

Approved by:

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Process Engineer\_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
Equipment Engineer

## **1**    **SCOPE**

The purpose of this document is to detail the use of the Bruce Furnaces. All users are expected to have read and understood this document. It is not a substitute for in-person training on the system and is not sufficient to qualify a user on the system. Failure to follow guidelines in this document may result in loss of privileges.

## **2**    **REFERENCE DOCUMENTS**

- Material Safety Data Sheets for Nitrogen, Oxygen, Hydrogen, Forming Gas, Trans LC and TCA.
- Appropriate Tool Manuals

## **3**    **DEFINITIONS**

n/a

## **4**    **TOOLS AND MATERIALS**

### **4.1**    **General Description**

4.1.1    Tubes #1-4 may be used to process either 4-inch or 6-inch wafers.

4.1.2    Tubes #5-8 may be used to process 4-inch wafers.

### **4.2**    **Quartzware**

4.2.1    Each tube has dedicated cassettes and a single baffle that may be used for either size of wafer.

### **4.3**    **Boat Forks**

4.3.1    Boat forks for each tube are located on the end of the boat loader.

## 5 SAFETY PRECAUTIONS

### 5.1 Personal Safety Hazards

- 5.1.1 This equipment uses high voltages. Do not operate with the covers off.
- 5.1.2 The furnaces operate at high temperatures. *Never touch any part of the furnace or any of the quartzware with your bare hands.*
- 5.1.3 Compressed Oxygen, Nitrogen, Hydrogen and Forming Gas are used in this equipment. Some of the tubes use Trans LC or TCA. Be sure to understand MSDS for each of these and know the hazards of working with compressed gases.

### 5.2 Hazards to the Tool

#### 5.2.1 Contamination

- 5.2.1.1 Never process wafers with metal or photoresist on them.
- 5.2.1.2 To avoid cross contamination always use the tube that is intended for the process you need.
- 5.2.1.3 Only process clean wafers in the furnaces.
- 5.2.1.4 Do not touch the wafers or boats and do not place them in areas that are not clean.

#### 5.2.2 Computer

- 5.2.2.1 Never edit a recipe that is not yours. The recipe should be copied to a new recipe number, the name should be changed and then the new recipe may be edited.
- 5.2.2.2 Do *not* start Warm Up recipes or Idle recipes.
- 5.2.2.3 Do not open too many files at once because the computer may lock up and not allow you to run a recipe.

#### 5.2.3 Gas line pressure

- 5.2.3.1 Do not adjust the pressure to any of the gas lines or bottles. Seek staff assistance.

## 6 INSTRUCTIONS

### 6.1 Initial State Check (These things are normally left on)

#### 6.1.1 Starting the computer

- 6.1.1.1 Verify that the two PCs next to the table are powered on.
- 6.1.1.2 Open the **ICCI GMI** folder on the desktop.
- 6.1.1.3 Double click the icon called **R.bat**. It will launch the scanning software program and must always be on.
- 6.1.1.4 Open the **ICCI Gmi Cell Manager** program.
- 6.1.1.5 Transfer over the idle program **999** to Tubes #1-4 and **990** to Tubes #5-8.
- 6.1.1.6 If the computer has been off, it is likely that the **Profile TC** settings will need to be reset. Follow instructions in Section 6.4.2.



### 6.1.2 **Tubes #1-4 Check**

- 6.1.2.1 Panel 1 - Alarm Processor - check that no red lights are lit. If any are on, consult the Equipment engineer before proceeding.
- 6.1.2.2 7351C DDC Controllers. Each tube on the Bruce controller rack should have a display screen that is lit up.
- 6.1.2.3 Panel 6 - Boat loader controllers. The breakers for each boat loader should be turned on.
- 6.1.2.4 Verify that the required gases are turned on. ( $N_2$ ,  $O_2$ ,  $H_2$ ,  $AR$  and  $H_2N_2$ )  
The valves are on top of the gas cabinet against the wall. Verify that the pressure gauge registers at least 15 psi. **NOTE:** For  $H_2$  the  $H_2$  switch in the red box located above the water cooler must be on.
- 6.1.2.5 Verify that the fans are on. **BREAKER 12 (panel 8, Bruce 1-4)**. On position is to the left.
- 6.1.2.6 In Tube 4, there is a temperature controlled Trans LC bubbler installed. If your process requires Trans LC, make sure that the bubbler is turned on and that the temperature has stabilized. It is located in the bottom of the source cabinet in the back of the furnace. There are level indicator lights on the unit that will tell when the liquid is low or the temperature is out of spec.



### 6.1.3 **Tubes #5-8**

6.1.3.1 7351 DDC Controllers. Each tube on the Bruce controller rack should have a display lit up in red.

6.1.3.2 In **Tubes #5** and **6**, there are temperature controlled TCA bubblers installed. If your process requires TCA, make sure that the bubbler is turned on and that the temperature has stabilized. They are located in the bottom of the source cabinet in the back of the furnace. There are level indicator lights on the units that will tell when the liquid is low or the temperature is out of spec.

6.1.3.3 Verify that the required gases are turned on. (**N<sub>2</sub>**, **O<sub>2</sub>**, **H<sub>2</sub>**, **AR** and **H<sub>2</sub>N<sub>2</sub>**) The valves are on top of the gas cabinet against the wall. Verify that the pressure gauge registers at least 15 psi. **NOTE:** For **H<sub>2</sub>** the **H<sub>2</sub> switch** in the red box located above the water cooler must be on.

6.1.3.4 On **Tubes #5-8**, the boat loaders have LEDs which indicate the status of the loader. If there are none lit, verify that the loaders are on. There is an on/off switch for each loader on the black boxes mounted near the floor. Also verify that they are plugged in.

## 6.2 Resetting the System

- 6.2.1 On the computer while in the **Process Manager Page** for a tube, press the **F7** key after a run is complete or when there is an error message displayed.

## 6.3 Operating the system

- 6.3.1 Before the system is heated up, use the boat loader control to manually open the tube and remove the cassette that you will be using with the fork; do *not* touch the cassette with your hands. All quartzware should remain in the tube and the cassette that will not be used should be moved to the left side of the baffle. For tubes 1-4, the boat loader controls are located at the top of the Bruce control rack. For tubes 5-8, the boat loader controls are located at the ends of the loader rails and may be manually operated when in the **Local** mode. Tubes 1-4 will close automatically during the heat up step and tubes 5-8 will need to be manually closed.



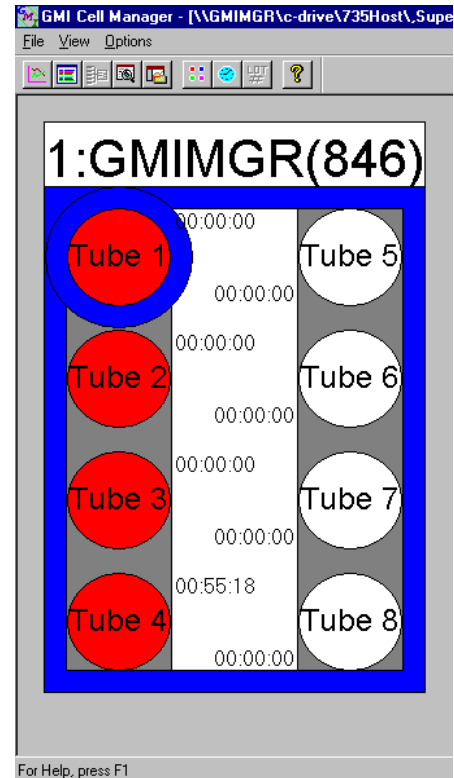
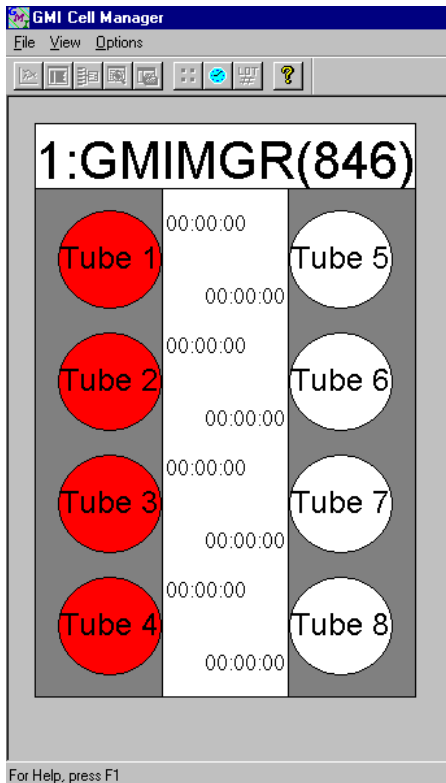
Direction Boat Loader, Bruce 2



MRL Boat Loader, Bruce 2



- 6.3.2 From the **GMI Cell Manager** on the furnace computer select the tube that you want to use by clicking on it once. A blue border appears around the selected tube. Double click on it to open the **Process Manager** for that tube.



Gas	Range	Units	Set Point	Actual	-10	% Deviation	+10
N2	20	SLPM	0	0.716			
O2	20	SLPM	0	0.326			
H2	20	SLPM	0	0			
H2/N2	20	SLPM	0	0.304			
ARGON	20	SLPM	0	0			
	0		0	0			
	0		0	0			

Location	Range	Offset	Set Point	Actual	-10	Degrees Deviation	+10	%Power
Load	1200	0	25	39				
Center	1200	0	25	41.7				
Source	1200	0	25	32.7				
P-Load	1200	0	25	96.8				
P-Center	1200	0	25	47				
P-Source	1200	0	25	40.7				

Recipe ID	Description
1	IDLE
45	Profile 450 C
55	Profile 550 C
65	Profile 650 C
100	Profile 1000 C
180	CMOS WELL DRIVE-IN
300	10000A WET OXIDE
311	1000A KOOI OXIDE
335	3500A WET OXIDE
350	5000A WET OXIDE
410	10000A WET OXIDE

### 6.3.3 Warm Up the Tube to 800C

6.3.3.1 Select **Send** and then **Recipe** from the top left of the page.

6.3.3.2 On the **Recipe Select** screen make sure that the recipe library is **Production**.

6.3.3.3 For Tubes #1-4, select **Recipe 888**. For Tubes #5-8, select **Recipe 996**. Select **OK** and **Yes** to confirm.

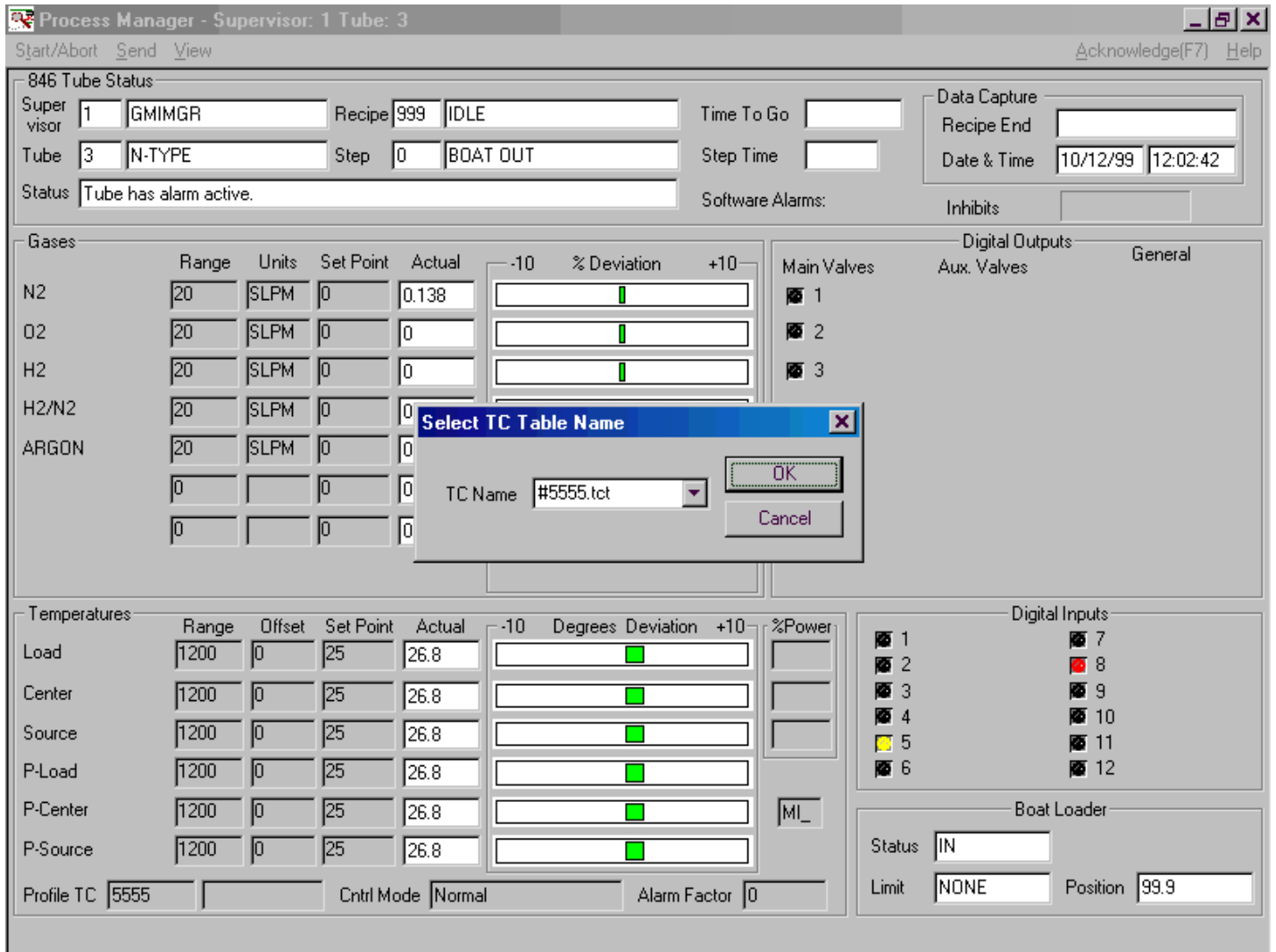
6.3.3.4 Warm up recipes *should not* be started.

- 6.3.4 Let the tube to heat up to 800C. Make sure that all of the temperature readings are 800C.
- 6.3.5 Load your wafers into the quartz cassette with the flats up and the fronts facing out of the tube. Dummy wafers for each tube are located in the white cabinet near the window. These wafers are only for the furnaces and should not be used in other areas.
- 6.3.6 From the **Process Manager** page for the tube that you will be using, select and download the recipe that will be run. **Tubes #1-4** will automatically open. **Tubes #5-8** should be opened manually with the loader controller in the **Local** mode.
- 6.3.7 When the tube is finished opening, immediately place your wafers on the center line of the cantilever using the fork. Make sure that baffle is to the left of the wafers and touching the cassette. The cassette that is not being used should be placed to the left of the baffle. Never touch Quartzware with your hands. For **Tubes #5-8**, the Boat Loaders should be switched back to **Remote**.
- 6.3.8 The recipe may now be started from the **Process Manager** page by selecting **Start/Abort** and then **Start Recipe**, or by using the **F5** key. Select **OK** to confirm.
- 6.3.9 To abort a recipe that has been started, from the **Process Manager** select **Start/Abort** and then **Stop Recipe** or press the **F5** key and confirm by selecting OK. Make sure that you are stopping your recipe and not someone else's. Please note that if you stop a recipe, it will immediately unload without cooling down which may result in damage to your wafers.
- 6.3.10 When the run is complete, the tube will open automatically. After removing the wafers, return the cassette to the cantilever. Select **F7** or use the **F7** key to acknowledge the recipe completion.
- 6.3.11 From the **Process Manager** page, for **Tubes #1-4** send **Recipe 999** and for **Tubes #5-8** send **Recipe #990** to idle the tube. **Tubes #1-4** will automatically close. **Tubes #5-8** should be manually closed with the boat loader. **Recipes 999** and **990** *should not* be started.
- 6.3.12 Return all dummy wafers to the proper box in the white wafer cabinet.

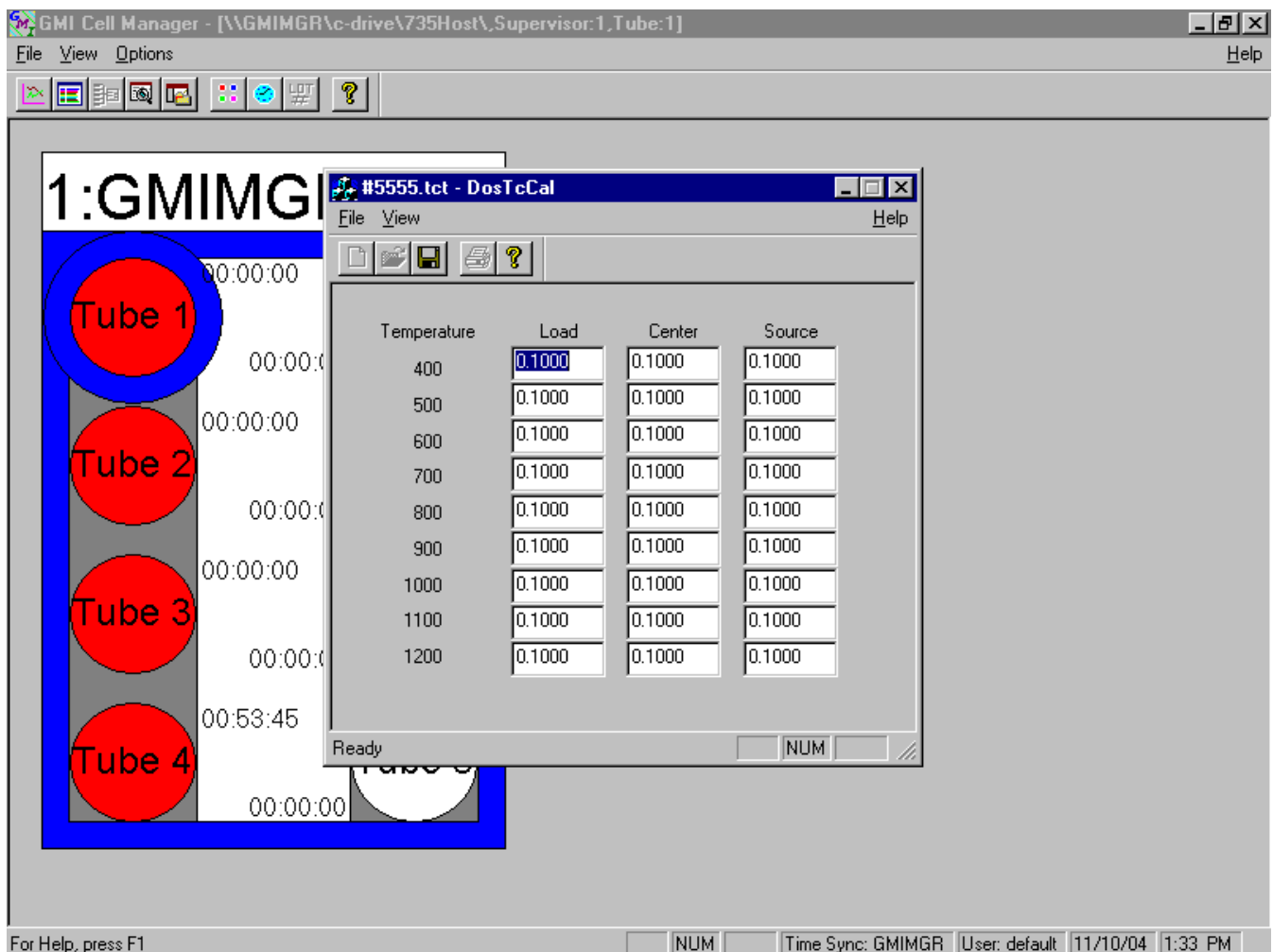


6.4 Errors during Run

- 6.4.1 If the computer does not allow you to download a recipe, try using F7 while in the **Process Manager** page to clear out any errors or to acknowledge a complete recipe.
- 6.4.2 If the temperature displays for the profile temperatures seem to be incorrect or over scale, select **View** and **TC Table Name** or just press **Ctrl, Alt, F9**. A **Select TC Table Name** screen will appear.



- 6.4.2.1 Select #5555.tct and press ok.
- 6.4.2.2 The **DosTcCal** window will appear.



6.4.2.3 Close the **DosTcCal** window.

6.4.2.4 Check the **Process Manager** to see that 5555 is in profile TC box in the lower left-hand corner.

6.4.2.5 This may be done while the recipe is running.

## 7 APPROPRIATE USES OF THE TOOL

7.1 Each tube is labeled to show its appropriate use. Make sure you have the correct process in the correct tube.

7.2 Never process metals or photoresist in the Bruce Furnaces.

**8 ATTACHMENTS**

**8.1 VIEWING AND PRINTING A DATA CAPTURE**

- 8.1.1 In the **Cell Manager** select **view** and then **Graphical Process Analyzer**.
- 8.1.2 A window will open displaying **Supervisor, Tube, Month, Day, Sequence** and **Recipe**. If you know the parameters that you want to view, type them in. If you are not sure and wish to view them all, click the “?” underneath the one you are not sure of. You may also select **All Files** to view all of the files. Click **OK**.
- 8.1.3 A list of files will be displayed. Select the file that you want to view and click **OK**.
- 8.1.4 The **Select Data Channels** page will show up. To add a gas flow or temperature reading to the graph, select it and click **Add**. Readings may be removed by selecting the reading and clicking **Delete**. Multiple data sources may be plotted on the same graph. When finished selecting, click **OK** and the graph will come up.
- 8.1.5 To print or save a graph, double click on it to open another window. To speed up the printing time you may select **Monochrome**. (Color is very slow on this printer) Click **Export** and select where the file should go. It may be saved to a file or sent to the printer. Finally click **Export** and be sure to close the data capture when finished.

**REVISION RECORD**

Summary of Changes	Originator	Rev/Date
Original Issue	Sean O’Brien	A-12/11/02
Added information about tubes #5-8	O’Brien	B-11/10/04
Added 5.2.2.3, 5.2.3, modified 6.3.5 to load with flats up, 6.3.9 warning	O’Brien	C-02/1/06