

GENERAL PROCESS AND OPERATION SPECIFICATION

Lesker PVD 75 DC Metal Sputter

I. SCOPE

- a. The purpose of this document is to describe requirements and basic operating instructions for the Lesker PVD 75, DC sputter tool. This tool is intended for thin film deposition of metals by DC sputtering. Use of this tool is limited to only approved thin films and substrates.

II. SAFETY

- a. Be sure that you are trained and signed off to use this equipment.
- b. Be sure to keep all doors and protective shields in place before operating this equipment.
- c. Use care when operating around high voltage or high current. **Ensure that all electrical power is removed from the power supply/generator before working on any sputter source.**
- d. High pressure gas cylinders for this tool are stored in ventilated gas cabinets located in the 7H1 service corridor. Be sure to ask a staff member for assistance to change out any gases.
- e. If you are unsure about any procedure or indication while operating this equipment be sure to contact a staff member or trainer for assistance.

III. APPLICABLE DOCUMENTS, MATERIALS AND REQUIREMENTS

- a. For more information about the detailed operation of this tool refer to the Lesker factory manual – “PVD 75 Thin Film Deposition System Operation Manual.” File name: PVD 75 Manual.pdf.
- b. Appendix A: Editing of Recipes in KJL Software
- c. Appendix B: DC Sputter Process Example Recipe
- d. Appendix C: Changing Targets
- e. This tool is intended to be used with a restricted selection of substrate and target materials.
- f. Approved target materials: Al, Cr, Cu, Ti, Ni, Ta, Nb, W, Mo
- g. Target materials provided by AggieFab as part of normal lab fees: Al, Cr, Cu, Ti, Ni
- h. Approved substrate materials: Glass, Si, PVDF (with no substrate heating)
- i. Other substrate and target materials must be pre-approved by the Materials Review Board before running in this tool.

IV. OPERATION

- a. Login using your operator username and password.
- b. Start PC Vent.
- c. After the venting process, confirm whether or not the metal (target) you want to use is loaded.
- d. If it is continue to step f. If it is not, you will need to change the target after the venting process has ended.
- e. Target Change Steps (if required).
 - i. **Safety! Ensure that all electrical power is removed from the power supply/generator before working on any sputter source.**
 - ii. Run Recipe: **Target Change.**
 - iii. Using the Recipe Database, find a recipe using your metal to determine the proper target or gun position.

- iv. Follow the steps in Appendix C for removal of the dark space (ground) shield and the target hold-down ring. Tools are located in door pocket. Note that the “Target Change” recipe will open the shutters to allow easy access for the target change. Note also that it is only necessary to *loosen* the screws at the bottom of the dark space shield. **DO NOT UNSCREW COMPLETELY.**
 - v. Find the storage boxes for both the current metal target and the target you would like to install.
 - vi. Remove the target and place it into its storage box.
 1. Note: Some targets are magnetic and will take some force to move off of the plate.
 2. Note: Within each storage box is some sort of holder for the target, usually aluminum foil. Place target into the holder.
 - vii. Within the storage box is a paper with dates and target life. Make note of the target life value (in KWHrs) on the KJL software, record the value and date it on the paper.
 - viii. Close the box and set it aside.
 - ix. Open the other box for the target to be loaded and pull the target out of its holder.
 - x. Place the target onto the plate again taking caution if the target is magnetic.
 - xi. Follow steps in Appendix C to re-install the hold-down ring and dark space shield.
 - xii. Press YES on the computer monitor to continue the process to close the target shutter.
 - xiii. Pull out the paper from the newly loaded target’s storage box and change the target’s life value on the Software to the last entry on the paper log sheet. Also make sure to rename the target with its appropriate metal on the Software.
 - xiv. Replace the paper into the box and take both the new and old box behind the machine to place in or near the storage bin.
- f. Run the recipe for Substrate Load/Unload to pull out the substrate holder.
 - g. Load your sample using the pins and kapton tape if needed.
 - h. Replace the substrate holder and press YES on the monitor to close the shutters.
 - i. Close the door and press the Start PC Pump button to pump down to vacuum.
 - j. Find which recipe you want to use and edit it as needed. Make sure to press Update VB if you want the changes to take effect.
 - i. If the recipe you want to use is locked for editing, find a similar recipe that you can edit.
 - ii. If no such recipe exists, copy the recipe and rename it to identify it as your own.
 - k. Once the pressure has gone below 5E-6 Torr, you can run your recipe. Find it on the recipe list, click it, and confirm you want to run it below the list.
 - l. The process is automatic from here, but you should record the Power, Voltage, and Amplitude values to confirm that everything is functioning properly.
 - m. Once the process has completed, vent the system, remove your samples, and pump it down again. Once the chamber is pumping, you can log out.

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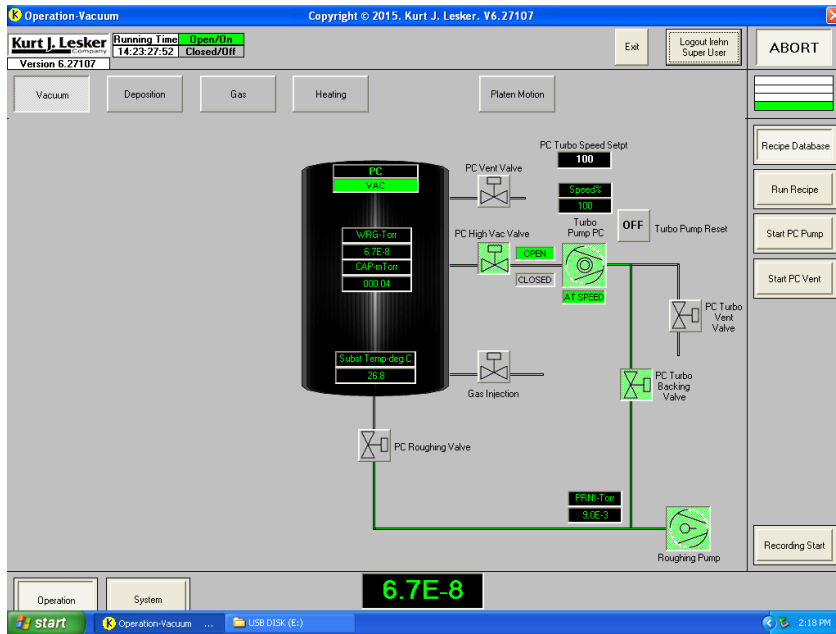


Figure 1. Main vacuum screen showing pumps and valve positions during normal operation under high vacuum.

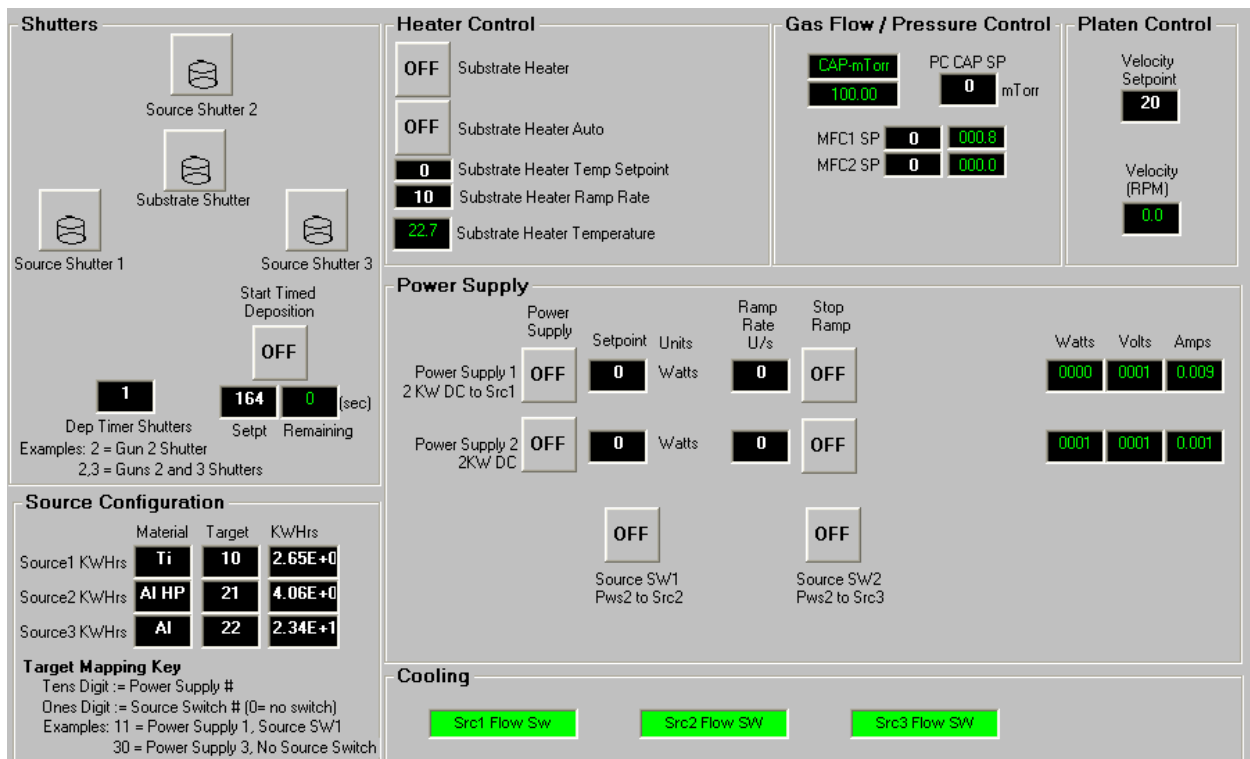


Figure 2a. The deposition screen showing shutters, gas flow, target and gun information.

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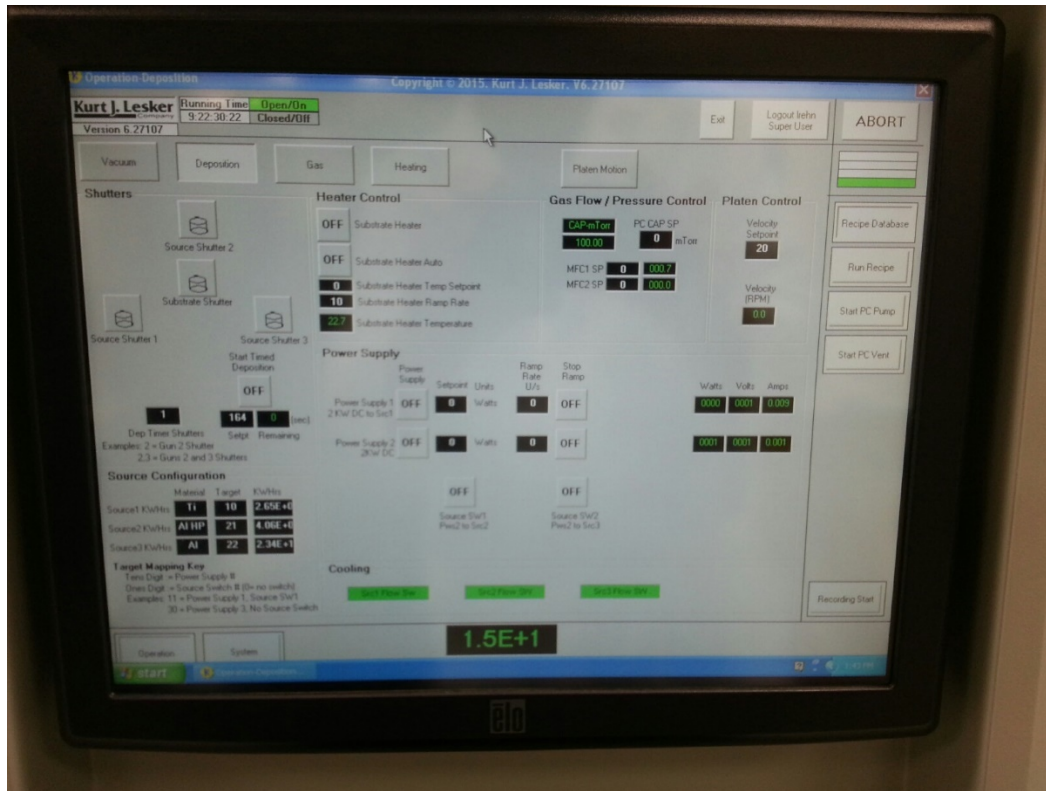


Figure 2b. Screen shot of the Deposition screen, including pull-down and side panel menu items.

- V. SIGNATURES AND REVISION HISTORY
 - a. Author of this document: Larry Rehn
 - b. Author Title or Role: Technical Manager
 - c. Date:
 - d. Revision: Original Issue

Approvals:

Technical Manager Signature: _____

Date: _____

Revision History:

Revision	Author	Date
Original Issue	L. Rehn	11/6/2015
Rev A		
Rev B		
Rev C		

Appendix A – Editing of Recipes in KJL Software:

Editing Recipes

Note: You can only edit recipes if you are the owner or if the owner has opened access to you for editing. The owner of a file cannot be changed and only the owner or a system administrator can delete the file.

Seq	Typ	Equipment	EquipmentItem	EquipmentItemOperation	Equipment/Test Value
1	Recipe	Source Shutter 3	Set Abort Recipe	Abort Process	
2	Recipe	Source Shutter 3	Run Recipe	Prepare to Deposit	
3	Recipe	Substrate Shutter	Run Recipe	Substrate rotation 20rpm	
4	Recipe	Substrate Shutter	Run Recipe	Gas 20mT Argon MFC1 turn on	
5	Recipe	Substrate Shutter	Run Recipe	Sputter Src3 Ignition 200W 3mTorr	
6	Shutter	Source Shutter 3		Turn_On/Open/Opening	
7	Shutter	Substrate Shutter		Turn_On/Open/Opening	
8	Recipe		Dwell	N Seconds (n or HH:MM:SS)	3600
9	Shutter	Substrate Shutter		Turn_Off/Closed/Closing	
10	Recipe		Run Recipe	Sputter Src3 Extinguish	
11	Recipe		Run Recipe	Substrate rotation stop	

#1:

Show Main/(Show All): Toggles the yellow recipe list between showing only Main Recipes or both Main and Sub Recipes. (The button displays the opposite of what is being used. For example, when the button reads “Show Main”, the recipe list will be showing all.)

Sub Recipe Check Box: Defines Recipe as a Sub Recipe; Default as Main Recipe

Delete: Remove Recipe file

Export All Recipes to XL: Used only by system administrators

Update VB: Save all recipes that have been edited

Reorder Items: Move lines of the recipe

Copy Recipe: Create new recipe file with all of the same specifications currently selected. You will become the “Owner” of the new file.

#2:

Include in VB List Check Box: (Default checked.) If checked, and if the recipe is a main recipe, it will be made visible in the yellow recipe list when Show Main is selected. If not checked, it will only show when Show All is selected.

Operator /Process Eng Can Use Check Boxes: (Default unchecked.) These boxes specify what groups are given access to editing the recipe file. If unchecked, only the owner and system administrators can edit it.

#3:

If the “Equipment/Item” column reads “Run Recipe”, then the next column will specify what Sub Recipe is being called. Sub Recipes contain most editable parameters of a process. By clicking on the Sub Recipe name, a drop down box will appear that will allow you to select which specific Sub Recipe to run. Other “Equipment/Item” commands specify an action to be taken within the Main Recipe.

Editing Sub Recipes

Sub Recipes are where most parameters are defined.

Seq	Typ	Equipment	EquipmentItem	EquipmentItemOperation	Equipment/Test Value
1	Recipe		Set Abort Recipe	Abort Process	
2	Power Supply		Power Supply1 Output Setpoint	Set Value = n.nn	0
3	Source		Source SW3	Turn_On/Open/Opening	
4	Power Supply		Power Supply 1	Turn_On/Open/Opening	
5	Power Supply		Power Supply1 Output Setpoint	Set Value = n.nn	50
6	Power Supply		Power Supply1 Fwd Power	Check Value > n.nn	20
7	Recipe		Dwell	2 Seconds	
8	Shutter		Source Shutter 3	Turn_On/Open/Opening	
9	Recipe		Dwell	2 Seconds	
10	Shutter		Source Shutter 3	Turn_Off/Closed/Closing	
11	Power Supply		Power Supply1 DC Bias	Check Value > n.nn	3
12	Power Supply		Power Supply1 Ramp Rate	Set Value = n.nn	2
13	Power Supply		Power Supply1 Output Setpoint	Set Value = n.nn	100
14	Power Supply		Power Supply1 Fwd Power	Check Value > n.nn	95
15	Gauge		Capman Pressure SP	Set Value = n.nn	3
16	Gauge		Capman Pressure	Check Pressure <= n.nn	3.2
17	Power Supply		Power Supply1 DC Bias	Check Value > n.nn	1
0					

Equipment/Test Value: This is where the parameters of a Sub Recipe within a process are defined and edited. The same owner permissions are required as in a Main Recipe for editing.

If there are a set value and a check value for the same parameter, make sure to change both values together to keep the logic true. For example, if the power is set to 200 W and the check is set to greater than 190 W originally, and you want to drop to only 100 W set point, make sure that the check point is reduced similarly to greater than 95 or something close.

Appendix B – DC Sputter Process Example Recipe

Refer to the **PVD75 Operation Manual** (page 57-58) for an example and explanation of steps required for a typical DC Sputter recipe.

DC Sputtered Process Example

Seq	Type	Equipment	EquipmentItem	EquipmentItem Operation	Equipment/ TestValue	GRST
1	-	Recipe	Set Abort Recipe	Abort Process		
2	-	Gauge	MKS979 WG Pressure	Check Value <= n.nn	.000005	AT
3	-	Valve	PC High Vac Throttle	Turn_On/Open/Opening		
4	-	Valve	PC High Vac Throttle Opened	Check_On/Open/Opening		AT
5	-	MFC	MFC1 Mode	Set Value = n.nn	4	
6	-	Valve	Gas Injection	Turn_On/Open/Opening		
7	-	Gauge	Capman Pressure SP	Set Value = n.nn	5	
8	-	Gauge	Capman Pressure	Check Pressure > n.nn	4.5	AT
9	-	Motors	Platen Motor Jog Velocity SP	Set Value = n.nn		
10	-	Motors	Platen Motor Go Continuous +	Turn_On/Open/Opening		
11	-	Motors	Platen Motor Velocity	Check Value > n.nn	19.9	AT
12	-	Power Supply	Power Supply 2	Turn_On/Open/Opening		
13	-	Power Supply	Power Supply2 Ramp Rate	Set Value = n.nn	10	
14	-	Power Supply	Power Supply2 Output Setpoint	Set Value = n.nn	200	
15	-	Power Supply	Power Supply2 Output Power	Check Value > n.nn	190	AT
16	-	Gauge	Capman Pressure SP	Set Value = n.nn	2.5	
17	-	Gauge	Capman Pressure	Check Pressure <= n.nn	2.7	AT
18	-	Recipe	Dwell	N Seconds (n or HH:MM:SS)	60	
19	-	Shutter	Source Shutter 2	Turn_On/Open/Opening		
20	-	Shutter	Substrate Shutter	Turn_On/Open/Opening		
21	-	Recipe	Dwell	N Seconds (n or HH:MM:SS)	2000	
22	-	Shutter	Substrate Shutter	Turn_Off/Closed/Closing		
23	-	Shutter	Source Shutter 2	Turn_Off/Closed/Closing		

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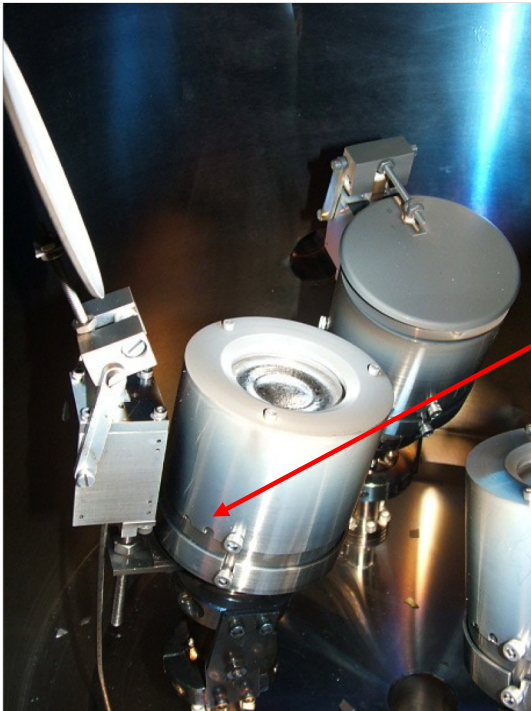
24	-	Power Supply	Power Supply2 Ramp Rate	Set Value = n.nn	10	
25	-	Power Supply	Power Supply2 Output Setpoint	Set Value = n.nn	0	
26	-	Power Supply	Power Supply2 Output Power	Check Value <= n.nn	5	AT
27	-	Power Supply	Power Supply 2	Turn_Off/Closed/ Closing		
28	-	Motors	Platen Motor Go Continuous +	Turn_Off/Closed/ Closing		
29	-	Gauge	Capman Pressure SP	Set Value = n.nn	0	
30	-	Recipe	Dwell	4 Seconds		
31	-	MFC	MFC1 Mode	Set Value = n.nn	0	
32	-	Valve	Gas Injection	Turn_Off/Closed/ Closing		
33	-	Valve	PC High Vac Throttle	Turn_Off/Closed/ Closing		
34	-	Valve	PC High Vac Valve Opened	Check_On/Open/ Opening		AT

Appendix C – Changing Targets (pp 63-64 from the PVD75 Operation Manual):

TARGET CHANGING

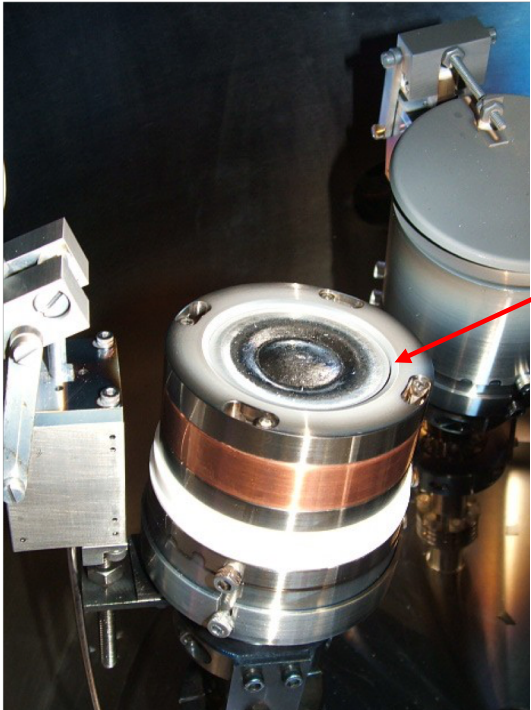
Installing/changing targets:

- 1) Loosen the 3 screws supporting the dark space shield and remove the shield (see Figure 7).
- 2) For a 2” source, loosen the 4 screws of the target hold-down ring (see Figure 8). For a 3 or 4” source, remove the 4 screws and remove the ring.
- 3) When removing a target of magnetic material, carefully slide the target to one side and pick it up (do not attempt to pry magnetic targets from the cooling well. This may result in permanent damage to the cooling well).
- 4) Place a new target on to the source, ensuring all parts are perfectly clean. If installing a magnetic target, take extra care that fingers or parts of a glove do not get pinched between target and source as the magnets are very powerful.
- 5) Tighten the hold-down ring screws evenly (do not over-tighten screws).
- 6) The dark space shield of the TORUS® source has three machined slots, which ensure .080” dark space on top of the 1/8”, 3/16”, and 1/4” targets. Loosen the three #8 screws and reposition the dark space shield to the correct slot when changing the target (do not over-tighten the 3 screws).
- 7) After installing a target, check shutter operation and clearance between the shutter and sputter source.



Loosen 3 screws to remove dark space shield.

FIGURE 7



Loosen target hold-down ring screws, twist and remove ring (2" source shown). Remove screws completely on 3" or larger sources.

FIGURE 8