1. Using the Karl Zuss Contact Aligner ("Exposure Only" Mode)

The Karl Zuss contact aligner is designed to allow precise patterning of photoresist layers, and alignment of existing layers to previous patterns on the wafer. This document describes how to use the Karl Zuss in "Exposure Only" mode, which does not include wafer alignment. These instructions will be enhanced to encompass the total operating instructions for the device in the future. These instructions are not a substitute for checking out on the machine, and as usual, the checkout procedure must be completed before unsupervised use of the machines is permitted.

1.1. CAUTIONS

1.1.1. Damaging the bulb

The primary way in which it is possible to damage the Karl Zuss is through improper thermal management, and/or improper operation. Always observe the following precautions

1.1.1.1. Scrupulously follow the instructions for turning on and off the cooling flow of nitrogen, detailed in steps 1.2 and 1.11.

1.1.1.2. Always report any bulb alarms to the cleanroom staff immediately.

1.1.2. Excessive contact force

1.1.2.1. When the wafer is brought into contact with the mask, no excessive force should ver be brought to bear. This can break the mask or the wafer, or result in damage to the aligner. Always proceed with a gentle touch.

1.1.3. Moving the wafer while in contact

1.1.3.1. Never make ANY adjustments to the position of the wafer (for purposes of mask alignment or otherwise) when in contact mode.

1.1.3.2. Contact mode is indicated by an indicator light labeled "contact".

1.1.4. Leaving machine in compromised position

1.1.4.1. Always leave the machine in a state that the next user will expect. This includes returning all settings to a somewhat centered value.

1.1.5. Dropping masks

1.1.5.1. Dropping masks is an easy way to severely set your research back. Whenever handling masks, use caution, and never assume they are secured by the vacuum chuck without checking

1.2. Power Up

1.2.1. Note start time

Note charge clock reading and record in the log book

1.2.2. Turn on all gases

1.2.2.1. Valves are located behind the aligner, mounted to the wall

1.2.3. Turn on lamp control box power switch

1.2.4. Turn on aligner power switch

1.2.5. Wait for 15 seconds

1.2.6. Turning on lamp bulb

1.2.6.1. Push the "lamp" button" on the lamp control box.

1.2.6.2. If an alarm sounds, the lamp failed to light. Press the button again to stop the alarm and wait five seconds.

1.2.6.3. Repeat 1.2.5.1 and 1.2.5.2 as necessary up to five times to get the lamp to light.

1.2.6.4. If the lamp lights, wait five to ten minutes for the lamp to warm up, before exposing. Other machine set-up tasks can be performed in this interim.

1.2.6.5. If the lamp fails to light after five tries, contact a cleanroom staff person.

1.3. Loading masks

1.3.1. Remove the mask carrier plate

1.3.1.1. Loosen the two thumb knobs which secure the mask carrier plate

1.3.1.2. DO NOT screw them all the way out

1.3.1.3. Slide out mask carrier plate to the left, flip over and place vacuum side up on the table

1.3.2. Exchange the mask carrier plate (if necessary)

1.3.2.1. Examine the mask carrier plate to see if it is appropriate for the size of mask being used.

1.3.2.2. If not, disconnect its vacuum hose connection, and exchange it for another plate in the mask plate storage drawer (to your right as you face the aligner)

1.3.2.3. Reconnect the new plate to the vacuum hose

1.3.3. Mount mask on carrier plate

1.3.3.1. Orient the mask so that its brown side is facing up (away form the mask carrier plate)

1.3.3.2. Position the mask over the vacuum sealing ring in the mask chuck plate (a small groove surrounding the mask exposure opening)

1.3.3.3. Make sure it completely covers the vacuum ring, and does not hang over the edge of the carrier plate

1.3.3.4. Flip the "mask" switch on the machine console to the up position to secure the mask to the carrier plate

1.3.3.5. Test this connection, by gently attempting to move the mask relative to the carrier plate.

1.3.4. Replace and secure mask carrier plate

1.3.4.1. Carefully flip the carrier plate and mask over, so that the mask is brown side down, positioning your hands to catch the mask if it falls

1.3.4.2. Slide the mask carrier plate back into position, being careful not to scratch the underside of mask as it passes over the frame of the aligner

1.3.4.3. Retighten the thumb screws to hold the carrier plate in place (Do not overtighten)

1.4. Installing sample chuck

1.4.1. Select chuck

1.4.1.1. Locate the chuck selections in the drawer to your right

1.4.1.2. Select a chuck that is appropriate for your wafer size. Your wafer should be able to cover all of the sample mounting vacuum holes, but not the outermost hole, used for drawing vacuum between the sample and the mask, right before alignment.

1.4.1.3. The appropriate chuck may already be in the machine

1.4.2. Remove existing chuck (if necessary)

1.4.2.1. Slide the sample stage out (to the right), being careful not to collide anything on the stage with the frame of the aligner

1.4.2.2. Lift the undesired chuck out of its location and place it in the chuck drawer

1.4.3. Insert new chuck

1.4.3.1. Place your chuck of choice in the same location, being careful to watch for the keys on seating surface

1.5. Mount Wafer

1.5.1. Place wafer

1.5.1.1. Place you wafer in the center of the chuck

1.5.2. Position wafer

1.5.2.1. Position it in a repeatable way, using flats and features as a reference, and do not cover the outermost vacuum hole

1.5.2.2. Slide stage back under mask

1.6. Set wafer height and make contact

1.6.1. Test contact position

1.6.1.1. Note the shadows of the mask features cast on your wafer below the mask

1.6.1.2. Test the vertical contact position, by gently lifting the lever on the left side of the aligner into the vertical position (continuing past vertical as necessary), while continuing to monitor the shadows

1.6.1.3. Stop lifting immediately when contact is made. This is identified by a slight resistance in the lever, and the convergence of the features in the mask with the shadows cast by them on the wafer.

1.6.1.4. Assess the position of the lever at the point of initial contact

1.6.1.5. If it is past the point labeled "contact", then the z-height needs to come up (The lever points right at the "contact" label when it is at 10 'o'clock, as viewed from the left side of the aligner.)

1.6.1.6. If the lever is on the near side of this label when contact is made, then the z-height needs to be reduced

1.6.2. Adjust z-height

1.6.2.1. Back off from contact and adjust the z-height knob at the base of the front of the aligner to raise or lower the z-height of the wafer

1.6.2.2. Iterate with this knob and the lever to achieve contact just at the point when the lever is pointing at the "contact" label

1.6.2.3.

1.6.3. Position the sample in x and y

1.6.3.1. Assess what part of your wafer will be exposed by the mask.

1.6.3.2. Bring the z-height lever to the front position

1.6.3.3. Use the x and y micrometers to adjust the position of the sample under the mask, if necessary.

1.6.3.4. DO NOT TOUCH THESE MICROMETERS AT ANY OTHER TIME IF YOU ARE WORKING IN THE EXPOSURE-ONLY MODE

1.6.4. Make Contact

1.6.4.1. Lift the z-height lever until contact is established at the right location

1.6.4.2. Push it gently to all the way to the back (9 'o'clock)

1.6.4.3. Note the contact light will come on

1.7. Perform Alignment

This step will be skipped for now, as it is not used in the exposure only mode

1.8. Expose

1.8.1. Set exposure time

1.8.1.1. Set the central knob of the clock to the right units by rotating it until the desired units are opposite the black triangle

1.8.1.2. Set the outer ring on the aligner to the number of these units that are desired form the correct exposure

1.8.1.3. Example: to expose for 28 seconds, select the 10s unit and set the ring to 2.8.

1.8.2. Expose

1.8.2.1. Make sure the lamp has stabilized at 273 V when the display is toggled to the volts setting

1.8.2.2. Push the expose button

1.8.2.3. Look away while the exposure occurs to reduce UV dosage to your eyes

1.8.2.4. Wait for the exposure to complete

1.8.2.5. If the machine alarms when the shutter opens, allow the exposure to complete, but note the bulb voltage and the actual light reading (mW/cm^2) by toggling the display setting using the console buttons. Log these and notify a cleanroom staff person.

1.9. Remove Samples and repeat as necessary

1.9.1. Leave the contact mode

1.9.1.1. Bring the contact lever back to the front position

1.9.2. Slide out sample

1.9.2.1. Slide stage out to right

1.9.3. Remove wafer from chuck

1.9.3.1. Pick up wafer and place in container.

1.9.4. Repeat the above sequence as necessary for each sample

1.9.5. When finished with all samples, proceed to next step

1.10. Remove Mask

1.10.1. Follow the steps under heading 1.3 in reverse order to remove mask

1.10.1.1. It is not necessary to restore the original mask plate.

1.10.1.2. You must place the empty mask carrier plate back in the aligner housing, when finished

1.10.1.3. It is not necessary to change the chuck when finished

1.11. Shutdown Machine

1.11.1. Shut off bulb

1.11.1.1. Turn off the bulb power by flipping the toggle on the lamp control box

1.11.2. Power off

1.11.2.1. Turn off machine power on aligner console

1.11.3. Shut Gases off (except nitrogen)

1.11.3.1. Shut off all gases (EXCEPT NITROGEN)

1.11.3.2. NITROGEN MUST BE LEFT ON FOR 15 MINUTES AFTER BULB IS SHUT OFF!!

1.11.4. Wait for bulb cooling period

1.11.4.1. Wait 15 minutes after bulb has been shut off

1.11.5. Log usage

1.11.5.1. During the bulb cooling time, log usage and any faults

1.11.6. Shut off nitrogen

1.11.6.1. After the appropriate 15 minute waiting period, shut off nitrogen