Creating a Firing Schedule

It takes time to heat the glass all the way through (just like it takes time to heat a pot roast all the way through). The thicker the glass (or the pot roast) the longer it takes to heat up.

Size does matter
How fast a piece of glass will slump depends directly on it's size. The wider the span, the faster it will respond to gravity and bend downward. Short spans take a lot longer to slump then long spans.

All kilns are born equal
Different makes of glass slump and fuse at different temperatures but the same makes of glass will respond to heat in the identical way at the identical temperature in all kilns. Any variance between kilns is caused by difference in temperature readings in those kilns. It's not the kiln that's different, and it's not the temperature that's different. It's what temperature is being displayed. Not all kilns read accurately. Adapting any kiln to any fixed firing schedule is as simple as learning how off true your kiln temperature readings are and compensating for the error margin.

Low and slow or fast and furious
Driving slow is safer then driving fast. The same applies to kiln firing glass. Ramping slower and holding longer at lower temperatures is safer. But there are times in both driving and kilnforming that you need to go faster. If you hit a slippery spot while driving and the cars starts to skid, hitting the brakes will cause you to lose control. The correct response is to hit the gas and drive out of the skid. There are times when the same applies for kilnforming. Speeding up sometimes prevents accidents.

Short span slumps – If you want to slump an unusually short span (as for creating weaving strips) it can take several hours (even days) for the glass to sag at the temperature you usually use to slump. To produce short slumps in a reasonable time, you’ll have to go up to a much higher temperature then you usually would.
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Ramp Speed up and down is determined by glass thickness.

- **Single layer**: 500°F dph (260°C)
- **Double layer**: 400°F dph (200°C)
- **Triple layer**: 300°F dph (150°C)

**Thermal shock – it’s difference not degree.**
If the heat is increased or decreased so rapidly it causes the surface of the glass to be a significantly temperature then the core of the glass, the resulting difference can cause the glass to crack. Any ramp speed that fails to cause thermal shock is safe.

**Distortion**
Glass softened by heat will respond to gravity and sag. A slow ramp speed is more likely to cause this than a quick ramp speed. Distortion is most frequently caused by glass exercising its wish to become ¼” (3mm) thick. If heated to full fuse temperature, the glass will get its wish.

**Equalization Soak**
The first segment in a firing schedule usually has a soak at near 1000°F (535°C) to be sure the glass has become uniformly that temperature. Because thermal shock doesn’t happen after that temperature, equalizing temperature at 1000°F (535°C) allows you to ramp much faster up to performance temperature.

**Performance Temperature** is the temperature at which the glass performs the way you want. Different temperatures produce different performance.
FIRING SCHEDULE ELEMENTS:

1. **Ramp up** (speed of temperature increase). This depends on the thickness of glass to prevent thermal shock cracks. When firing scraps, it's safe to ramp very fast. The glass is already broken so there's no reason to worry about it cracking. 600°F (315°C) dph (degrees per hour) would be conservative. You could ramp as fast as 800°F dph (425°C).

2. **Equalization hold.** Often done at 1000°F (535°C) to ensure glass is heated uniformly. Important with large pieces, but not needed with scraps. Equalization could be completely eliminated.

3. **Ramp to performance.** After equalization, it's possible to speed up ramp speed. Irrelevant if you skip equalization hold.

4. **Performance hold.** Glass responds to heat in different ways at different temperature. Each make of glass is different with higher COE glass usually melting at lower temperatures. COE 104 glass should full fuse at 1425°F (775°C).

5. **Ramp to anneal.** This is done as fast as possible to move the glass temperature quickly down through the zone likely to cause devitrification.

6. **Anneal hold.** The glass is held at a set temperature to allow it to rebuild strength. How long depends on glass thickness.

7. **Stain point hold.** The glass is held at the strain point to release any residual stress in the glass.

8. **Finished ramp down.** Like the ramp up, the rate the glass cools will determine whether or not it cracks from thermal shock. For most projects, the down ramp will match the up ramp - but ramping up to melt scraps can be much faster then ramping down a finished project.