1 SCOPE

The purpose of this document is to detail the use of the K&S Dicing Saw. 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
- Appropriate Tool Manuals

3 DEFINITIONS

n/a

4 TOOLS AND MATERIALS

4.1 General Description

4.1.1 The K&S Dicing Saw is a programmable dicing saw that is capable of dicing wafers up to 6 inches in diameter.

5 SAFETY PRECAUTIONS

5.1 Personal Safety Hazards

5.1.1 Do not operate the saw with the covers removed or any interlocks defeated and use caution when the blade is in operation.

5.1.2 The dicing saw may create flying debris or sharp pieces. Always wear safety glasses and use caution when handling wafer pieces.
5.2 Hazards to the Tool

5.2.1 Failure to keep the drains clear. If the drains are not kept clear of dicing debris, an overflow could result.

5.2.2 Bad Recipe Parameters. Failure to use the correct recipe parameters can result in cutting into the wafer chuck or damaging the blade by cutting too fast. See appendix for appropriate recipe parameters.

5.2.3 When changing the blade, make sure it is very tight.
6 INSTRUCTIONS

6.1 Initial State Check

6.1.1 Behind the machine open the Cold Water, DI Water, Vacuum and Compressed Air valves.

6.1.2 Powering Up the Saw

6.1.2.1 Pull the red power knob on the bottom left of machine. (Not necessary if the saw was left in the Overnight Mode)
6.1.2.2 Push the blue reset button on the console.
6.1.2.3 Make sure that the monitor is on. When the date screen appears, just press ENTER. (Don’t bother entering the date because the saw has no internal clock.)
6.1.2.4 If you get the message “RE-SETUP HEIGHT BUTTON STATION” just press ENTER.
6.1.2.5 Press DISPLAY to bring up the microscope screen.

6.1.3 Manual Blade Height Check

6.1.3.1 Performing a manual blade height check is recommended before starting a run. This can also be done to override blade wear >0.98.
6.1.3.2 Press TEACH button.
6.1.3.3 Press B for Height.
6.1.3.4 Wait for “KEY <ENTER> TO PERFORM HEIGHT” message and press ENTER.
6.1.3.5 The height check will take between 1 to 5 minutes. If you are unsure if the height is being performed, you can remove the donut around the z-axis stepper motor and you will be able to see the stepper motor moving.
6.1.3.6 When prompted whether you are using a New Blade or Old Blade, select New Blade by keying SHIFT and ENTER (S/Enter).

6.2 Resetting the System

6.2.1 The system may be reset by pressing the reset button.

6.3 Operating the system

6.3.1 Load the Dicing Recipe

6.3.1.1 Press DISPLAY button until the Edit screen appears
6.3.1.2 Use the arrow keys to highlight DIRECTORY at the bottom of the screen and press ENTER
6.3.1.3 Use the up or down arrows until the name of the dicing program can be seen on the screen.
6.3.1.4 ASSIGN should be highlighted at the bottom of the screen, if not highlight it and press ENTER.
6.3.1.5 Choose the desired program using the up or down arrow keys. Press ENTER and press ENTER again to confirm. The program should appear in the Edit screen.
6.3.1.6 If needed, edit the recipe as described in the appendix.

6.3.2 Load the Wafer

6.3.2.1 Press DISPLAY until the Edit screen appears.
6.3.2.2 Press AUTO
6.3.2.3 Press Enter to start cutting. When the saw is ready, the message “INSERT A NEW SUBSTRATE AND KEY <ENTER>” will be displayed
6.3.2.4 Lift the cover and put the wafer on the chuck. Push down on frame and twist so that the metal frame is under all four pins, close the cover and press ENTER. The wafer will load to the first alignment block.
6.3.2.5 If you need to remove the wafer without cutting, press the Display button to go back to the program. Press the Auto button and then Enter. You will be prompted to insert a new substrate and the current wafer will be released so that you may take it out, adjust it or put in a new wafer.

6.3.3 **Aligning a Wafer**

6.3.3.1 The first time that you perform alignment for a program, the alignment area is defined. Next time the program is used, the alignment will come up in the same area and not need as much adjustment.

6.3.3.2 The focus and illumination may be adjusted during alignment by pressing 1 to bring up the menu, 0 to choose focus and using the arrow keys to make the adjustments. The Enter key will take you back to the alignment.

6.3.3.3 Perform alignments. Typically one alignment block needs to be performed for rows and one for columns. The Enter key will move the view between the two sides of the wafer. Once alignment for the first block (rows) is completed, be sure that the reticle is on the right alignment mark and press SHIFT + ENTER at the same time to switch to the next alignment block (columns). Once the second alignment has been preformed, be sure that the reticle is on the right side, then press SHIFT + ENTER to begin cutting.

6.3.3.4 During cutting, press ENTER to pause the saw in between cuts. Once it is pressed, the saw will finish its current cut and then stop.

6.3.3.5 Usually after the first cut the saw will stop for an inspection step. At this point the Y-offset may be adjusted and measurements may be taken. See sections 6.3.4 and 6.3.5 for details.

6.3.3.6 Depending how your program is set up, a height check may be automatically performed after a certain number of cuts.

6.3.4 **Y-offset**

6.3.4.1 The screen reticle can be matched with the actual kerf width. During inspection after the first cut is made, press 1 to bring up the menu and choose option 4 for Y-offset adjustments.

6.3.4.2 Once finished, press ENTER to resume cutting.

6.3.5 **Measurements**

6.3.5.1 Measurements on the wafer can be taken by pressing SHIFT and the decimal point to zero distance counter (x,y coordinate). Use the UP, DOWN, LEFT, or RIGHT arrows to measure distance. If the cut is off, move the cursor to the correct location and press SHIFT + ENTER to continue cutting from the correct indexing point. If the cut is not off, then press ENTER to resume cutting.
6.3.6 **Unloading wafer**

6.3.6.1 After the last cut, the chuck will move to the unload position. Press ENTER to release vacuum. (A beeping sound will be heard)
6.3.6.2 Wait a few seconds for the air to blow under the wafer then remove it from vacuum chuck (you should see it bulge outward).
6.3.6.3 Be sure to lift the wafer so that any water left on the wafer falls into the trough and not on the chuck (if water is on the chuck, use air gun dry it off).
6.3.6.4 If cutting another wafer, load and follow alignment procedures again. If not, press MANL and then DISPLAY.
6.3.6.5 Turn off the spindle by pressing the SPINDLE key.

6.3.7 **Putting the saw into Overnight mode (Idle)**

6.3.7.1 Press DISPLAY button until the edit screen appears.
6.3.7.2 Press the left cursor key twice and highlight DIRECTORY at the bottom of the screen and press ENTER.
6.3.7.3 Use UP or DOWN arrow until Overnight can be seen in the program menu.
6.3.7.4 ASSIGN should be highlighted at the bottom of the screen, if not, highlight it and press ENTER.
6.3.7.5 Select Overnight and press ENTER. Press ENTER to confirm.
6.3.7.6 On the back of the machine close the Cold Water, DI Water, Vacuum and Compressed air valves.
6.3.7.7 On the screen, “Utility status” should appear, AIR PRESSURE …“OFF”. If so, the monitor can be turned off and the idle (overnight) shutdown is completed.
6.4 Errors during Run

6.4.1 If water comes out the right side spout then the drains are clogged and need to be cleaned out using the shop vac.

Location of Drain Holes (as viewed from the top of the machine with the covers off)
6.4.2 If the red light flashes and there is an error message near the bottom of the screen indicating problems related to X-AXIS, Y-AXIS, Z-AXIS, press the DISPLAY button. These errors are likely to occur (if at all) during power up. You should see that each axis homes itself (very slowly, look carefully). If nothing happens, press DISPLAY again until they start to move. Once the axis has homed, a message might appear saying “PRESS RESET BUTTON”. Press RESET. If during booting the same error occurs again, follow the same procedure as stated above. However, once you have reached the “PRESS RESET BUTTON” stage, turn the machine power off and wait for a few minutes before powering up again.

6.4.3 During power up, the error message “WAFER ON VACUUM CHUCK” may be displayed even though there is no wafer. This error has to do with the vacuum chuck sensor and requires adjustment. Please contact the tool technician.

6.4.4 When starting to cut, the spindle stops, the red light flashes, and the screen shows the status of all areas of the machine with a star (*) next to the “BLADE WATER”. Try to restart the cut. Hit Display and then Auto. A height check will be performed and then you will be prompted to insert a substrate. Hit Enter twice and make sure that there is sufficient water flow. This often only happens on the first cut. If it happens again, contact the tool technician.

6.4.5 If the status screen shows a star (*) next to the AIR light and red light flashes, make sure the Air valve on the back of the machine is opened and press DISPLAY. The red light should turn off.

7 APPROPRIATE USES OF THE TOOL

7.1 This tool is intended for dicing silicon wafers. Other materials may damage the dicing blade or require special dicing blades.
8 ATTACHMENTS

8.1 Writing and editing a program

8.1.1 Copying a program

8.1.1.1 Press the Display button until the EDIT screen appears.
8.1.1.2 Use the right arrow to highlight DIRECTORY and press Enter.
8.1.1.3 At the Directory screen, use the right arrow to highlight DUPLICATE and press Enter.
8.1.1.4 Use the arrow keys to select the program to be copied and press Enter. A screen will appear asking for a new job name. Press the Index button a screen with alpha-numeric characters will appear. Use the Up and Down arrows to select the character and the Right and Left arrows to move between the characters. When finished press Enter and Enter again to confirm.

8.1.2 Editing a program

8.1.2.1 Press the Display button until the EDIT screen appears.
8.1.2.2 Use the right arrow to highlight EDIT and press Enter.
8.1.2.3 Use the Up and Down arrows to move between lines and make changes. When finished, press Enter and the cursor will return to the bottom of the screen.
8.1.2.4 To move to the next block use the Up and Down arrows.
8.1.2.5 Blocks 1 and 3 are alignment blocks, while 2 and 4 are cutting blocks. For alignment blocks the Cut Depth should be either 0.0000 or 0.0025. For cutting blocks the Cut Depth may be any other value.
8.1.2.6 After the editing is complete, move the cursor to save at the bottom of the screen and press Enter.

8.1.3 Explanation of Dicing Parameters

8.1.3.1 Thickness: This is equivalent to the wafer + thickness of the back tape + thickness of the optional front tape.
8.1.3.2 Blade Exposure: This is set automatically by the saw and will vary as the blade wears down. Do not change this value.
8.1.3.3 Auto Height Rate: Distance the saw will cut before performing an automatic height check. Recommended value is 750mm.
8.1.3.4 Spindle Speed: Speed at which the blade turns, in thousands of RPMs. Do not exceed 20.
8.1.3.5 Angle: Angle in degrees rotated from the initial alignment for the block. Blocks 1 and 2 are usually 0 degrees. Blocks 3 and 4 are usually 90 degrees.
8.1.3.6 Loop Count: This is the number of times that a block is repeated. For most purposes this should be set at 1.
8.1.3.7 **Cut Depth**: This is the depth the saw will cut into the wafer from the total thickness. A commonly used standard is to cut halfway through the back tape. The Cut Depth is calculated by subtracting ½ of the back tape thickness from the total thickness discussed above.

8.1.3.8 **Start Cut**: Starting point on the X-axis where the cut will begin. For 6” wafers, leave this value at -33.40 mm. The Index button will give a (-) sign.

8.1.3.9 **Cut Length**: This is the length of the cut. It is typically up to 25 mm longer than the width of the substrate to assure that the blade completely clears the wafer.

8.1.3.10 **Index**: In an alignment block this is the distance between where the alignment was locked and where the saw will move to make the first cut. In a cutting block this is the distance the saw will travel between cuts.

8.1.3.11 **Cut Count**: The number of cuts to be made.

8.1.3.12 **X Entry Speed**: Speed at which the saw enters the wafer. (mm/sec or inch/sec) The exact value will depend on the type of blade used. For resinoid blades with 30 micron diamond grit or larger, 6.000 mm/sec is a typical maximum value.

8.1.3.13 **X Cutting Speed**: Speed at which the saw cuts through the wafer. (mm/sec or inch/sec) The exact value will depend on the type of blade used. For resinoid blades with 30 micron diamond grit or larger, 6.000 mm/sec is a typical value.

8.1.3.14 **Z Speed**: Speed at which the blade comes down in the Z direction. A typical value is 0.3500 mm/sec.

8.1.3.15 **Inspect**: This function allows the saw to pause after a cut for a quality control inspection. Typically an inspection is done after the first cut in each direction. The right most group of numbers in the cut blocks should be 0001 to pause the saw after the first cut. During this pause the arrow keys may be used to move around the wafer and inspect the cut. Press Enter to resume cutting. If the right most group of numbers is 0000, no inspection will be made. Inspections are not done on alignment blocks, only on cutting blocks.

8.1.3.16 On the last page of a program, there are various options that may be set.

```
8.1.3.16.1 **Unit**: Select millimeters or inches.
8.1.3.16.2 **Reference Point**: Select No.
8.1.3.16.3 **Alignment**: Select Manual.
8.1.3.16.4 **Process Flow**: Select Dual
8.1.3.16.5 **Quality Diameter**: Enter the diameter of the wafer to specify the maximum distance between the two alignment points
```
8.2 Example program

THICKNESS: 0.6273
BLADE EXPOSURE: 0.2950
AUTO HEIGHT RATE: 750.00
SPINDLE SPEED: 20.000

**BLOCK #01 OF 04**

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<tr>
<td>Cut Depth</td>
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<tr>
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<tr>
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<td>X CUTTING SPEED</td>
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<tr>
<td>Z SPEED</td>
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</table>

- **UNIT**: INCH/MM
- **CUTTING TYPE**: DICE/SCRIBE
- **REF. POINT**: YES/NO
- **ALIGNMENT**: MANUAL/NO/AUTO
- **PROCESS FLOW**: SINGLE/DUAL/ONE/DUAL2
- **QUALITY DIAMETER**: 152.39

Note: BLOCKS 1 and 3 are alignment blocks, and BLOCKS 2 and 4 are the actual cutting blocks.
8.3 Mounting a wafer on a dicing frame

8.3.1 Use wafer mounter on opposite side of room. Turn it on by pressing the red power button.
8.3.2 Set the dial to the wafer diameter (2” through 6”)
8.3.3 Cut a piece of tape (in cabinet), remove backing and place dicing frame on the tape. The blue tape (G-19) has a medium tack, the black tape (G-36) is high tack and the clear tape (D-650) is UV curable.
8.3.4 Flip frame and tape over and cut tape with utility knife or razor blade, then peel off excess tape.
8.3.5 Place on mounter, with sticky side up, being sure to align the pins with the notches on the frame.
8.3.6 Centered the wafer on the black vacuum chuck (mounter’s cover). Try to place the wafer in such a way that the flat is parallel to one of the flats on the saw frame. (usually flat down)
8.3.7 Press the orange vacuum button.
8.3.8 Close the lid and press the green start button.
8.3.9 Once it is finished, lift the latch about 1/32 to 1/16 of an inch and let go, the mounting wheel may continue.
8.3.10 Once the wheel is homed (stops spinning), open the lid and remove the wafer.
8.3.11 Inspect the back for any air bubbles. If there are any, use fingers to press out the bubbles (wafer is now ready to be diced)
8.3.12 Turn off the wafer mounter with the power button.
8.4 Changing a dicing blade

8.4.1 Make sure the spindle is *off and completely stopped*. The main power may be left on.
8.4.2 Remove the right side trough cover by lifting and pulling it out.
8.4.3 Remove the spindle blade cover by unscrewing the two bolts.

8.4.4 Use the flange tool to remove the saw flange. Press the hex key in the hex hole and line up the two pins on the spindle lock nut. Turn the grip counter clockwise while turning the red hex handle clockwise. (It is on very tight)
8.4.5 Place the flange lock tool pin-side-up on the counter. Place the saw flange on the flange lock tool so that the holes in the back of the flange fit over the pin.

8.4.6 Use the flange tool on the front side of the flange to remove the nut that holds the flange together by turning the grip counter clockwise.

8.4.7 Remove the saw blade and replace. Be sure to place new blade on the side of the flange that has the ring to hold the blade in place. Place the other half of the flange, with the hub, together with the blade.
8.4.8 Put flange on top of flange lock tool and use the flange tool again to tighten the nut that holds the flange together. *It should be put together with high torque.*

8.4.9 Place flange back on spindle with the flat side facing the saw.

8.4.10 Use the flange tool to tighten the ring to hold the flange on the spindle. *This should be done with as much torque as possible.*

8.4.11 Attach the spindle blade cover.

8.4.12 Replace the trough cover.

8.4.13 Perform manual height check (specified in saw manual) and Press SHIFT + ENTER for new blade.