of each step is indicated by color and check mark.





- Green and checked ☑ indicates a completed step.
- Yellow and Unchecked ☐ indicates step in execution.
- Unchecked ☐ indicates step is to be completed.

8) Select **Process Summary View** to display the most recent process, diagnostic messages, and an **Alert Element** indicating times spent in Critically Low/High status and Warning Low/High status.

Alert Element

Process Summary **Alert Element** allow users to quickly identify non-conforming data points.

1) The Critically High segment appears when a parameter exceeds the upper limit
2) The Warning High segment appears when a parameter is above target range, but below upper limit
3) The In Range segment appears when a parameter is within system range
4) The Warning Low segment appears when a parameter is below target range but above lower limit.
5) The Critically Low segment appears when a parameter is below lower limit.

System Parameters

1) Parameters are controlled via recipes or manual command.

2) Plate Temperature: The bake plate will heat until the temperature defined is within range of **Set Point** as defined in Precondition. The process will continue onto the next step thereafter. The temperature should eventually reach and stabilize at the **Set Point** as the process continues.

3) Lift Pins Height: The lift pins are used to adjust the height of the wafer in relation to the surface in millimeters. The height can be set between 0.0 mm and 13.0 mm.

4) Bake Method: The Bake method describes how a wafer is heated. There are 4 bake methods:

a) **Lift Pins Bake:** In this method, the substrate will be lifted to a set distance from the hot surface.

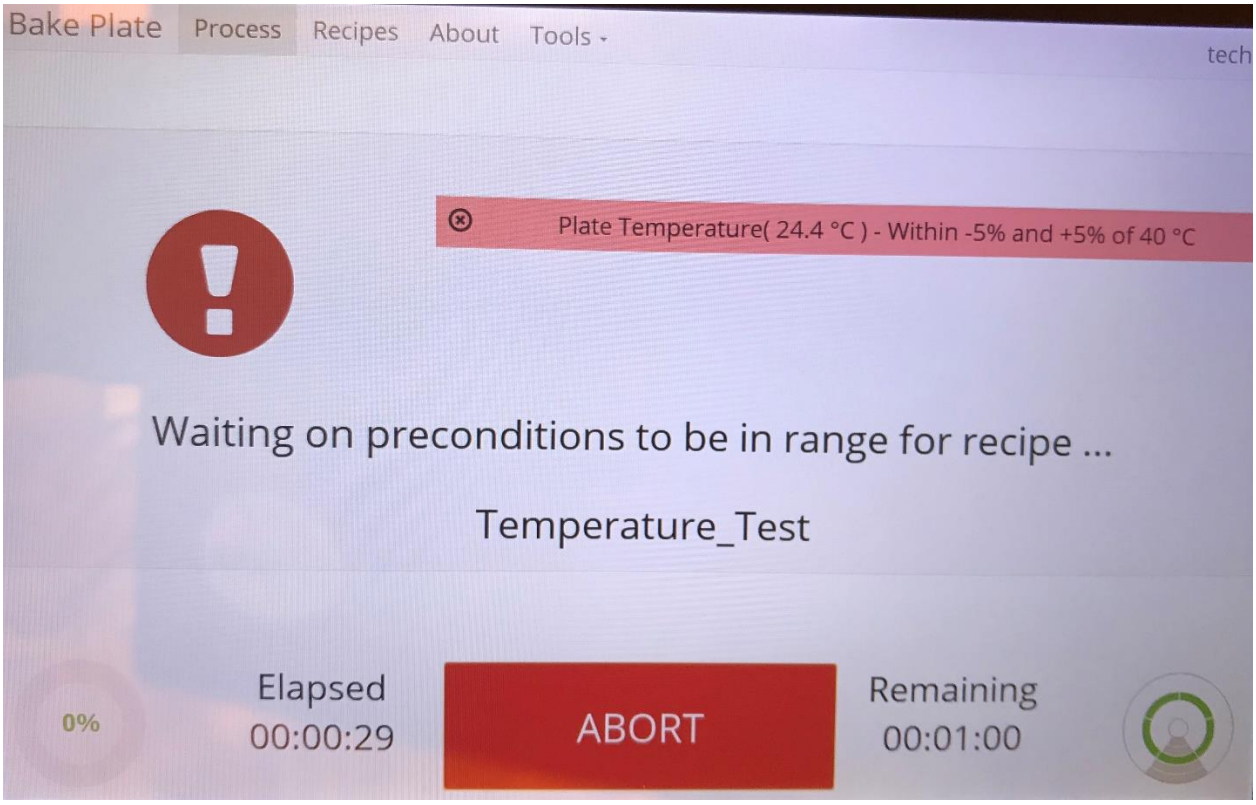
b) **Proximity Bake:** In this method, the substrate will float on a pillow of supplied nitrogen gas. The substrate is heated by a combination of heated gas and radiant heat from the hot surface. Slower heating reduces blistering and cracking of films.

c) **Vacuum Bake:** The vacuum or hard-contact method holds the substrate securely in place and ensures bake uniformity by minimizing bowing and warping of substrate.

d) **Contact Bake:** The contact method allows gravity alone to hold substrate against surface of the chuck and is an intermediate of the previous two methods.

Running a Recipe

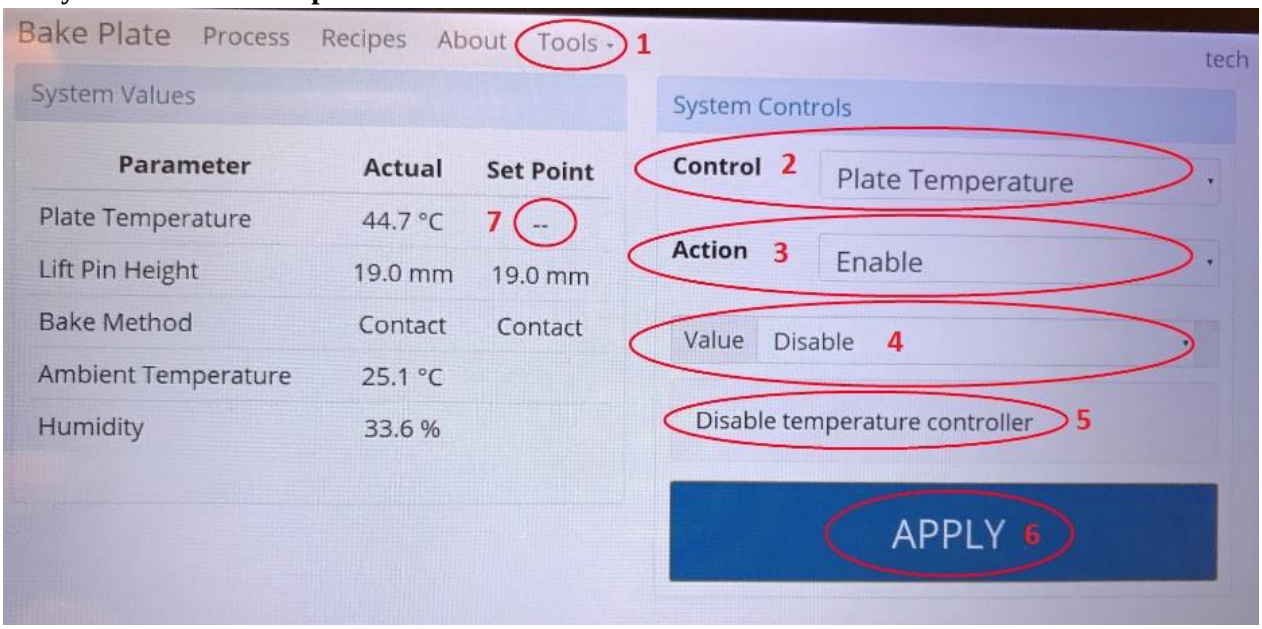
1) Select **Recipes Tab.**
2) Click **Load.**
3) Search for and select recipe.
4) Click **Run** and recipe steps will appear in **Process Tab.**
5) Click **Start** button in the **Process Tab**. If preconditions are met, recipe will begin running. Users may be required to follow prompts on screen during recipe execution.
6) If preconditions are not met, the tool will display a “Waiting on preconditions to be in range for recipe…” message. Users may choose to wait or **Abort**.



7) When the recipe completes, the lift pins will move to their default positions 19.0mm and a pop-up message associated with a beeping sound will prompt users to remove wafer.

8) **Attention!** Users must manually disable Plate Temperature at the end of each run. Plate Temperature will **NOT** automatically be disabled, and the surface will continue to remain hot until manually disabled. Logging out will also **NOT** automatically disable the Plate Temperature.

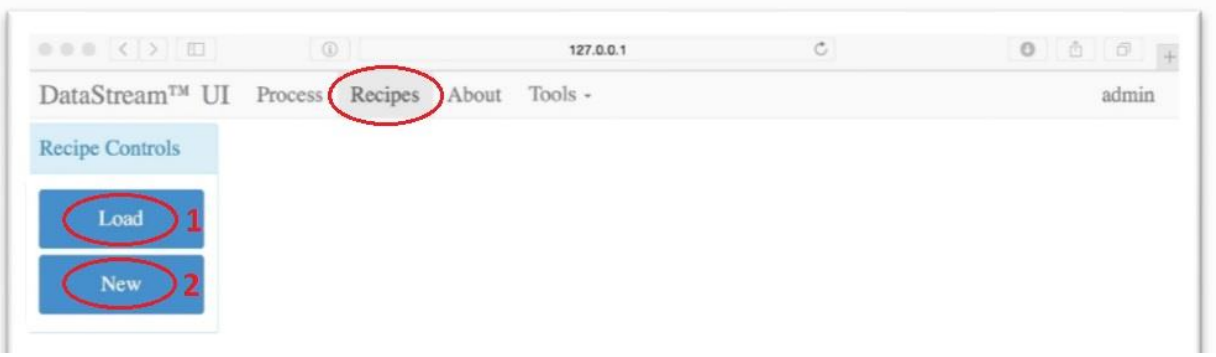
Manually Disable Plate Temperature



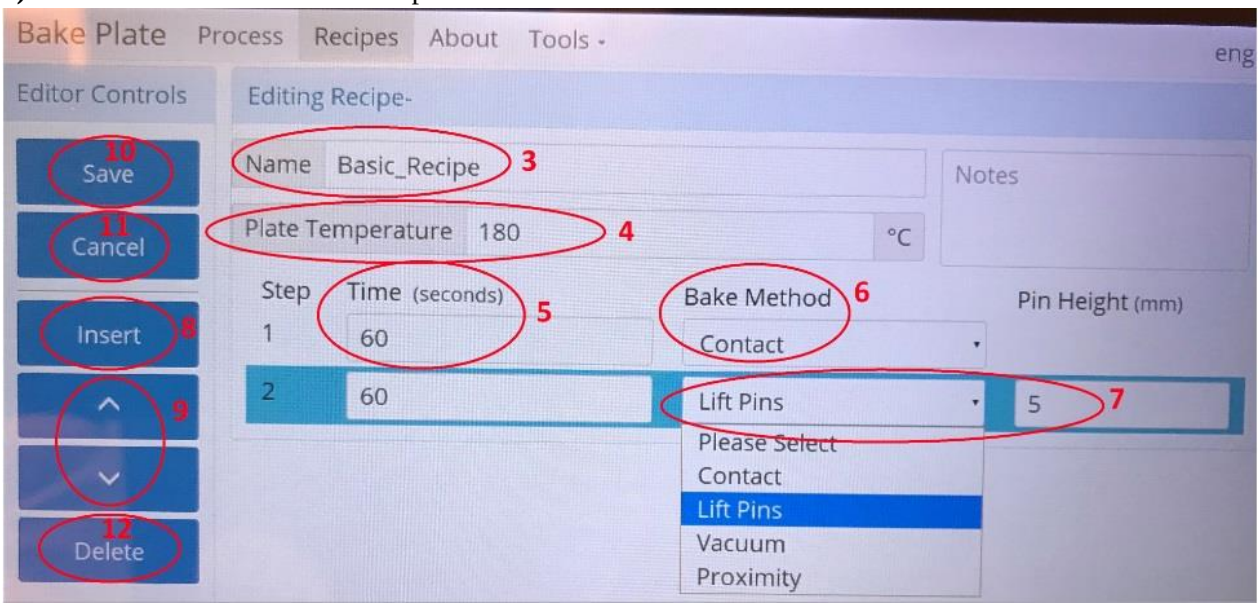
1) Click on **Tools Tab** and select **Manual Control.**
2) Click on the dropdown menu next to **Control** and select **Plate Temperature.**
3) Click on the dropdown menu next to **Action** and select **Enable.**
4) Change **Value** to **Disable**.

5) A message below should display "**Disable Temperature Controller**".
6) Click **Apply.**
7) Plate Temperature **Set Point** should display **"--"** indicating it is disabled.

Creating or Editing a Basic Recipe



1) Click **Load** under **Recipes Tab** to load an existing recipe.
2) Click **New** to create a new recipe.



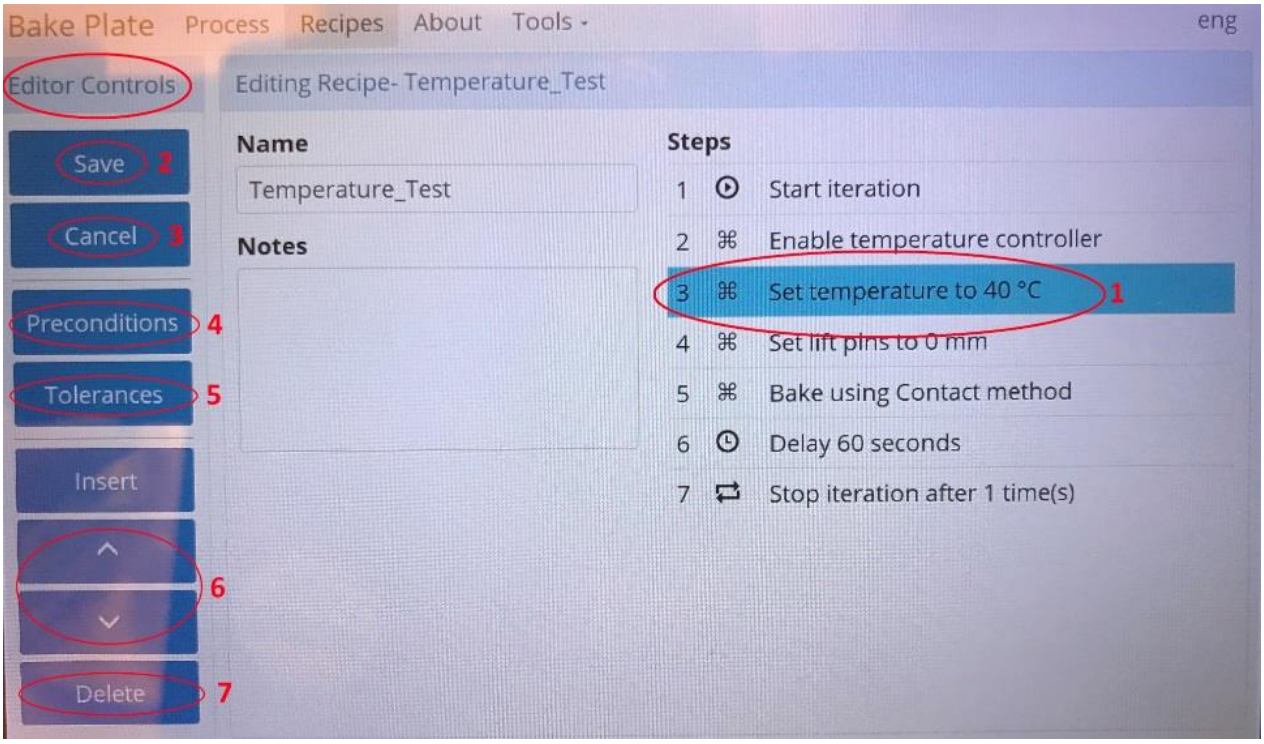
3) Enter **Name** for recipe.
4) Enter **Plate Temperatur**e in C.
5) Enter **Time** in seconds.
6) Select **Bake Method.**
7) Set **Pin Height** if using Lift Pins Bake method.
8) Click **Insert** to add steps.
9) Use **Up or Down** arrows to move step.
10) Click **Save** button to save recipe.
11) **Cancel** button will cancel new recipe or cancel changes to existing recipe. Clicking Cancel button once will display an **Action Confirmation** indication "**!**". **Action confirmation** is required for any action that can result in loss of data. To confirm the action, you must click on the button a second time while the confirmation indication "**!**" is visible for 3 seconds.

12) **Delete** button will delete selected step. Action Confirmation will be required.

Creating or Editing an Advanced Recipe

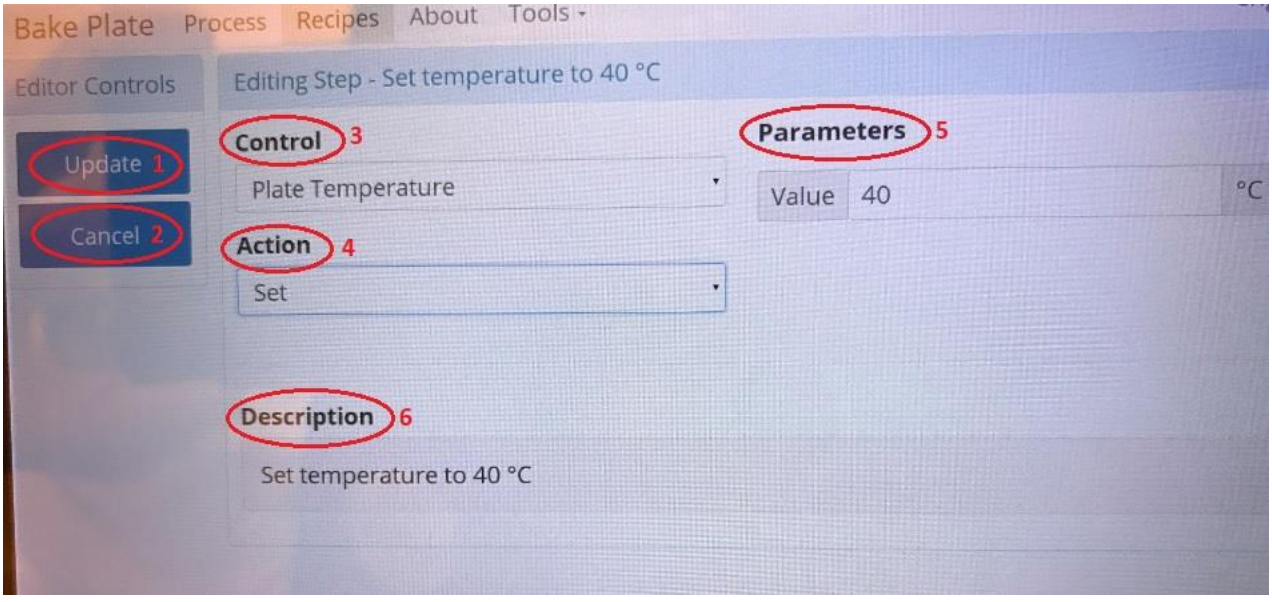
1) Logging in as "eng" will allow users to create or edit advanced recipes.
2) **Enter username**: eng
3) **Enter password**: eng0
4) Advanced users have the option to change a Basic Recipe into an Advanced Recipe allowing a wider range of controls.
5) **Load or Create** a new Recipe. All new recipes are initially Basic Recipes.
6) After creating a new Basic Recipe, Clicking **Advanced** button once will display an **Action Confirmation** indication "**!**". User must confirm action by clicking a second time within 3 seconds.
7) If a recipe is loaded, first click the Edit button, then click Advanced button and confirm action.
8) **Action confirmation** is required for any action that can result in loss of data. To confirm the action, you must click on the button a second time while the confirmation indication "**!**" is visible for 3 seconds.
9) **Warning!** Once the **Save** button is pressed on a converted recipe, it cannot be changed back to a Basic Recipe.
10) **Cancel** button will discard all changes to the recipe.
11) Bake recipes can have unlimited number of steps. Users can set bake time, the bake method in each step and set lift pin height in **Lift Pins** method.
12) Users can insert a new step after a selected step, move selected step up or down, or delete selected step.

Advanced Recipe Editor



1) In the Advanced Editor Controls, double click a process step's row will open its **Step Editor**.
2) **Save** button will save all changes to the recipe and overwrite any existing recipe with same name.
3) **Cancel** button will discard all changes to the recipe.
4) **Precondition** button will open Precondition editor.
5) **Tolerances** button will open Runtime Tolerances editor.
6) **Up and Down Arrows** will move selected steps.
7) **Delete** button will permanently delete step.

Step Editor

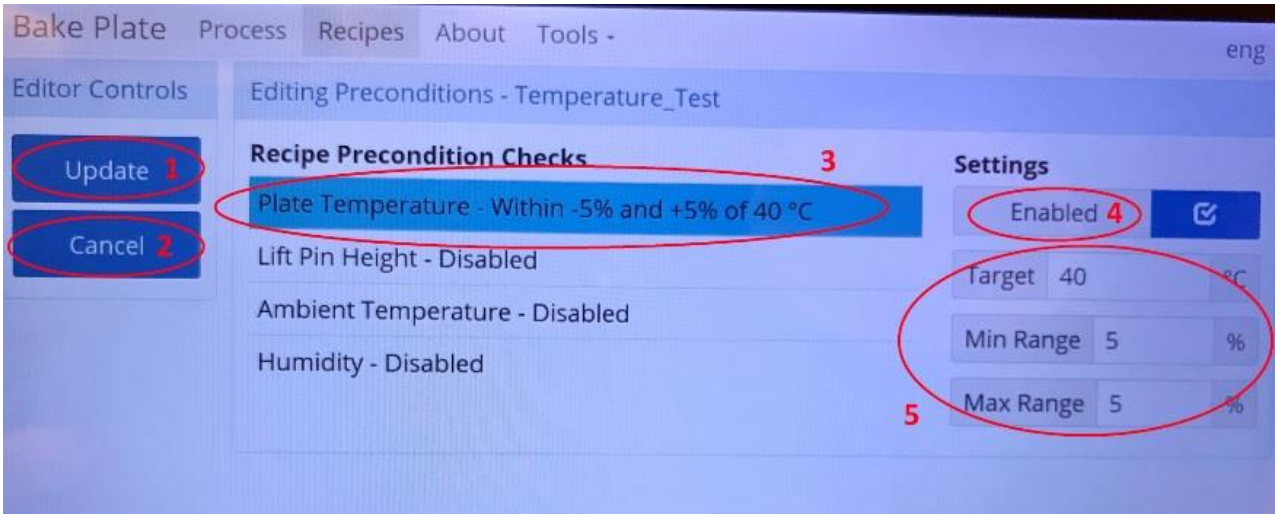


1) **Update** button will save current values of the step and return to recipe view.
2) **Cancel** button will discard any changes to the step and return to recipe view.
3) **Control** drop-down menu lists possible controls for users, which include commands, delays, and user prompts.

4) **Action** drop-down menu further specifies action to be performed.
5) **Parameters** are a list of required parameters for a given Control and Action combination.
6) **Description** will be displayed in log files and during recipe execution.

Preconditions

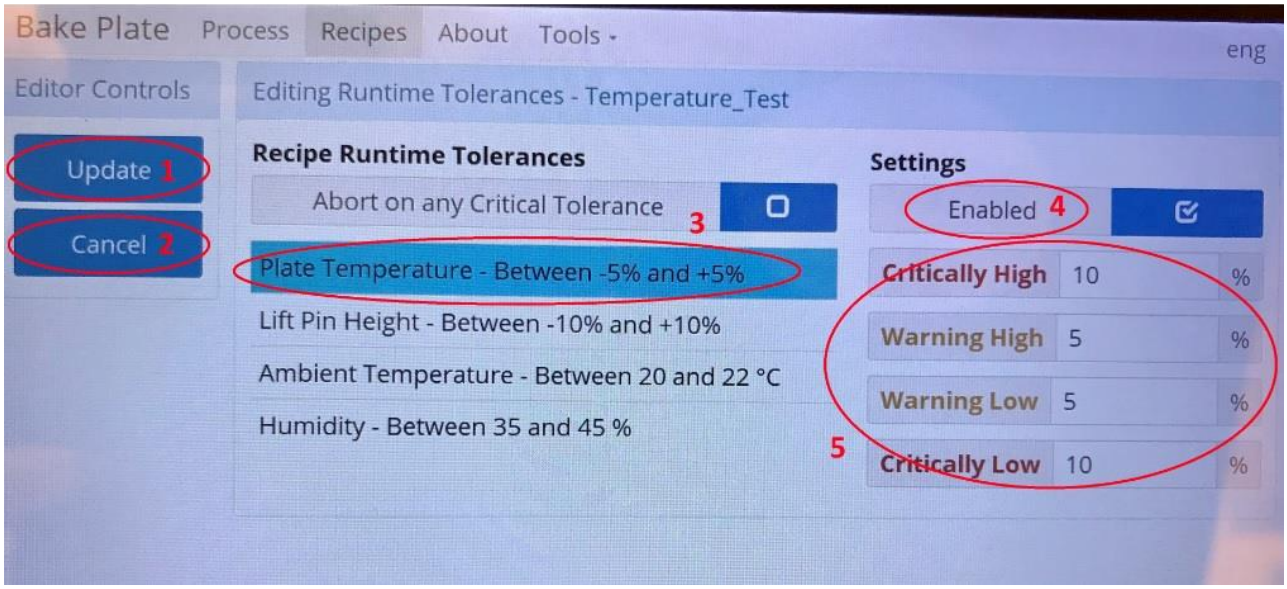
The tool must be in range of precondition parameters before starting a recipe. The tool will attempt to bring parameters in range at the start of the process.



1) **Update** button will save all required preconditions.
2) **Cancel** button will discard all changes to preconditions.
3) Select the **Precondition Row** to show the parameter being verified.
4) **Enable/Disable** button toggles whether the selected precondition should be evaluated.
5) Set values for precondition parameters under **Settings.**

Runtime Tolerances

Tolerances are parameter verification tests run during recipe execution. Tolerances are used to drive the process alerts on the Process and Manual Control pages.

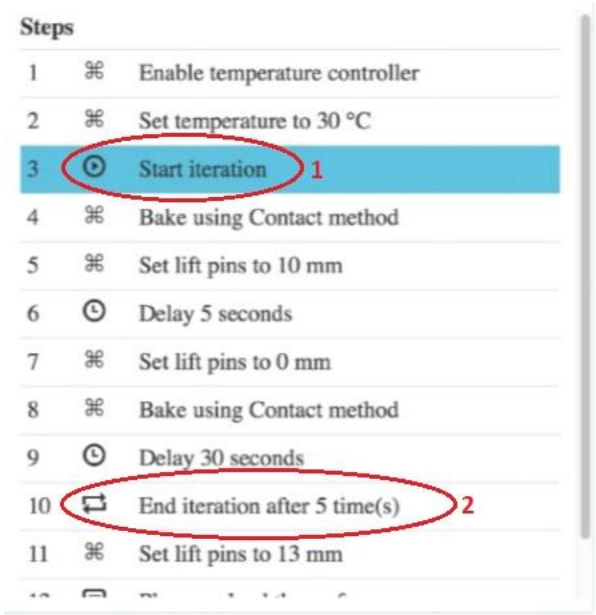


1) **Update** button saves all monitored tolerances.
2) **Cancel** button discard all changes to tolerances.
3) Select the **Tolerance Row** to shows the parameter being monitored.
4) **Enable/Disable** button toggles whether the selected tolerance parameters should be evaluated.

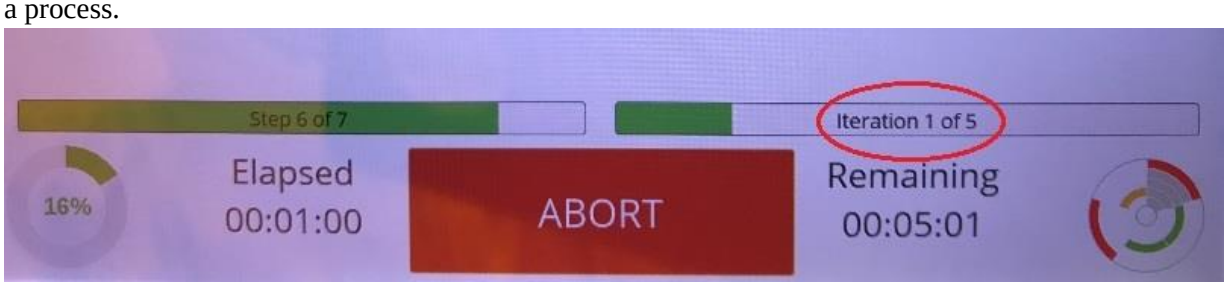
5) Set values for tolerance parameters under **Settings.**

Iterations

1) Users can set number of iterations for a recipe by selecting where the iteration loop starts, ends, and how many times it should repeat.



The recipe Progress View on the process page indicates how many iterations have been completed during a process.



Contributors	Revised Date
Joey Vo	05/28/2021