glass magic
GLASS FUSING INSTRUCTION

STACKOLOGY I

VERBEEK GLASS STUDIO

We are a full-service kiln-glass studio, gallery, and gift shop in the historic Factory East warehouse in Toronto's Leslieville neighbourhood.

Since 2018, we've helped over 3,500 people of all ages discover their creativity through glass-fusing workshops.

We run weekly workshops (from family-friendly projects to team-building events), offer open-studio time and teach advanced kiln forming, sculpting and casting; and, have a popular glass gift shop filled with unique studio-made gifts.



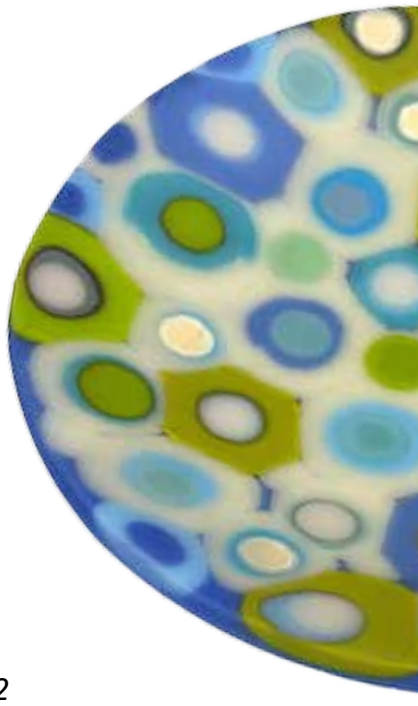

GENERAL DISCLAIMER: Everything has been done to ensure that the content of this eBook is accurate at the time of publication, however any discrepancies or inaccuracies that you might suspect or encounter are your responsibility for verification.

YOUR SAFETY: Given the range and variables with each fuser's materials, workspace, kilns and glass practices, we cannot prevent the actions taken by, nor guarantee the safety, of any individual consulting this eBook. These instructions are based on our informed experience but cannot guarantee successful outcomes for any glass projects you undertake as a result.

CONTACT: layne@verbeekglass.com, www.glassmagicbooks.com

INSTAGRAM: @glassmagicbooks, @verbeekglassstudio, @layneverbeek

2025-10 1.0



WHY I BEGAN GLASS MAGIC BOOKS

I'm grateful for the growing body of glass-fusing knowledge built through the shared experiences and generosity of artists worldwide.

I also benefit from meeting so many people through my workshops; sharing, laughing and often discovering new things about fusing.

With ***Glass Magic Books***, I also aim to share what I've learned and to present glass fusing in new and more visually engaging ways.

Yet, my ultimate goal remains the same: to help show adults that they ***can*** re-discover their youthful creativity. Glass fusing just happens to be a perfect way to do that!

CREATIVITY

Creating is a life-long journey of discover and self expression and, key to that, is learning to trust and grow our creative instincts.

So, I urge you to challenge some of the old and typical fusing methods that we all know and practice. Stop, and ask yourself...

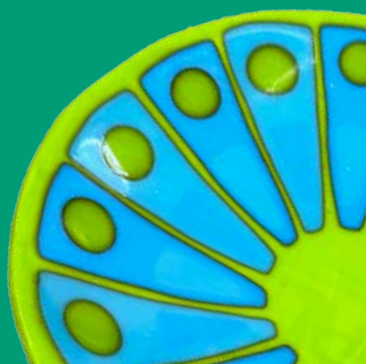
"WHAT IF..." DREAMING

WHAT IF I...?

- Change the order of steps—or turn the glass upside down?
- Pre fuse parts before assembling the rest?
- Fuse, smash, mix, and re-fire?
- Design for me, not for others?
- Borrow methods from other art forms?
- Trust my instincts, even when it feels counterintuitive?
- Try one of my wild ideas—or all of them?

The real magic of glass is self discovery!

Layne Verbeek is an award-winning Canadian sculptor and glass artist. His work includes sculpture, custom installations and wall art.



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STACKS: SURFACE TENSION AT ITS BEST

"How can I harness surface tension to make...?"

One of the very first things we learn as glass fusers is *surface tension*—how it works and how it affects glass during firing and fusing.

GLASS' HAPPY PLACE

The "6 mm rule" is glass artists' shorthand for the height glass wants to reach to when melted. The rule isn't just a reference point; it illustrates the universal behavior of surface tension and liquids.

6 mm

Left unhindered in the kiln, glass will always move—thinning and flowing outward or pulling in and thickening—until it reaches its natural equilibrium and height of 6 mm (¼").

LEARNING TO HARNESS SURFACE TENSION

For my open studio students, surface tension often reminds them who's boss.

When seeing one of their newly fired pieces, they'll often say, "But it was supposed to..." or "I wanted it to...".

That's when I remind them: surface tension is boss—and back to the drawing board they go.

SURFACE TENSION AND STACKS

Keep in mind the following ways surface tension is specifically used and affects the glass made in stack fusings:

1. Significant glass movement
2. Pieces will enlarge visually by area, but thin during flow that reduces each piece's thickness
3. Colour intensity may thin (glass is opalescent, not completely opaque*)
4. Pieces may change shape when they flow into neighbouring pieces
5. Upper pieces may cause lower pieces to deform as they melt down
6. Heat effects such as discoloration, devitrification are more likely to occur

SURFACE TENSION ALWAYS RULES... No matter how thin or thick, big or small, how it's assembled or how its placed in the kiln.

1. *To keep things simple, I refer to "opalescent" glass as "opaque" throughout this book.*

HOW THIS BOOK WORKS

POPULAR STACK DESIGNS IN NEW WAYS	
Square Stacks **Mixed** Stacks **Transparent** Stacks **Floating** Stacks **Radial** Stacks **Circle** Stacks	Details Examples Ideas

OR

NEW STACK DESIGNS	
Basket Stacks **Pooling** Stacks **Node** Stacks **Flower** Stacks **Mid-Century** Modern	Details Examples Ideas

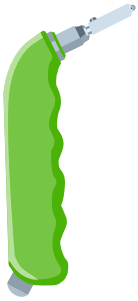
+

7 TIPS FOR ALL STACKS
1. Design Principles
2. Making Dots
2. Cutting for Stacks
3. Stack Assembly
4. Let the Kiln Do the Work
5. Firing Schedules
6. Post Firing

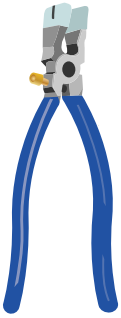
+

HEAT & A BIT OF MAGIC

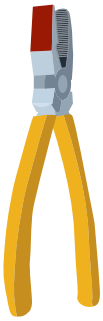
TOOLS AND MATERIALS



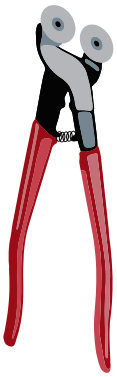
CUTTER[1]



RUNNING PLIERS

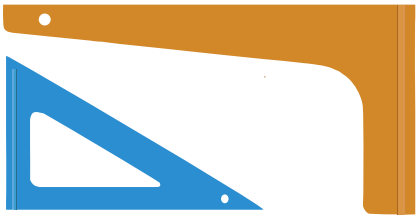


BREAKER GROZIERS[2]

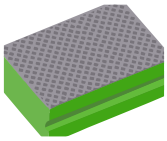


MOSAIC NIPPERS

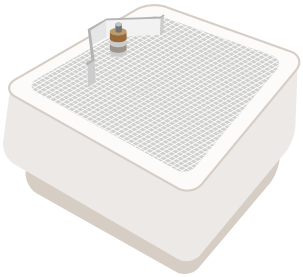
FINE SIFTER



GLASS CUTTING SQUARE WITH GUIDE EDGE



DIAMOND PAD



GLASS GRINDER

1. *Don't put oil in the cutter as it causes scale and devitrification. This is a holdover from stained glass making.*
2. *I paint the flat prong of the groziers red so students can quickly identify which grinding prong is up.*

KILN WASH VS KILN PAPER

KILN WASH VERSUS PAPER

At our studio, for nearly all of our fusing projects, we coat shelves with kiln wash instead of using kiln paper.

This is particularly important for stacks because the flowing glass can often pick up and bond with the kiln paper as it moves

WHY?

- Much cheaper and can be used for multiple firings
- Reduces silica dust exposure (shelf scraping and re-wash is far less frequent than paper replacement)
- Cleaner results when glass will move or spread across the shelf (e.g., stacks, cabochons, flow designs)

KILN PAPER

We use kiln paper sparingly due to it's cost and because lasts only 1–2 firings.

WHEN WE USE KILN PAPER

- For assembling, gluing, and transferring small or delicate designs that would otherwise require us to build the piece directly in the kiln
- Kiln carving projects

GLUING FOR THE KILN

GLASS TAC™ VERSUS OTHER GLUES

Our studio uses *Bullseye GlassTac™ Gel* for all assembly projects. We have had mixed experience with other common glues with some leaving residue or mineral deposits on the glass after firing. (I do find *Aleene's ClearGel Tacky Glue™* is good (in small amounts) for stacks as it is quick setting. Too much, however, can also leave residue after firing.

CRAZY GLUE (CYANOACRYLATE)

Many studios and fusers use various forms of crazy glue for its practicality, but we've discontinued it due to staff members experiencing asthma-like symptoms after prolonged use. Use with caution.

OCCUPATIONAL ASTHMA AND CRAZY GLUE

Occupational asthma is an allergic reaction to inhaling the strong vapors of cyanoacrylate.

Extended exposure to cyanoacrylate can cause shortness of breath, wheezing, coughing and chest tightness.

GLUING FINISHED PIECES

TWO-PART EPOXY

There are a few fast-acting two-part epoxies that work well for bonding glass-to-glass. Ensure you use an epoxy that clearly states it dries and remains clear as many epoxies yellow over time.

Our preferred epoxy is **JB WELD CLEARWELD™ QUICK SETTING EPOXY - CLEAR**. It usually sets in less than 10 minutes. We've used it for over seven years with minimal issues. And, if the bond does come apart, we can re-glue with it easily.

ULTRAVIOLET GLUE

Ultraviolet (UV) glue, applied and cured under UV light, is a quick and effective way to bond glass-to-glass. However, it works best when the surfaces of the glass pieces are smooth and flat (epoxy is better for uneven surfaces) and at least one of the glass items is clear or a very light transparent colour.

Our preferred UV glue is **LOCTITE 349™**, and we use a LED UV light that emits 365nm light.

Note: UV light doesn't travel well through red glass and is slow or inconsistent with other glasses that have dark tints.

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TIPS 1: DESIGN PRINCIPLES

These six design principles can help you create a new pattern: its layout, colours, stack combination, placement and the glass needed.

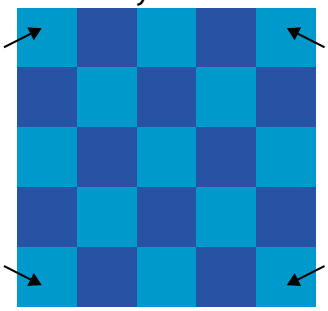
1 ODD VERSUS EVEN ROWS AND COLUMNS

When working with multiple coloured pieces, think about whether your design works best with an even or odd count.

Odd numbers often create stronger symmetry and a more balanced focal point.

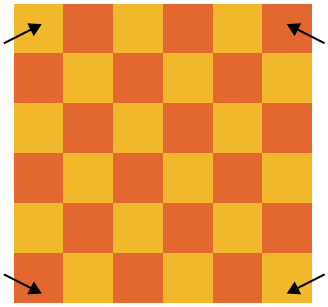
Odd: 5 strips

5 x 5 array



Even: 6 strips

6 x 6 array



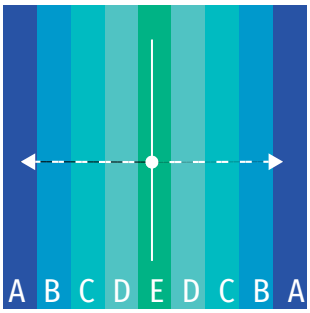
2 SYMMETRICAL OR PARALLEL LAYOUTS

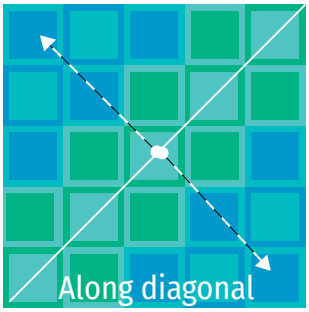
While instinct usually guides us toward what "looks right," a closer look at layout patterns can help when you're stuck.

Exploring symmetry, parallels and or deliberate shifts in alignment is a quick way to refresh or rethink a design.

Symmetrical

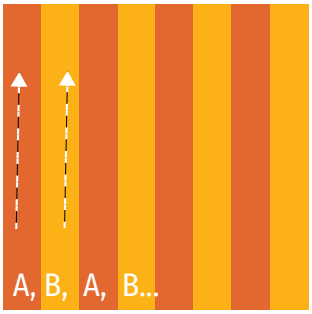
Arrange from a center line outward, odd only

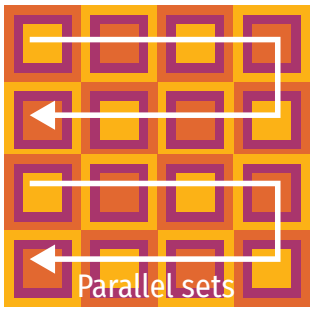




Parallel

Any type of pair, repeated, even only



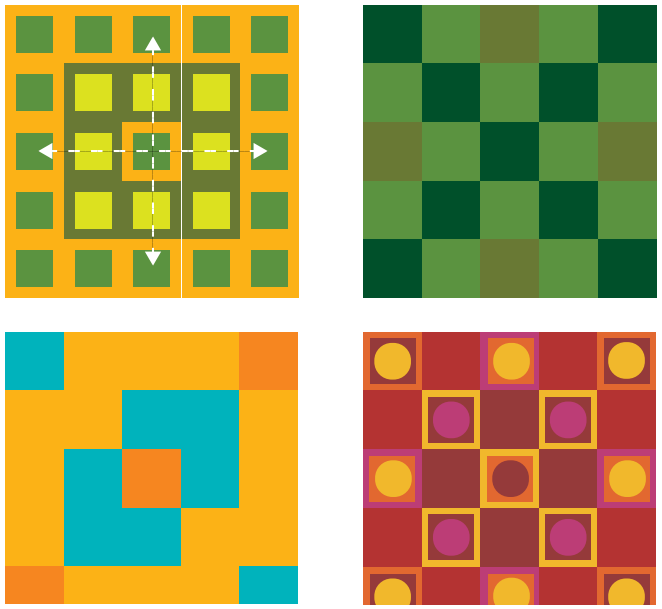


3 RADIAL LAYOUTS

Creating layouts of pieces that are both symmetrical and arranged outward from a center line or center point create visually stimulating “radial” designs.

Working with multiple shades of one colour, or graduated sets of colours shows of radial design particularly well.

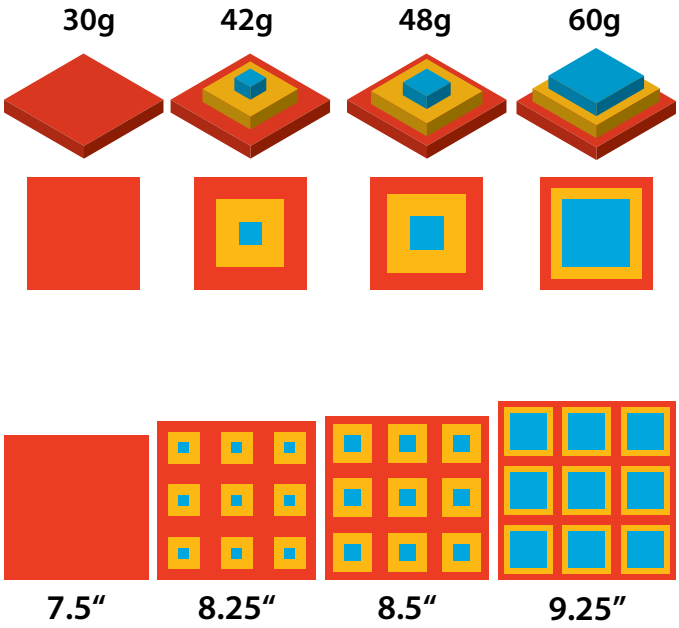
Radial
Symmetry from a center point, odd or even



4 STACK SIZE COMBINATIONS

The illustrations at right show the total weight of three different 2.5 x 2.5” stack combinations.

As you can see, the size and resulting weight of each layer relative to the one below (or total weight) is just as important as the number of layers used.



7.5 x 7.5” 6mm tray (clear + red) compared with the final dimensions of trays made each of the stack combinations (clear + 9 stacks).

5 STACK POSITIONING

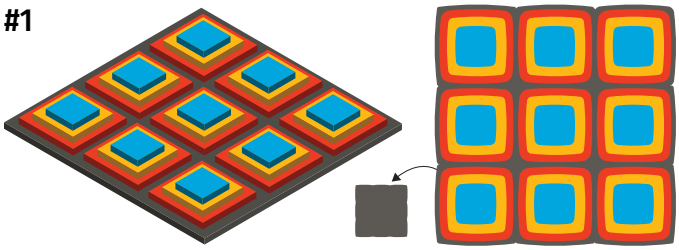
Final edge shape is influenced by ***both*** stack position and weight: heavy or close-to-the-edge stacks cause pronounced contours; light or inward stacks result in smoother edges.

6 STACK SPACING

STACKS SPACED APART ON ONE LAYER

When stacks are spaced evenly on a base but leaving the base colour revealed, the base glass will pull up between and around the stacks until the 6 mm is reached (#1).

#1

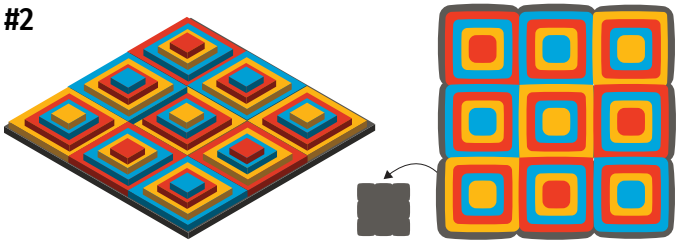


STACKS TIGHTLY FITTED ON ONE LAYER

When the first layer of the stacks are tightly fitted, they essentially form a new second layer "base" (#2).

In this case, the final piece will show little or no black around its edges. The edges will be less rounded too.

#2



7 ONE VERSUS TWO BASE LAYERS

ONE LAYER BASE

To ensure a single-base piece won't change size, the stacks' weight must equal that of the base. Spacing the stacks evenly on that base *can* also create scalloped edges (#1).

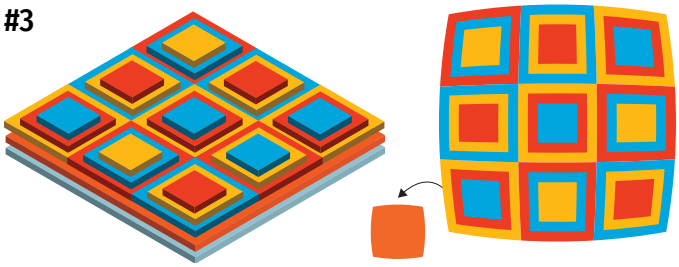
However, uneven placement leads to varied edges and an unpredictable overall shape. (Not that that's a bad thing!)

TWO LAYER BASE

Two-layer bases change everything.

Already 6mm, they act like a deep pool that absorbs and expands with the downward flow of the heavier stacks. This results in a pleasing "inflated" style (#3).

#3



TIPS 2: MAKING DOTS

1 REGULAR AND LARGE DOTS

RELIABLE SIZING

Dots are fun to use, but not the easiest to make. At right are common dot sizes and the glass needed to make them. For many dots of a consistent size, its best to score and cut a grid of same sized squares at the same time. *See DOT FUSE schedule on page 19.*

DOTS - INCHES	
Dot Size	Squares to Fuse
1/8"	1 Coarse Frit
3/16	1/4" square
1/4	3/8"
3/8	1/2"
1/2	2 x 1/2"
3/4	2 x 5/8" or 4 x 1/2"
1	2 x 7/8" or 4 x 5/8"

DOTS - MILLIMETERS	
Dot Size	Squares to Fuse
3mm	1 Coarse Frit
6	9mm square
9	12mm or 2x 6mm
12	15mm or 2 x 9mm
15	3 x 12mm
20	25mm or 2 x 15mm
25	2 x 20mm or 4 x 15mm

EASY DOT CLEANING

Fired dots (especially opaques) often come out with kiln wash stuck to the bottom.

No worries! Five minutes in a citric acid wash does the trick. *See TIPS #7, item #3, page 23.*

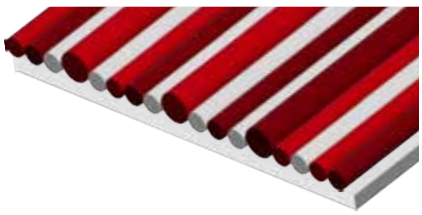
DEVITRIFICATION

Dots have a much higher risk of devitrification (*page 24*) as making them requires longer holds at higher temperatures; so its best to avoid devit-prone colours.

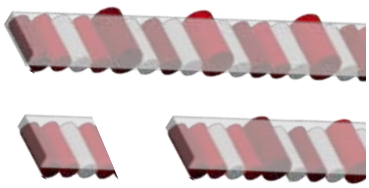
2 STRINGER DOTS

Another way to make fun fused dots is to use stringer. Tack fuse stringers of your choice onto a small sheet. Then cut them into squares for full fusing. We make these unique dots, varying sizes for ornaments and projects all year round.

1. Glue row of stringers on a sheet of clear. CONTOUR FUSE.



2. Turn sheet over, to score smooth side. Cut strips into squares.



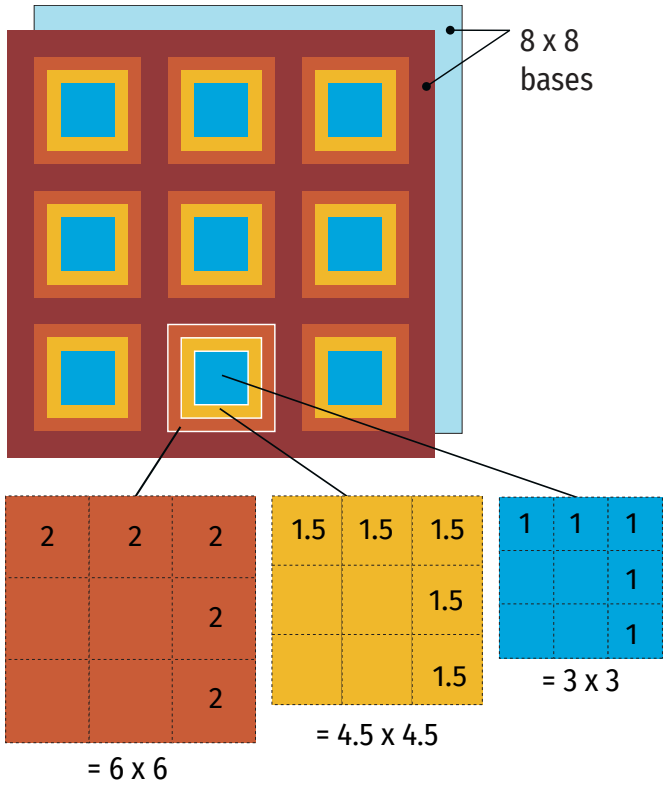
3. Lay squares,

TIPS 3: CUTTING FOR STACKS

1 CUT PIECES FROM SINGLE-COLOR SHEETS

Whenever possible, cut all squares or pieces of a given color from one sheet.

Starting with a single, pre-measured sheet makes planning easier and ensures a more consistent set. (Cutting equal squares from multiple sheets is rarely exact!)



2 MEASURE AND SCORE CONSISTENTLY

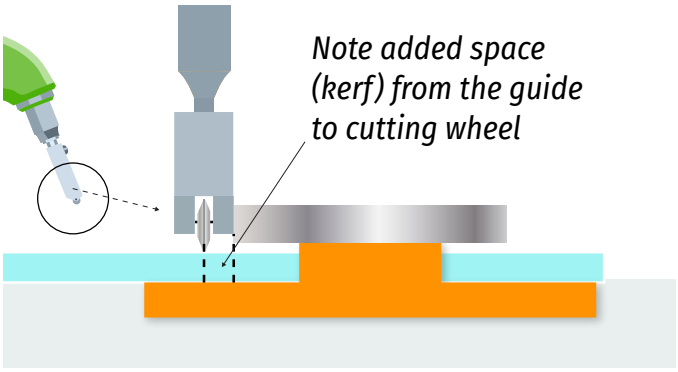
Whatever system you use (Morton System™, Studio Glass Cutter™, ruler and square), always score from the same side of the center guide.

Guides can drift, may not be perfectly centered, and most of us favor one side. Consistency keeps pieces accurate.

3 ACCOUNT FOR THE KERF SPACING

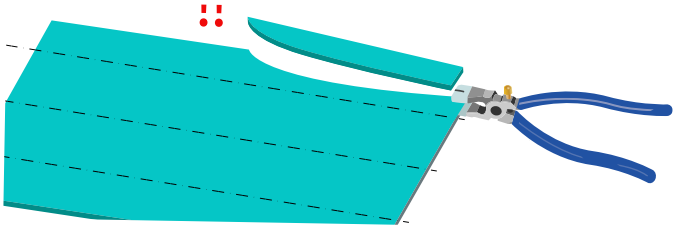
The cutter's head holds the wheel slightly away from the guide, adding about 1/16" (1.5 mm) to each cut.

While this may seem minor, small differences can add up fast, leaving final widths of a project wider or narrower than planned.



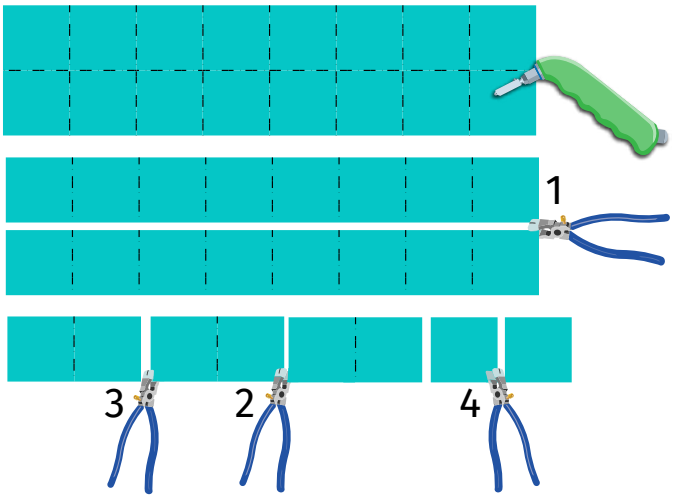
4 THE RULE OF HALVES

We've all faced the frustration of running one or more strips of a larger piece of glass, but, instead of following your scorelines, the cracks veer off to one side. You try again, it fails again and you waste more glass.



WHY?

We forget the "rule of halves." A score is just a suggested path. If it's not near the center of the sheet, the crack will likely ignore the score and run towards the narrower side of the glass.

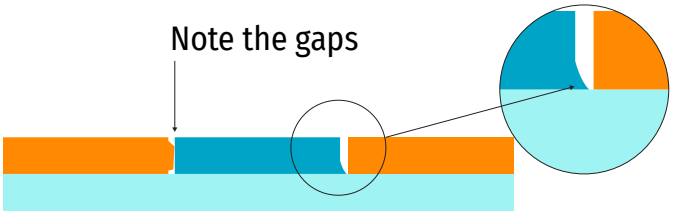


For single strips: cut off ¼ or ⅓ of the sheet, score at least two strips of the size wanted, and use one.

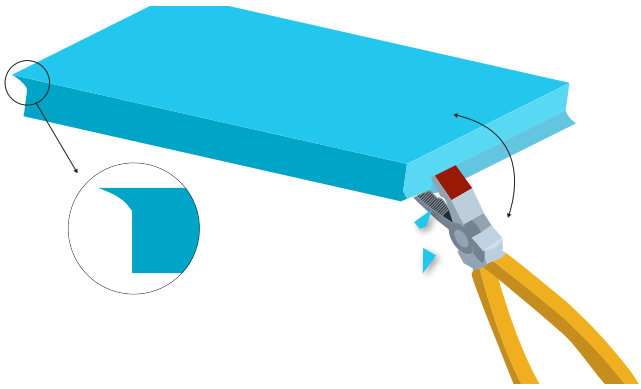
For multiple strips: always run the center score first, then split each new piece in half until you reach your desired widths.

5 TRIM UNEVEN EDGES

Even with careful glass scoring, some pieces break unevenly, leaving sharp "needles" along their edges. This prevents you from being able to align pieces tightly.



So, after running, check every piece and trim any needles with groziers, a diamond pad, or grinder.



6 CUTTING SMALL CIRCLES (1-5” / 2-12 CM)

1. RUNNING ARCS

Trace: Draw a circle on a piece of glass slightly larger than the desired final size (this allows easier trimming and reduces waste).

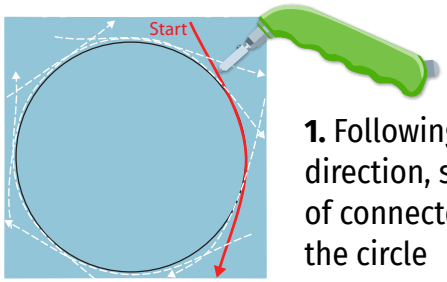
Score Arcs: Score the circle using a series of arcs—all made in the same direction.

Starting off the line, score to and around the line a small amount and then off. Again start of the line, placing the cutter in the groove of the previous score, follow the line, score to join the previous score and then off. Repeat until the circle is complete.

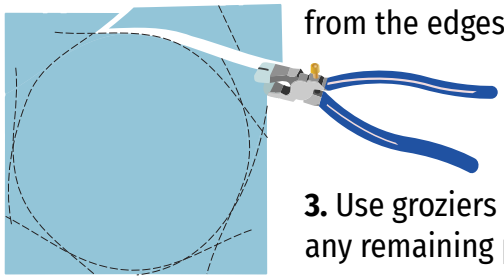
Small Circles: Use breaker groziers to remove the arcs.

Large Circles: Use running pliers to remove sections around the circle.

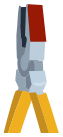
Finish the Edge: Use groziers (or grinder) to remove and or grind off remaining bits.



1. Following the same direction, score a series of connected arcs around the circle



2. In order, run the arcs from the edges



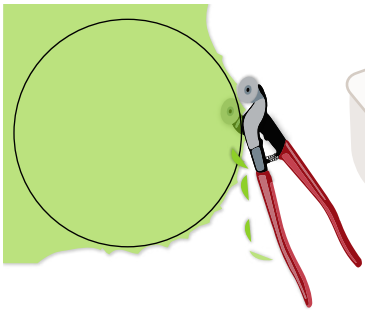
3. Use groziers to trim any remaining points

2. NIPPING

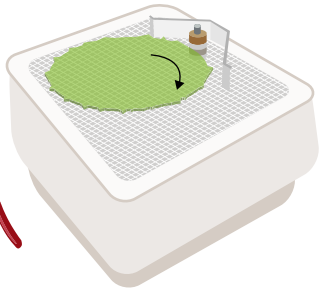
Trace: Draw a circle on a slightly oversized square piece of glass.

Cut with Nippers: Use mosaic nippers to nip along the line in one direction. (Pieces will alternate between large and small depending on the position in the circle.)

Finish the Edge: Use groziers (or grinder) to remove and or grind off remaining bits.



1. Nip glass along the line.You may need a second pass.

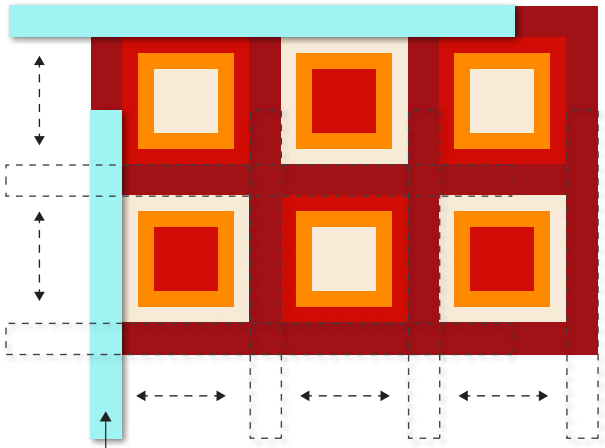


2. Grind edges if needed.

TIPS 4: STACK ASSEMBLY

1 USE A GUIDE(S) TO SPACE STACKS EVENLY

To ensure proper spacing, cut an extra strip of glass to the desired width and use it as a spacer while gluing your strips in place.



Use spacers for mini stack gluing

2 BALANCE THE UNEVEN STACK ROWS

It's common to find some of your rows of stacks are slightly longer or narrower than the base.

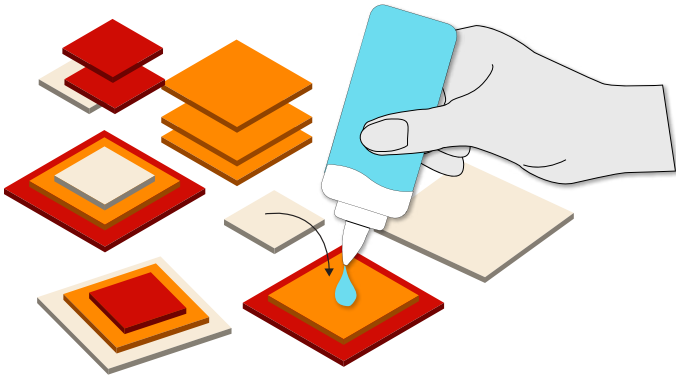
Center these rows just the same— some will be shorter than the base, some might hang over a bit on the base. These small overhangs or shortfalls usually disappear after a full fuse.

3 GLUE MINI STACKS FIRST

Centering the pieces all at once on the base can be tricky as they can shift as the glue sets.

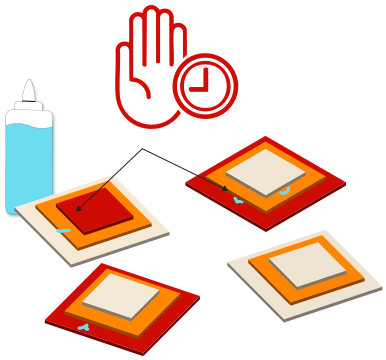
A better approach is to glue your mini-stacks first. Once they are nearly dry, double-check their alignment.

Then, once the glue is completely set, glue these mini stacks onto the base glass piece(s).



4 ALWAYS LET GLUE COMPLETELY DRY BEFORE MOVING

One of the most common hiccups in stack making is moving a piece too soon after gluing. (Pieces can slide on the glue before drying.)



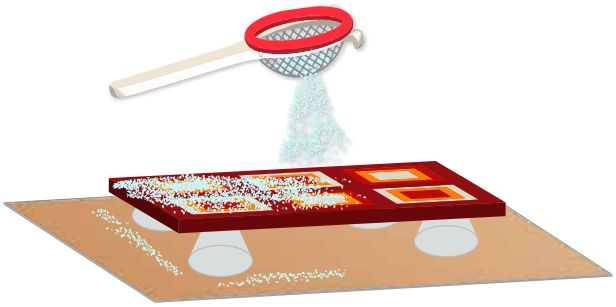
5 SPRINKLE CLEAR GLASS POWDER BEFORE LOADING

Adding a layer of clear glass powder and re-firing a piece can remove devit and heat stress.

But while making the stack samples for this book, I found that adding a coat of powder ***in advance*** helped me avoid most re-firings.

With the project on raised mounts, sprinkle a thin layer of clear powder over the entire surface.

RETURN FOR FULL FUSE: Don't use a TACK or CONTOUR schedule as the powder will not melt completely or reach full gloss.



STEP 1: Place project on raised mounts

STEP 2: Sprinkle from 8" /20 cm above

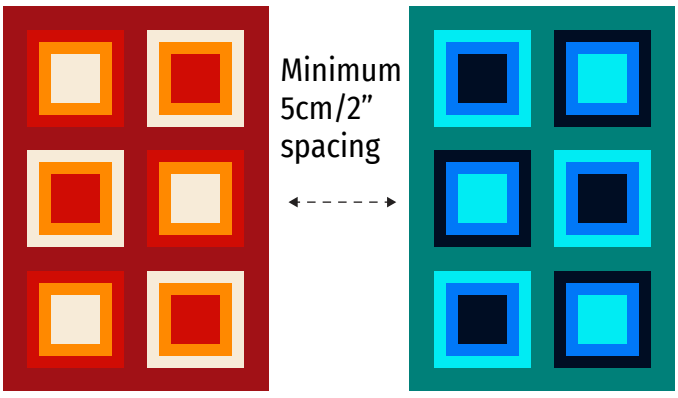
Don't apply the powder in the kiln, as it will fall around the edges and fuse into needles

6 DOUBLE-CHECK STACKS IN THE KILN

To double-check, take a photo. I find zooming into a photo helps me verify the many narrow spacings.

7 USE WIDER SPACING IN THE KILN

Stack projects are usually comprised of more glass than typical 2-layer projects and will spread out during firing and risk fusing with their neighbour. Account for this when loading.



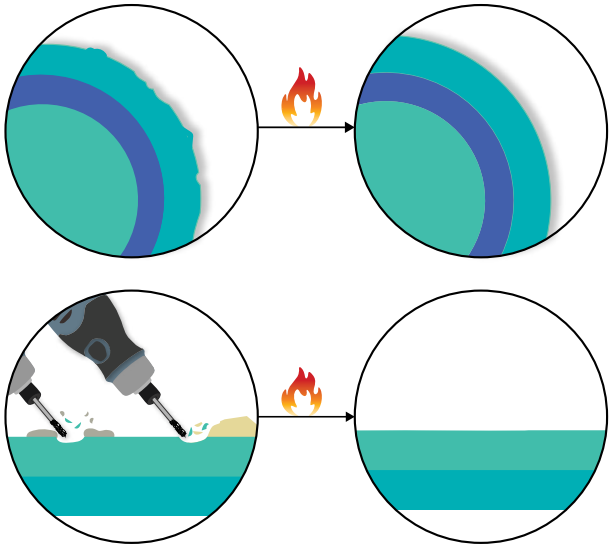
TIPS 5: LET THE KILN DO THE WORK

I often remind my students to "let the kiln do the work" wherever possible.

The benefit of being able to re-fire glass one or a few more times means we can turn to the kiln to fix mistakes made during a firing or limit the amount coldwork needed to finish a piece.

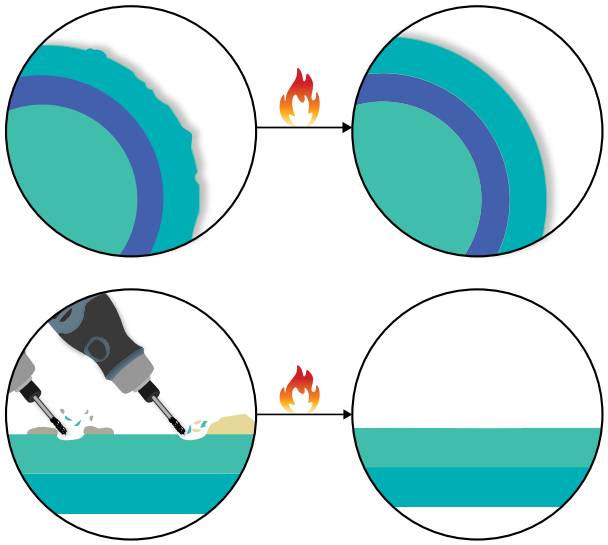
SO, GET YOUR KILN TO:

1. **Round the edges or level the surface** of a piece by re-firing it at FULL FUSE with the same or longer hold (~1490 °F, ~810 °C).
2. **Fix the surface** of a piece that you needed to grind into to remove unwanted bits (a frit dot of colour that got there by mistake, or a tiny piece of kiln material that fell onto the piece during firing)
3. **Fire polish** a piece that you finished with lap or hand-grinding. *FIRE POLISH (1300-1350 °F, 732 °C)*
4. **Cover devitrification** by dusting the piece with a layer of clear powder and returning it for a second *FULL FUSE* (1490 °F, 810 °C).



SPECIFICALLY FOR STACK PROJECTS:

5. **Make mini circles** (AKA dots) of various sizes that can then be stacked and fused to include circles into your a pattern
6. **Lock custom elements** like stringers, and accessory glass by tack fusing your design in advance. This avoids some shifting that happens all of a projects many parts are fired in one go (*See page 27*)



TIPS 6: FIRING SCHEDULES

With a quick search, you'll find countless kiln schedules—some tailored to specific kilns, others based on personal experience with heating, processing, and cooling rates.

Like many, I started with manufacturer and teacher schedules, refining them through trial and error. Over time, I have found certain adjustments simply work better for me.

Many prefer slow or 2-3 step ramps and longer-than-necessary anneal times. I note where my experience differs, so you can decide what's best for you.

NOTES

MANUFACTURER SPECIFICATIONS

The standard fusing and anneal temperatures shown reflect Bullseye's and Oceanside's current online specs.

OCEANSIDE

Extra Ramp Step: Oceanside has an initial ramp step of 282°F/139°C to 1050°F/566°C however many artists who work with Oceanside glass do not include this step.

Extra Anneal/Cool Steps: Oceanside also lists two steps after the standard 60 minute 950°C annealing. Rely on your experience here.

BULLSEYE

Second Anneal Step: Bullseye recommends a second annealing step (700°F / 371°C), however, my experience is that this step is unnecessary for most 6mm projects.

FOR THE FOLLOWING SCHEDULES

1. **Bubble Squeeze for Dots, Small Pieces, or Tacked Pattern Pieces:** Bubble squeeze is not needed. These pieces are small and heat fast during ramp-up. Holds around 1200°F (650°C) are needed for projects sized from two-layer coasters and up.
2. **Annealing Small Pieces:** Small 6 mm pieces like dots and tack-fused pattern-glass require little or no annealing. These cool enough during the kiln's descent and will also be annealed once part of a final project.
3. **Temp Range:** Some schedules show a range (e.g., 1350–1400 °F). Because heating glass is affected by many variables, all schedules used in fusing should be seen practical guidelines rather than exact targets.
4. **Legend:** I have noted wherever a temperature target varies between

Annealing target:	Peak fuse target:
900°F | 950°F	1490°F | 1465°F
482°C | 510°C	810°C | 796°C

DOT FUSE °F			
STEP	RAMP	TEMP	HOLD
1	400	1500	15-30[1] min
2	9999	**900** | **950**	15[2] min

DOT FUSE °C			
STEP	RAMP	TEMP	HOLD
1	204	815	15-30[1] min
2	9999	**482** | **510**	15[2] min

1. 15 minutes for pieces smaller than 1/2" / 1 cm, larger pieces need more time.
2. I've included this minimum anneal, but I find it's typically not necessary.

MINIMUM TACK FUSE °F (SMALL PIECES ON 1 LAYER)			
STEP	RAMP	TEMP	HOLD
1	350	1350	5 min

MINIMUM TACK FUSE °C (SMALL PIECES ON 1 LAYER)			
STEP	RAMP	TEMP	HOLD
1	177	732	5 min

1. Glass tack begins to tack at 1250 °F / 677 °C, so holding at a slightly higher temperature is sufficient for a good tack.
2. No anneal required.

TACK FUSE °F (2 FULL LAYERS - 6MM)			
STEP	RAMP	TEMP	HOLD
1	300	1350-1400	5-10 min
2	9999	**900** | **950**	60 min
3	100	**700** | **800**	1[1] min

TACK FUSE °C (2 FULL LAYERS - 6MM)			
STEP	RAMP	TEMP	HOLD
1	149	732-760	5-10 min
2	9999	**482** | **510**	60 min
3	40	**371** | **385**	1[1] min

1. Many schedules put 0 minutes here, I put 1 minute to minimize confusion when viewing schedules on my controllers.
2. For 3 or more layers (9mm +) consult your manufacturer's THICK SLAB annealing specifications.

STANDARD FULL FUSE °F			
STEP	RAMP	TEMP	HOLD
1	350	1225	60 min
2	350	**1490** | **1465**	10-25[1] min
3	9999	**900** | **950**	60 min

STANDARD FULL FUSE °C			
STEP	RAMP	TEMP	HOLD
1	176	663	60 min
2	176	**810** | **796**	10-25[1] min
3	9999	**482** | **510**	30 min

1. Limit holding square projects to 10 minutes—any longer and the corners will start to round too much.
2. Holding round projects longer can be helpful—particularly if the glass is uneven or has irregular edges.

STACK FUSE °F			
STEP	RAMP	TEMP	HOLD
1	300	1225	60 MIN
2	350	1500-1525[1]	45-60 MIN[2]
3	9999	**900** | **950**	60 MIN

STACK FULL FUSE °C			
STEP	RAMP	TEMP	HOLD
1	149	663	60 min
2	176	815-829[1]	45-60[2] min
3	9999	**482** | **510**	60 min

1. I prefer stack fusing at 1500–1525°F (816–829°C). Some artists hesitate to take their kilns this high, concerned about devitrification. But in my experience, if devit is going to occur, it will— even at a few degrees lower. Firing at this temperature allows the glass to become more fluid and ensures a more even flow.

*2. For any stack project that has 3+ layers that weigh as much or more as the 2 layer base, **a lot of flow** has to happen on the way to 6mm. A 45-60 minute hold ensures these projects rarely have to be re-fired.*

FIRE POLISH °F			
STEP	RAMP	TEMP	HOLD
1	150	1000[1]	1 MIN
2	350[2]	1350[2]	5-10 MIN
3	9999	**900** | **950**	60 MIN

FIRE POLISH °C			
STEP	RAMP	TEMP	HOLD
1	66	538[1]	1 min
2	176[2]	732[1]	5-10[2] min
3	9999	**482** | **510**	60 min

1. Glass can crack at temperatures below 1000 °F / 538 °C. However, you can ramp at any speed without issue once the glass is above this temperature.

2. I prefer to ramp faster to target at this point. Once glass reaches 1250 -1300°F / 677-704 °C it is soft enough to move and has already begun to polish. While this is no issue for 6MM of glass, 9mm+ glass can soften too much if it is heated too slowly to this target.

SLUMP °F (TRAYS)			
STEP	RAMP	TEMP	HOLD
1	300	1180[1]	5 MIN
3	9999	**900** | **950**	60 MIN

SLUMP °C (TRAYS)			
STEP	RAMP	TEMP	HOLD
1	149	538[1]	5 min
3	9999	**482** | **510**	60 min

1. Trays take less heat and less time than bowls to slump.

SLUMP °F (BOWLS)			
STEP	RAMP	TEMP	HOLD
1	300	1200	8-10 MIN
3	9999	**900** | **950**	60 MIN

SLUMP °C (BOWLS)			
STEP	RAMP	TEMP	HOLD
2	149	649	8-10 min
3	9999	**482** | **510**	60 min

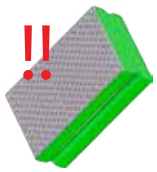
TIPS 7: POST FIRING

1 PROJECT SURFACE OR EDGES ARE UNEVEN

If the stacks or parts of the plate remain mounded or uneven, it was not held long enough at the process temperature (top temperature where glass melts).

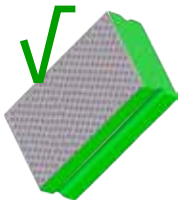
THE FIX

- **RE-FIRE:** Double check the piece for kiln wash, trim excess sharps or needles on the glass and return to the kiln for another full fusing; OR
- **TRIM AND RE-FIRE:** If you suspect the edges may not even out after another full fusing, consider either trimming some glass off adding a square or two to the stack where more glass will likely fix the issue.



Finished Stacks

Never use a pad on the top surface of your finished stack, the scratches will remain. Use it sparingly to grind needles and edges.



Stacks to be Re-Fired

Only use a diamond pad on the top surface of your stack if you intend to refire it on full fuse.

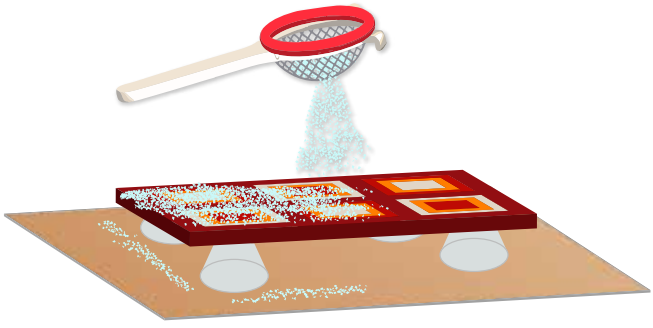
2 PIECES COME OUT ROUGH OR DULL

Stacked designs are prone to devitrification as these require longer holds at higher temperatures *(see page 24)*.

THE FIX

Re-fire with a coating of clear glass powder. On raised mounts, sprinkle a thin, layer of the powder evenly across the piece.

RETURN FOR FULL FUSE: Don't use tack, contour or slumping schedules as the powder will not melt completely or reach full gloss.



STEP 1: Place project on raised mounts

STEP 2: Sprinkle from 8" /20 cm above

Don't apply the powder in the kiln, as it will fall around the edges and fuse into needles

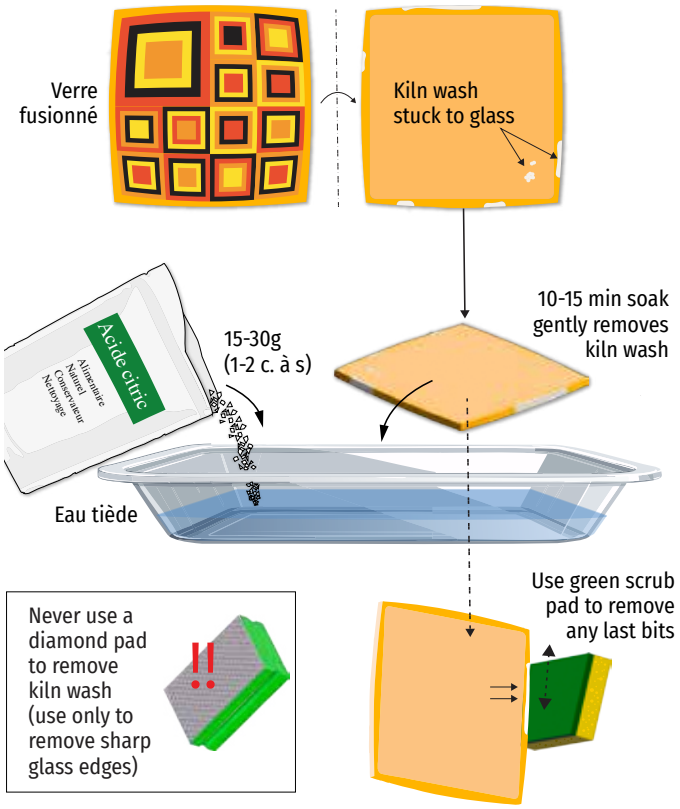
3 KILN WASH STUCK TO THE BOTTOM OF THE FIRED GLASS

We've all felt the frustration of opening the kiln to find white silica stuck to our pieces. This occurs with:

1. **Opaque colours** that touch a shelf. (*See sidebar at right.*)
2. **Uneven builds or stacks** as these require glass to (spread out or contract) to reach 6mm. This causes the glass to drag across the shelf, picking up kiln wash or paper.*

THE GOOD NEWS: FOOD-GRADE CITRIC ACID

Food-grade citric acid is a fuser's best friend! Mixed with warm water, it quickly removes residue from almost any piece, big or small!

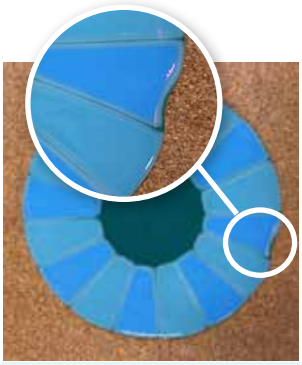


WHY DOES KILN WASH STICK TO GLASS?

Transparent glass is coloured by oxides (cobalt for blue, selenium for reds), but these concentrations are low enough that they let light to pass through the glass.

Opaque glass contains more oxides and ***opacifiers*** (e.g., sulphur, cadmium) that scatter or absorb light.

As a result, these additives change the viscosity of the glass (how it flows) and how it interacts with surface kiln wash or paper.



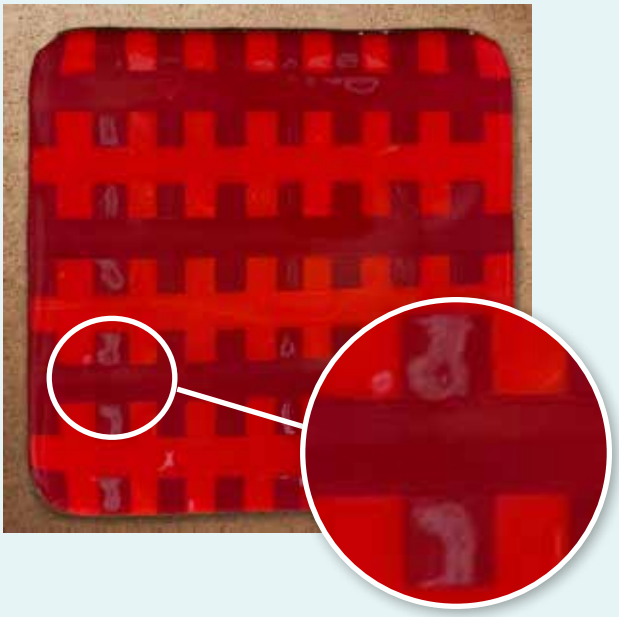
LESSON LEARNED! I was not thrilled to discover that part of this piece's edge—a piece that I very carefully built—failed to flow and round. So I checked its reverse side.

STUCK KILN WASH: This patch meant that the kiln wash was too thin. The flowing glass picked it up but was then stopped on the now bare patch of the ceramic shelf below.

DEVITRIFICATION AND HEAT EFFECTS ON FUSED GLASS

Devitrification (devit) is when kiln-fired glass has lost its smooth, glossy surface and instead develops a dull, hazy, or rough crystalline appearance.

Glass atoms typically fire and settle in a way that allows light to easily pass through the surface creating the “glassy” effect. However, some conditions can cause the glass atoms to crystallize. This interrupts and scatters the light, creating a dull effect.



CAUSES

The Devit Risk Zone: 718–790 °C/1325–1450 °F: Hot enough for glass to start to melt but not enough for it to fully melt back properly.

Long Heat Holds: Some glass colours are more likely to form crystals the longer they sit at high temperatures (718+ C°/1325 °F).

Impurities and surfaces: Dust, oils, or grinding residue on the surface can give a “starting point” for crystals to be more easily created

Colour Composition: Some glass colours have a chemical makeup that lowers the barrier to forming crystals.

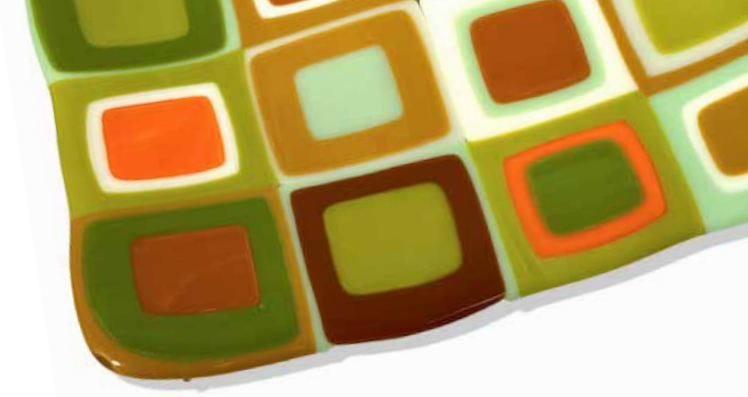
Multiple Firings: Each round of heat exposure is cumulative to the glass and provides another chance for the glass to devitrify (particularly for opaque glasses).

WHY DEVIT APPEARS MORE OFTEN WHEN FUSING STACKS

- Longer, high heat holds
- Multiple firings, and
- The use of specific devit-prone glass colors

(I find devit appears frequently with certain opaques: whites, reds, ambers and lighter blues.)

1. SQUARE STACKS



Stacking squares is very satisfying and the range of ways you can combine colours and assemble pieces is endless.

As the majority of steps for assembling stacks are covered in the ***Tips Section*** (pages 6 to 21) this and each of the following stack technique sections will focus on:

1. **DETAILS:** Additional points and directions specific to the stack style
2. **EXAMPLES:** Photos and notes of stack pieces that our studio has made
3. **IDEAS:** Illustrations of new stack designs and colour combinations to help spark your creativity

DETAILS

It's important to see stacking as one of *many general techniques or methods* in glass making. Stacking is also a versatile technique and not limited to just trays or bowls.

Think of stacking, weaving, raking, and edge construction as just some of the many tools available to you. You can use a technique alone or combine it with others to experiment and create your desired effects.

I also make mini stacks that I fuse with other glass to find new patterns and effects. Stacking patterns go well in coasters, magnets, key chains, sun catchers, tealights, etc.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	**REACTIVES**
IRIDESCENTS	ACCESSORY GLASS

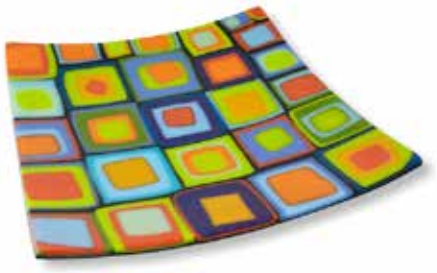
DISPLAY A STACK: Make a stack you want to display. At the same time, fuse a base.

Smooth edges bond your stack to a 6mm base with a two-part epoxy (*See page 6*).

EXAMPLES

FIRST LEVEL PIECES AS A LAYER: Filling same-sized squares over a base can give scalloped edges.

VARIED LAYOUT: Varied square sizes and placement fuses to irregular edges.



FINISHED EDGES: Uneven edges are best ground and finished to square.

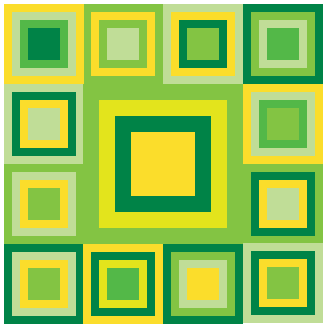
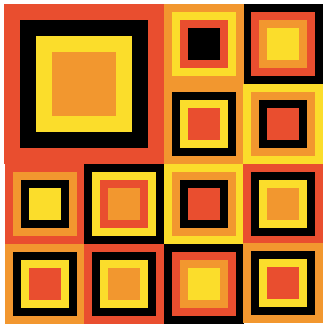
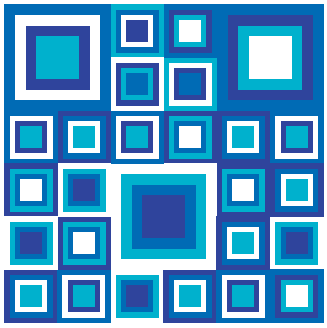
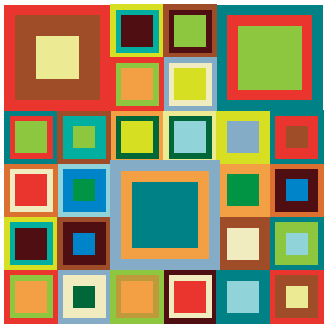
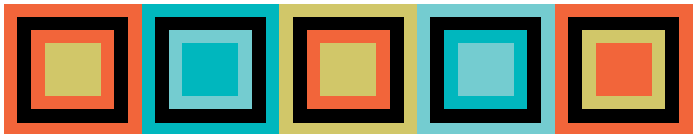
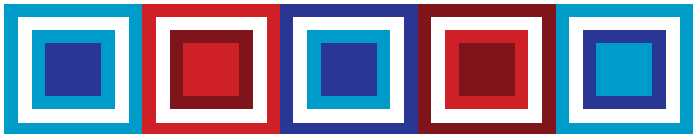
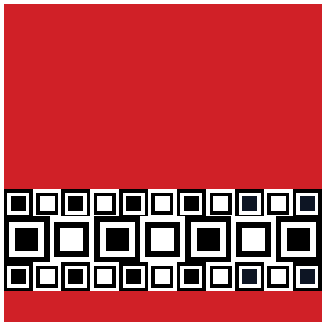
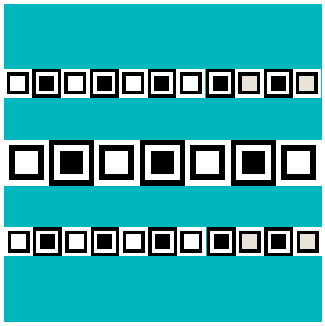
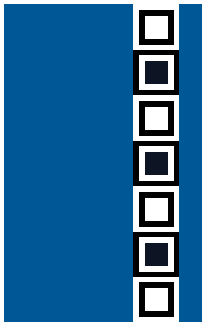
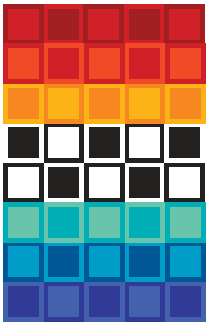
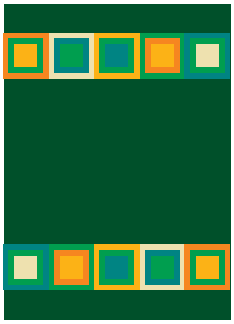
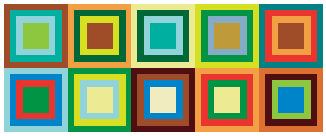
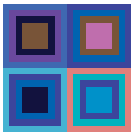
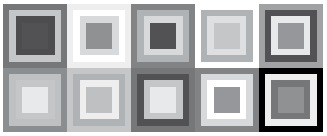
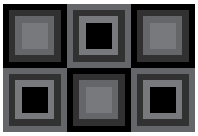
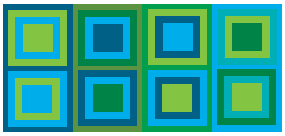
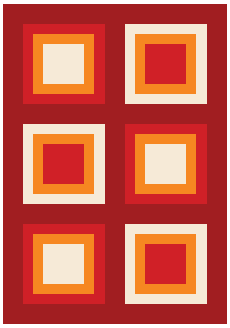
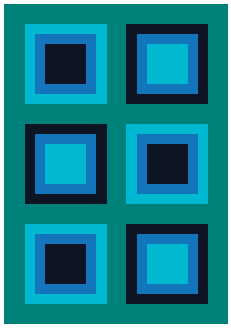
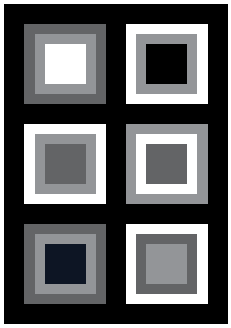
LARGE SQUARES: Using fewer colours, fewer layers and larger pieces will fuse to calmer, less busy designs.

STACK MOUNDS: Firing just to the point where stacks are rounded but raised can be a neat effect for a center piece.

IRIDESCENT GLASS: Due to its metal coating iridescent glass crackles during fusing as the metal will not stretch or flow.

RING EFFECT: Top every stack with the same base colour to create this ring/loop effect.

IDEAS

2. MIXED STACKS

The most freestyle of stacks is the mixed stack. I found that initially I went crazy mixing any scrap glass i had to make a new piece.

But, over time, I found that mixed stack designs could be elevated with a little bit of planning and interesting colour arranging.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

DETAILS

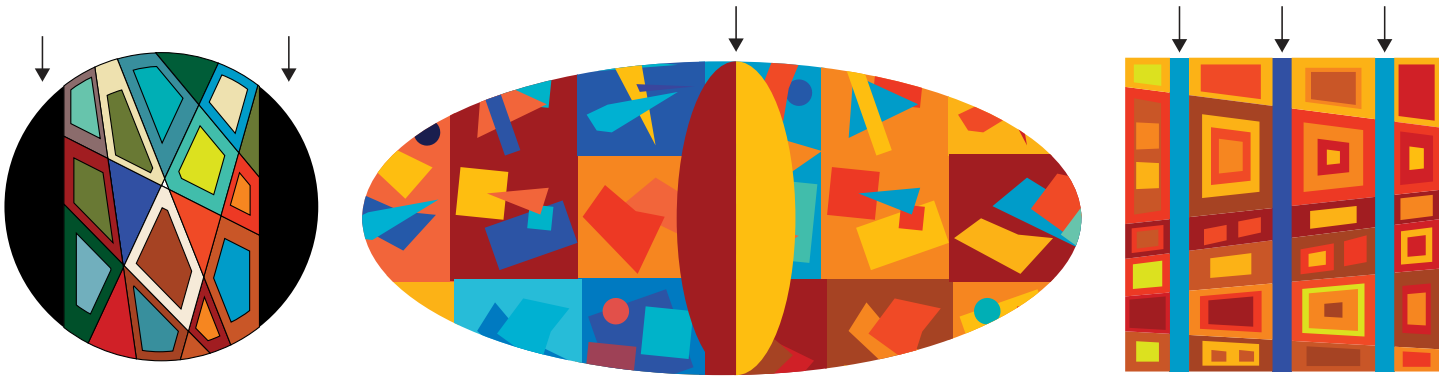
CONSIDER FOCAL POINT(S)

A design tip that I frequently give to my students is:

"Even if your design appears random—in its shapes, sizes, or colours—you can show the viewer that this was your intention by including one or two focal points."

Focal point(s) signal to the viewer that, although the design may appear random or unplanned, the placement of these feature(s) indicate the artist's intent. (*See below.*)

Focal Points with "Randomly Designed Stacks"



OTHER EXAMPLES

Using a mixed shape design can play up to colour changes in fired vanilla.

Stripes and open areas can create focus for the stack areas.

Mix dots or other shaped glass.

Stacking triangles requires far less precise cutting and can create fun effects.

Tight fitting triangles and polygons (shapes with 3 or more sides).

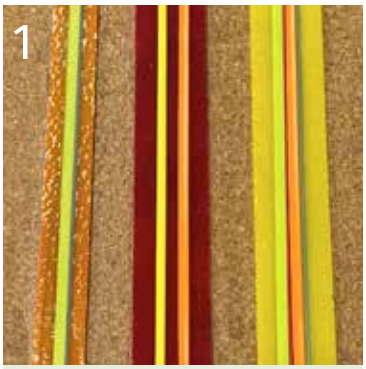
These shapes were hand cut with mosaic nippers. The edges create organic shapes.

Streaky glass tends to be unappealing results in stacks.

A design like this takes a lot of patience!

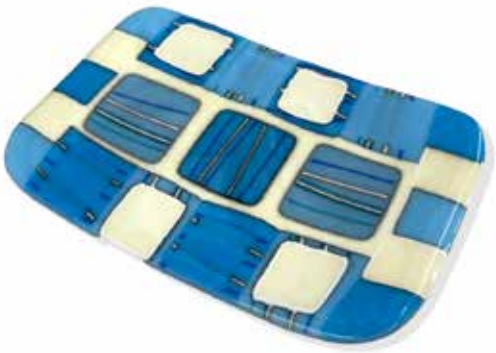
Dots and squares.

NEW: MAKE YOUR OWN PATTERNED GLASS



Choose accessory glass and design patterns. **TACK FUSE**

Trim pattern glass and use like any other **STACK FUSE**



Dusting clear powder when Stack fusing reduces extra firings.

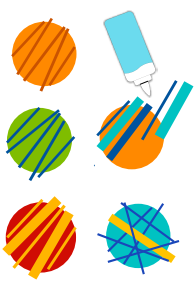
Next, consider if or how to shape before slumping.

NEW: STACKS AND STRINGERS

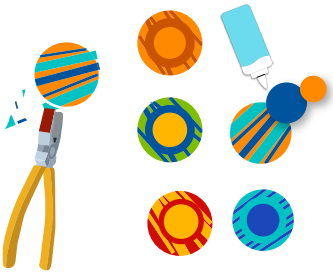
Accessory glass on an accordion (ridged) black (with clear base).

The ridged glass didn't help keep the stringers straight. They were pushed by upper pieces.

EXPLORE ACCESSORY GLASS PATTERNS

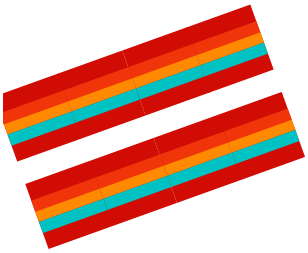


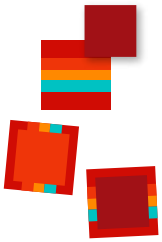
1: Add glass to pre-cut circles. **TACK FUSE.**

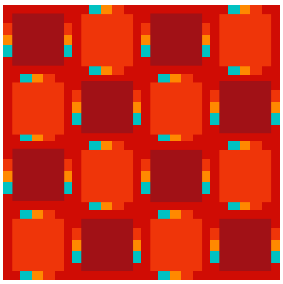


2: Trim edges for stacking. Pre-glue stacks and let them fully dry before final build.

3: Consider rounding the edges of the bases to build on the circular theme.







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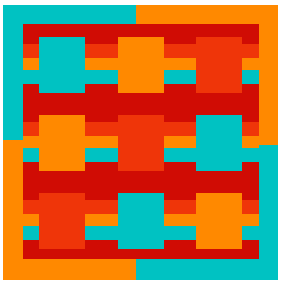

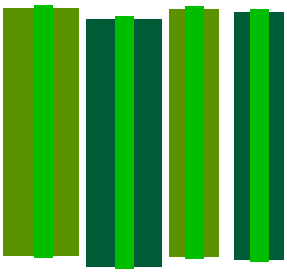

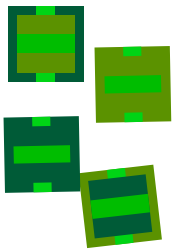

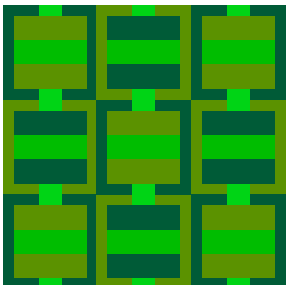

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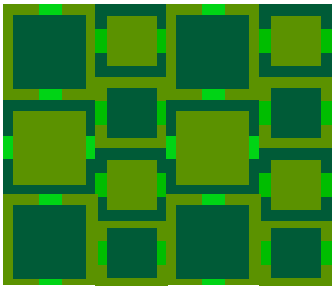

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3. TRANSPARENT STACKS

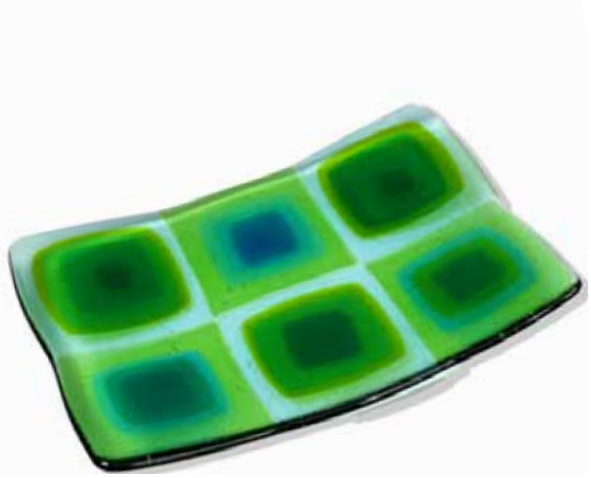
Creating pleasing stacks from transparent colours can be challenging. Unlike opaques, which hold their identity after firing, transparent glass colours compound.

So, layering two or more (especially darker or more intense tints) can produce muddied or overly dark results if not carefully planned.

THIS TECHNIQUE BEST WITH:

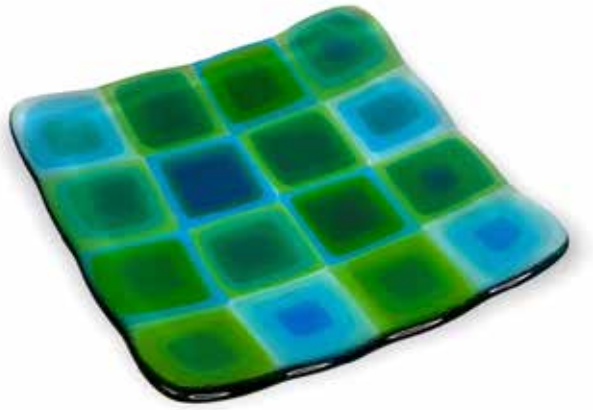
OPAQUES	**TRANSPARENTS**
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

DETAILS



Keep Stacks Short: I like to limit these stacks to 2–3 pieces. This ensures that the new colours I want to make as a result of fusing the stacks will be prominent in the design.

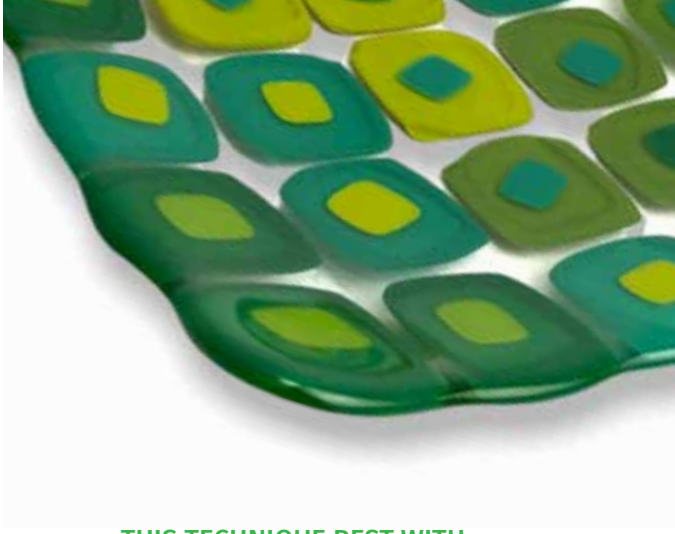
Build "Large to Small, Light to Dark": Place larger, lighter tints on the bottom (these become the outer pieces after fusing) and smaller, darker ones on top (these are inner fused layers). This prevents lighter tones from being covered by deeper colours.



Everything Spreads: In fusing stacks until they flatten to 6mm, every piece you cut will thin and spread out— finishing larger than before. Bear this in mind when choosing the sizes for darker, bolder colours.

Order Doesn't Change Outcomes: Once fused, colours merge into a single thickness and single new colour. The sequence of stacking doesn't alter the resulting hue—only the choice of tints does.

4. FLOATING STACKS

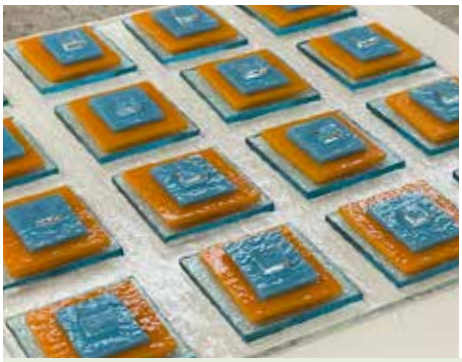


I call this technique “floating stacks” to show my students how opaque sets on a clear base (or transparent coloured base) can be a lovely effect that showcases the glass.

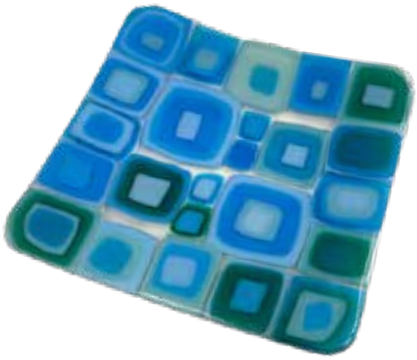
Keep in mind, that if the first layers of the stacks are different colours, this, and their pattern will also be visible from the underside.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

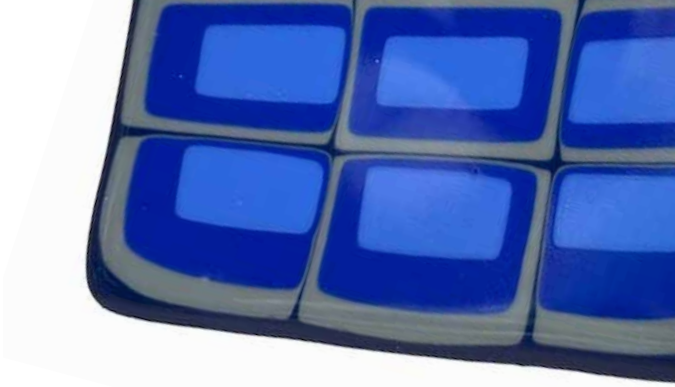


Single Base Layer — Scalloped Edge Result: The combined glass weight of the widely spaced stacks on this single 10 x 10” / 25 x 25 cm clear base is less than that of a fully fused, 2-layer piece. With less glass, the piece contracts during firing; resulting in the gentle scalloped edges.



Two Base Layer, Rounded Edges: With two clear base layers. This design has the required glass weight to meet a 10 x 10” / 25 x 25 cm 6mm tray. So, the extra weight of the stacks forces the piece to round or “inflate” during stack fusing. Even with some edge grinding, this tray is now larger than 10 ¼ x 10 ¼”.

5. RADIAL STACKS



Radial Stacking—a stack pattern that radiates out from or in towards the center—creates a great effect. However, this works best with precisely cut and assembled pieces.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

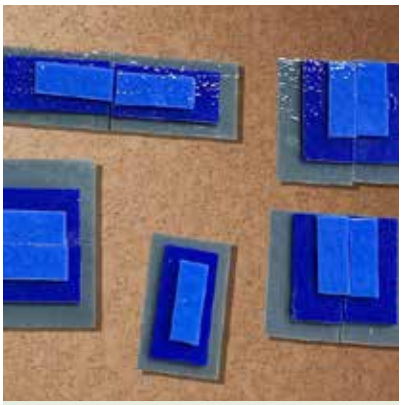
DETAILS

Cutting many identically sized pieces from multiple pieces of glass is not fun.

So, when your design calls for specific sizes and counts in certain colors, it's easiest to calculate and pre-cut a total sheet area for each colour. This helps a lot with size consistency. (*See below.)*

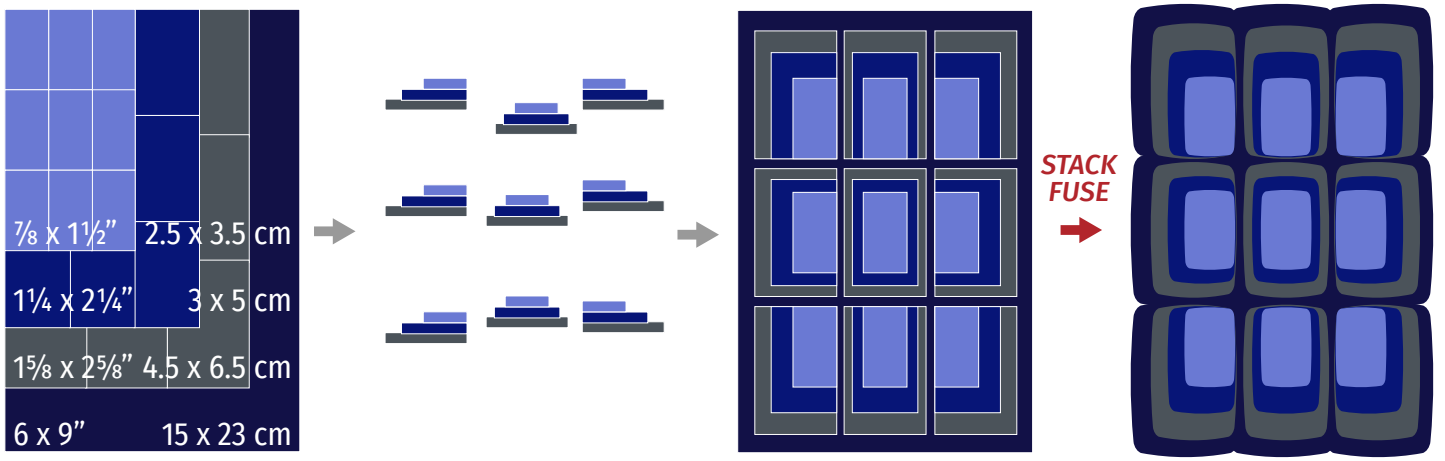
PRE-GLUE STACKS

As shown at right, I prefer to glue the mini-stacks before assembling them on the base. This helps ensure the pattern comes more accurate.



PRE-GLUE individual stacks. This makes aligning all onto the base

ASSEMBLY

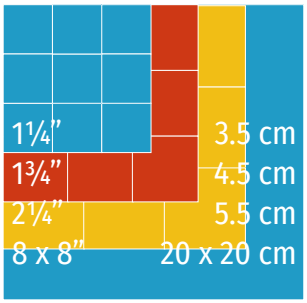


1: Cut, finish all squares

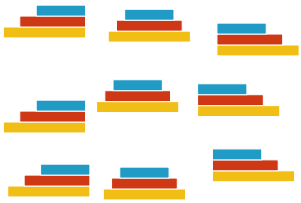
2: Glue individual stacks

Note: Single layer base fuses with shaped edges

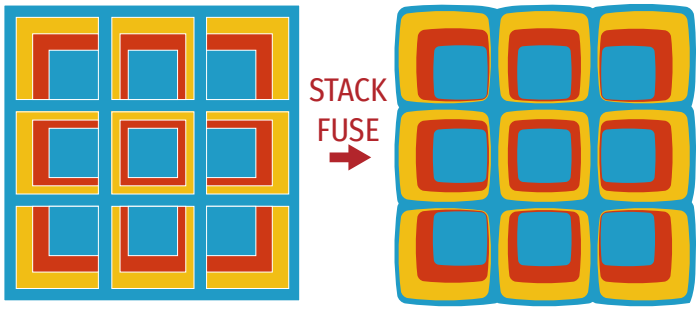
ASSEMBLY



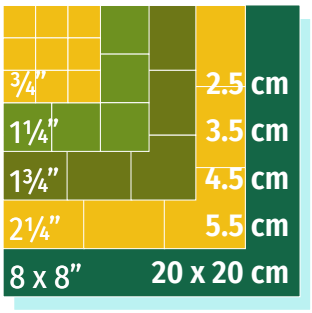
1: Cut, finish all squares

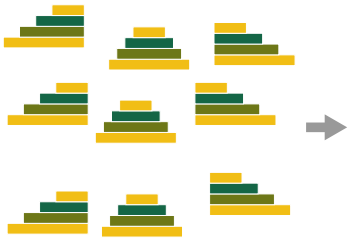


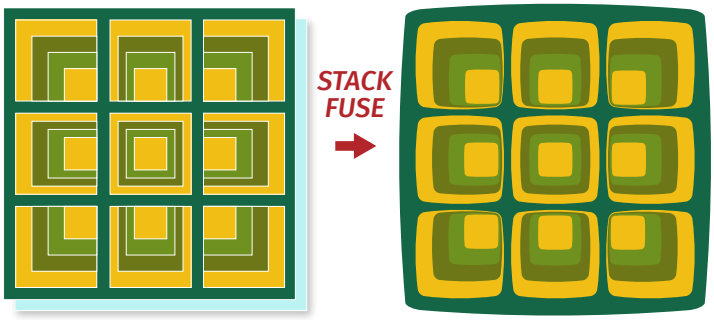
2: Glue individual stacks

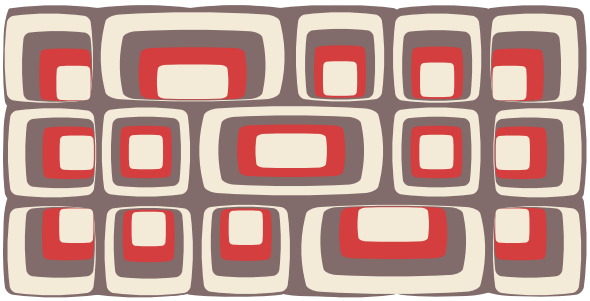


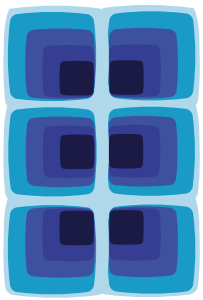
Note: Single layer base fuses with shaped edges

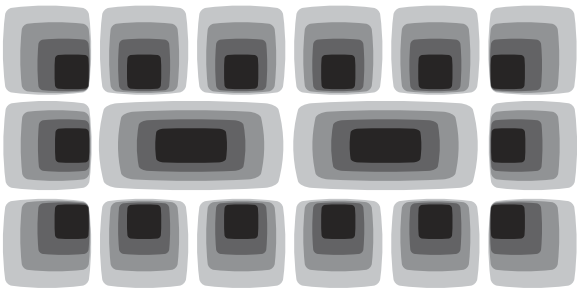


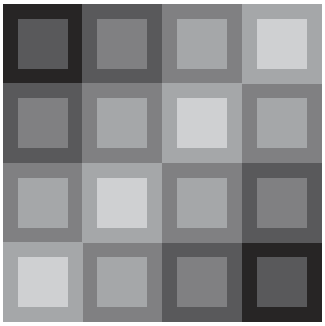


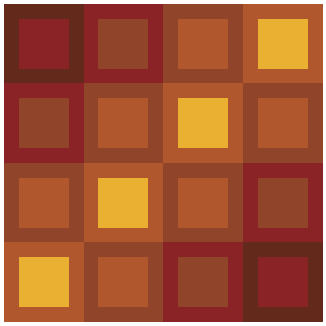


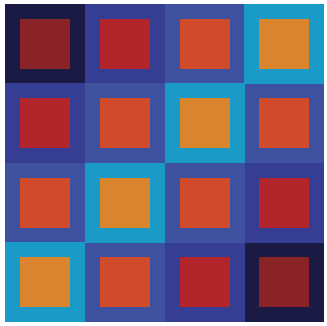


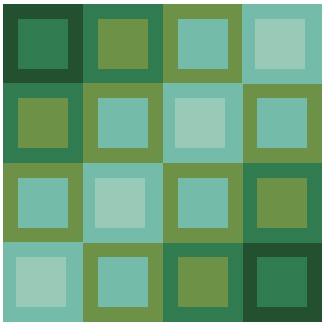












1. CIRCLE STACKS

As you know, the vast majority of stack designs are square or rectangular. And the few that are circular uninspiring squares trying to fit neatly into circles.

"SLICED SQUARES MAKE SMALLER SQUARES, BUT SLICED CIRCLES MAKE PIE."

With this in mind, following are five new designs—radials, circles in circles, and others—that are enhanced in the round and not too difficult to make.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

Varied shapes and stack.

Center circle stack surrounded by mixed squares and edged with strips

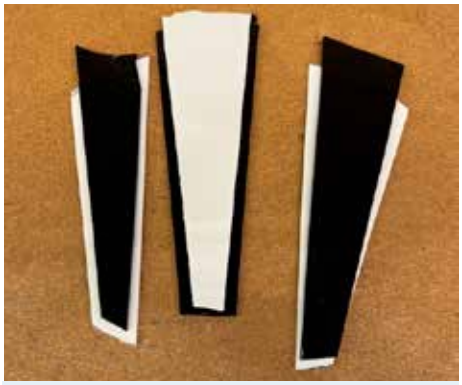
Nipped stacked ovals

Nipped stacked ovals

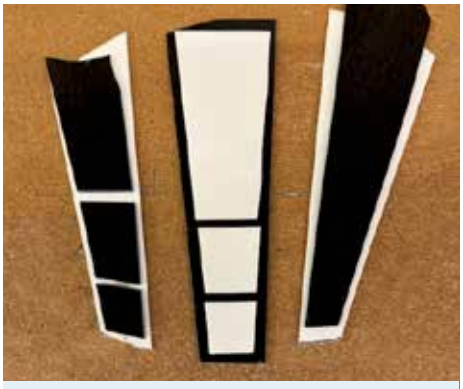
EXAMPLES

CHECKERED RAYS

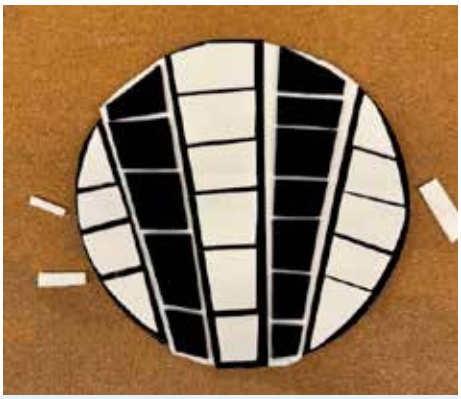
Cut angled opaque pieces to fill a clear circle.



Lift and cut smaller wedges with ¼" / 6 mm spacing.



Lay top on lower to mark and cut; repeat to fill layer.



The three white pieces were cut out for spacing.

Fully assembled.

Fused. The white tops puckered. Unexpected, but caused by the glass pressing from the sides.

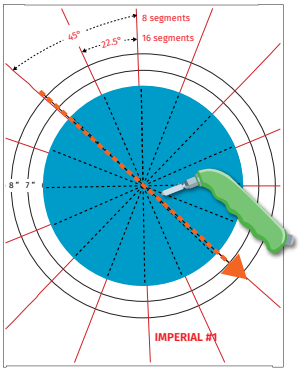
Note the lifted kiln wash; this piece was nearly four layers and needed to flow a lot.

Ta-dah!

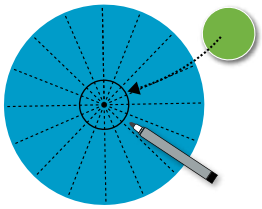
RADIAL POINTS AND DOTS

Plastic cup used as center guide

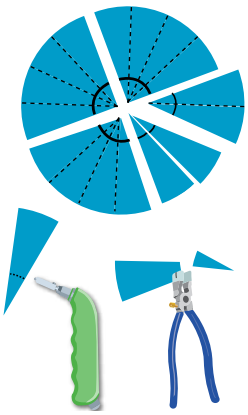
Note: A cut green circle is put in to make the center 6mm and to and prevent the points from flowing inward.



Step 1: Using either of the *Angle Grids*, draw and **firmly scoring** lines on the smaller circle. (Stronger scoring usual helps with runnings.)

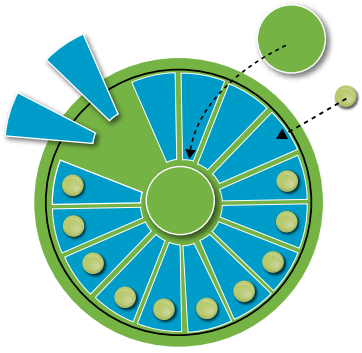


Step 2: Cut and place circle in the center and draw a dry-erase marked circle.



Step 6: Following the *Rule of Halves*, carefully split each disc.

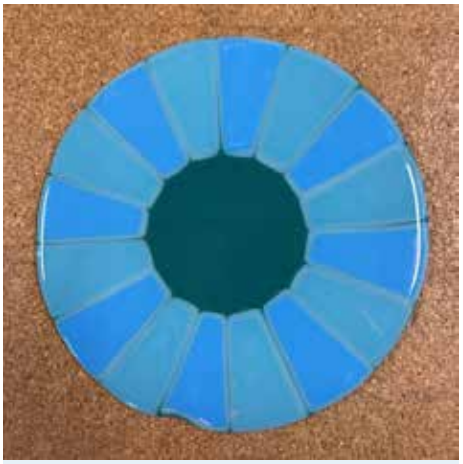
Then, score and cut the points off.



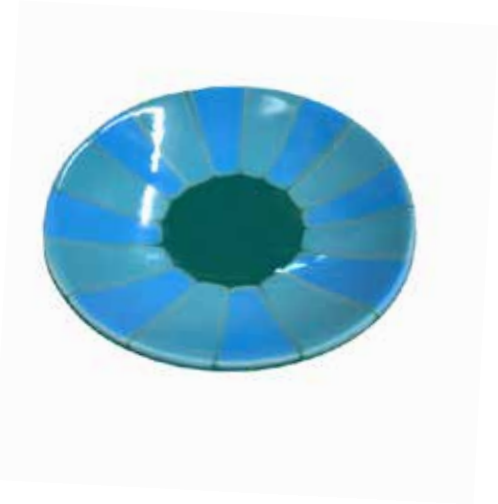
Step 4: Draw a dry-erase ring at (½"/1cm inside base). Glue center circle. Use these two as guides to arrange pieces. Add layer of dots or other pieces.

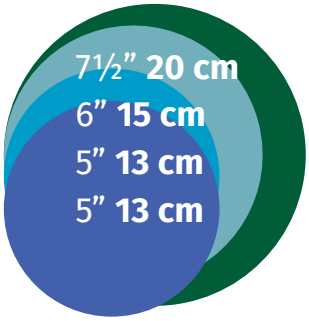
RADIAL BLUE TONES

Ready for stack fusing

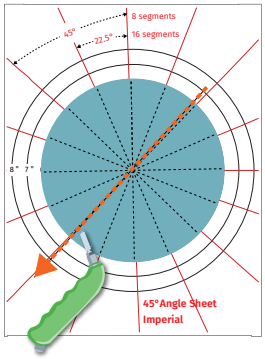


Scalloped edge needs grinding

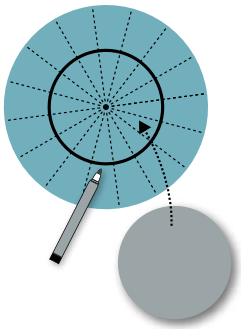




Step 1: Cut 3 opaque circles. Sizes can vary, but allow for enough spacing when the wedges are placed.

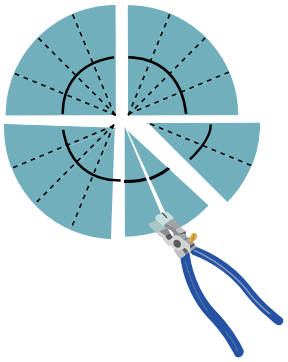


Steps 2-4: Using either *Angle Grid*, **firmly score** your desired pieces on each of the 3 smaller circles. (Stronger scoring helps with running.)



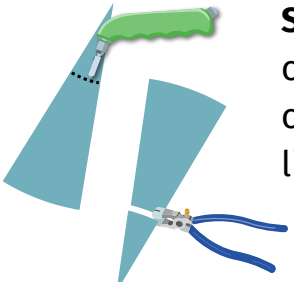
Step 5: With template, trace a dry-erase circle on each.
Don't score yet.

Sizing:
SM: 2¾" / 7 cm guide
M: 3¼" / 9 cm guide

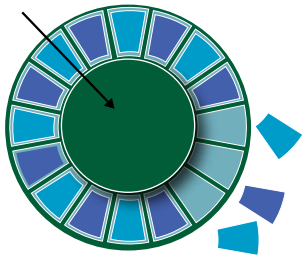


Step 6: Noting the*Rule of Halves*, carefully split each disc.

(If you break a piece, either cut a new one or reduce the design by one)



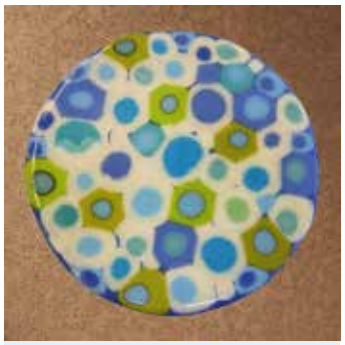
Step 6: Score each of the pie pieces on the second line and cut.



Step 7: Glue a 3¾" / 9 cm center circle (base colour or other). This can also guide as you glue pieces. Once dry, add layer of alternating colours.

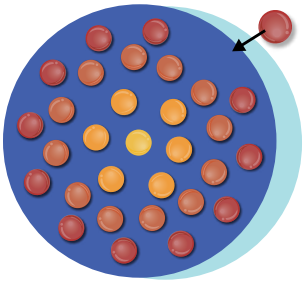
DOTS GALORE

Round 1: Two-dot stacks. Bottom pieces are upside down.



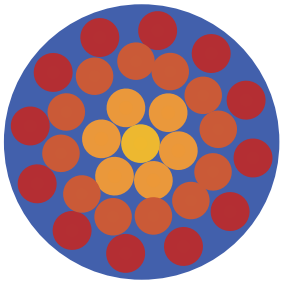
Stack Fused: Devit & kiln wash to remove.

Round 2: Few more dots to finish the look.

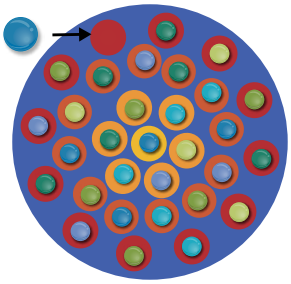


Step 1: Following your design, glue dots onto the 2 base layers

STACK FUSE

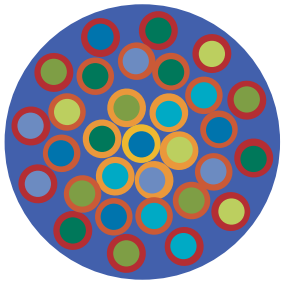


Stack Fused: Dots have spreadout and are flush with base



Step 3: Glue second set of smaller dots in centers

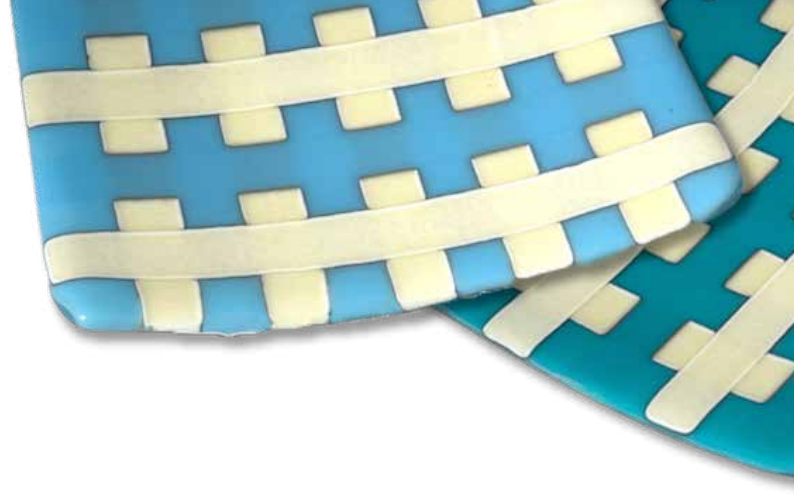
STACK FUSE



Step 4: Check for devit; or, add more dots for a third firing

This plate came out quite fun. Next time, I'll place the outer row closer to the center to allow a clear edge.

2. BASKET STACKS



This is a simple but distinct design that came to once me while I was ***"What if..." Dreaming*** while waiting for my dentist. (*See sidebar.*)

Although this design is as easy as laying two colors of strips in a specific order and pattern, the "trick" or "effect" is that the top colour, e.g., yellow, melts with down and appears as one with the piece below.

However, if you look at the photo below, when vanilla is fused, its borders are revealed due to the unique effect heat has on the edges of vanilla. The result is pleasing but the basket weave "effect" isn't as strong as the trays in the top right.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

"WHAT IF..." DREAMING

PUT THE PHONE DOWN!

Instead of grabbing my phone when I'm bored, waiting, or can't sleep, I try to let my mind wander into "What ifs."

- What if I change the glass order...
- What if I add or remove a step...
- What if I fire this part first, then that one...
- What if I sandblast before slumping...

Now and then, one of these musings becomes an idea worth testing.

It's a great way to pass the time—and the more you do it, the better your ideas get!

TIPS

As we often say in our studio, “The options are endless.”

The following designs (with sizing, assembly order, and pattern type) are here to spark your creativity.

Follow these three tips as you build:

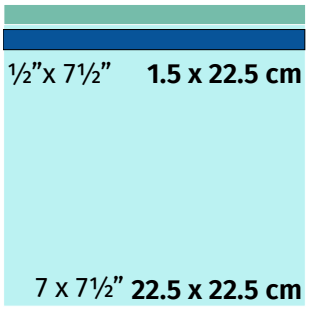
1. **Choose strip width:** Decide the best width (⅜” / 1 cm, ½” / 1.5 cm, etc.).
2. **Pre-cut by color:** Once you’ve chosen the size, calculate and pre-cut one sheet for each color. This ensures you have enough glass of each color and keeps pieces consistent in size.
3. **Align carefully:** Use a ruler or glass strip as a guide for even spacing and layout.

EXAMPLES

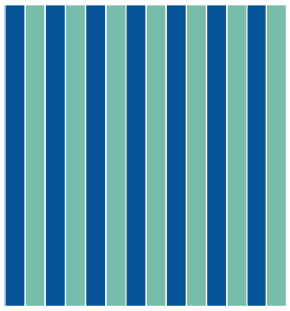
Wide ½” / 1.25 cm Strips (Parallel design)

Narrow ⅜” / 1 cm Strips (Parallel design)

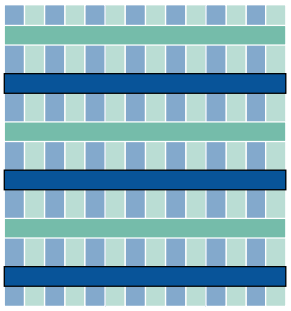
PARALLEL DESIGN (EVEN NUMBER OF STRIPS ON EACH LAYER)



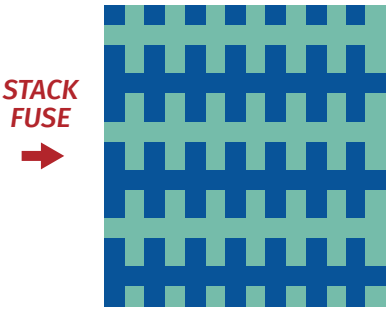
Step 1: Cut clear base
10 pieces of colour A
10 of colour B



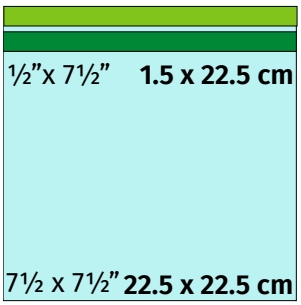
Step 2: Glue first row.
If pieces are off size,
center all on the base



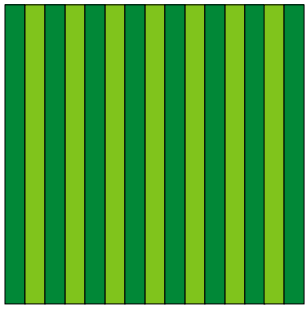
Step 3: Once layer 1 dry
trim and add layer 2
strips. Let dry again.



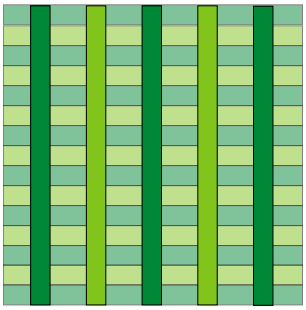
SYMMETRICAL DESIGN (ODD NUMBER OF STRIPS ON EACH LAYER)



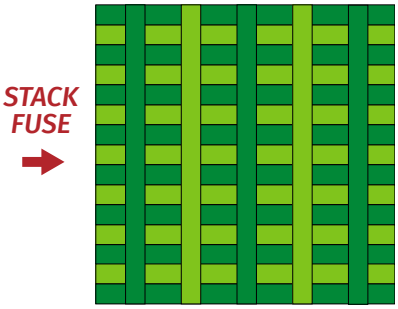
Step 1: Cut clear base
9 pieces of colour A
11 of colour B



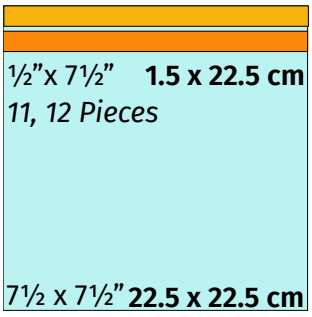
Step 2: Glue first row.
If pieces are off size,
center all on the base



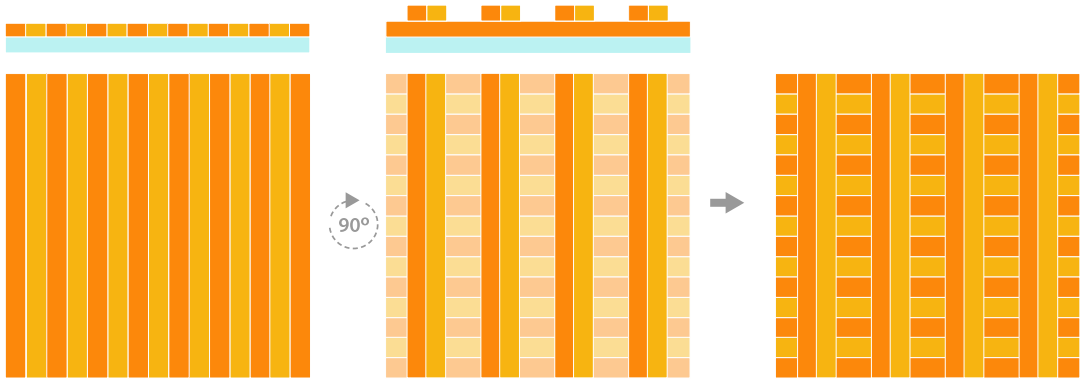
Step 3: Once layer 1 dry
trim and add layer 2
strips. Let dry again.



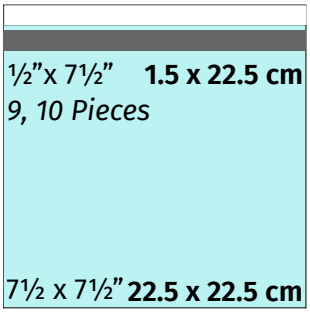
IDEAS

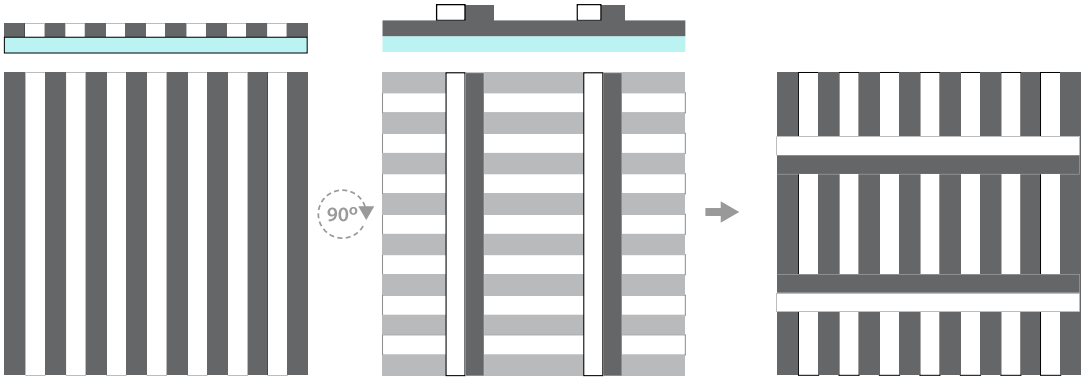


Parallel

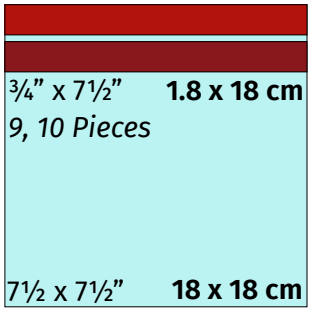


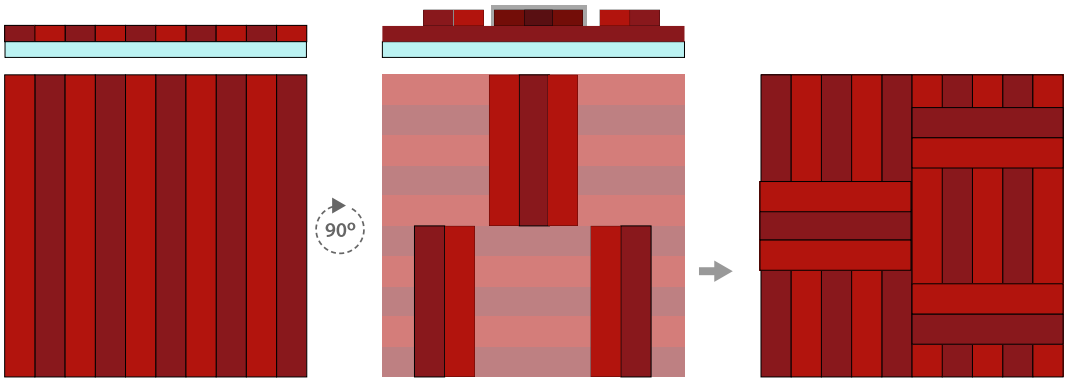
Note eqaul number
of strips (A, B, A, B...)



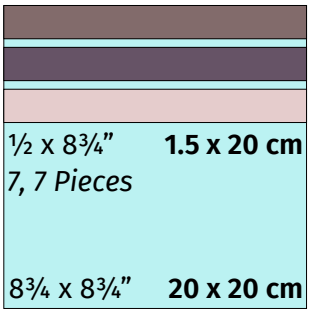


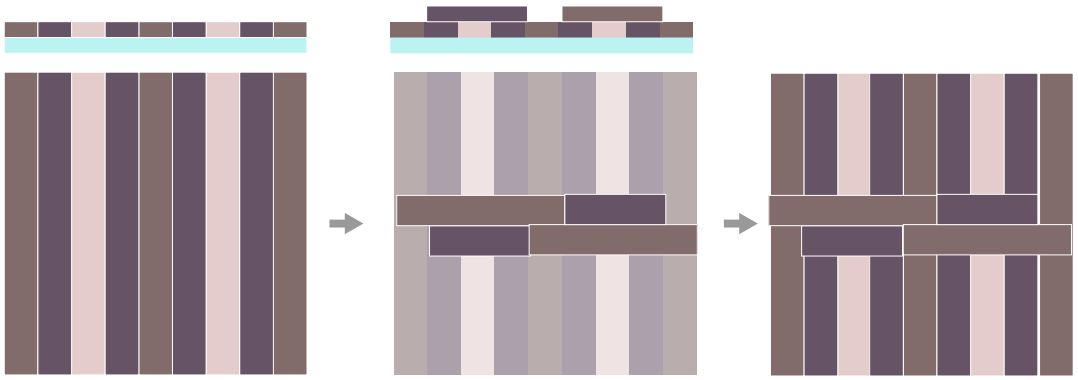
Symmetrical





Mixed Design





Symmetrical

3. POOLING STACKS

POOLING

An effect many glass artists have made is what I refer to as pooling.

By adding clear or transparent glass layers to a stack creates unique effects.

The clear or transparent glass sinks into the opaque glass making “pools” that have the illusion of a dip in the glass that you could touch.

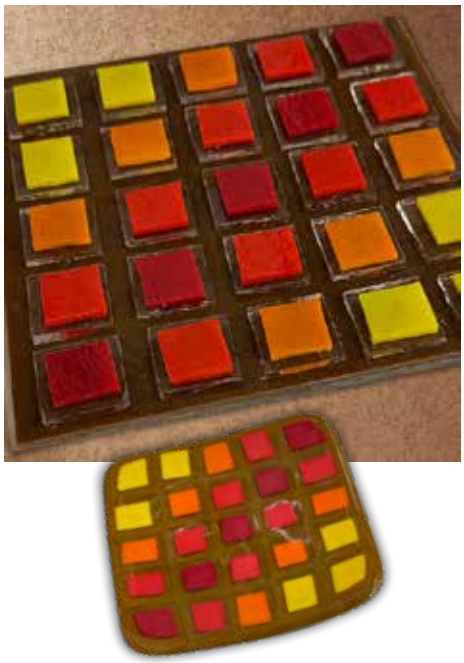
Following are a number of new examples using this *pooling effect* in a more consistent way.

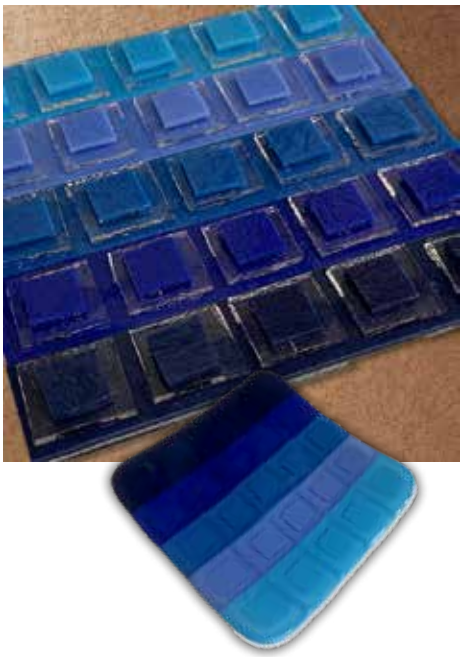
In the following examples, I use 3mm clear squares and or large 6mm clear dots with opaques to create variations in pooling.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

EXAMPLES

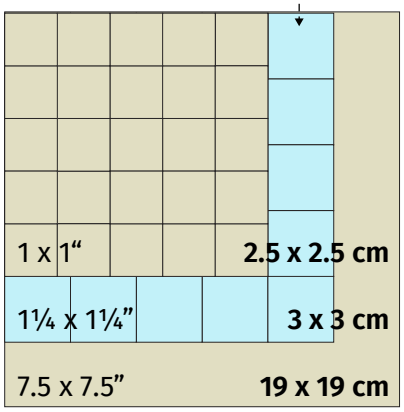


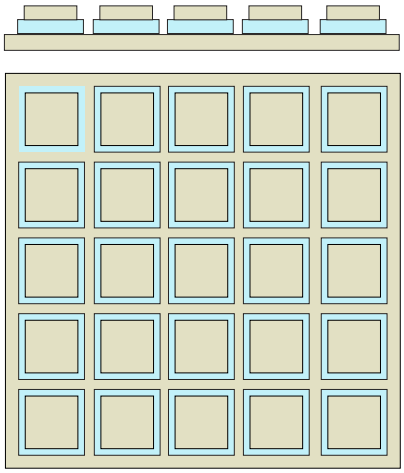


ASSEMBLY

1 base layer

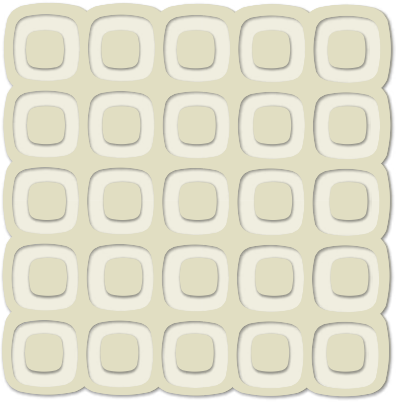
Clear squares





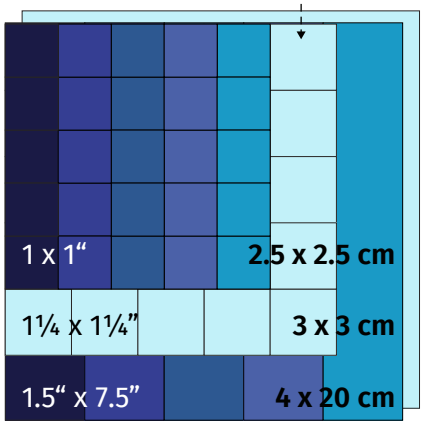
STACK FUSE

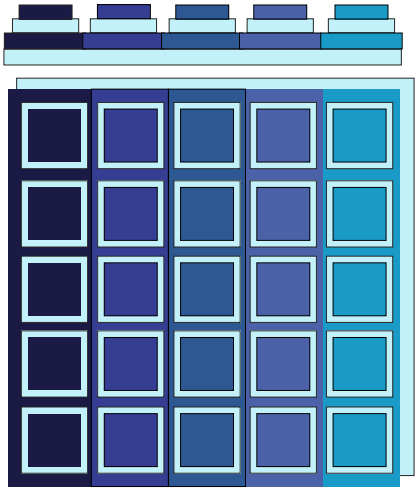
“Scalloped” edges result from using 1 base layer



2 base layers

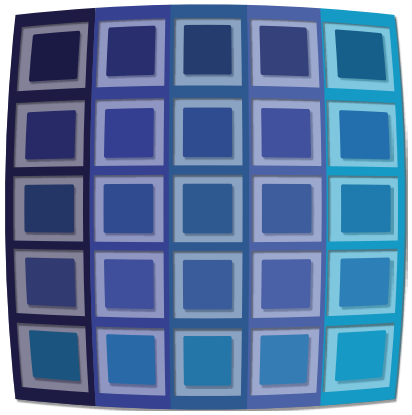
Clear squares



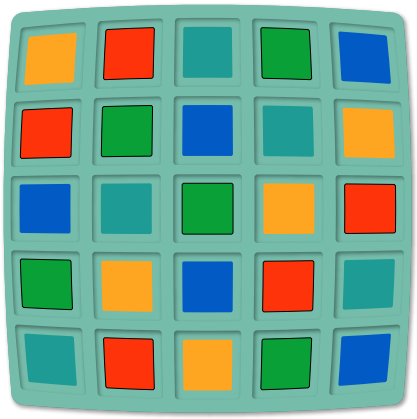


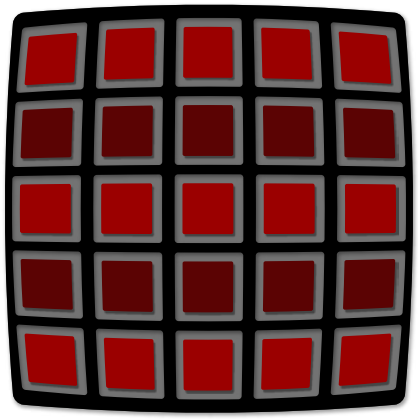
STACK FUSE

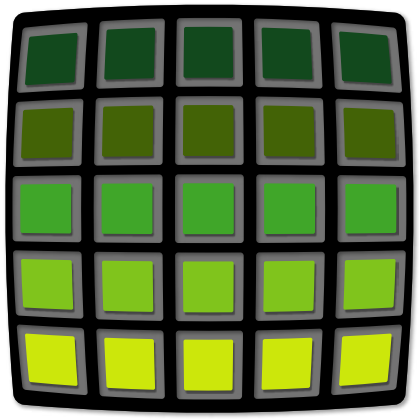
“Inflated” and smooth edges result from using 2 base layers



IDEAS







4. NODE STACKS

This is my favourite new design.

It came to me when I was trying to make novel stack combinations with the variety of accessory glass that we make and keep at our studio.

DETAILS

MULTIPLE STAGES: Most node stacks are made in two or three stages, each followed by a stack fusing

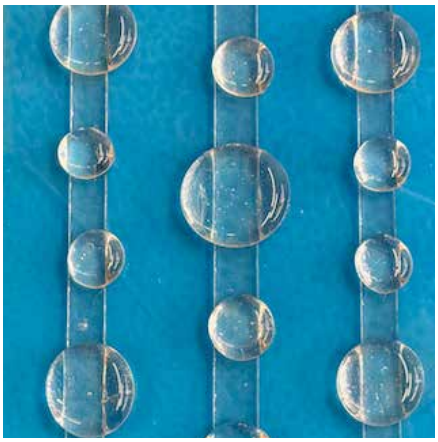
CLEAR POWDER: Stacks get a lot of heat from the multiple firings, so expect to top the piece with clear powder one or more times.

CAREFUL WITH SIZING AND SPACING: Cut pieces smaller and place them farther apart than expected — they expand and shift closer with each firing.

CLEAN DOTS ONLY: Ensure all dots (especially opaques) are ***completely*** free of kiln wash. Even slight residue will come to the surface—requiring cleaning / grinding and re-firing for it to be completely removed.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS



EXAMPLE

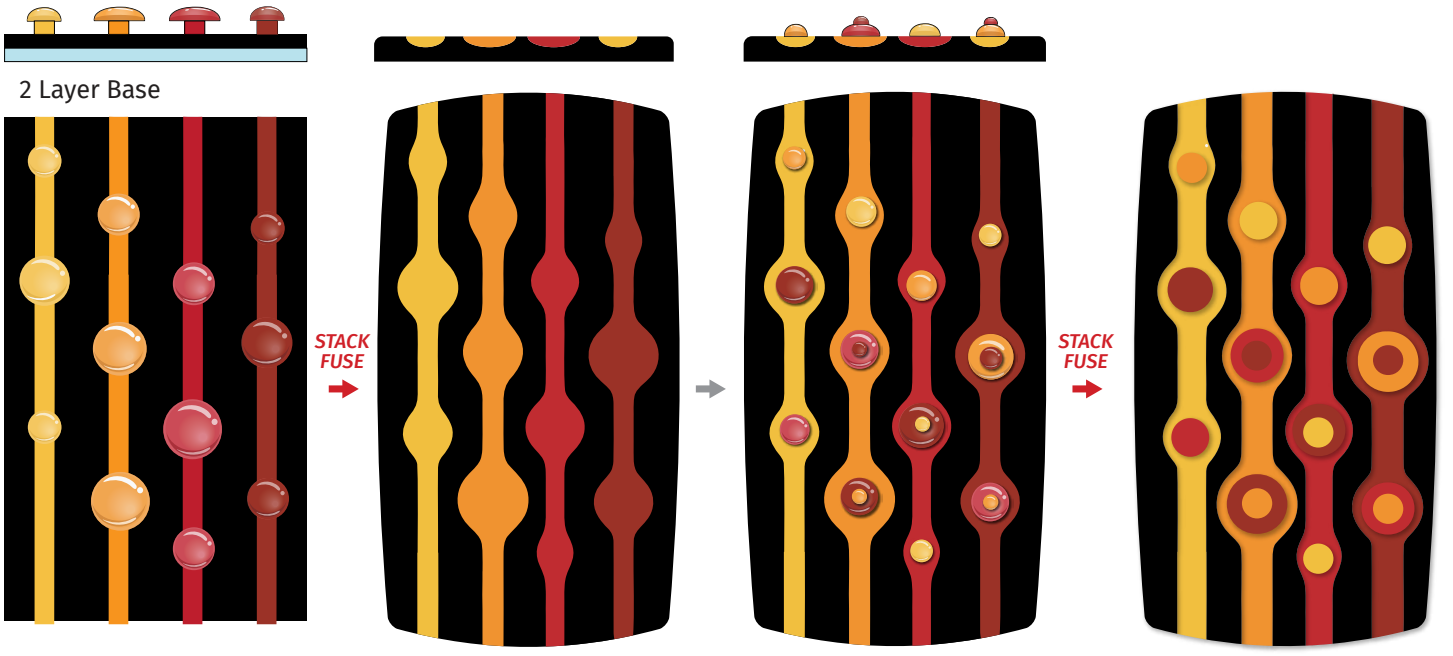
Step 1: Place and glue first strips and dots. Careful placement for this layer is key.

Stack Fused 1: Clean. Don't fix devit or residue until after the second firing.

Step 2: Glue opaque dots. (Nudging pieces left or right may help correct for flow of clear below.)

Stack Fused 2: Fix devit or kiln wash residue by grinding and re-firing (*See page 20.*)

NODES OPAQUE STYLE



Step 1: Stack and glue matching strips & dots

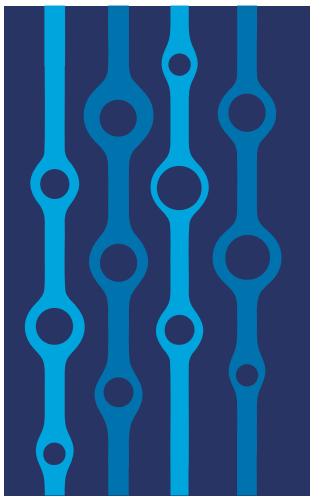
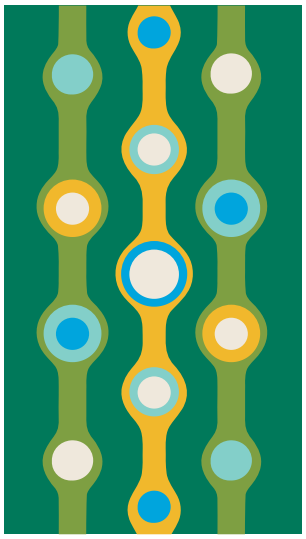
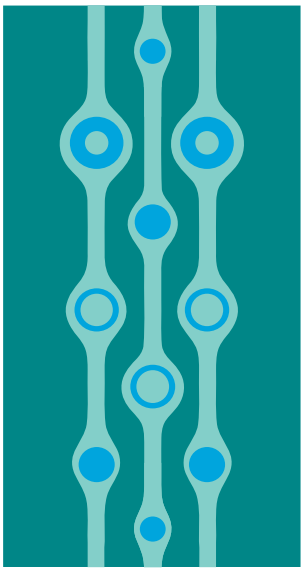
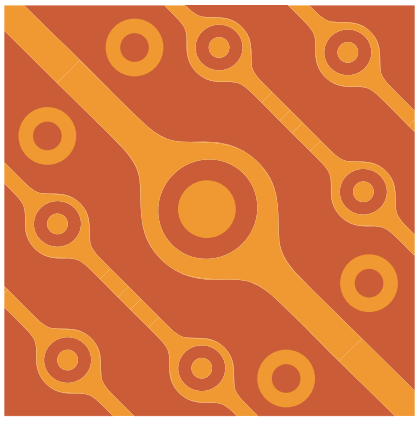
Full Fuse 1: Result

Step 2: Stack and glue dots, you may be able to stack in twos

Full Fuse 2: Result

IDEAS

TWO-STAGE PROJECTS

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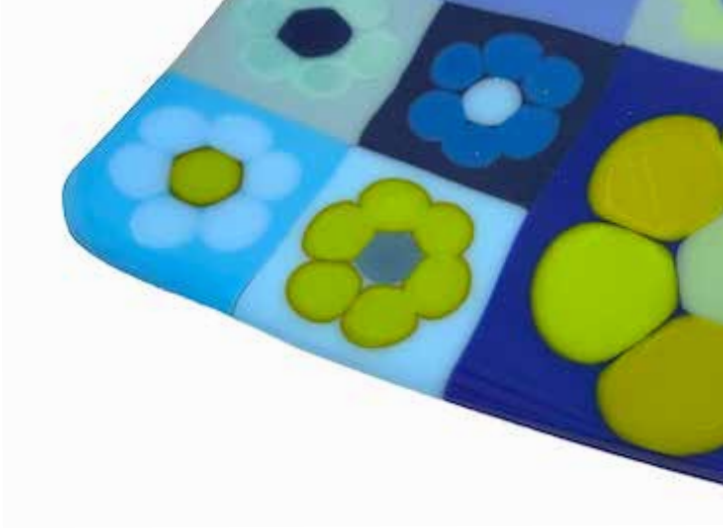
5. FLOWER STACKS



When this idea popped in my head, I thought, "Why didn't I think of this before!".

We show kids how to make these simple flowers on their projects, but we can also elevate these flowers with stacks.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

DETAILS

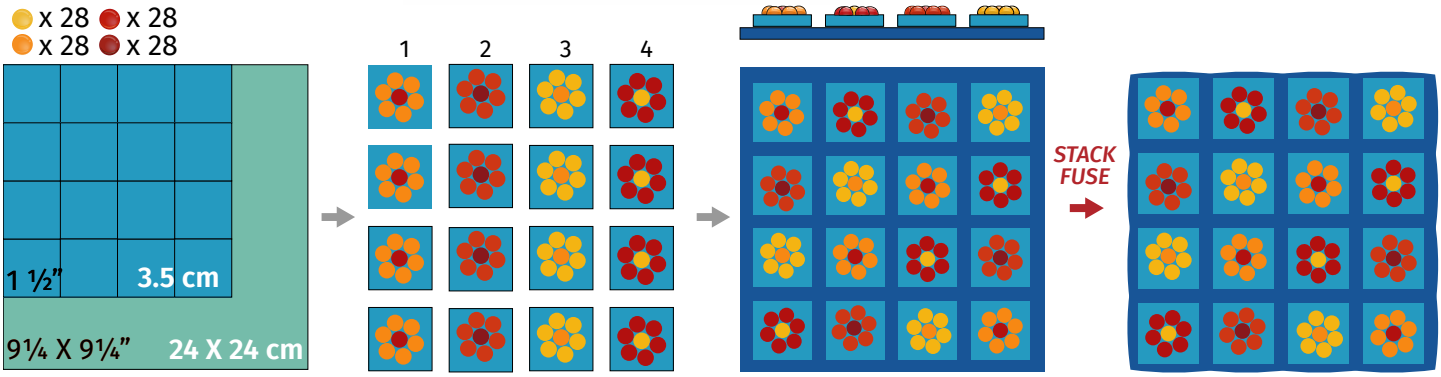
1. **Use Larger Dots Too:** Consider making larger than dots specifically for your design(s). (*See page 12 for making dots of different sizes.*)
2. **Beware of Kiln Wash:** Any bit of kiln wash that is stuck to a dot ***will*** surface during stack fusing. Keep this in mind. Choose specific low-risk colours or dots that are clear of any wash. (*See page 23.)*
3. **Glue Mini-Stacks Before Full Assembly:** Projects with many pieces like this are best done in stages.

Step 1: Place and glue first dot stacks before full assembly.

Step 2: If using devit-prone colours, dust with clear power before firing.

Stack Fused: Check and fix for kiln wash residue and devit before slumping.

EXAMPLES



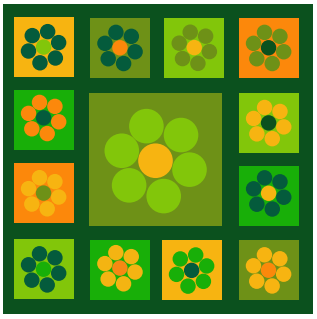
1: Gather glass, cut all stacks.

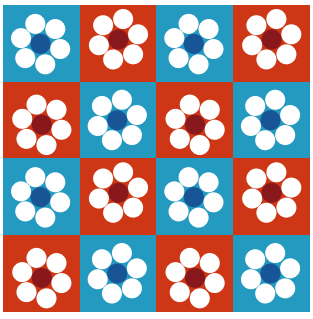
2: Glue each dot stack separately

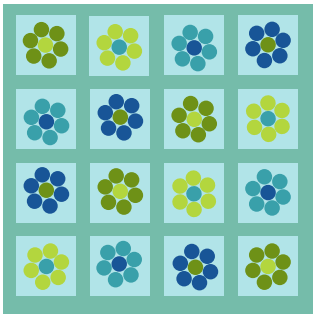
3: Arrange and glue stacks on base

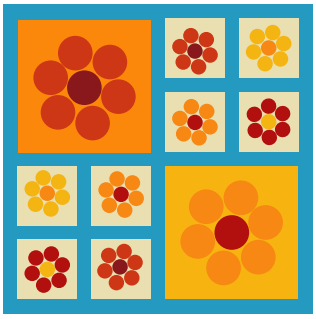
4: 1 base layers tend to fuse with curved edges.

IDEAS









6. MID-CENTURY MODERN

Maybe this isn't your style, but a quick Google search for well known design movements, graphic styles or colour patterns can point you in creative directions.

You might want to 80's pop, Bauhaus, Cubism, 60's Atomic, Art Deco, etc.

THIS TECHNIQUE BEST WITH:

OPAQUES	TRANSPARENTS
CLEAR	REACTIVES
IRIDESCENTS	ACCESSORY GLASS

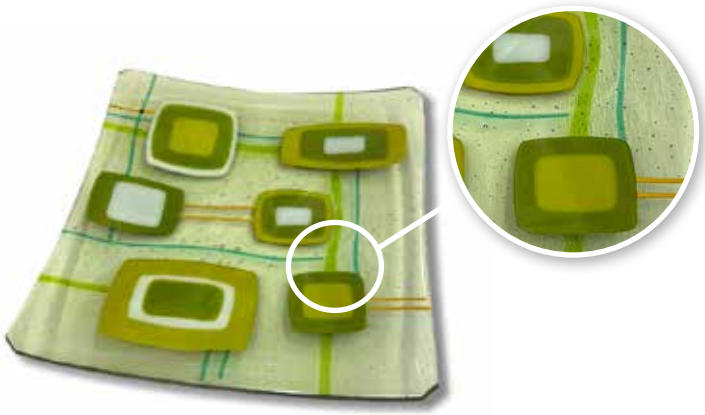
DETAILS

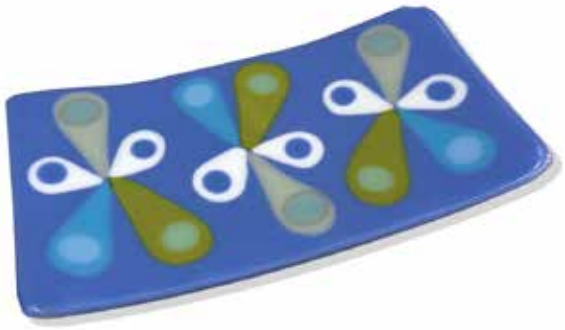
TWO-STAGE FIRINGS

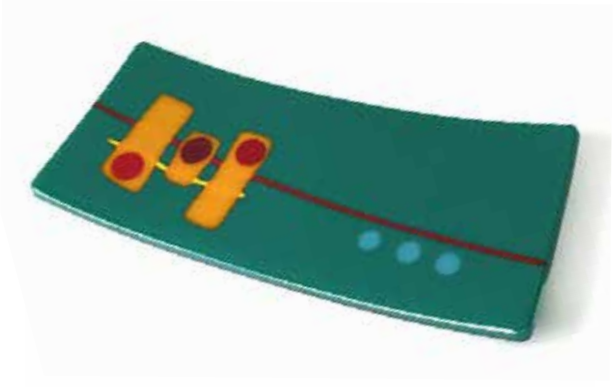
For certain stack projects its good to consider ***firing in stages***.

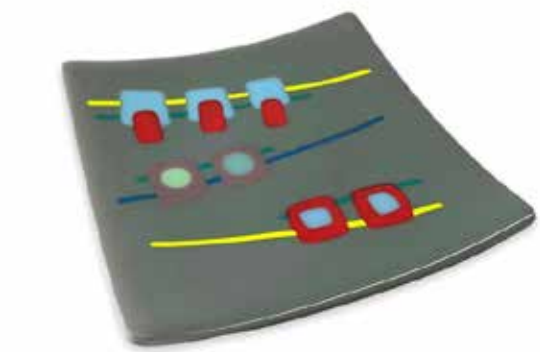
As you can see in the green tray below, the stringers in the design came out curved and distorted. This is because I fired all layers at once.

To avoid this, fuse in stages—stringers are much smaller and will be "pushed around" by bigger pieces above.



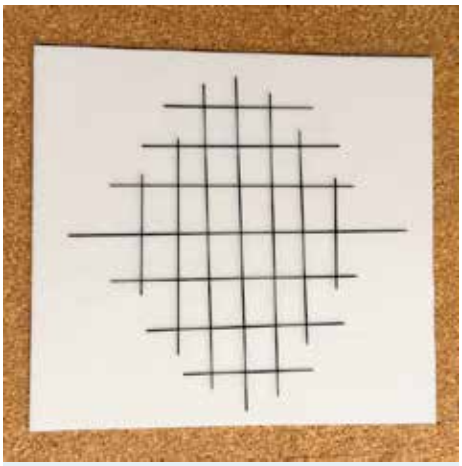




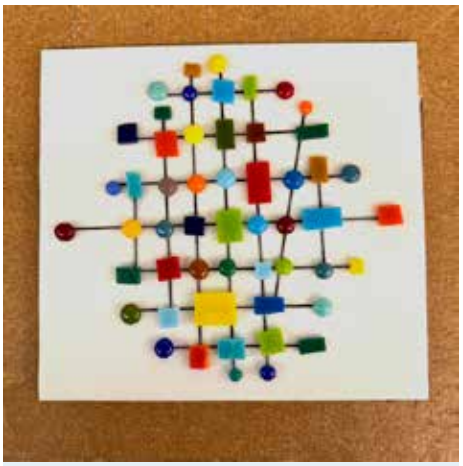


EXAMPLE

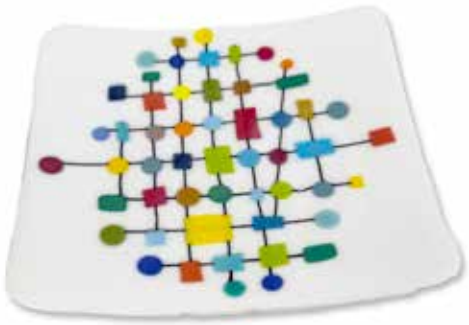
ATOMIC PATTERN

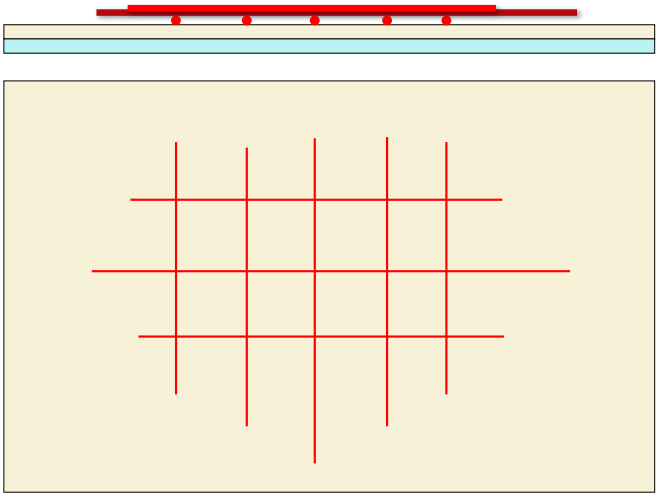


1: Place and glue 1mm stringers on the two-layer piece. FULL FUSE.



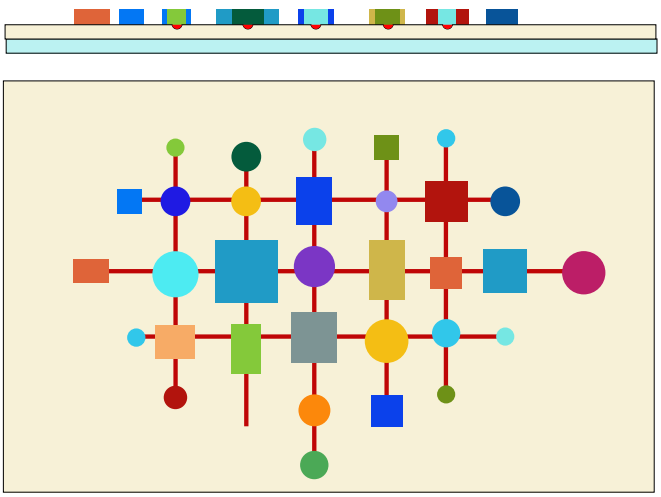
2: Add dots and squares. Remember these will expand, so smaller is best. FULL FUSE again.



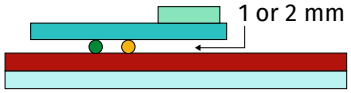


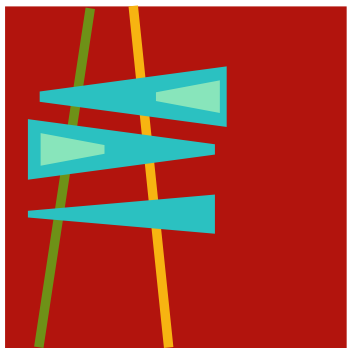
Stage 1: Full fuse stringers first. (Firing them at the same time as the other pieces leads to flow interaction with the lines coming out distored.)

STACK FUSE

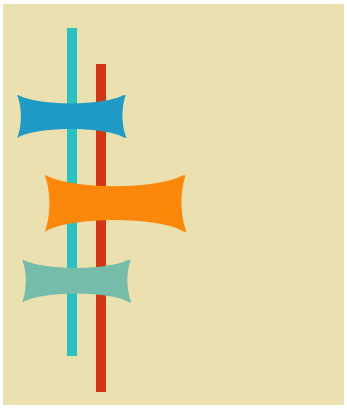


Stage 2: Add shapes and full fuse. Depending on their size, add 10–15 minutes to the process temperature to ensure an even 6 mm throughout.

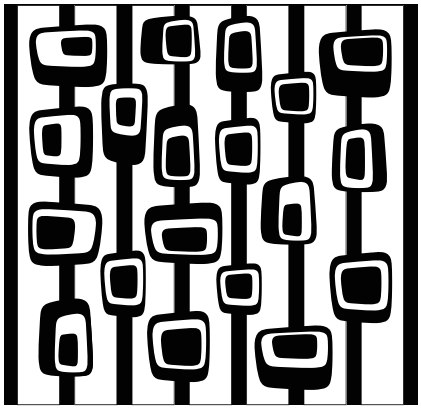




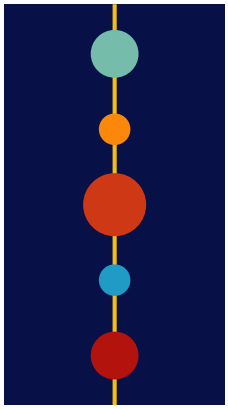
IDEAS



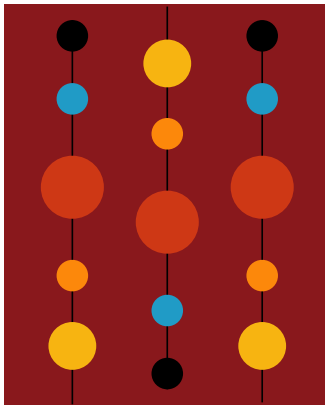
1 Stage



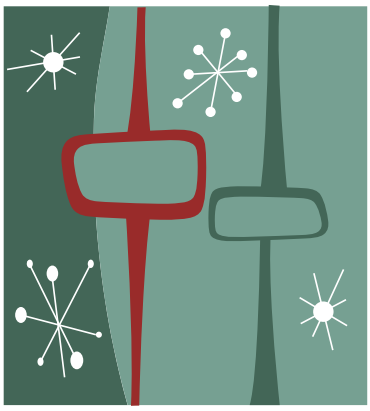
2 Stages



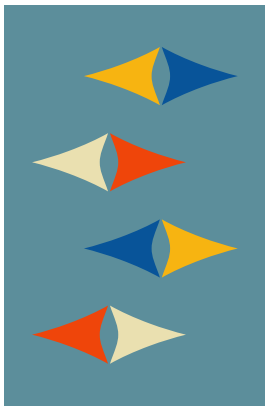
1 Stage



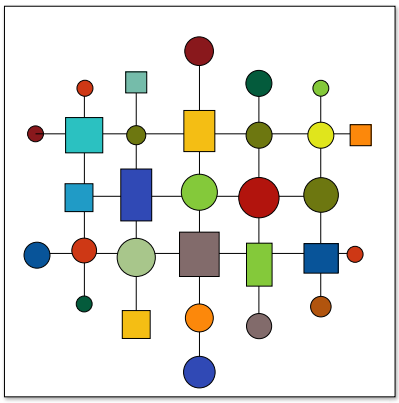
2 Stages



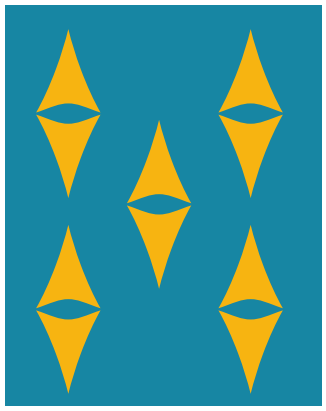
2 Stages (optional)



1 Stage

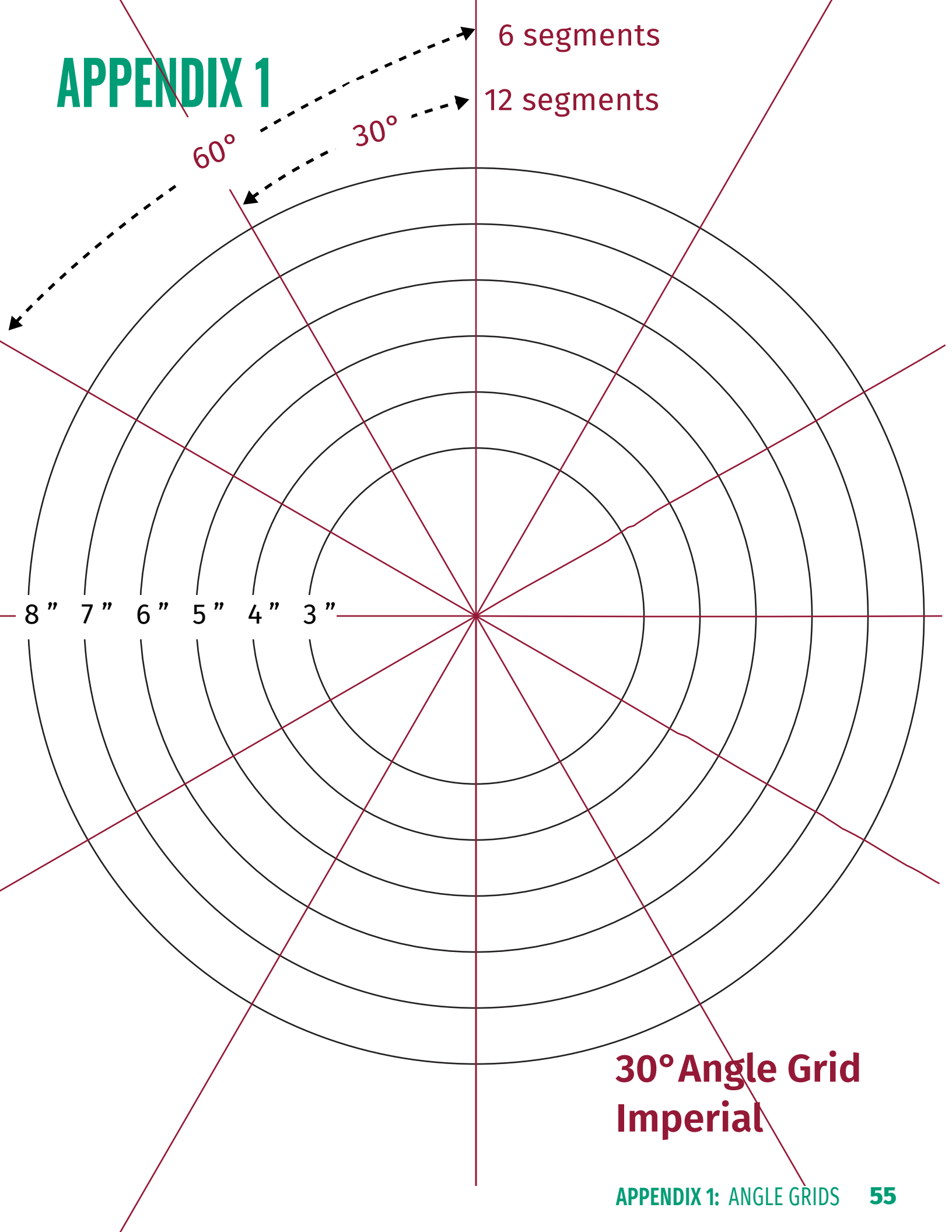


2 Stages

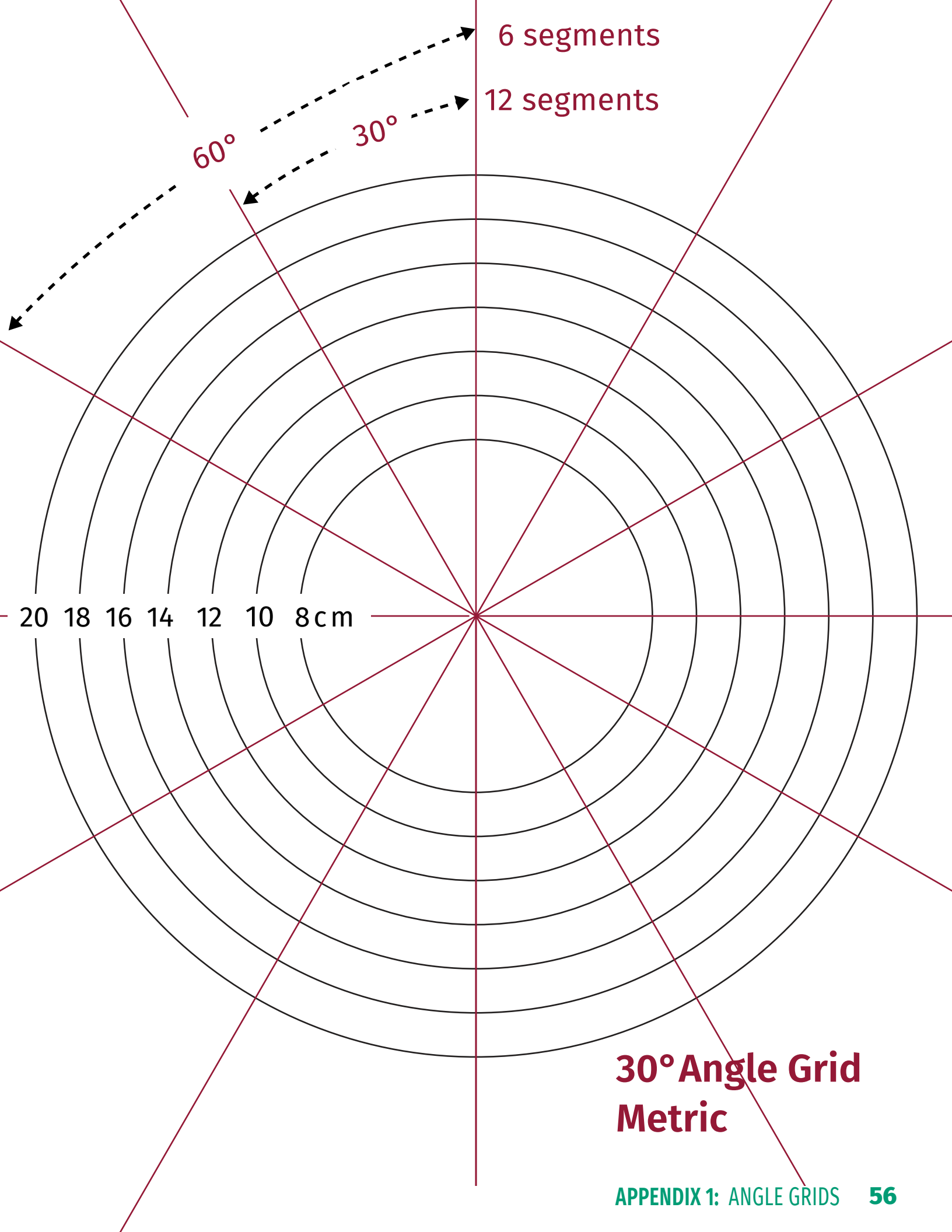


1 Stage

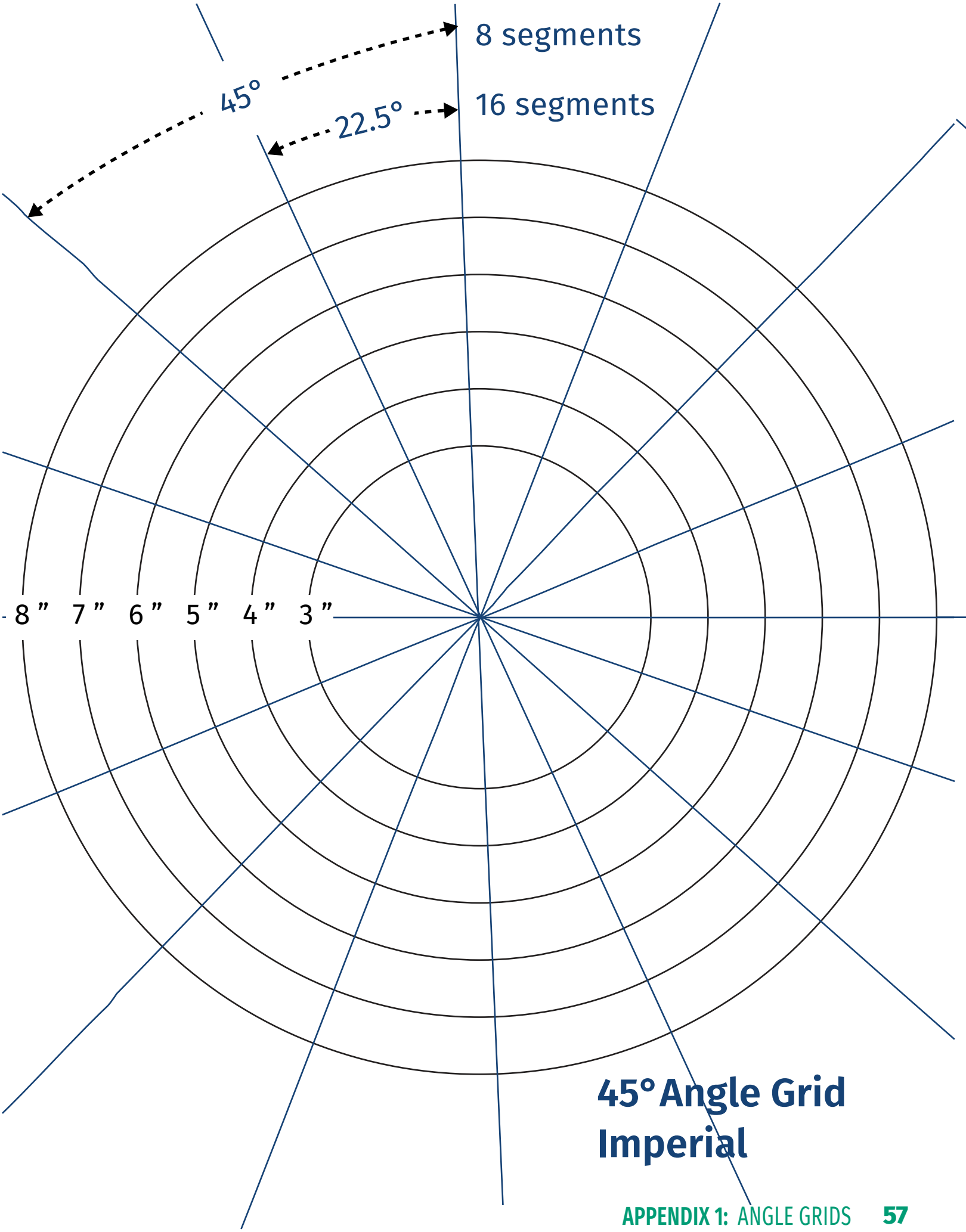
APPENDIX 1



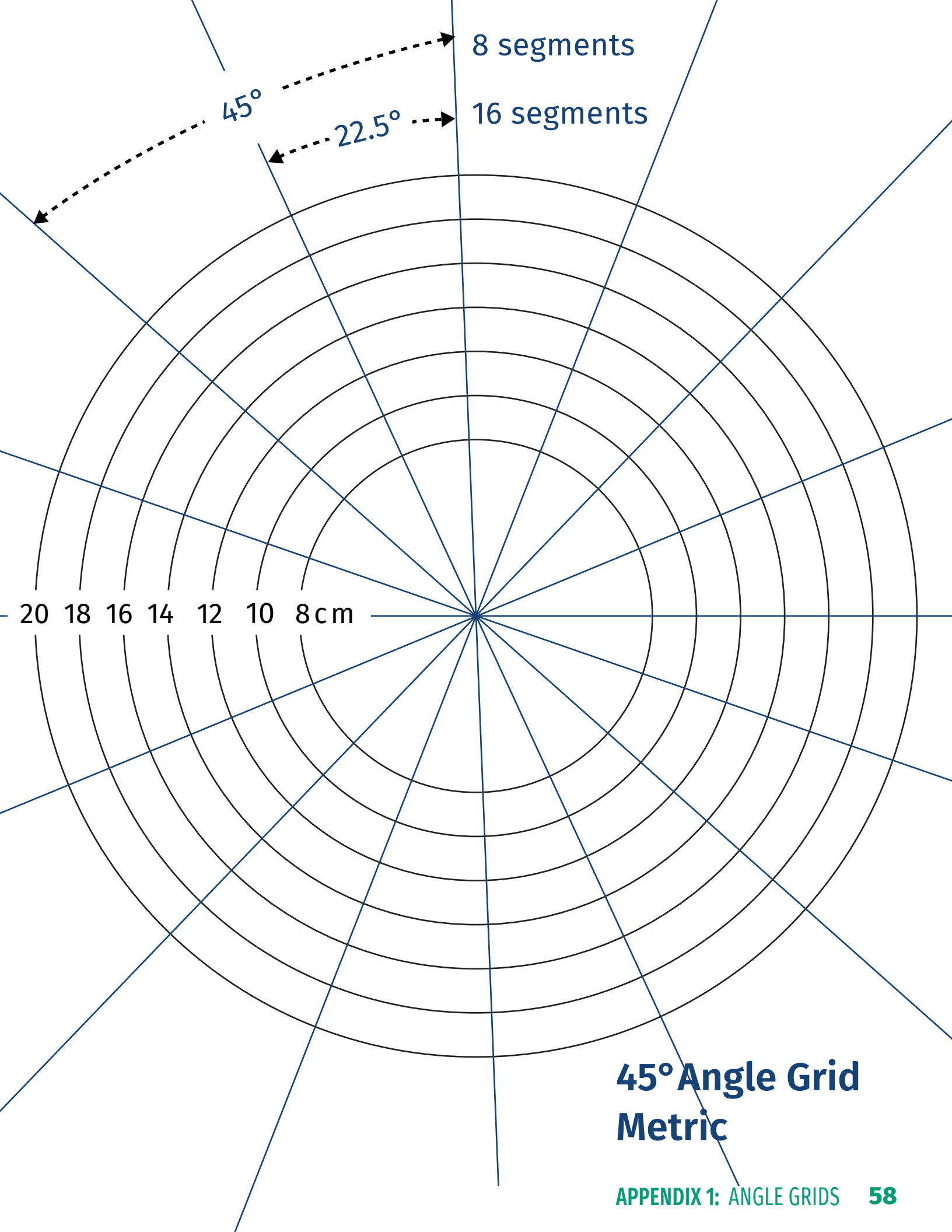
30° Angle Grid Imperial



30° Angle Grid Metric



45° Angle Grid Imperial



45° Angle Grid Metric

APPENDIX 2: CIRCLE WEIGHTS

CIRCLE WEIGHT - INCHES

DIAMETER	WEIGHT		
INCHES	3mm	6mm	9mm
3”	34 g	68 g	103 g
4	61 g	122 g	182 g
5	95 g	190 g	285 g
6	137 g	274 g	410 g
7	186 g	372 g	559 g
8	243 g	486 g	730 g
9	308 g	616 g	923 g
10	380 g	760 g	1140 g
11	460 g	920 g	1380 g
12	547 g	1094 g	1642 g
13	642 g	1285 g	1927 g
14	745 g	1490 g	2235 g
15	855 g	1710 g	2565 g
16	973 g	1946 g	2919 g

CIRCLE - CENTIMETERS

DIAMETER	WEIGHT		
CM	3mm	6mm	9mm
8 cm	38 g	75 g	113 g
10	59 g	118 g	177 g
12	85 g	170 g	254 g
14	115 g	231 g	346 g
16	151 g	302 g	452 g
18	191 g	382 g	573 g
20	236 g	471 g	707 g
22	285 g	570 g	855 g
24	339 g	679 g	1018 g
26	398 g	796 g	1195 g
28	462 g	924 g	1385 g
30	530 g	1060 g	1590 g
32	603 g	1206 g	1810 g
34	681 g	1362 g	2043 g
36	763 g	1527 g	2290 g
38	851 g	1701 g	2552 g
40	942 g	1885 g	2827 g

HOW TO USE THESE CIRCLE CHARTS

Use this chart to estimate the weight or final diameter of any circle stack.

1. Lookup 6mm Weight: A 10” diameter bowl (25 cm) fired to 6 mm thick will weigh about 760 g.

2. Size After Expansion: If you’ve made a stack project with many differently sized pieces and want to know what diameter it will reach at once it fully fuses to 6 mm, simply weigh the glued and assembled piece.

Then, find the closest weight in the 6 mm column—the corresponding diameter in the chart shows the project’s expected circular size.

APPENDIX 3: RECTANGULAR WEIGHTS

SQUARE/RECTANGLE - INCHES

SIZE		WEIGHT		
H	W	3mm	6mm	9mm
4”	4”	77 g	155 g	232 g
5	5	121 g	242 g	363 g
6	4	116 g	232 g	348 g
6	6	174 g	348 g	523 g
7	7	237 g	474 g	711 g
8	4	155 g	310 g	465 g
8	5	194 g	387 g	581 g
8	6	232 g	465 g	697 g
8	8	310 g	619 g	929 g
9	4.5	196 g	392 g	588 g
9	6	261 g	523 g	784 g
9	9	392 g	784 g	1176 g
10	4	194 g	387 g	581 g
10	5	242 g	484 g	726 g
10	6	290 g	581 g	871 g
10	8	387 g	774 g	1161 g
10	10	484 g	968 g	1452 g
11	11	585 g	1171 g	1756 g
12	4	232 g	465 g	697 g
12	6	348 g	697 g	1045 g
12	8	465 g	929 g	1394 g
12	9	523 g	1045 g	1568 g

SQUARE/RECTANGLE - CENTIMETERS

SIZE		WEIGHT		
H	W	3mm	6mm	9mm
10cm	10cm	75 g	150 g	225 g
12	12	108 g	216 g	324 g
14	10	105 g	210 g	315 g
14	14	147 g	294 g	441 g
16	16	192 g	384 g	576 g
18	18	243 g	486 g	729 g
20	10	150 g	300 g	450 g
20	12	180 g	360 g	540 g
20	15	225 g	450 g	675 g
20	20	300 g	600 g	900 g
22	22	363 g	726 g	1089 g
24	12	216 g	432 g	648 g
24	16	288 g	576 g	864 g
24	24	432 g	864 g	1296 g
26	13	254 g	507 g	761 g
26	26	507 g	1014 g	1521 g
28	28	588 g	1176 g	1764 g
30	10	225 g	450 g	675 g
30	15	338 g	675 g	1013 g
30	20.0	450 g	900 g	1350 g
30	25.0	563 g	1125 g	1688 g
30	30.0	675 g	1350 g	2025 g

HOW TO USE THESE SQUARE CHARTS

1. Lookup 6mm Weight: A 20 × 20cm tray (about 8 x 8”) weighs about 600g.

2. Size After Expansion: Weigh the glued and assembled piece. Find the closest weight in the 6 mm column—the corresponding H/W in the chart shows the project’s expected final size.

NOTE: Only compare squares to squares (10x10 with 12x12) and rectangles by proportion (1x2 with 2x4 or 3x4 with 6x8).

APPENDIX 4: TEMPERATURE CONVERSION

F°	C°
100 F°	38 C°
150	66
200	93
250	121
300	149
325	163
350	177
400	204
600	316
700	371
800	427
900	**482**
950	**510**
1000	538
1200	649
1225	663
1250	677
1300	704
1325	718
1350	732
1375	746
1400	760
1465	**796**
1490	**810**
1500	816
1525	829

C°	F°
38 C°	100 F°
66	150
93	200
121	250
149	300
163	325
177	350
204	400
315	600
371	700
426	800
482	**900**
816	**950**
538	1000
649	1200
663	1225
677	1250
704	1300
718	1325
732	1350
746	1375
760	1400
796	**1465**
810	**1490**
816	1500
829	1525

glass magic