Chapter 5.2

Tystar2 MOS Dry/Wet Oxidation & Anneal Atmospheric Furnace (4” and 6”)
(tystar2 - 386)

1.0 Title
Tystar2 MOS Dry/Wet Oxidation & Anneal Atmospheric Furnace (4” and 6”) (tystar2)

2.0 Purpose
Provide specific operation and process information for Tystar2 atmospheric MOS (dry/wet oxidation and anneal) furnace that is capable of processing both 4” and 6” wafers.

3.0 Scope
This chapter covers the general furnace description for Tystar2, TYCOM and furnace operation procedure, which includes process recipe loading, wafer loading/unloading, process status, user level problem diagnosis, and wafer cleaning requirements.

4.0 Applicable Documents

Revision History
4.1 Tylan Diffusion Furnace System Instruction Manual (copy in Office).
4.2 TYCOM 9900 Microprocessor Control System Instruction Manual (copy in Office)
4.3 Oxide Growth Chart, Semiconductor Technology Handbook (in the binder stored under TYCOM terminal)
4.4 Material Safety Data Sheets for TCA (Dichloroethene), Oxygen, Nitrogen, and Forming Gas H2/N2 (copies in the lobby).

5.0 Definitions & Process Terminology

5.1 ROP: Remote-Operation Panel
5.2 DNTLK: Door interlock, if door is not closed, no process gas can flow.
5.3 MOS Furnace: This type of furnace is used to fabricate MOS devices, whose performance can be greatly impacted by trace contaminants. Wafers processed in a MOS furnace must be MOS compatible. Absolutely no metal film is allowed in any MOS furnace, except the MOS sintering furnace, which allows Al and refractory metal films.
5.4 Non-MOS Furnace: This type of furnace is used for non-MOS processes such as MEMS applications.
5.5 Dry/Wet Oxidation: A high temperature oxidation (dry O2 or steam) process that oxidizes the underlying Si to form SiO2. Dry oxidation uses oxygen for better process control. Wet oxidation uses both DI water and oxygen for fast reaction rate.
5.6 Annealing: A high temperature process that uses N2 to keep wafers in an inert atmosphere. Major Tystar2 applications, include dopant diffusion and activation, LTO/PSG densification and film stress release.
5.7 **TCA Cleaning**: A high temperature process that uses Dichloroethene and oxygen to clean the furnace quartz parts and interior, by removing possible metallic contaminants in these areas.

5.8 **Furnace Flat Zone**: An area inside the furnace with least temperature variation across it (best place to process wafers).

6.0 **Safety**

Follow general safety guidelines in the lab as well as the specific safety rules, listed below:

6.1 **Electric Shock Hazard**: Tystar furnaces utilize **high electric power** (high current) to generate heat. Do not open the side panels or touch the high power electrical parts in the furnace cabinet.

6.2 **Chemical Hazard**: TCA (Dichloroethene) is used for in-situ cleaning of quartz wares. TCA poses moderate health and high fire hazards. Please refer to the MSDS for first aid information.

6.3 **Burn Hazard**: Cantilevers, boats, and wafers coming out of the furnace are very hot. Wear face shield when loading/unloading wafers. Proceed with caution. Avoid touching any furnace quartz ware to prevent burning your hands, as well as contaminating the furnace. No flammable chemical, especially organic solvents are allowed at the load station, when the tube is open.

6.4 The process staff must check all new recipes, before they can be used on any Tystar furnace. Customized recipes should be stored on a separate diskette (user’s diskette), not on the standard furnace diskette.

7.0 **Statistical/Process Data**

7.1 Nanolab web page: Process Monitoring/Furnaces.

7.2 Problem and comment section, under the equipment menu of Mercury.

7.3 Enable message for each Tystar furnace.

8.0 **Available Process, Gases, Process Notes**

8.1 Wafer Cleaning Requirements, before loading them into Tystar furnaces.

8.1.1 Non-metalized wafers to be processed in Tystar1 must go through the standard pre-furnace cleaning procedure. This entails a 10 minute piranha dip in Msink8 and Msink6, and an ensuing one minute HF dip for oxide removal if desired. Photoresist coated non-metalized wafers must initially have their photoresist processed in the Matrix Asher or stripped at Msink1 (PRS-3000 bath). This is required for both MOS and non-MOS wafers. The wafers must then be cleaned in Msink8 and Msink6. Msink6 is the pre-furnace clean step prior to wafer introduction into Tystar1. This means photoresist removal from non-metalized wafers requires an additional cleaning at Msink8 regardless of whether the process is MOS or non-MOS. For a complete description of pre-furnace wafer cleaning please see Section 1.3 in Chapter 5.00, Tystar Furnaces Overview.

8.1.2 No cleaning steps are necessary for wafers that are transferred directly from one MOS furnace to another MOS furnace. Similarly, no cleaning steps are necessary for wafers that are transferred directly form one non-MOS furnace to another.

8.2 Wafer Cleaning Requirements, before loading them into Tystar furnaces. Non-metalized wafers to be processed in Tystar1 must go through the standard pre-furnace cleaning procedure. This entails a 10 minute piranha dip in Msink8 and Msink6, and an ensuing one minute HF dip for oxide removal if desired. Photoresist coated non-metalized wafers must initially have their photoresist processed in the Matrix Asher or stripped at Msink1 (PRS-3000 bath). This is required for both MOS and non-MOS wafers. The wafers must then be cleaned in Msink8 and Msink6. Msink6 is the pre-furnace clean step prior to wafer introduction into Tystar1. This means photoresist removal from non-metalized wafers requires an additional cleaning at Msink8 regardless of whether the process is MOS or non-MOS. For a complete description of pre-furnace wafer cleaning please see Section 1.3 in Chapter 5.00, Tystar Furnaces Overview.

There is **ABSOLUTELY NO EXCEPTION** to this rule.
Available Processes

8.3 Tystar2: MOS furnace for general dry/wet oxidation, and annealing (maximum temperature 1050°C)

8.4 TCA clean: Available for Tystar2.

Available Gases

8.5 Nitrogen (N\textsubscript{2}): Used to purge out room air and keep the process tube in an inert/clean atmosphere.

8.6 Oxygen (O\textsubscript{2}): Used for dry/wet oxidation process.

8.7 DI Water Vapor (H\textsubscript{2}OVAP): Used for wet oxidation.

8.8 Forming Gas (H\textsubscript{2}/N\textsubscript{2}): Not connected.

8.9 Argon (Ar): By request only.

8.10 TCA (C\textsubscript{2}H\textsubscript{2}Cl\textsubscript{2}): Used for in-situ process tube cleaning.

8.11 Nitrogen Carrier (N\textsubscript{2}CARR): Used to carry TCA vapor to the process tube.

Special Process Notes

8.12 Tystar2 should be used for MOS clean Dry/Wet oxidation and anneal processes. In the event that Tystar2 may be out of service, and there is no other MOS furnace available, then Tystar1 may be used as a backup to Tystar2 (dry/wet oxidation and/or anneal). This requires process staff approval.

8.13 Absolutely no wafer with metal on it is allowed in Tystar2.

8.14 After the TCA process, please check the MFS460 alarm. If you do not know where it is located, ask staff for help. If the MFS460 is alarming, no process gas, except N\textsubscript{2}, can flow for your process.

8.15 The maximum process temperature for Tystar2 is 1050°C.

8.16 The H2ORDY and TAPERDY TYCOM heating parameters should be monitored to increase your chances of a successful wet oxidation process.

9.0 Overall Furnace Operation

9.1 General Tystar Furnace Operational Guidelines

The Tystar Furnace consists of three basic modules: Load Station Module, Furnace Module, and Source Cabinet Module. Nanolab users are permitted to access the Load Station Module, only (clean room area). Source cabinet and furnace module access are reserved for trained staff, and should not be touched by Nanolab users (chase area). Failure to do so, could pose potential hazard(s).

The Load Station Module (in the clean room area) houses a laminar flow unit with HEPA filters for clean air distribution. A Boat Loader Unit opens/closes the furnace door and pulls-out/pushes-in the cantilever rods, upon which the boats are waiting to receive work wafers. The boat loader operation can automatically be controlled by a process recipe, or manually controlled by using the ROP’s command keys (see Section 9.3, below).

The Furnace Module consists of a quartz process tube, thermocouples, and heating element. Furnace Flat Zone is divided into three sections: Load, Center, and Source. The temperature is
controlled through a PID electronic board (DTC). All the control parameters can be set in the process recipe. The volume of the quartz tube is approximately 45 liters. The process gas is flown into the tube from the “source” end, and vented through the holes in the “Load” end of the furnace.

The Source Cabinet Module contains several units: the Mass Flow Controllers (MFCs) for process gas flow regulation; the DI water vapor generator for steam generation; and the TCA bubbler for tube cleaning purpose. An electronic gas control system, referred to as MFS 460, controls/coordinates all MFCs and interlocks. This unit is designed to ensure safe furnace operation. Authorized staffs are the only people allowed to access this unit, which is located at the back of the furnace (service chase area).

9.2 **TYCOM Terminal**  
(loading recipes onto ROP and looking at status of run in progress)

The TYCOM Terminal controls and monitors all Tystar Furnace operational steps through process recipe(s). This unit consists of a CPU with two floppy disk drives, a CRT monitor and a keyboard. The auxiliary drive #1 is used for copying diskettes. This unit can copy the entire content of a diskette; hence, care must be taken not to overwrite Nanolab standard process diskettes. Disk drive #2, on the right hand side of TYCOM terminal could be used for viewing or loading the recipes onto remote control panel unit in front of the tube. This drive is also used for single recipe copying/editing, and by temporarily storing the recipe content onto the computer memory, performing the edit task, and ultimately copying the recipe back onto the diskette in its final form. Standard recipes for an individual furnace are stored on a designated floppy diskette, labeled with the furnace name, e.g. Tystar2. Each floppy disk has a special format and is assigned to a particular tube. Please consult with staff whenever you need to generate customized recipes specific to your needs. Keep your recipes on a separate diskette, away from dedicated furnace diskettes and do not alter the content of the furnace recipe diskettes.

**TYCOM Commands**

TYCOM CPU only recognizes CAPITAL letters. You can also use the numerical keypad located on the right hand side of the keyboard, however, be aware that the [Enter] key on the numerical keypad is not recognized by the computer. This particular key can cause errors, when loading a recipe.

Various functions can be invoked through TYCOM commands listed on the following table (1st column).

<table>
<thead>
<tr>
<th>Commands</th>
<th>Function</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI DI</td>
<td>Displays the recipe directory of the diskette in Drive #2.</td>
<td>DI RE 1SWETOXA</td>
</tr>
<tr>
<td>DI RE “recipe name”</td>
<td>Displays the content of a recipe on the diskette in Drive #2.</td>
<td></td>
</tr>
<tr>
<td>LO “recipe name” “#”</td>
<td>Load a recipe to a Tystar furnace.</td>
<td>LO 2SDROXYA 2</td>
</tr>
<tr>
<td>DI ST “#”</td>
<td>Displays current status of a Tystar furnace (see Section 9.2.1).</td>
<td>DI ST 3</td>
</tr>
<tr>
<td>DI DE “#”</td>
<td>Displays the system configuration of a Tystar furnace.</td>
<td>DI DE 3</td>
</tr>
<tr>
<td>DI AL “#”</td>
<td>Displays previous process alarms of a Tystar furnace.</td>
<td>DI AL 4</td>
</tr>
</tbody>
</table>

9.2.1 **Display Furnace Status**

When you use DI ST commands, the CRT monitor displays the status of the Tystar furnace. This information is very important, especially for equipment problem diagnosis.
The following example further explains the Display Furnace Status page, and any Tystar qualified users are expected to understand this display, as it is described below.

Snap shot of Tystar2 furnace status page is displayed below, where “2SWETOXA” recipe is loaded onto the tube, and the furnace is in an idle mode.
**Display Header (first 4 rows of the Display Furnace Status Page, shown above)**

The first row displays the current Date and Time stored in TYCOM CPU. The second row showing * = DISABLED is merely a definition term, and DOES NOT mean that the furnace is disabled, and should not cause any confusion. An asterisk in front of any INPUT or OUTPUT should be interpreted as that particular function disabled for the time being (e.g., N2* = 3000 would simply means, N2 is disabled). Please note that all of the INPUTs and OUTPUTs shown above are enabled, no asterisk in front of any of them.
Third and fourth lines of the table can be explained as follows:

<table>
<thead>
<tr>
<th>TUBE</th>
<th>Tystar furnace #.</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATUS</td>
<td>READY (idle, recipe loaded, but it is not running)</td>
</tr>
<tr>
<td></td>
<td>RUN (recipe is running)</td>
</tr>
<tr>
<td></td>
<td>HOLD (recipe held at a certain step)</td>
</tr>
<tr>
<td></td>
<td>STNBY (no recipe is loaded, indicates power failure)</td>
</tr>
<tr>
<td>PROCID</td>
<td>Recipe ID, stated in the first line of the recipe, usually same as the recipe file name.</td>
</tr>
<tr>
<td>ET</td>
<td>Total time elapsed since the process started.</td>
</tr>
<tr>
<td>STEP</td>
<td>Current recipe step</td>
</tr>
<tr>
<td>TIME-TO-GO</td>
<td>Time left to run in the current step</td>
</tr>
<tr>
<td>STEP ET</td>
<td>Time elapsed in the current step</td>
</tr>
</tbody>
</table>

9.2.1.2 OUTPUTS Column – Process parameter settings sent from TYCOM CPU to a Tystar furnace

| N2CARR, N2, H2/N2, O2, AR | Process gas flow settings |
| SPEED                     | Boat pull-out/push-in speed settings. |
| TEMPL, TEMPC, TEMPS       | Temperature settings for Load, Center, and Source Zone |
| ANAO6, ANAO8              | Available for future use |

9.2.1.3 RELAYOUT Column – Commands sent from TYCOM to Tystar furnace to turn on/off Contact Closure Switches

| N2CARR, N2, H2/N2, O2, and AR | Turn on/off the NUPRO valves of individual process gas. When it is off, then no process gas flows, regardless of the value of flow setting displayed on the terminal. |
| H2OVAP                      | Turns on/off the NUPRO valve between the process tube and the DI water heater. This turns ON, only for the WET OXIDATION case (recipe). |
| TLC                         | When ON, N2CARR flows through the TCA liquid reservoir, then into the process tube, carrying with it the TCA vapor to clean up the tube. When OFF, N2CARR flows directly into the quartz tube without carrying TCA. |
| H2OPUR                      | When ON, prompts the purge/clean of the DI water heater (vacuum mode). H2OVAP AND H2OPUR should not be ON at the same time. |
| H2OHTR                      | DI Water heater, which can generate steam for WET OXIDATION process. It takes approximately 15 to 20 minutes to reach operating temperature, after it is turn ON (H2OHTR = ON). |
| HTTAPE                      | Heat tape that is wrapped around the quartz tube that connects the DI water heater to the process tube. This tape should be ON, whenever WET OXIDATION process is in progress, and it is designed to prevent water condensation in the line. |
| DTCENA                      | Turns on the DTC board for furnace temperature control. Every recipe must have DTCENA = ON statement in its step 0001. |
| LOAD/UNLOAD                 | UNLOAD = ON pulls the boat cantilever out, LOAD = ON pushes it back into the furnace. LOAD and UNLOAD should not be turned on |
simultaneously (recipe). The boat speed is controlled by the SPEED shown under OUTPUT column of display status (Section 9.2.1).

CCOUT11, 12, 13 Available for future use.

9.2.1.4 RELAYIN – Contact Closure Sensor inputs from Tystar furnace (feedback) to TYCOM CPU

Once the door is closed and the process is running, you should see BPIN ON (H2ORDY and TAPERDY ON for the case of wet oxidation process, only). All the other RELAYIN conditions should be OFF.

DNTLK Door Interlock. When ON, indicates the furnace door is not properly closed, hence no process gas will flow (safety feature).

H2ORDY/TAPERDY H2OHTHR or HTTAPE OFF means they have not reached their proper operating temperatures.

N2PRSAL Stands for Low Nitrogen Pressure Alarm. In the event that this is ON, all NUPRO valves will close (except N2), and no process gas will be flown into the tube. Always check N2PRSAL before running any process.

TLCALM When ON, indicates that TCA reservoir level is low or not at a proper operating temperature. Check the status of this TLCALM under RELAYIN column of the display status furnace page, and make sure TLCALM = OFF before starting your run/clean TCA clean recipe.

BPIN/BPOUT Boat cantilever at IN and OUT position.

H2OLEAK Stands for DI Water Leak Alarm. It comes ON, when humidity sensors in the furnace cabinet sense presence of water. In such event, DI water to the H2OHTHR will automatically be shut off.

9.2.1.5 INPUTS – Actual Temperature and Gas Flow readings from furnace thermocouples and mass flow controllers

TEMPL, TEMPC, TEMPS These are actual temperature readings for Load, Center, and Source zones. A letter H, G or L (H = High, G = Good, and L = Low) in front of the temperature reading indicates how well the actual temperature is tracking the target temperature within each zone. This criterion is set by the target temperature and temperature band (tolerance) defined in a particular recipe. Finally, the 4-digit numbers to the right of the temperature readings define the amount of electric power consumed by each furnace zone (no units, just counts). The absolute maximum count is 4095. Bank1 furnaces rarely climb above 3000 counts (high mass element) during their operation at elevated temperatures. High counts near the maximum may be an indication of power leakage, furnace element degradation or other issues which need to be reported.

CALIBL, CALIBC, CALIBS Calibrated temperature readings. If these readings differ from TEMPL, TEMPC, TEMPS by more than 2ºC, then process temperature may not stabilize. Report the problem on Mercury.

N2CARR, N2, H2/N2, O2, AR Actual process gas flows. A letter (H, G, L) in front of the flow reading indicates whether the flow is in the recipe tolerance band. If no tolerance is defined in the recipe, then it is assumed to be infinite, and the letter G appears at all times.
9.2.1 Display Process Alarms

There is no special abort sequence for the Tystar Atmospheric Furnace. Therefore, you need to check your process run history and make sure that all the recipe steps were properly completed without any problem. This can be accomplished by entering **DI AL #** command at the TYCOM terminal. Please note that, due to the limited amount of memory space on the ROP, run history information may be partially or completely lost. This is because, often enough, ROP reaches its limits (full memory), hence purges the information out. This could impact your desired information. Unfortunately, nothing can be done about it.

9.2.2 WAND/TYCOM Interface

Some TYCOM commands can be executed through the WAND command on the silicon2 UNIX computer.

9.2.2.1 Under WAND main menu, select **E** (Equipment Communication). Then press the space bar to select **t** (Tylan furnace interface). The TYCOM COMMUNICATION sub-menu will be displayed.

9.2.2.2 Under the TYCOM COMMUNICATION sub-menu, press **d** (Display Status) to display Tystar furnace status. Same as **DI ST #** command on TYCOM terminal.

9.2.2.3 Under the TYCOM COMMUNICATION sub-menu, press **D** (Display Definition Table) to display Tystar furnace configuration. Same as **DI DE #** command on TYCOM terminal.

9.2.2.4 Under the TYCOM COMMUNICATION sub-menu, press **r** (Recipes) for some recipe related commands.

9.2.2.4.1 Press **c** to copy recipe(s) to your top directory in your Microlab root directory (recipe must be available on the diskette, and your inserted in the TYCOM CPU’s disk drive #2).

9.2.2.4.2 Press **d** to display the directory of the diskette currently in TYCOM CPU disk drive #2. Works just like **DI DI** command on the TYCOM terminal.

9.2.2.4.3 Press **I** to display a recipe content on the diskette currently in TYCOM CPU disk drive #2. Same as **DI RE recipe-name** command on the TYCOM terminal.

9.2.3 Other TYCOM Commands

There are several commands such as: RU, HO, CO, AC, and AB that should be executed at the ROP for safety reasons. Please refer to Section 9.3.6 for the details of these commands.

9.3 Remote Operating Panel (ROP)

Every Tystar furnace has a Remote Operating Panel (ROP) that is located next to its Load Station Module. The ROP is used to perform all the process operation after recipe loading at TYCOM terminal. It consists of MFC and gas connection schematics, a LED display panel, several LED lights, and buttons, all of which are explained in the following sections. See **Figure 1** for a schematic view of the ROP.

9.3.1 Furnace Schematics

Process gas plumbing for bank1 Tystar furnaces are shown on the left top corner of the ROP (**Figure 1**).
9.3.2 **Furnace Zone LED**

There are three LEDs on the ROP under furnace zone, one for each zone. One flash count on each of these LEDs equating to one electric current pulse going through the heating element for that particular furnace zone.

9.3.3 **Boat Control**

There are 6 square buttons under Boat Control section of the ROP, which are used for manual boat in/out control. These manual control buttons can only be used while the furnace is in an idle mode (the LED Display Panel reads READY, Section 9.3.5). The following sub-sections describe how to pull-out/push-in furnace door and boat cantilevers.

9.3.3.1 Press [Manual] once, if the LED on the button is OFF.

9.3.3.2 Select the boat speed by pressing either [Fast] or [Slow].

9.3.3.3 Press [In] to push-in the furnace door and boat cantilevers. Press [Out] to pull out furnace door/boat cantilevers. You need to press and hold the button; otherwise the boat will stop moving.

9.3.4 **Hardware Alarm**

There are two LEDs displayed under Alarm Cause section of the ROP. These are hardware temperature control alarms OT and SCR, shown in Figure 1, below. In the event that either of these LEDs is ON, one needs to press the [Alarm Ack] button to silence the alarm (located just below LEDs), and immediately notify the staff. During non-office hours, abort the process and report the problem on Mercury.

9.3.5 **LED Display Panel and Numerical Pad Section of the ROP**

There are few Numerical keypads, and one LED display panel in this section of the ROP. LED Display can be cycled through some useful information about the status of the furnace, shown in Sections 9.3.5.1 through 9.3.5.5. This can be accomplished by pressing the [7/Status] button repeatedly.

9.3.5.1 Process Status

- **RUN** Process in progress.
- **READY** Idle status, recipe loaded, but it is not running (holding at step 0001 of the recipe).
- **END** Process ends, Alarm sounds. Press [Alarm Ack] to silence the alarm and return to READY status.
- **STNBY** Standby status, recipe lost due to power failure or furnace computer reset. A recipe needs be loaded. Otherwise, the furnace will start cooling down with all gases shut off.

9.3.5.2 Recipe Name: Process ID based on first line of the recipe. This is usually the same as the recipe file name.

9.3.5.3 **STEP**: The current step number of the recipe in progress.

9.3.5.4 **Time**: Remaining time for current process step (HH:MM:SS)

9.3.5.5 **Temperature**: Average temperature of the three furnace zones

**Note:** Do not press any other numeric buttons on these numeric pads, as they are designed for industrial manufacturing use. Failure to do so may cause panel not to function properly. If any of these keys were pressed by mistake, push the [Clear] button, followed by [7/Status] to clear this problem.
9.3.6 Process Operation Buttons

There are four buttons, on the far right side of the ROP, which are used for process control. Their functions and corresponding TYCOM commands are listed in the following table.

<table>
<thead>
<tr>
<th>ROP Button</th>
<th>TYCOM Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Recipe</td>
<td>Run]</td>
<td>RU #</td>
</tr>
<tr>
<td>[Hold</td>
<td>Clock]</td>
<td>HO #</td>
</tr>
<tr>
<td>[Alarm</td>
<td>Ack]</td>
<td>AC #</td>
</tr>
<tr>
<td>[Abort]</td>
<td>AB #</td>
<td>Abort the current process, the furnace skip to END state.</td>
</tr>
</tbody>
</table>

9.4 Available Recipes

9.4.1 Tystar2 (MOS Dry/Wet Oxidation and anneal): 2DRYOXA, 2WETOXA, 2N2ANNA, 2HIN2ANA

9.4.2 TCA cleaning: 2TLCA.

9.5 Processing a Run (Loading Recipe and Wafers)

Loading a Recipe

9.5.1 Enable the Tystar furnace.

9.5.2 Check that no recipe is running in furnace and the ROP displays READY.

9.5.3 Insert the recipe diskette for the furnace into floppy drive #2, right-hand side of TYCOM CPU (every furnace has its own standard recipe diskette).

9.5.4 If you are not sure about the recipe name, enter DI DI at TYCOM Terminal to display the recipe directory on that particular diskette in drive #2.

9.5.5 Type in LO recipe-name # (# = furnace number) on the TYCOM terminal, then press the [enter] key to load recipe.

9.5.6 Enter the proper process parameter(s) when prompted by the computer. You can use the numeric keypads. However, TYCOM does not recognize the [enter] key on the numeric keypads, hence will not load your recipe. Use [enter] key to the left of the numerical keypad instead (main part of the key board).

9.5.7 TYCOM Terminal should now display RECIPE LOADED SUCCESSFULLY, if there were no errors in your recipe, and/or parameter entries.

Do not use RU # on the TYCOM terminal to start the process. Use the [Recipe|Run] button on the ROP instead (Section 9.5.9). This is strongly recommended, as it lets one check and make sure that her/his desired recipe is properly loaded (ROP), and that there is no one else in bank1 trying to load/unload wafers from furnace(s) (more in compliance with Nanolab etiquette).
Load Wafers and Run a Process Recipe

9.5.8 Go to the front of the load station module of the Tystar furnace. Press [7|Status] button on the ROP to make sure the furnace is at READY state and the recipe name is correct.

9.5.9 Put on the face shield.

9.5.10 Press [Recipe|Run] button. The furnace door will open and wafer boats will come out. Be aware that furnace door will automatically close after 20 minutes. If boats start moving in, and you need more time to load your wafers, then press [Alarm Ack] button before furnace door gets closed. You get another 20 minutes to load your wafers.

9.5.11 Transfer your wafers from MSink6 to the furnace in the black transfer wafer box. See Section 8.1 for wafer cleaning requirement.

9.5.12 Load MOS clean wafers using the MOS clean vacuum wand with red tubing. Load Non-MOS wafers using the Non-MOS vacuum wand with black tubing. All wafers should be loaded with their flats up for a better wafer support, and consistent run-to-run results.

9.5.13 Do not wear poly gloves over clean room gloves when loading/unloading wafers. The poly gloves are usually too big, and slippery. The tips of the poly glove may melt on the hot quartz ware and could cause contamination, which may be hard to notice (colorless and transparent). The poly gloves should be used at MSink6 before transfer to the furnace.

9.5.14 Once wafers are loaded onto the boat, press [Alarm Ack] button on the ROP. The boat will start moving into the furnace, and if for some reason you need the boat to come back out again (add/remove or reposition wafers), then press [Alarm Ack] once. Pressing the same button once more will move the boat back into the furnace.

9.5.15 After the door closes completely, check DNTLK on the TYCOM Terminal. Process will continue automatically, if DNTLK is OFF. You can also monitor the status of the process run remotely (Section 9.2.3).

9.5.16 If the DNTLK is ON, the process will abort after a few minutes. Press [Alarm Ack] button to silence the alarm. Check that the track and cable of the boat loader is cleared of any obstacle. Press [Recipe|Run] button again. If problem continues, report the boat loader problem on Mercury.

Unload Wafers After Process Ends

9.5.17 ROP displays END and alarm beeps, once the process is completed. Press [Alarm Ack] button to silence the alarm, and reset the furnace to READY state.

9.5.18 To unload your wafers, press [Recipe|Run] button again, and the boats will move out. When the boats stop moving, wait for a few minutes to cool down the wafers. Then use the appropriate vacuum wand to unload them onto the cooling rack next to the furnace (Tystar2 quartz boats). Wafers may still be too hot, so you may have to wait for a few more minutes, before placing them in plastic cassettes/box.

9.5.19 Press [Alarm Ack] button to move the boats back into the furnace. Once furnace door closes completely, press [Abort] button followed by [Alarm Ack], and the furnace should return to READY state. If you press [Abort] button before the door closes, the boats will stop moving; hence furnace door will be left open. Follow Section 9.3.3 to close the door manually.

9.5.20 Disable the Tystar furnace on Mercury. Unload wafers from the cooling rack into wafer a box.
10.0 Troubleshooting Guidelines

10.1 TYCOM Terminal is blank.
   10.1.1 Press [Enter] key. The terminal may be in sleep mode.
   10.1.2 Turn the terminal OFF, then ON. This will reset the terminal. Adjust brightness/contrast if needed.
   10.1.3 If none of the above works, then you will need to reset the TYCOM CPU (Section 10.2).

10.2 Reset TYCOM Terminal
   10.2.1 Gently slide the TYCOM CPU out.
   10.2.2 Once the backside is exposed, you can find a black square power switch, at the top left corner of the CPU. Toggle this switch off then on.
   10.2.3 Check all the wires connected to the backside of the CPU, and make sure that they are secured. Gently slide the CPU back to its original position.
   10.2.4 On TYCOM terminal, Enter ACT PR, then [Enter].
   10.2.5 Enter IN DA dd/mm/yy; enter IN TI hh:mm:ss to set the date/time.

10.3 I/O Error
   There is a communication problem between the TYCOM CPU and the furnaces. Report problem on Mercury.

10.4 Door won’t open/Boat loader stuck
   10.4.1 Make sure there is nothing obstructing the movement of the boat loader.
   10.4.2 Make sure the cable that pulls the boat loader is not loose. If so, ask staff to adjust the tension of the cable.
   10.4.3 Try to move the boat loader manually. (Section 9.3.3)
   10.4.4 If the boat loader gets stuck on the track, give it a little pull/push, which may help it overcome some friction. Do not use excessive force.
   10.4.5 If all the above steps fail, report problem on Mercury.

10.5 N2PRSAL is ON
   Nitrogen pressure alarm is on. Do not attempt to run any process. Wait until the liquid nitrogen tank is refilled.

10.6 OT/SCR alarm is ON
   The furnace electronic board cannot control the temperature. Silence the alarm. Find Staff immediately. During off hours, abort process and report problem on Mercury.

11.0 Figures & Schematics

11.1 Figure 1 - Tystar2 (Wet/Dry Oxidation & Anneal Tube) ROP Display
Be sure to know…

1. Maximum temperature.
2. MOS vs. Non-MOS rule.
3. Loading and changing a recipe.
4. TCA cleaning: when, why and how to do it.
5. Troubleshooting the TYCOM screen.
6. Cleaning wafers before they go into the furnace.
7. Sending recipes to the furnace.
8. Wafer loading into boats and into the tube.
9. Displaying the status of a process.
10. Unloading wafers and closing the tube.
11. Which vacuum wand to use at which furnace.
12. Alarms and what to do when you hear them.
13. Preventing contamination in the VLSI.
15. Which furnace uses which gas(es).