GENERAL PROCESS AND OPERATION SPECIFICATION

TYSTAR 3600 MINI TYTAN LPCVD

1. SCOPE

a. The purpose of this document is to describe requirements and basic operating instructions for TYSTAR 3600 MINI TYTAN. This tool is intended for LPCVD deposition of low-stress silicon nitride Si3N4 (LSN) and low temperature oxide (LTO).

2. SAFETY

- a. Be sure that you are trained and signed off to use this equipment per AggieFab policy.
- b. Refer to Safety Features in MINI-TYTAN 3600 FURNACE SYSTEM SUMMARY.
- c. Operating personnel need to be aware of the hazards that they may be exposed to while operating the tool.
 - i. Electrical Hazards: High voltages can exist at the tool, pumps and other areas.
 - ii. Toxic Substance Hazards: wafers may be coated with toxic materials. Exercise caution when handling processed materials.
 - iii. Process Gases: Silane, Dichlorosilane, and Ammonia are used in the system.
 - iv. High Temperature Hazards: quartzware and wafers may be hot after processing. Handle all quartzware with care.
- d. If you are unsure about any procedure or indication while operating this equipment, contact a staff member or trainer for assistance.

3. APPLICABLE DOCUMENTS, MATERIALS AND REQUIREMENTS

- a. For more information about the detailed operation of this tool refer to the TYSTAR operation manual: DCS-30, FCS-10, which are available on the Syncplicity.
- b. Appendix A: Recipe Editing
- c. Appendix B: Wafer Loading/Unloading Procedure

4. **OPERATION**

Only silicon and quartz wafers which have not been processed previously (including tape, pen markings, photoresist, metals, etc.) and fit securely in an available boat may be processed in the tool.

- a. Login to iLab and start the TYSTAR. This will turn off the interlock and enable gas flow.
 - i. Check the lights of interlock box under subfloor and make sure the green lights are on (Figure 1).



Figure 1. Interlock box under subfloor, showing tool ON iLab status.

ii. Check exhaust abetment system - Jupiter Scientific Callisto located on the adjacent side of Bay 2. Make sure the green light is on (Figure 2).



Figure 2. Exhaust abetment system (Jupiter Scientific) with green light on.

- b. Use the stylus to tap the FCS-10 (Furnace Control System) computer screen on the front of the tool to wake it up.
 - i. Do not operate the tool using the free-standing DCS-30 (Data Capture System) computer.
- c. Press *DISPLAY STATUS* to show the current state and set points.
- d. Verify STBY.00x is running and held at STEP: 0060. Press *EVENT* to continue the remaining backfill steps of the "STBY.00x" recipe.

	- Displ	ay	process	Status	STB	1.001		Press NI	XTPAGE	to cont	inue.
DE:RUN	 N		END:00.	23.10		STEP:006	0		ST_	TTG:00.0	0.00
GNAL	SETPT		ACTUAL	SIGNAL	SETPT	ACTUA	IL I	SIGNAL S	SETPT	SIGNAL	ACTUAL
N2PRC I2BKFL NH3 DCS	PRC 0. G KFL 200. G NH3 .0 G DCS .0 G UNT 0. G CPR 0. H ULU 0N	G G G G	0. 190. .0 .0	TEMPL TEMPC TEMPS RMPRATE TCUENA TCUID	400.0 400.0 400.0 50 50 0 F F 0	H 503. H 505. H 499.	.7	BOATOUT BOATIN RUN IDLSHLD ABORT PREN2 PRENH3	OFF OFF ON ON OFF ON OFF	DNTLK Antlk Bntlk Untlk Gntlk Bpauto Outlmt	OFF OFF OFF OFF OFF OFF OFF
YSHUNT Prcpr Ateulu Eakchk	0. 0. 0n 0ff	G H	5. 174. OFF OFF	BOATSPD Sonic Event	.0 OFF	G . OF	.0 F	PREDCS UACNH3 UACDCS PREUAC COOLRNG	0FF 0FF 0FF 0FF 0N	INLMT TUBEOT SCROT CABOT VACHIAL GUHTRAL	ON OFF OFF OFF OFF OFF OFF
							i		i	EXHNTLK	OFF
A	B C		D E	F	G H	1	J	K	L M		OFF OFF ABO
A N	B C		D E	F	G H T U	I V	J	K K	L M Y Z		
A	B C 0 P 2 3		D E Q F 4 E	F S 6	G H T U 7 8	1 V 9	J W	K X	L M Y Z ENTER		
A N I	B C O P 2 3 e Buttons		D E Q F 4 E	F S 6	G H T U 7 8	 V 9	J W	K X	L M Y Z ENTER		
A N 1 Configurable MAIN M	B C O P 2 3 ie Buttons	NEX	D E Q F 4 E	F S 6 COMMAND	G H T U 7 8 DISF	I V 9	J W O DISI	K .	L M Y Z ENTER DISPLAY F		
A A A A A A A A A A A A A A A A A A A	B C D P 2 3 e Buttons 4ENU	NE	D E Q F 4 E KT PAGE	F S 6 COMMAND HOLD	G H T U 7 8 DISFL	I V V S HAY DIR. AY RECIPE	J W DISI REI	K X PLAY STATUS CIPE DELETE	L M Y Z ENTER DISPLAY I RECIPE I		

- e. Check for tool IDLE state on DISPLAY STATUS view.
- f. Press *MAIN MENU* to navigate to the main screen.
- g. IF AND ONLY IF edits to the standard AggieFab recipes are desired, follow Appendix A: Recipe Editing for detailed steps on changing recipe parameters, including temperature, pressure, and gas flows. This is only for experienced users and requires additional training. DO NOT EDIT DEPOSITION TIME!

- h. Press the RECIPE LOAD soft button,
- i. Use the arrows to navigate to the desired recipe (LSNITR.001 or STNITR.001 for Tube 1, LTO.003 for Tube 3). Press *ENTER* twice (slowly) to select and wait for system to load recipe.
- j. The recipe will load, and the system will check for process errors. Here, the user will be prompted for a deposition time (STEP DEPO). Enter the desired deposition time in HH.MM.SS format and press enter.



This image shows a 30 second deposition being entered.

k. Press *MAIN MENU*, press *RUN* to start the loaded recipe. Navigate to the current status screen by pressing *DISPLAY STATUS*.

🛃 Terminal -	TouchScree	n - 1	UBE 1 - T1														
FNC: DS	- Disp	Lag	, proces	s	Status		LSNI	T	R.001		Press N	EXI	TPAGE	to	conti	nue	
10DE : I DL	E		END:00		00.00		S	T	P:IDL	E			ST_	TTG:	00.00	. 00	
IGNAL	SETPT		ACTUAL	1	SIGNAL	5	ETPT		ACTUA	LI	SIGNAL	SET	трт ј	516	NAL A	CTU	AL
N2PRC	0.	G	0.	ł	TEMPL	5	50.0	L	455.	2	BOATOUT	(DFF DN	DA	NTLK NTLK	OF OF	F
N2BKFL	500.	G	496.	Ì	TEMPS	5	50.0	L	456.	6 1	RUN	1	DFF DN	BU	NTLK	0 N 0 F	F
NH 3	. 0	G	. 0	ł	RMPRATE TCUENA		.0 OFF			ł	ABORT PREN2	(DFF DN	G BP	NTLK Auto	ON	
DCS	. 0	G	.0	ł	TCUID		0				PRENHS	6	DFF DFF	00	NLMT	OF	F
PSHUNT	0.	н	591.	ł	SONIC		5.0 0FF	G	5.		VACDOS		DFF	S	CROT	OF	F
ATEULU	0.	"	2079. OFF	į	EVENT				OF	F	COOLENG	č	DN	VAC	HIAL		Ē
.EAKCHK	OFF		OFF											GUH N2P GAS EXH	TRAL RSAL NTLK NTLK	OF OF OF	F F F
A	в		D	E	F	G	н		1	J	к	L	м		Ŷ		ABORT
N	0 F		Q	R	s	T	U		v	w	×	Y	z	4			
1	2 3		4	5	6	7	8	1	9	0		E	NTER		₽		CLEAR
Configurable	Buttons	_		5073													
MAIN M	ENU	N	EXT PAGE		COMMAND		DISP	LAY	DIR.	DISP	LAY STATUS	D	ISPLAY E	QUIP.	<- B/	NCKSP	ACE
RU	۷		EVENT	1	HOLD		DISPL	AY F	RECIPE	REC	IPE DELETE	1	RECIPE L	DAD	RECI	PE MO	DIFY
LOAD	IN	L	0AD OUT		HOST PARAM		DISPLA	ΥH	ISTORY		ON	1	OFF		ALA	ARM A	ск

1. Tube will be backfilled with nitrogen and cantilever will move out. The cantilever will reach the outer limit and the alarm will sound at STEP: LDWF.

- m. Press *ALARM ACK* to silent the alarm and *HOLD* to pause the timer. Wait 10 minutes for wafers/boat to cool down.
- n. Follow Appendix B: Wafer Loading/Unloading to load your process wafers into the boat and load the filled boat onto the cantilever.
- o. When wafer loading is complete, press *RUN* to restart the timer and *EVENT* to trigger the cantilever to move back in and the door to close.
- p. Wait for door close and pump down, when PRCPR value reaches < 20 mTorr the tool can be left to run the remaining pump/purge and deposition steps. When deposition is complete, the alarm will sound at STEP: HLD1.

	- Disp	lay	, proces	55	Status	LSN	ITR.0	01	Press N	EXTPAGE	E to cont	tinue.
DE:RU	N		END:01	1.5	1.30	_	STEP:	HLD1		ST_	TTG:00.0	00.00
GNAL	SETPT		ACTUAL	1	SIGNAL	SETPT	AC	TUAL	SIGNAL	SETPT	SIGNAL	ACTUAL
N2PRC	0.	G	0.	ł	TEMPL TEMPC	550.0	L 5 L 5	28.3	BOATOUT BOATIN	OFF OFF	DNTLM	COFF COFF
NH3	200. G .0 G .0 G 0. G	195.	-	TEMPS	550.0	L 5	42.1	RUN IDLSHLD Abort	OFF ON OFF	BNTLN UNTLN GNTLN	COFF COFF COFF	
DCS	.0 G 0. G 8. G	. 0	1	TCUENA TCUID	0FF 0			PREN2 PRENH3	ON OFF	BPAUTO Outlmi	D OFF OFF	
SHUNT	.0G 0.G 0.G 0N	5.	1	BOATSPD	.0	G	. 0	PREDCS		TUBEO1	I ON I OFF I OFF	
PRCPR		178.	ł.	EVENT	011		OFF	PREVAC	OFF	CABOI	OFF	
TEULU	0 N		OFF	į.							VACLOAL Guhtral	OFF OFF
. nn o nn				i.					i i		GASNTLE	OFF
				i					1	i	EXHNTLE	(OFF —
A	в	;	D	E	F	G H		J	I K	L M	EXHNTLA	COFF
A N	B (;	D Q	E R	F	G H T U		L L	I К / Х	L M Y Z		
A N 1	B 0 0 F	,	D	E R 5	F S 6	G H T U 7 8		ر س 0	I К / Х	L M Y Z ENTER	EXHNTLA	
A N 1 Configurab	B C O F 2 3	;	D Q 4	E R 5	F	G H T U 7 8	y y	L L	I K X L K	L M Y Z ENTER		
A N I	B C O F 2 3 le Buttons 4ENU	> 	D Q 4 EXT PAGE	E R 5	F S 6	G H T U 7 8 DIS	U U V		K / X -	L M Y Z ENTER DISPLAY		ABOF ABOF CLEA BAOKSPACE
A N Configurable MAIN 1	B C O F 2 3 le Buttons MENU	> 	D Q 4 EXT PAGE	і в 5	F S 6 COMMAND HOLD	G H T U 7 8 DISP	PLAY DIR		K K	L M Y Z ENTER DISPLAY I RECIPE		

- q. Press *ALARM ACK* to silence the alarm. Press *EVENT* to trigger the unloading process at STEP: BKF1.
- r. The cantilever will reach the outer limit and the alarm will sound at the unload step (STEP: ULWF for Tube 1 and STEP: UNLD for Tube 3).
- s. Press *ALARM ACK* to silence the alarm and *HOLD* to pause the timer. Wait 10 minutes for wafers/boat to cool down.
- t. Follow Appendix B: Wafer Loading/Unloading to unload the boat from the cantilever and remove your process wafers.
- u. Place the boat back, press *RUN* to restart the timer, and *EVENT* to trigger the cantilever to move back in. Process will continue to recipe end and state IDLE.
- v. Press *MAIN MENU*, then *RECIPE LOAD*. Arrow to the standby recipe (STBY.001 for Tube 1 or STBY.003 for Tube 3) and press *ENTER* twice to load.
- w. Press *RUN* to begin the standby recipe, and *DISPLAY STATUS* to change the view back to the status screen.

5. SIGNATURES AND REVISION HISTORY

- a. Author of this document: Hui Chen
- b. Author Title or Role: Research Associate Engineer
- c. Date: September 5, 2019
- d. Revision: A

Approvals:

Technical Manager Signature: ______

Date: 9 August 2021

Revision History:

Revision	Author	Date	Change
Original Issue	Hui Chen	September 5, 2019	
Rev A	Hui Chen	September 5, 2019	
Rev B	Megan Makela	March 5, 2021	
Rev C	C. J. Karber	August 5, 2021	Variable DEPO step.
Rev D			
Rev E			

Appendix A - Recipe Editing

NOTE: Recipe editing can only be done at the IDLE state by experienced users with additional training using the FCS-10 touchscreen computer. Follow standard process operation to place tool in IDLE before attempting to edit a recipe.

Tube 1 Low-Stress Nitride (LSN) – "LSNITR.001"

- 1. For Filename:, enter "LSNITR.001" and press ENTER.
- 2. In the cmd: field, enter "Gxxxx", where "xxxx" is the step name, and press *ENTER* to go to the step you wish to edit.
- 3. In the cmd: field, enter "SP" and press *ENTER* to edit set points for the step.

Termina	I - Touchs	icreen - T	UBE 1 - T1											>
C: RE nmand ep: T	- Re Choi EMP	cipe ces:	Edit Gssss	(LSN , Gss	ITR.00 55.nnr cc)1 n, n,) <u>c</u> B, N, nt: TE	md: SF I, DEL MPS 83	, FO	<c , SP, S ti</c 	CMD - SI, U Lme:	for ed I or H 00.10.	it men (for h	u> elp)
MMAND CM H	FIEL D key - dis	D HEL retu play	.P Irns to this p	o the bage	(CMD edit	key ent	puts ry pag	the cu e	ırsor	in the	e com	mand fi	eld)	
nnand Gs B N	s to sss - - go - go	Selec Goto Back to Ne	t a Si step to pro xt exi	tep: ssss eviou istin	s step g step	1		Gssss	5.nnn	n – Got	to st	ep ssss	+ nnn	n
nnand FO SP SI VI nnand I	s to - fa - ou - re - re s to - Ins	Selec ult r tput spons spons Inser	t Type setpon setpon setpon seto seto seto seto stor l step at	e of se ov int r statu input Delet fter	Step [eride espons s (on/ value e a St currer) ata for se f off es (cep: nt s	: curre or cur) inpu TEMP >	nt ste rent s ts for 650 c	ep step thi: leg.C EL - 1	s step) for t DELete	this curr	step ent ste	p	
A	В	с	D	E	F	G	н	1	J	к	L	м	Ŷ	ABORT
N	0	Р	Q	R	s	Ť	U	v	w	×	Y	z 🗸		·]
1	2	3	4	5	6	7	8	9	0		ENT	ER	₽	CLEAR
Configura MólN	ble Buttons	N	EXT PAGE		COMMANE		DISPLA		DISPL	STATUS	DISE		<- BACK	SPACE
B	UN		EVENT		HOLD		DISPLAY	RECIPE	RECIP	E DELETE	RE	CIPE LOAD	RECIPE	MODIFY
LO/	AD IN		DAD OUT		IOST PARA	м.	DISPLAY H	IISTORY		ON		OFF	ALARI	M ACK

Temperature

- 1. Enter "GTEMP" in the cmd: field and press ENTER. Enter "SP" in the cmd: field and press ENTER.
- 2. Use the arrows to move the cursor to TEMPL, enter desired temperature, and press *ENTER*. Repeat for TEMPC and TEMPS.
 - a. Default temperature is 835°C.

TYSTAR 3600 MINI TYTAN General Process and Operation Specification

C: RE	- Rec	ipe	Edit	(L	SNITR.	001) c	nd:		<	CMD -	for	edit	nenu	>
nmand	1 Choic	es:	Gssss	, G	ssss.n	nnn,	B, N,	1, DE	L, F0,	SP,	SI, U	I or	H (f	or he	1p)
p: 1	EMP					conne	nt: TE	MPS 8	35	t	ine:	00.1	10.00		
					SP -	Setp	oints	(outp	uts)		<	nore	page	 s>	
	N2PRC		8. 50	СМ		TE	MPL 8	35.0	DEGC	E.	BOAT	оит	OFF		
	12 BKEI	2.0	8 50	CM		TE	MPC 9	25 8	DECC		POO	TIN			
	NUO	20	a se	CM		10	MD 5 0	95.0	DECC		DON		0.5.5		
	nes			CM			ATE	0.7.8	D / H		INC		0.55		
	063					Tou			071		IDES		011		
	.24041		0. 10	KK	1	100	ENH U			1	нв	UKI	UFF		
120	PRCPR	-	0. MI	UR		10	UID	8	1000		PR	ENZ	UN		
Gr	ATEULU	ON			1	BOAT	SPD	.0	IPM		PRE	NH3	OFF		
LI	AKCHK	OFF			1					1	PRE	DCS	OFF		
A	в	с	D	E	F	G	н	1	J	к	L	м	1		ABO
N	0	Ρ	Q	R	s	T	U	v	w	×	Y	z	\$		
1	2	3	4	5	6	7	8	9	0		ENT	ER	4	Ŀ	CLEA
Configura	ble Buttons									~	•				
MAIN	MENU	NE	XT PAGE		COMMA	ND	DISPLA	Y DIR.	DISPLA	Y STATUS	DISP	LAY EQU	IIP.	<- BACKS	SPACE
F	IUN		EVENT		HOLD		DISPLAY	RECIPE	RECIP	DELETE	REC	IPE LOA	D	RECIPE N	IODIFY
	1	-		-		-	-				1		11		-

Pressure

- 1. Enter "GSTBP" in the cmd: field and press *ENTER*. Enter "SP" in the cmd: field and press *ENTER*.
- 2. Use the arrows to move the cursor to PRCPR, enter desired pressure, and press ENTER.
 - a. Default pressure is 250 mTorr.

C: RE	E - Rec	ipe E	dit	LSHI	r R . C	101)		nd:		<	CMD -	for ea	it ne	nu>
nnand	1 Choic	es: G	ssss,	Gsss	5.nn	nn, B	, N,	I, DE	L, F0,	SP,	SI, UI	or H	(for	help)
ep: 5	STBP				c	onnen	t: \$1	ABLE	PRESSU	R t	ine:	00.10	. 0 0	
				SI		Setpo	ints	(out	uts)		 (m	ore pa	aes>	
	N2PRC	8		4		TEN	1PL	NC	DEGC	1	BOATO	ит от	F	
	12 D V E I	15.0	see	8 97 10 11		TEN	IPC	NC	DECC		PRAT		i r	
	LUNG	150		8				No	0000		DUNI			
	NH3		0 2001			TER	182	NG	DEGG	1	K			
	DCS		0 SCCI	•		кирка	TE	. 0	D/M	1	IDLSH	LD 01		
1	SHUNT	0	. TORI	8		TCUE	NA C	IFF		1	ABO	RT OF	FF	
	PRCPR	258	. MTO	2	1	TCU	ID	0		1	PRE	N2 01	4	
Gr	TEULU	ON			1	BOATS	PD	. 0	IPM	1	PREN	H3 01	F	
L	акснк	OFF			1					Г	PRED	CS OF	F	
A	B	с	D	E	F	G	н	1	J	к	L	м	Ŷ	ABOR
N	0	Р	Q	R	s	T	U	v	w	×	Y	z		\triangleright
1	2	3	4	5	6	7	8	9	0		ENTER		₽	CLEA
Configura	ble Buttons-	- 1823 2		1.1			62			-			139	7.2
MAIN	IMENU	NEX	t page	00	IMMAN	ID	DISPL	AY DIR.	DISPLA	Y STATUS	DISPLA	Y EQUIP.	<- BA	CKSPACE
F	IUN	EV	ENT		HOLD		DISPLAY	RECIPE	RECIPE	DELETE	RECIP	e load	RECIP	E MODIFY
	1			1	2.2.12									

Gas Flow

- 1. Enter "GPNH3" in the cmd: field and press ENTER. Enter "SP" in the cmd: field and press ENTER.
- 2. Use the arrows to move the cursor to NH3, enter desired high flow for NH₃ flow stabilization, and press *ENTER*.
 - a. Default flow rate is 100 sccm.

rminal	Keyboard	Help												
C: RE	- Rec	ipe	Edit	(L	SNITR.	001) c	nd:		<1	CMD -	for e	dit ne	nu>
nnand	Choic	es:	Gsss	s, G	5555.N	nnn,	B, N,	1, DE	L, F0,	SP,	sı, vı	or I	l (for	help)
ep: P	PNH3					conne	nt: PA	E NH3		t	ine:	00.02	2.00	
					SP -	Setp	oints	(outp	uts)		<	nore p	ages>	
	N2PRC		0. S	ссм		TE	MPL	NC	DEGC	1	BOATO	ОТ (FF	
•	2BKFL		0. S	CCM	1	TE	MPC	NC	DEGC	1	BOAT	IN C	FF	
	NH3	100	. 0 S	CCM	i	TE	MPS	NC	DEGC	÷.			IFF	
	DCS		. 0 .5	CCM	· [RHPR	ATE	. 0	D/M		IDLSF		FF	
P	SHUNT		а. т	ORR		тси	ENA 0	IFF		1	ARC		IFF	
	PRCPR	NC	то () Н	TOP	- 2	10		0		10	PPF	N2 (IN IN	
	TEULU						CBD		TOM					
	TEOLO	UN					310	. 0	114		FREE	ina i		
LE	АКСНК	UFF			1					1	PREL	ics i	IFF	
A	B	с	D	E	F	G	н	1	J	к	L	м	Ŷ	ABOR
N	0	Ρ	Q	R	S	T	U	v	w	×	Y	z		
1	2	3	4	5	6	7	8	9	0		ENTE	R	₽	CLEA
Configura	ble Buttons-			_						-	(1000	
MAIN	MENU	NE	kt pag	iΕ	COMMA	ND	DISPLA	IY DIR.	DISPLA	Y STATUS	DISPL	AY EQUIP	<- B4	CKSPACE
R	UN	E	VENT		HOLD)	DISPLAY	RECIPE	RECIPE	DELETE	REC	IPE LOAD	RECI	PE MODIFY
10	AD IN	LO	AD OUT	T	HOST PA	RAM.	DISPLAY	HISTORY		ON		OFF	ALA	

- 3. Enter "GPDCS" in the cmd: field and press *ENTER*.
- 4. Use the arrows to move the cursor to NH3 and enter desired flow rate. Arrow down to DCS, enter desired flow rate, and press *ENTER*.
 - a. Default NH₃ flow rate is 20 sccm.
 - b. Default DCS flow rate is 100 sccm.

IC: R	E - Rec	ipe Ed	lit (LSNIT	R.001)	cnd:		<0	MD - for	edit	nenu)	
nman	d Choic	es: Gs	sss,	Gssss	.nnnn,	B, N,	I, DE	L, F0,	SP, S	I, VI or	H (fe	or hel	Lp)
ep:	PDCS				conn	ent: P	RE DCS		ti	ne: 00.	01.00		
				SP	- Set	points	(outp	uts)		<more< td=""><td>pages</td><td>5></td><td></td></more<>	pages	5>	
	N2PRC	8.	SCCI	1	T	EMPL	NC	DEGC	1	BOATOUT	OFF		
	N2BKFL	Ø.	SCCI		т	EMPC	NC	DEGC	1	BOATIN	OFF		
	NH 3	28.6	scci	1	Т	EMPS	NC	DEGC	1	RUN	OFF		
	DCS	100.0	scci		RMP	RATE	. 0	D/M	1	IDLSHLD	OFF		
	PSHUNT	0.	TORF	- 1	TC	UENA	OFF		i.	ABORT	OFF		
	PRCPR	NC	NTOF		т	CUID	0		1	PREN2	0 N		
G	ATEULU	0 N		1	BOA	TSPD	. 0	IPM	i	PRENHS	ON		
L	ЕАКСНК	OFF							1	PREDCS	ON		
													_
A	в	с	D	E	F G	н	1	J	к	L M	1		ABOR
N	0	P	q	R	s T	U	v	w	×	Y Z	4		
1	2	3	4	5	6 7	8	9	0		ENTER	1	5	CLEA
Configur	able Buttons-						-		-	li .		_	
MAJ	N MENU	NEXT	PAGE	00	MMAND	DISPL	AY DIR.	DISPLA	Y STATUS	DISPLAY EQ	JIP.	<- BACKSF	PACE
	RUN	EVE	INT	H	IOLD	DISPLA	Y RECIPE	RECIP	DELETE	RECIPE LOA	AD F	RECIPE MO	DDIFY
-				-			11						

Tube 3 Low-Temperature Oxide (LTO) – "LTO.003"

- 1. For Filename:, enter "LTO.003" and press ENTER.
- 2. In the cmd: field, enter "Gxxxx", where "xxxx" is the step name, and press *ENTER* to go to the step you wish to edit.
- 3. In the cmd: field, enter "SP" and press *ENTER* to edit set points for the step.

rminal	al - Touchs	Screen - T	UBE 3 - T	3										
IC: RI	E - Re	cipe	Edit	(LT	0.003	_) c	nd: S	Р	<0	HD - F	or ed:	it nen	u>
nnan	d Choi	ces:	Gssss	, Gs	sss.nn	nn,	B, N,	I, DE	L, FO	, SP, 5	I, VI	or H	(for h	elp)
ep: :	STB1				c	onne	nt: ST	ABLE	TEMPS	ti	ne: O	0.02.	88	
HMAN Ci H	D FIEL MD key - dis	D HEL retu splay	.P Irns t this	o th page	(CMD e edit	key ent	puts ry pag	the c e	ursor	in the	conma	nd fi	eld)	
nnan G: B N	ds to ssss - - go - go	Selec Goto Back to Ne	t a S step to pr xt ex	tep: sss evio isti	s us ste ng ste	р р		6555	s.nnn	n - Got	o step	5555	+ nnn	n
S	I - re	spons	e to	stat	us (on	/011) inpu	ts fo	r this	s step				
S V nnan I	I - re I - re ds to - Ins	spons spons Inser ert s	e to se to t or step a	stat inpu Dele fter	us (on t valu te a S curre	tep: nt s	tep	650 D	r thi: deg.C EL -	s step) for t DELete	his st curren	ep t stej	P	_
S U MMAN I	I - re I - re ds to - Ins	spons spons Inser ert s	t or t or t or	stat inpu Dele ifter E	us (on t valu te a S curre	tep: nt s	tep	650 D	r thi: deg.C EL - I	s step) for t DELete K	his st curren	ep t stej 4	ŕ	ABOI
N N	I - re I - re ds to - Ins B 0	c C P	t or t or tep a	stat inpu Dele fter E R	us (on t valu te a S curre	tep: nt s	tep	650 D	L -	s step) for t DELete K X	this st curren L h	ep t stej 4 z ¢		ABO
S U MMAN I A N	I - re I - re ds to - Ins B 0 2	c c c c	tor tor tep a D Q	stat inpu Dele fter E R 5	us (on t valu te a S curre	G T 7) INPU ТЕМР > tep H U 8	65 0 0	J U U U U U	s step) for t DELete K X	L N ENTER	ep t stej 4 z		ABOF
S U MMAN I A N 1 Configure	I - re I - re ds to - Ins B 0 2 2	c P 3	tor tor tep a Q	E	us (on t valu te a S curre F S 6	G T 7) 1npu TEMP > tep H U 8	650 D	J W 0	s step) for t DELete K	L b CUTTEN	ep t stej 4 2 \$		
A N Configure MAIN	I - re I - re ds to - Ins B 0 2 able Buttons	c P 3	to to rise to rise to rise to rise to rise p a long	Stat inpu Dele fter R 5	us (on t valu te a S curre F S 6	G T T	tep	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	J USPL	S STEP) for t DELete X X	L N ENTER	ep t stej 2		
S Inmann I A N 1 Configure MAIN	I - re I - re ds to - Ins B 0 2 able Bultona N MENU	C P 3	E to t or t p Q Q A EXT PAGE EVENT	E	us (on t valu te a S curre F S S COMMAN HOLD	G T T	tep	1 V 9 (Y DIR. RECIPE	LISPLA	K For t DELete K X X Y STATUS E DELETE	L h CUTTEN Y 2 ENTER DISPLAY RECIPE	ep t stej 2 EQUIP.	P	ABOF CLEA KSPACE

Temperature

- 3. Enter "GSTB1" in the cmd: field and press ENTER. Enter "SP" in the cmd: field and press ENTER.
- 4. Use the arrows to move the cursor to TEMPL, enter desired temperature, and press *ENTER*. Repeat for TEMPC and TEMPS.
 - a. Default temperature is 450°C.

: RI	E - Rec	ipe Ed	it (I	TO.003	S) c	nd:		<	CMD - for	edi	t nen	1>
nan	d Choic	es: Gs	sss, 1	ssss.n	nnn,	B, N,	1. DE	L, FO,	SP,	SI, VI or	н (for h	elp)
	STB1				conne	nt: ST	ABLE	TEMPS	t	ine: 00.	82.8		
					Sete	ointe	(outo	utc)		(BOY 6			
	NORRO		600H				Te e				pag		
	MZPRU	U .	SECH		16	HFL 4	58.8	DEGE		BOHIOUI	0		
	N2BKFL	200.	SCCM	1	11	MPC 4	50.0	DEGC		BOATIN	OFF		
	02	. 0	SCCM	1	TE	MPS 4	50.0	DEGC	1	RUN	ON		
	SIH4	. 0	SCCM	1	RMPR	ATE	. 8	D/M	1	IDLSHLD	OFF		
1	MKSPRS	0.	TORR	1	TCU	ENA O	FF		1	ABORT	OFF		
	PRCPR	400.	NTOR	1	TC	UID	0		1	PREN2	0 N		
G	ATEULU	ON		1	BOAT	SPD	. 0	IPM	L	PRESINA	OFF		
				1					1	VACSIH4	OFF		
													_
A	в	с	DE	F	G	н	ł	J	к	L M] [Ŷ	ABOR
N	0	P	Q F	s s	T	U	v	w	×	Y Z	4		
1	2	3	4	6	7	8	9	0		ENTER	1	₽.	CLEA
Configura	able Buttons									1	-		
MAIN	N MENU	NEXT	PAGE	COMM	AND	DISPLA	Y DIR.	DISPLA	Y STATUS	DISPLAY EC	UIP.	<- BACK	SPACE
F	RUN	EVE	NT	HOL	D	DISPLAY	RECIPE	RECIPE	DELETE	RECIPE LC	IAD	RECIPE	MODIFY
			_		-						- 3		

Pressure

- 3. Enter "GSTB1" in the cmd: field and press ENTER. Enter "SP" in the cmd: field and press ENTER.
- 4. Use the arrows to move the cursor to PRCPR, enter desired pressure, and press *ENTER*.
 - a. Default pressure is 400 mTorr.



Gas Flow

- 5. Enter "GPRO2" in the cmd: field and press ENTER. Enter "SP" in the cmd: field and press ENTER.
- 6. Use the arrows to move the cursor to O2, enter desired O_2 flow rate, and press *ENTER*.
 - a. Default flow rate is 30 sccm.

C: RE	- Rec	ipe E	dit	(L	TO.003)	cnd:		<	CMD -	for	edit	nenu	1>
nnand	Choic	es: G	5555	G	ssss.ni	nn,	B, N,	1, DE	L, F0,	SP,	s1, U	I or	H (f	or he	(1p)
ep: F	R02					onne	nt: T	URN OF	02	t	ine:		3.00		
					SP -	Setn	nints	(outr				more	nane	s>	
	NOPPC		50	м		TE	MPI		DECC		ROOT	онт	OFF		
	ZBRFL		. 561	. 11		16	MPG	450.0	DEGC		BOH	IIN	UFF		
	02	30.	0 50	M	1	TE	MPS	450.0	DEGC	1		RUN	ON		
	SIH4		0 50	см	1	RMPR	ATE	. 0	D/M	1	IDLS	HLD	OFF		
,	IKSPRS	8	. TO	RR	1	TCU	ENA	OFF		1	AB	ORT	OFF		
	PRCPR	NC	NT	R	1	TC	UID	0		1	PR	EN2	ON		
GF	TEULU	ON			1	BOAT	SPD	. 0	IPM	I.	PRES	IH4	OFF		
LE	AKCHK	OFF			Т					I.	VACS	IH4	OFF		
					1		1	1]	2		
A	В	Ľ	U	E		<u>u</u>	н	<u> </u>			-	м		5	ABOR
N	0	Ρ	Q	R	s	т	U	v	w	×	Y	z	\$	4	
1	2	3	4	5	6	7	8	9	0		ENT	ER	4	IL I	CLEA
Configura	ble Buttons-									-	<i>(</i>		-		
MAIN	MENU	NEX	T PAGE		COMMA	ND	DISPL	AY DIR.	DISPLA	Y STATUS	DISF	PLAY EQU	IP.	<- BACK	SPACE
R	UN	EV	/ENT	11	HOLD		DISPLA	Y RECIPE	RECIPI	DELETE	RE	CIPE LOA	0	RECIPEN	MODIFY
							50 C				-				

- 7. Enter "GPSIH" in the cmd: field and press *ENTER*.
- 8. Use the arrows to move the cursor to O2 and enter desired flow rate (same as step "GPRO2"). Arrow down to SIH4, enter desired flow rate, and press *ENTER*.
 - a. Default SiH₄ flow rate is 20 sccm.

: RE	- Rec	ipe Ed	it (L	T0.003)	cnd:		<	CMD - for	edit	nenu>	
manc	Choic	es: Gs	sss, G	5555.N	nnn,	B, N,	1, DE	L, FO	, SP,	SI, VI or	H (fe	or help)	
D: F	SIH				conne	nt: 1	URN OF	SIH4	t	ne: 00.	02.00		
					Set n	oints	(out)			(more			
	NODDO		600H							POATOUT	orr		
	NZFRG		3668		11	HFL.	450.0	DEGC		BOH1001	077		
N2BKFL 02 Sih4 MKSPRS PRCPR Gateulu		0.	SCCM SCCM SCCM Torr	1	TE	MPC	450.0	DEGC	1	BOATIN	OFF		
		30.0		1	TEMPS Rhprate Tcuena		450.0 .0 OFF	DEGC D/M	1	RUN	ON		
		20.0		1					1	IDLSHLD	OFF		
		0.		1					1	ABORT	OFF		
		NC NTOR On		1	TCUID Boatspd		0 .0	IPM	1	PREN2	0 N		
				1					1	PRESIN4	0 N		
LE	AKCHK	OFF		1					T	VACSIH4	OFF		
												5	_
A	в	C I	DE	F	G	н	1	J	к	L M	1	AP	80R
N	0	P (Q R	s	т	U	v	w	×	Y Z	4	4	
1	2	3	4 5	6	7	8	9	0		ENTER		ι μ	LEAJ
onfigura	ble Buttons								-				
MAIN MENU		NEXT PAGE		COMMAND		DISPLAY DIR.		DISPLAY STATUS		DISPLAY EQUIP.		<- BACKSPACE	
RUN		EVENT		HOLD		DISPLAY RECIPE		RECIPE DELETE		RECIPE LO	AD F	RECIPE MODIFY	
1						la construction of				1			

Appendix B - Wafer Loading/Unloading Procedure

- 1. Select the correct size boat for your substrate.
 - a. Boats for 2 inch, 3 inch, 4 inch, and 6 inch wafers are available.
- 2. Place wafers in the wafer boat (Tube 1 LSN) or shroud (Tube 3 LTO) with wafers sitting in the quartz slots. Do not cross slot.
 - a. For Tube 1 LSN, wafers are placed front to back, with polished (to be deposited on) surface facing toward the open end of the tube (viewing corridor).
 - b. For Tube 3 LTO, wafers are placed back to back, with polished (to be deposited on) surface facing out.



Figure 3. Back to back wafer placement in Tube 3 LTO boat.

- 3. Place dummy wafers in the extra slots as needed. Tube 1 LSN boats can hold up to 25 wafers and Tube 3 LTO boats can hold up to 26 wafers.
 - a. The end wafers, slot 1 and slot 25 for Tube 1 LSN wafer boat or slot 1 and slot 26 for Tube 3 LTO, are always dummy wafers
- 4. Use side lift handlers to carefully pick up the boat for loading or unloading.
 - a. The small handler fits Tube 1 LSN boats and the large handler fits Tube 3 LTO boats



Figure 4. Side lift handlers.

b. For LSN Tube 1, align the handler arms with the two tubes of boat, and insert into the tubes (Figure 5).



Figure 5. Handler use for Tube 1 LSN boats.

c. For Tube 3 LTO boats, always use the handler to the upper/top shroud off the boat first, and then move the lower shroud with wafers.



Figure 6. Handler use for Tube 3 LTO boats.

d. Place the wafer boat/shroud on the cantilever where center of boat/shroud is around 9 inches from baffle plate.



Figure 7. Placement of boat on cantilever.