

KSU GLASS HANDBOOK

(Operations & Safety Manual)

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Opening the Studio

1. Turn on Lights.
2. Turn on Glory-Holes.
 1. Turn on the Blue ball-valve for the gas (top left on main gas line to Hole).
 2. Press and hold reset button on Eclipse (top right button) for 6 seconds.
 3. Release button and listen for blower to turn on.
 4. In 30 seconds you should hear a loud “Click” and the Orange light above Hole should to Green. (If it does not turn green—or turns green briefly and then switches back to orange—note the Error Code on the Eclipse control box. e.g. FA7, etc.)
 5. **If Hole does NOT light, repeat steps 1-4 at least 5 times before contacting one of the Grad Students or me (debanks@kent.edu).**
3. Press Button marked “Pipe-Warmer”.
4. Make sure an Annealer is ON! If not, EMPTY & TURN ON! (See Pg 3: **How to Use the Annealers**)
5. Empty “CLEAR” break-off bins into Cullet Washing Station. (Located in Kiln Room)
6. CHECK that Glory-Holes & Pipewarmer are ON. (Green light is on.)

7. **Make sure FURNACE IS ON!** (If furnace is off—green light is orange—note the error code on Eclipse (FA-2, etc), current temperature then follow reset procedure. IF TEMP IS BELOW 1800 FIRST TURN DOWN THE SET-POINT TO 1800 THEN RELIGHT/RESET. Below 1800 the furnace will need to be ramped up SLOWLY to prevent damage to crucible. But, it's most important that it is relit as quickly as possible to prevent further temperature loss! Contact me immediately if the temp is below 1800 (debanks@kent.edu).

How to Use the Annealers

TURNING ON an ANNEALER:

1. Be SURE annealer is EMPTY & Swept Clean.
2. Press EZ2 (EZ2 light should turn off).
3. Press EZ1 on any “B” Kiln. (EZ1 light should come on **and “Profile” icon illuminate.**)
4. Flip Sign on appropriate Kiln to Green.
5. Use chalk to write date/time it went up (on black square on front of annealer).

TURNING DOWN an ANNEALER:

1. Flip Sign on Kiln to Red.
2. Use chalk to write date/time it went down (on black square on front of annealer).
3. Press EZ1 Button (until EZ1 light turns OFF).
4. Press EZ2 on controller for that Kiln. (EZ2 light should come on and “Profile Icon” light up.)

EMPTYING ANNEALERS:

1. Be sure kiln is below 200°F BEFORE OPENING!
2. Place glass on appropriate shelf in Classroom.
3. Sweep broken glass out of Annealer.

Annealer Manual

SAFETY

- THE INTERLOCK SYSTEM:
 - KSU Glass Studio Annealers are equipped with an Interlock System which sense when a door has been opened and instantly kills electric power to the elements. This prevents the possibility of electric shock in the event a user accidentally touches an element while loading or servicing a kiln.
- HEAT SAFETY CONCERNS:
 - The *annealing temperature* of the glass type used at KSU Glass is roughly 960°F. **Proper safety gear must always be worn when working inside a hot annealer**—face-shield, Kevlar gloves and fire-resistant jacket are standard. **Always wear the face-shield when putting hot glass pieces into an annealer!** The shield allows the user time to deliberately and carefully place the work in an appropriate place. More importantly, the shield will protect the user in the event a glass piece violently cracks or fractures and sheds glass shards (in essence **explodes**), which is a common occurrence when working glass at annealing temperatures.
- PUTTING WORK AWAY SAFELY:
 - **Best practice for Studio Glass is to work with a partner.** A partner is hugely important when transferring a finished work to the kiln for annealing. The practice of simply “breaking it off the puntie” into the annealer is crude, indelicate, and unsafe.
 - **Always load work from the back of the annealer to the front.** Never place a finished piece of glass right in front of

the annealer unless an annealer is full. Loading from back-to-front means other students won't have to reach over your work (potentially damaging it) to put away their work. Loading an annealer properly is a sign of good work ethic and professional consideration.

- **It is not a good idea to get into the habit of reaching into an electrically powered kiln with a highly conductive steel rod**, even though we have redundant safety “kill-switches” that kill electric power to our Annealers when a door is opened. Should our system fail, the user would be in danger of receiving a very dangerous and substantial electric shock. Of course, with redundant safety systems this is very, very unlikely to happen, so of greater concern is the habit itself.
 - **Have your partner put on the Kevlar gloves and shield and take control of the finished work for you.** Habits formed in an academic setting get transferred to the professional sphere and it is important to learn good, safe practice from the beginning.
 - CLEANING & MAINTENANCE:
 - **Annealers need to be kept clean of dust and broken glass.** This not only keeps finished work from being scratched or picking up dirt when put away, but also keeps you safe when emptying an annealer.
 - **After emptying an annealer sweep and/or vacuum glass shards from the interior.**
-

HOW TO RUN THE ANNEALERS

- **EZ-1 BUTTON USE:**
 - **The “EZ-1” Buttons send annealers up** to annealing temperature: 960°F.
 - **NEVER Press EZ-1 unless you’re sure that:**
 - The Annealer is empty.
 - The Annealer is Clean.
 - The Annealer doors are properly closed and the Interlocks engaged—indicated by a blue light in the “Interlocks” light next to each controller.
 - **After pressing the EZ-1 Button you should see the EZ-1 light come on in the right column of the display AND the “Profile Icon” should also be illuminated.**
 - If you press EZ-1 and nothing happens, wait a few seconds and press it again. If there is still no response then alert an Instructor, Grad, Tech or Senior student. If none of these are available (e.g. if you’re Opening the Studio and can’t immediately contact someone by text or phone) then **send up another Annealer.**
- **EZ-2 BUTTON USE:**
 - **EZ-2 sends the annealer down into “slow-cool”/annealing mode.**
 - **Never press EZ-2 until:**
 - The annealer is full and can’t fit any more glass.
 - **Or:** the Studio is Closing and there is another Annealer available for the next day. (In the event that both large annealers are on and one Annealer is half-empty and the other is full, only send down the full annealer. That way there will be space for students working early the next morning.)

- OTHER BUTTONS:
 - Unless you've been properly trained you should **NEVER press any button other than EZ-1 or EZ-2.**
 - **If you accidentally press another button immediately press the Infinity Button (∞)** until the display shows the two temperatures (red on top and green below); this means you are out of program mode and back to default screen.
-

WATLOW BASIC FUNCTIONS:

Watlow controllers combine the ease of a simple thermostat with the sophistication of a programmable kiln controller. However, they are based on a completely different set of parameters than Digitry™ (GB-4) controllers. Most notably, you don't need to run a program to turn a furnace or kiln on or off, or raise or lower the temperature. Programs are useful, because they can turn a kiln (or furnace) up or down over a specified time without you being there. However, we can simply use the AUTO function to manually set the temperature, just like your thermostat back home. For example, if a kiln is at room temperature and you turn it on with the Set Point at 960°F (Annealing Temp) then the kiln will ramp up to that temperature as fast as possible (AFAP), no program needed.

This is the simplest way to run our controllers, but it's also the most primitive. It allows for simple ON/OFF programs, and you can't anneal thick work or slowly heat up a delicate glass component for a hot-sculpted piece.

PROGRAMING BASICS:

That's where programs come in.

The advantage of the Watlow is that it can run a furnace charging profile, a glory hole, an annealing or casting kiln. In the past glass studios have relied on separate types of controllers to run Annealers, Furnaces, Flory-holes and Casting Ovens. This made for confusion and redundancy, since the user had to be familiar with several operating systems in order to keep a glass studio running. This means more cost in operation and maintenance.

One of the major differences is that unlike the traditional Digitry™ GB-4's, the Watlow **does not** use cumulative time. This means that you can very easily jump to any step in a program and change it without affecting any of the other steps. (For example, if you programmed your kiln for 3 hours at casting temperature—1500°F—but aren't sure the glass will fill the mould completely in that time, you can easily jump to that step and change it.) In essence, each step is a stand-alone piece of programming.

Another difference is that it is very difficult for someone to accidentally forward a Profile (program) to the next step while the kiln is running. This has always been a major drawback of the GB-4 controller: it is far too easy to accidentally send a Profile to the next step and inadvertently damage a casting or large blown piece. However, it takes several complicated steps to do this with a Watlow.

You'll also notice that each Watlow controller is assigned to an individual piece of equipment (furnace, casting-kiln, annealer, etc). Again, this is a safety feature that reduces the chance that someone will accidentally tamper with a Profile while a kiln is in use. On Digitry's GB-4s, each controller can run up to 4 pieces of equipment, so it's fairly easy to tamper with the wrong kiln. But,

the Watlow™ controller should drastically reduce unfortunate incidents, especially in a community studio setting where a lot of users are interacting with a controller.

The KSU Glass Studio's Watlow Controllers have a few other unique features. Most notably, they have been individually programmed for their designated use. For example, the Blowing Annealers (B1, B2, B4 and B5) are programmed not to exceed 1000°F. This is to ensure they cannot accidentally be sent past annealing temperature and slump or melt the glasswork inside. Casting Kilns, on the other hand, are programmed with a max temperature of 1600°F (although we rarely exceed 1550° in most casting scenarios).

So, if you need to preheat a piece of glass to be worked hot—for example a “stuff-cup” or thick murrini—you should use the top-loading Pickup Oven: B3, which has been programmed to reach 1200°. If your object is too large to fit into that kiln, we have the small, front-loading Wet Dog annealer (B4) that can be programmed for such use by an Instructor or Grad-student. You'll need to let them know ahead of time, reserve the kiln for that use and be sure it is returned to normal operating parameters after use.

Another thing to note is that the Watlow™ controllers are **not** tied to the safety (Interlock) system. That means that the controller will continue to run a profile, **regardless of the Interlock condition**. Simply put, it doesn't matter if the door to a kiln is open or closed, if you start a profile, that profile will begin running. The Interlock doesn't communicate with the controller, it simply kills electric power to the elements inside the annealer or kiln. So, if you start a profile while the doors are open, the profile will begin running even though no power is going to the kiln. Here's an example, say you've programmed the Pickup Oven to preheat a glass part over 4 hours to 1000° but you forget to close

the door until 3 hours later (perhaps when you come in to prep for your blowslot and noticed the door was open). Well, when the door closes power is then sent to the elements and the Watlow recalculates, it will now send the kiln up to the Set Point (1000°) in only 1 hour (because 3 hours have already elapsed). The controller only knows what you program into it, which was “go from room temp to 1000° in 4 hrs”. It doesn’t care that it wasn’t getting hot for 3 of those hours, it only knows that after 4 hours it has to be at 1000°.

TERMS

- **Annealer:** Electrified, insulated container for the slow, controlled cooling of glass for the purpose of removing stress.
- **Controller:** Watlow controllers located in grey control panel located in Class Room. KSU Glass Controllers are equipped with EZ-1 and EZ-2 capability, which facilitate 1-touch operation of Annealers. (see *Watlow Controllers* below).
- **Elements:** High-temperature, resistant wire coils which power most Annealers, Kilns and Ovens.
- **EZ Button(s):** Watlow controller button that allows user to run a *profile* with the push of a single button.
- **Interlock:** Safety switch that senses when Annealer doors are open and kills electric power to the Kiln. (These are small silver tabs on front of KSU Glass Studio front-loading Annealers and indicate that doors are properly closed (and power on) with a green light. If light is off then door is open and no power is going to the Annealer. (See *Preventing Glass Breakage* and *Safety* below)
- **Kiln:** Interchangeable with *annealer* but refers more commonly to equipment for casting glass. The term **Oven** is also used. (e.g. Casting oven or casting kiln or annealing oven.)

- **Profile:** A program/series of steps inputted into a controller.
- **Set Point:** The temperature the controller is set to attain and/or hold. (e.g. Annealing temp: 960°F)

Blow-Slot Duties

First Blow-Slot Duties:

1. Empty “DEAD GLASS” bins into Dumpster outside Sculpture.
2. Change Block-bucket water for your bench.
3. Empty Annealer onto corresponding Shelf.
(Annealer B1 to Shelf marked B1, etc. Do NOT empty if above 200.)
4. Sweep out broken glass and shards from Annealer.

AFTER EVERY BLOW SLOT:

1. Sweep area around Bench, Gloryhole, and Furnace when done.
(No broken glass left on floor. Period.)
2. Remove personal blow pipes/punties from Pipe Warmer and store in your locker.
3. Put away Tools.

Alternate Blow-Slot Duties:

1. If using Pick-Up Box (Advanced Students Only):
 - Make sure it’s below 200°F before you open/remove work.
 - Place cool/annealed work on corresponding Shelf (B2).
 - Press EZ1 on B2 Controller to send up to holding temp (960°F).
 - Use Up/Down Arrows (↑,↓) on B2 Controller to adjust to desired temp.
 - When finished Press EZ2 to send down/turn off!

Closing the Studio

WHO ARE CLOSERS?

The last blow-slot of the day (regardless of when) is a “Closing” slot.

Closing Procedure:

1. Turn Blue ball-valve on Gas Line (top left of Hole) perpendicular to the line.
(This shuts the fuel OFF). Green light above Hole should turn orange.
2. Press Button marked “PIPE-WARMER” on Pipe-Warmer Controller
(Button pops out & flame goes off).
3. Turn Annealer Down:
 - Flip Sign to RED
 - Draw down arrow (↓) on chalkboard square on front of kiln.
 - Note date/time on chalkboard square (so we can track when a kiln was sent down.)
 - Press EZ-2 on controller* for that Annealer (e.g. B-2). (* Located in Flame-Shop/Classroom).
4. Send up Annealer for the next day.
 1. **Empty an Annealer** (if needed and if below 200°F) onto appropriately marked shelf in Classroom. (e.g. Annealer B1 glass goes on shelf marked B1)
 2. Sweep out broken glass/sand/etc in empty annealer.
 3. Press “EZ-1” on corresponding controller to send up the **empty and clean** Annealer.
5. Sweep ENTIRE Hot Shop floor THOROUGHLY!
6. Put Glass Tools & Brooms AWAY!

How to Charge the Furnace

1. Press “EZ1” Button **ONCE**.
(Profile Icon looks like a “mountain”. This means the Charging Program has started.)
2. Wait Until Top Temperature (green) Reads: 2250°F.
3. Fill Charging Chute & Dump a SINGLE charge.
 - Each charge should consist of 50/50 Nuggets/Recycle Cullet (e.g. 1 shoot Nuggets : 1 shoot Recycle).
4. WAIT till charge has fully MELTED (20-30 mins).
5. Repeat Step (3) until glass level is rough 4 inches from crucible sill.
6. Clean Up! Sweep around Furnace(s), etc.
7. DO NOT PRESS ANY MORE BUTTONS ON CONTROLLER.

NOTES ON CHARGING

Pressing the EZ1 Button initiates the Charging Program (or Charging Cycle). Here is what that program does:

1. Ramp the furnace up to 2250°F (charging temp) as fast as possible (AFAP).
2. Hold at 2250°F (working temp) for 8 hours.
3. Ramp the furnace back down to 2050°F AFAP.
4. Hold at 2050°F.

After the program has completed it will “Hold” at working temperature indefinitely, until the next charging cycle. The EZ1 light will remain illuminated, but that doesn’t mean it’s running the Charging Program. Only when the Profile Icon is illuminated is

the controller running the program. After that program has finished running it goes back to holding at operating temperature.

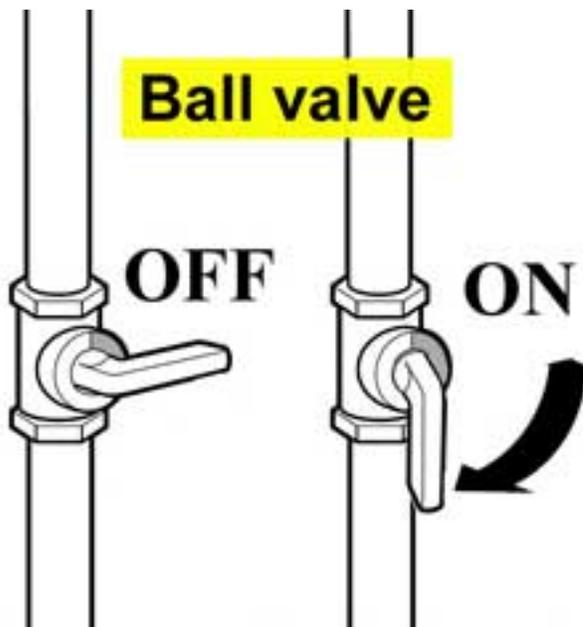
There's a fairly complicated explanation for this. When we program our controller to run our furnace, we have a couple different options for the final step of the program. We can choose "END/OFF" or "END/HOLD". With the first option the furnace will turn off, at the end of the program. Obviously, that's not good. We want our furnace to keep running and providing us with good glass. So, the best option is to END the program and then HOLD at the last temperature that was in the program.

If you look above at the program we use, Step 3 is to return to 2050°F. As soon as the furnace reaches that temperature the program is complete. Over. It has ended. However, because we chose END/HOLD the furnace will automatically hold at that temperature, even though the program is no longer running. Basically the last instruction from the program to the furnace was to HOLD, so it will.

Flame Shop Procedures

Turning on the Torches:

1. See that black dial on the wall with the green label marked "vent"? That is the ventilation that will keep the air you are breathing nice and clean while you work, **please turn exhaust vent dial to "on"**.
2. **Do a quick table check to ensure that all of the ball valves and torches are in the off position.** For ball valves, the off position is perpendicular to the gas/oxygen line. (see diagram below)



3. **Always check *all* torches on the *whole* table**, and any unused torches, to ensure that when we turn everything on for our torches, we are not creating a leak elsewhere in the room. For the torches, the knobs turn clockwise (right-tighty) for the “off” position.
4. Follow the hoses back from the torch you want to work on, and identify which gas line and oxygen tank operate that torch.
5. **Turn ON the Main On/Off valve at the top of the oxygen tank** (lefty-loosey).
6. On the regulator, use the “T-Pin” valve to adjust the pressure, which you will watch on the left gauge, by turning the clockwise, righty-tighty. Turning slowly set the oxygen pressure to 10psi. (We read the inside numbers on the dial). (NOTE! If you set the pressure too high, you will need to *bleed the lines*, see shut down procedure.)
7. Follow the hose that is coming off of the oxygen tank regulator, there is a main-line ball valve that needs to be turned ON to supply your ½ of the table (the handle says “OXY”).

8. Locate the natural gas line that is operating your torch, it is a black pipe that drops down from the ceiling closest to your oxygen tank. The blue handle says "GAS", turn the ball valve to the "ON" position, (**see diagram above**). There is no pressure to set for the natural gas.
9. At your torch you will need to turn **ON** the oxygen and gas ball valves under the table that feed your torch, see diagram above.
10. On your torch, notice that you have green (oxygen) and red (gas) knobs. Remember PO-OP! When lighting the torch, turn on the gas (red) first, by slowly turning the red knob ON (about ½ turn, lefty-loosey). Hold your striker underneath and strike to light your torch. Once you have a flame, adjust it up or down so that you have about a 6" flame. SLOWLY, turn on turn on the oxygen (green knob, lefty-loosey). Adjust your flame until you have a ¼" inner cone.

NOTE! If you take a short break (10 min), you will need to turn off your torch, the main valve on the oxygen tank, and the main gas line (you do not need to re-adjust the t-pin, or under the table ball valves). If you are taking a longer break, please see shut down procedure.

Turning Off the Torches (Shut Down Procedure):

1. At the torch, remember PO-OP, turning off the oxygen knob first, and then the gas.
2. At the oxygen tank, turn off (righty-tighty) the Main On/Off valve. Loosen the T-Pin valve (lefty-loosey) until it jiggles.
3. Turn off the ball valve for the main gas line (the black pipe that drops down from the ceiling)
4. Go back to your torch and briefly open the gas and oxygen knobs, letting the gasses trapped in the lines "bleed" out. This

is called *bleeding the lines*. Make sure that you re-close the knobs on the torch (righty-tighty).

5. Turn ball valves for both the oxygen and gas lines to the off position under the table.
6. Turn ventilation off.

General Safety

- **Eye protection MUST be worn AT ALL TIMES in the Hot Shop & Cold Shop. NO EXCEPTIONS!**
- **Proper clothing must be worn in Hot Shop & Cold Shop:**
 - Natural fiber clothing (cotton, etc). NO SYNTHETICS.
 - Long pants; no shorts or skirts.
 - NO opened-toed shoes: sandals, clogs, etc.
 - Leather shoes preferred.
 - No dangly, loose jewelry.
 - Long hair must be kept back.
 - NO ear-buds or headphones in the Hot Shop.
- Ear protection MUST be worn during loud operations in the Cold Shop. **NO EXCEPTIONS!**
- **Do not attempt to operate any piece of equipment that you have not been properly trained on.**
- **Non-Glass Student or the general public are NOT allowed INSIDE the Hot Shop** (except on special occasions—official tours, demos, etc).

Hot Shop Safety

- **Eye protection must be worn AT ALL TIMES in the Hot Shop. NO EXCEPTIONS!**
- **Proper clothing must be worn:**
 - Natural fiber clothing (cotton, etc). NO SYNTHETICS.
 - Long pants; no shorts or skirts.
 - No tights/leggings. (They're usually synthetic.)
 - No opened-toed shoes: sandals, clogs, etc.
 - Leather boots/shoes preferred, with **thick soles**.
 - No dangly, loose jewelry.
 - Long hair must be kept back.
- **Keep floor clean of broken glass!** Broken shards of glass are nearly the sharpest objects on earth, sharper than a surgeon's scalpel. Broken glass on the floor is a hazard: it is slippery, and can cause someone to lose their footing, and if someone does fall on it they can be seriously cut and injured. **There is no excuse for broken glass left on the floor.** If you see glass shards immediately use the corn brooms—natural fibres that won't melt—to sweep them up and toss into the appropriate bin. (Colored glass in DEAD GLASS and clear in CLEAR.)
- **Music must be kept to a reasonable level.** You must be able to clearly and safely communicate with your partner(s) and fellow glassworkers.
- **No Headphones/Ear-buds in Hot Shop.**
- **Use Kevlar gloves and face mask to safely put work away.**
- **ALWAYS wear a DUST MASK when sweeping/vacuuming out Annealers.**

- **ALWAYS wear a DUST MASK when emptying CLEAR glass into Recycling bin or disposing of DEAD GLASS in dumpster.**
- **Note that all metal equipment and tools can be hot at any time.** Test items before touching by holding hand nearby to feel for radiant heat.
- **Burns: If you do get burned do not ignore even the most minor, as they frequently turn out to be worse than they first appear.** Basic first aid: run cold water over the burn for at least 5 minutes. If the burn is at all serious go to the health center. If you are burned while working, stop and take care of it! You are more important than the glass.
- **Do not attempt to operate any piece of equipment that you have not been properly trained on.**
- **Non-Glass students are NOT ALLOWED to be inside the Hot Shop.**

ALWAYS announce yourself LOUDLY when approaching someone working with hot glass.

Cold Shop Safety

- **Eye protection must be worn AT ALL TIMES in the Cold Shop.**
- **CAUTION: BROKEN GLASS IS SHARP!** Molten glass can be scary, but broken glass is far more dangerous. The human nervous system will instantaneously pull away from a hot surface, often involuntarily. So, it's nearly impossible to *continue* to burn yourself with hot glass. Most burns in the Hot Shop are superficial at worst. By contrast broken glass can cut you. Cuts cause bleeding—which opens the body to infection—and can cause the victim to faint from the mere

sight of blood, causing far worse injury from a fall onto a concrete floor. Moreover, cuts can occur on major arteries and put the victim in danger of bloodloss. Therefore, great care should be taken when working with cold glass.

- **NEVER Cold Work when tired or sick.**
- **NEVER Cold Work alone (there should at very least be someone in the Hot Shop).**
- **NEVER startle someone that is Cold Working.**
- **Hearing protection MUST be worn whenever any equipment is in use in the Cold Shop.**
 - Ear plugs are located on top of the Cold Shop Cabinet.
 - Earmuffs can be found hanging throughout the Cold Shop, and should remain next to appropriate equipment on designated hangers. (e.g. Next to the Diamond Saw(s), Belt Sander and Sand Blaster(s).
- **Dust masks or respirators should be worn whenever there is airborne glass dust.**
 - When using: Diamond Saw(s), pneumatic Die-Grinders, Belt Sanders and Sand Blasters.
- **Be cautious of wet floors!** Almost all equipment in the Cold Shop uses water. This means that the floors are very often wet and can be slippery. Caution should be used anytime you are working in or moving through the Cold Shop. **In event of excess water, please squeegee water into nearest drain immediately!** Squeegees can be found hanging throughout the Cold Shop. Mop up water residue with mop.
- **Clean and remove ALL GLASS DUST!** Cold Working equipment grinds glass to create a tenacious dust that is composed mostly of amorphous silica. This dust can be invisible when wet but obvious as a white film when dry. Although less dangerous than *crystalline silica*, ***Amorphous Silica* dust is a classified as Hazardous**

Substance and is controlled by OSHA guidelines. **All glass/silica dust must be cleaned off all surfaces after each use of any machine or work area!** Failure to do so will result in docking of Participation Grade and (if it continues) revoking of access to Cold Shop.

Never use equipment you have not be trained on or feel uncomfortable with.

Terms:

- ***Amorphous Silica:*** is essentially melted glass. The melting process changes the regular crystalline structure of *Crystalline Silica* into an irregular structure. This structure seems to make all the difference as far as health concerns go, because the “closed” structure of melted glass means that it won’t stick to lung tissue the way *Crystalline Silica* does. [NOTE: the full health risks of *Amorphous Silica* have NOT been assessed, and preliminary finding in animals suggest that it can cause severe respiratory complications, but that these were somewhat reversible. There are no findings that suggest *Amorphous Silica* is a carcinogen or will cause Silicosis. However, there are no conclusive findings that prove this form of silica is fully safe, so safety precautions should be instituted.]

Kiln Room Safety

- **Refractory materials, bedding sand and mould materials all contain Crystalline Silica, which is a serious health hazard.** (see below: Terms: *Refractory* and *Crystalline Silica*)
- **Dust masks/respirators MUST be used when loading or unloading ANY kiln.**
- **ALWAYS wear dust mask/respirator to divest a casting from a Plaster/Silica mould.**
- **Mould divesting should ALWAYS be done under ventilator in the Plaster Room and thoroughly cleaned up when finished.**
- **Properly dispose of Used/Fired mould (dumpster).**
- **Face-mask, gloves and fire-resistant jacket MUST be used when “charging” a kiln during a firing.** (See terms: “Charging”)
- **Only dry moulds in designated kilns and ALWAYS vent with small sliver of kiln shelf or brick.** This prevents build up of steam—which can burn you when you first open the kiln if not vented.
- **Preheat glass before charging a mould.** This will reduce risk of thermal shock, which can cause glass to explode and injure you and damage the kiln elements. It will also speed up the casting time and reduce chances your mould will fail.

Terms:

- ***Charging:*** to load glass into a mould or furnace, typically while at firing temperature.

- ***Crystalline Silica***: also known as “free” silica, crystalline silica is present in all quartz sand and dirt and its “open” crystalline structure causes it to stick to lung tissue when inhaled. **Exposure can lead to *silicosis*, lung fibrosis caused by the inhalation of dust containing silica. The condition is irreversible, chronic and progressive.**
- ***Refractory***: a substance that resists heat.

Plaster Room & Sandblaster Safety

SAND BLASTER ROOM SAFETY

- **ALWAYS wear Respirator or Dust Mask when in Blasting Room.** Sand blasting media—slag, sand, silicon carbide—can contain produce large quantities of dust. Even though we have an excellent ventilations system, you should always practice safe working habits.
- **Keep Blasting Room door closed AT ALL TIMES!**
- **Hearing Protection required when Blasting.**

PLASTER (MOULD) ROOM SAFETY

- **ALWAYS wear respirator/dust mask while mould-making!** Mould-making refractory contains free or crystalline silica, a known Hazardous Substance, exposure to which can cause silicosis. (See Terms: *Crystalline Silica*)
- **Clean up Immediately after yourself:**
 - Sweep and/or Mop floor.
 - Sponge down Table and Sink THOROUGHLY.
 - Scrape and wipe scale, buckets and mould forms (cottles).

Terms:

- ***Crystalline Silica***: also known as “free” silica, crystalline silica is present in all quartz sand and dirt and its “open” crystalline structure causes it to stick to lung tissue when inhaled. **Exposure can lead to *silicosis*—lung fibrosis caused by the inhalation of dust containing silica. The condition is irreversible, chronic and progressive.**

Diamond Saw Use

QUICK USER MANUAL

1. **Put on HEARING & EYE PROTECTION!**
2. **Turn On the water supply**, (on wall: ¼-turn).
3. **Go SLOW.**
(A slow cut is a clean and SAFE cut.)
4. When done **clean saw THOROUGHLY.**
(NO glass shards or dust/residue left on saw.)
5. **Empty Collection Basin** under saw.
(Scrape glass residue into trash.)
6. When done, **Turn OFF water supply.**
7. **Clean Floor.**

DIAMOND SAW SAFETY

- **EYE PROTECTION is ALWAYS required, including use of face shield if appropriate.**
- **HEARING PROTECTION is ALWAYS required.** Earplugs are located on top of Cold Shop Cabinet. Earmuffs are hanging in various locations around Cold Shop.

- **ALWAYS make sure the water is on BEFORE beginning a cut.** The Diamond Saw is water cooled. This prevents your glass from cracking and the blade from overheating and warping.
- **NEVER force a glass piece through the saw!** The diamond saw blade used to cut glass has a continuous edge. It does not actually “cut” the glass but rather grinds it away. It needs time to do this. The slower the cut, the smoother it will be. Too fast and the glass can crack, chip violently and (worst of all) the blade can grab the glass and pull it, jamming the blade and breaking the glass. So, go slow!
- **NEVER hold the glass so that your hand is in line with the blade!** Even though the blade isn’t “sharp” in the same way a knife blade is, it can harm you if your hand is pulled into it. More likely, however, is the likelihood that the glass itself will break and cut you if your hand is in line with the blade, and therefore likely fracture lines.
- **Thoroughly CLEAN the saw (including the basin) after finished!** No visible sign of glass dust (white powder) should be left on any part of the saw, floor or surrounding wall after cleaning. This tenacious dust is composed mostly of amorphous silica and can be invisible when wet but obvious as a white film when dry. Although less dangerous than *crystalline silica*, *Amorphous Silica dust is classified as Hazardous Substance* and is controlled by OSHA guidelines. (see Terms: Amorphous Silica) **Failure to properly clean up will result in docking of Participation Grade and (if repeated) revoking of access to Cold Shop.**
- **Be cautious of wet floors!** Almost all equipment in the Cold Shop uses water. This means that the floors are very often wet and can be slippery. Caution should be used anytime you are working in or moving through the Cold Shop. **In event of excess water, squeegee water into nearest drain**

immediately! Squeegees can be found hanging throughout the Cold Shop. Mop up water residue with mop.

GENERAL DIAMOND SAW NOTES:

1. **NEVER run the saw without water!** It will overheat and severely dull the blade and (worse) break your glass. The water not only cools the glass and blade, but helps remove ground material that would otherwise build up and “bind” the blade. If you turn on a saw and no water is spraying off the blade, make sure the water supply is turned on at the wall and that it is in fact connected to the machine. If it’s turned off you can simply turn it back on again by turning the valve counter-clockwise. If the water supply is not connected to the machine notify a Grad Student, Studio Tech, Professor or Advanced Student.
2. **A diamond saw doesn’t “cut” glass, it grinds it away.** This is important because you have to consider that the grinding action will leave a fairly rough surface on the glass (depending on the type of blade) and that surface might have to be removed to achieve the final look you’re going for. So, it’s prudent to be cautious when cutting the pour-cup off a casting, for example. Leave a little more than you think so you have enough material to finish the surface without eating into the casting. Remember, you can always remove material, but it’s nearly impossible to add any back on!
3. **Plan your cuts** with some visual mark. Oil-based pencils (China-markers) work great, as do Sharpie® However, to protect your marks from the force of the water use clear tape—it can take quite a while to finish a cut and the constant water spray can remove your carefully placed marks.
4. **Always make a test cut** on a piece of scrap glass. This provides a visual guide for depth of cut, width and finish. It can

also reveal any issues with the saw before you cut your artwork.

5. **Go slow!** Remember, you're *grinding* the glass away. This takes time. If you rush and push too hard the glass can “bind” in the saw and destroy your work, damage the saw motor and ruin the blade (roughly \$300 to replace).
6. **When finished cutting make sure to remove all glass debris.** This includes removing glass shards and cutoffs—clear glass can be put in the “Clear” Breakoff bins, colored glass can be put in the “Dead Glass” bins. Glass shards are a hazard and should never be left on the saw bed, basin or floor surrounding the saw. These shards can cut you or scratch your work.
7. **Clean glass dust off all surfaces of saw when done!** This includes sponging out the interior of the saw basin. There should be no white residue left after proper cleaning. Glass dust is a respiratory hazard and will not be tolerated.
8. **Turn off water when done.** Never leave the water-supply on. If the water is left on it can drip, which will cause the saw blade to rust, creating a rough spot on the blade which can damage work. Rust can also seize sensitive moving parts of the machine, which are expensive to replace.

Sandblaster Use

QUICK USER MANUAL

1. CLOSE DOOR to Blasting Room.
2. Turn ON the Ventilation System (“On” button on right wall).
3. Turn on Air (turn yellow lever down counter clockwise).
4. Turn on the light inside Blaster.
5. When done, Turn “Off” Ventilator, Light & Air.
6. CLOSE DOOR on way out.

HELPFUL SANBLASTER TIPS

- If blaster not shooting grit, try placing nozzle against gloved palm and firing. This will blow out anything clogging the intake.
- If still not blasting properly, empty and sift blasting medium. There may be debris from previous blasting—plaster, paper, tape, glass fragments, etc—blocking the intake.