

The following slides describe the glass making process, and review the tempering process.

These slides are courtesy of Andersen Windows, Stillwater, Minnesota.





# Glass

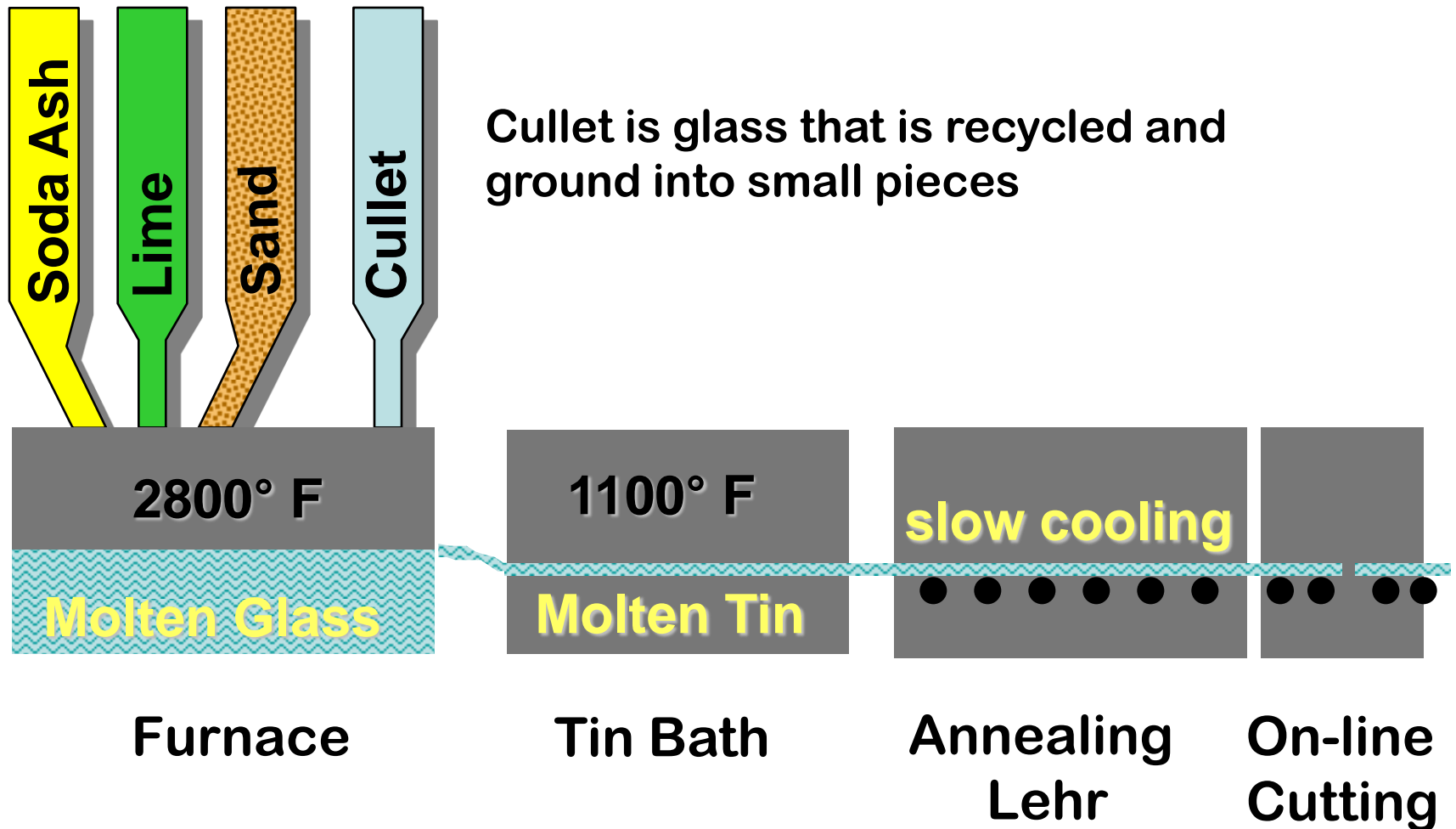
**What is the difference between (regular) annealed glass and tempered glass?**

**Raw materials are mixed together in a furnace that heats them to 2800 degrees F. As the materials melt and mix together, they float on a bath of molten tin. This is where the term 'float glass' comes from.**

- As the glass comes out of the furnace is slowly cooled and travels down the line on rollers.**
- As it moves down the line the glass is checked for defects by a laser. Any defects are marked and cut out further down the line in the cutting process.**
- As the new glass comes to the end of the line is cut to size, and stacked on racks to be shipped.**

**These steps are summarized in the next diagram.**

# Float Glass: The Process



# Annealed Glass

- **Advantages:**
  - **Cost**
- **Limitations:**
  - **Breaks in sharp pieces**
  - **Not as strong as Tempered Glass**
  - **Size limitations**

**The tempering process consists of the following steps:**

**1) First the glass is washed and then heated.**

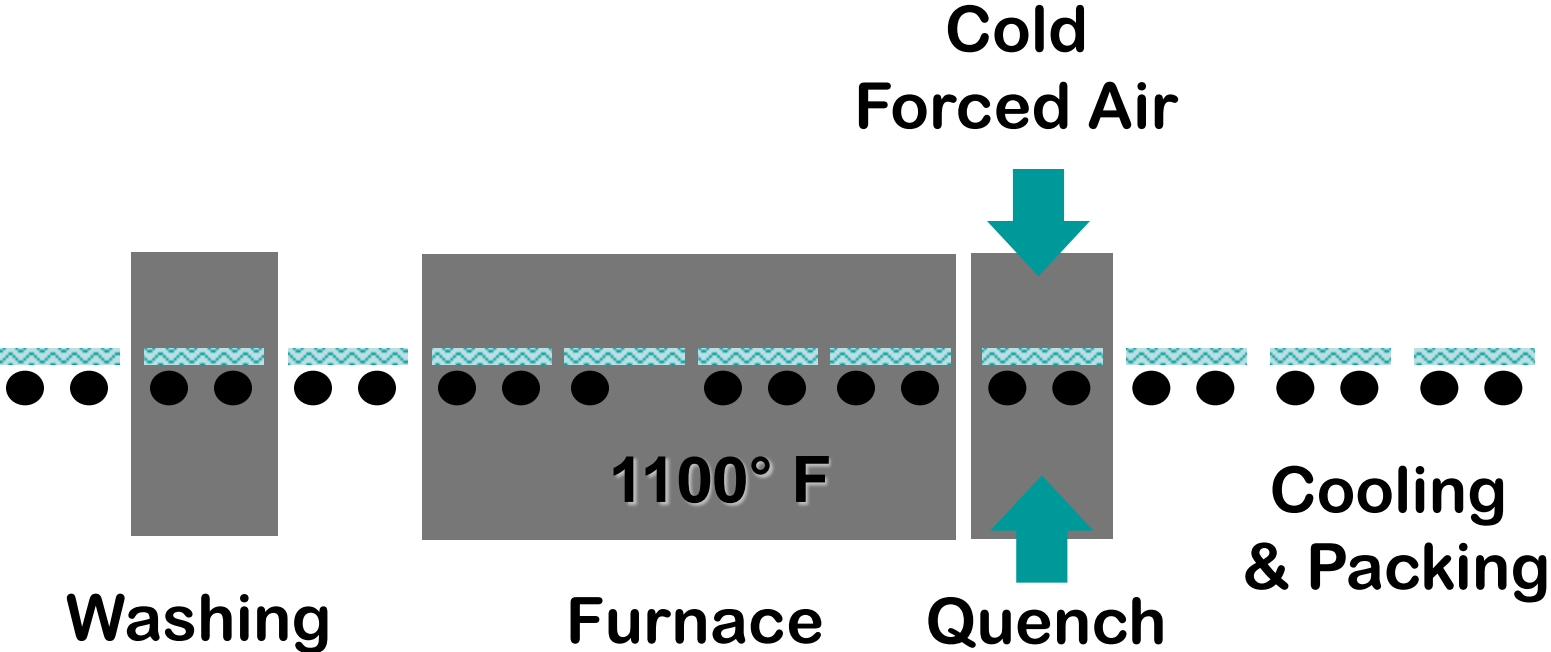
**2) In order to temper glass, it must reach 1100°F (the softening point for glass.)**

**3) The glass is then cooled with cold air. Quenching with forced cold air sets up the tension and compression zones.**

**4) The tempered glass continues down the rollers to cool more and be packed for shipping. Glass to be tempered must be cut to size before the tempering step.**

**A flow chart in the next slide provides a summary of the tempering process.**

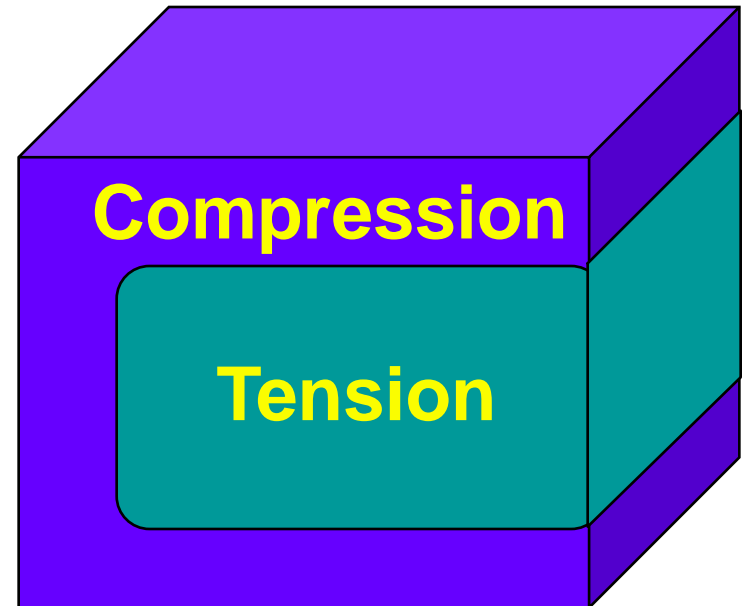
# Tempered Glass: The Process



Slide courtesy of Andersen Windows

# Tempered Glass

- Glass expands when heated
- Quenching “freezes” this expansion on the outside
- Center cools more slowly, and contracts. Sets up tension and compression zones.





- **Tempered Glass is required for door products and some windows installed near doors. If tempering is done improperly then distortion can result.**
- **Tempered glass is stronger than annealed glass. If annealed glass (raw float) has a strength factor of “1”, tempered glass would be “4”.**

# Tempered Glass

- Advantages:
  - 4 times the stronger than annealed
  - Breaks into small, harmless pieces.
  - Qualifies as Safety Glazing
- Limitations:
  - Must be cut to size before tempering
  - Optical distortion (roller wave, strain pattern)