

ASTM STANDARDS AND THE CANDLE INDUSTRY

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Workshop Presenters
Jim Becker – Candle Solutions
And
Bob Moss – SEA Ltd.

WHAT IS ASTM?

- ASTM International is one of the largest voluntary standards development organizations in the world-a trusted source for technical standards for materials, products, systems, and services. Known for their high technical quality and market relevancy, ASTM International standards have an important role in the information infrastructure that guides design, manufacturing and trade in the global economy.

WHAT IS THE PROCESS OF STANDARD DEVELOPMENT?

- Stake holders and interested parties including manufacturers, retailers, suppliers, testing laboratories and representatives from the US Consumer Products Safety Commission (CPSC) discuss test parameters, methodologies, procedures, terminology, requirements, and more to develop consensus standards.

WHAT ARE THE STANDARDS THAT AFFECT THE CANDLE INDUSTRY?

- ***F 1972 - 05 STANDARD GUIDE FOR TERMINOLOGY RELATING TO CANDLES AND ASSOCIATED ACCESSORIES***
- ***F 2058 - 07 STANDARD SPECIFICATION FOR CANDLE FIRE SAFETY LABELING***
- ***F 2179 - 02 (REAPPROVED 2007) SPECIFICATIONS FOR ANNEALED SODA-LIME SILICATE GLASS CONTAINERS THAT ARE PRODUCED FOR USE AS CANDLE CONTAINERS***
- ***F 2326 - 04 (REAPPROVED 2009) STANDARD SPECIFICATION FOR COLLECTION AND ANALYSIS OF VISIBLE EMISSIONS FROM CANDLES AS THEY BURN***
- ***F 2417- 09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLES***
- ***F 2601- 09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLE ACCESSORIES***

ARE THE STANDARDS MANDATORY?

- ALL STANDARDS ARE VOLUNTARY AT THIS TIME
 - THERE IS A PETITION (submitted by NASFM) TO THE CPSC TO MAKE THE STANDARDS MANDATORY
- WHAT DOES IT MEAN TO BE A VOLUNTARY STANDARD?
 - VOLUNTARY MEANS IT IS UP TO YOU TO FOLLOW THE STANDARDS OR NOT, **HOWEVER**
 - IF ONE OF YOUR CANDLES FAILS AND CAUSES PROPERTY DAMAGE OR INJURY, THE LAWYERS WILL CITE THESE STANDARDS AS THOUGH THEY ARE MANDATORY, **THEREFORE**

**IT IS IMPERATIVE THAT YOU BECOME FAMILIAR WITH
AND FOLLOW THE REQUIREMENTS OF THESE
STANDARDS**

F 1972 - 05 STANDARD GUIDE FOR TERMINOLOGY RELATING TO CANDLES AND ASSOCIATED ACCESSORIES

- No Specific requirements for F1972-05. This standard provides the working terminology so that everyone using the standards uses the same terms and definitions.
- These are terms that will appear in subsequent candle standards that the reader - user should become familiar with.
- If you do not have a copy of this standard one can be purchased through ASTM for about \$35. You can order on line at www.astm.org

WHAT ARE THE
REQUIREMENTS OF EACH
STANDARD?

F 2058 - 07 STANDARD SPECIFICATION FOR CANDLE FIRE SAFETY LABELING

- **WARNING STATEMENT WORDING (OR EQUIVALENT)**
 - “BURN WITHIN SIGHT”
 - “KEEP AWAY FROM THINGS THAT BURN”
 - “KEEP AWAY FROM CHILDREN”
- **NEW PLACEMENT REQUIREMENTS FOR CANDLES WITH PACKAGING**
 - **MUST BE PLACED ON THE TOP OR SIDES OF THE PACKAGE**
 - IF THE WARNING IS PUT ON THE BOTTOM OF THE PACKAGE, THE WORDS “SEE BOTTOM PANEL FOR SAFETY INFORMATION” MUST APPEAR ON THE TOP OR SIDE OF THE PACKAGE
- **NEW PICTOGRAM OPTIONS**



F 2058 - 07 STANDARD SPECIFICATION FOR CANDLE FIRE SAFETY LABELING

- **PICTOGRAMS CANNOT BE USED WITHOUT TEXT**
- **LABELS MUST BE VISIBLE TO THE CONSUMER AT THE POINT OF SALE**
- **FREESTANDING AND FILLED CANDLES (EXCLUDING TEALIGHTS) – FIRE SAFETY WARNING MUST APPEAR ON THE TOP, BOTTOM OR SIDES OF THE CANDLE AS WELL AS ON THE PACKAGING**
- **SMALL CANDLES WITH LESS THAN 21 CM³ (SUCH AS VOTIVES) CAN USE WARNING STATEMENT “BURN WITHIN SIGHT” WITH THE SAFETY ALERT SYMBOL**

F 2058 - 07 STANDARD SPECIFICATION FOR CANDLE FIRE SAFETY LABELING

**TABLE 1 Minimum Size Requirements for the Components of the
Text-Only Fire Safety Warning Option**

Surface Area of the Warning Panel	Minimum Height of the Safety Alert Symbol and the Signal Word "WARNING"	Minimum Height of Fire Safety Warning Statements
21 cm ² (3.3 in. ²) or less ^A	1.5 mm (0.06 in.)	1.3 mm (0.05 in.) ^B
Greater than 21 cm ² (3.3 in. ²) but less than 60 cm ² (9.3 in. ²)	1.5 mm (0.06 in.)	1.3 mm (0.05 in.) ^B
60 cm ² (9.3 in. ²) or greater	1.8 mm (0.07 in.)	1.5 mm (0.06 in.) ^B

***F 2179 - 02 (REAPPROVED 2007) SPECIFICATIONS FOR
ANNEALED SODA-LIME SILICATE GLASS CONTAINERS
THAT ARE PRODUCED FOR USE AS CANDLE CONTAINERS***

- **Thermal shock resistance requirements**
- **Containers must survive a thermal shock with a 90°F differential between the hot and cold water baths. Containers exposed to hot water bath for 5 minutes, 15 second transfer time and then 30 seconds in cool water bath. Typical bath temperatures are 160°F for hot water bath and 70°F for cool water bath.**

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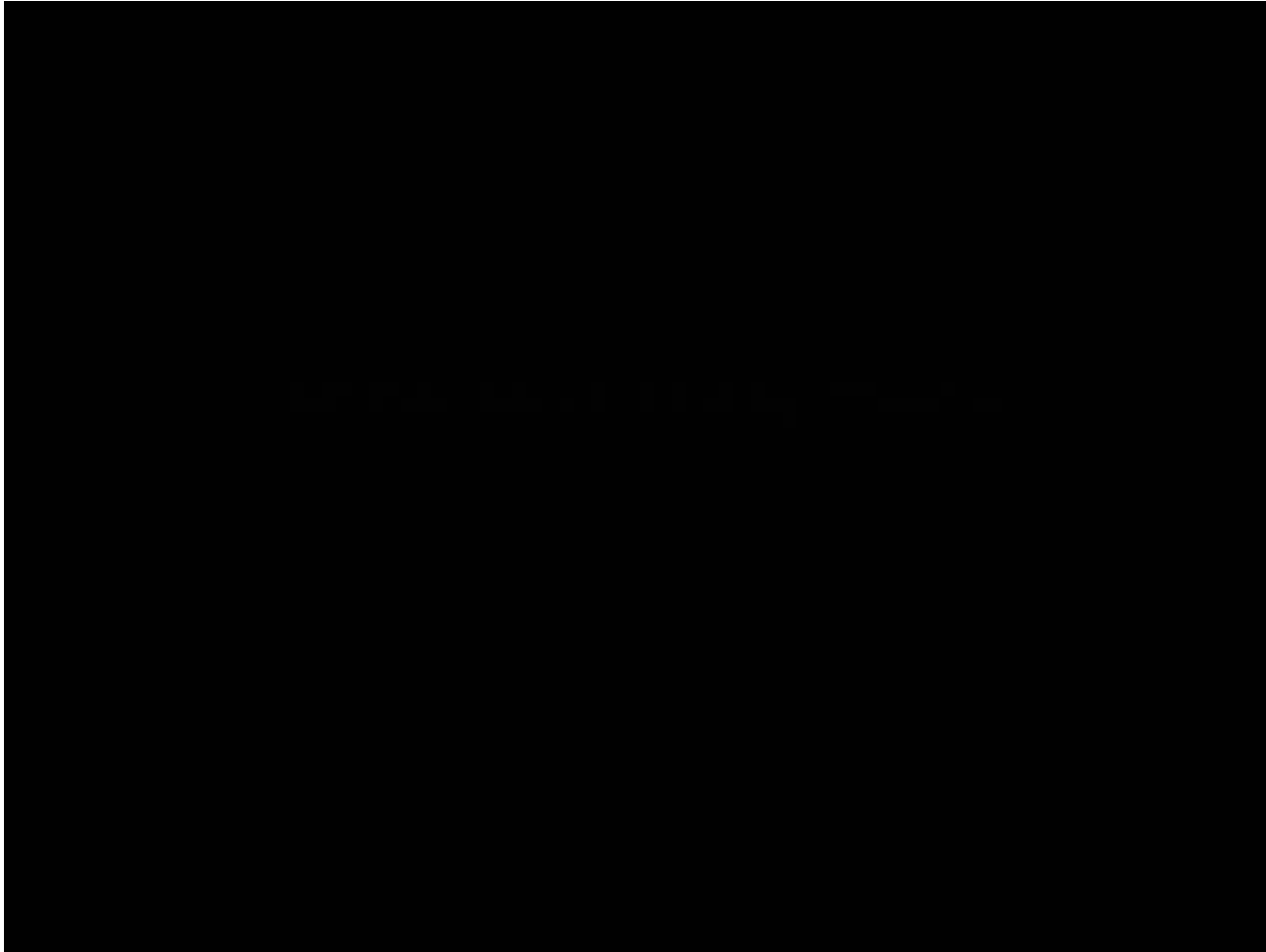
Annealing requirements

- **Polariscope method – containers examined using crossed polarized light to look at residual strain in the glass. Glass is evaluated to determine apparent and real temper. To meet the specification the real temper must be 4 or less.**
- **Real temper = Apparent temper / $(T/0.160)$
where T = the thickness of the container**

REFERENCED ASTM STANDARDS FOR ASTM F2179

- ***ASTM C 149 TEST METHODS FOR
THERMAL SHOCK RESISTANCE OF
GLASS CONTAINERS***
- ***ASTM C 148 TEST METHODS FOR
POLARISCOPE EXAMINATION OF GLASS
CONTAINERS***
- ***ASTM C 224 PRACTICE FOR SAMPLING
GLASS CONTAINERS***

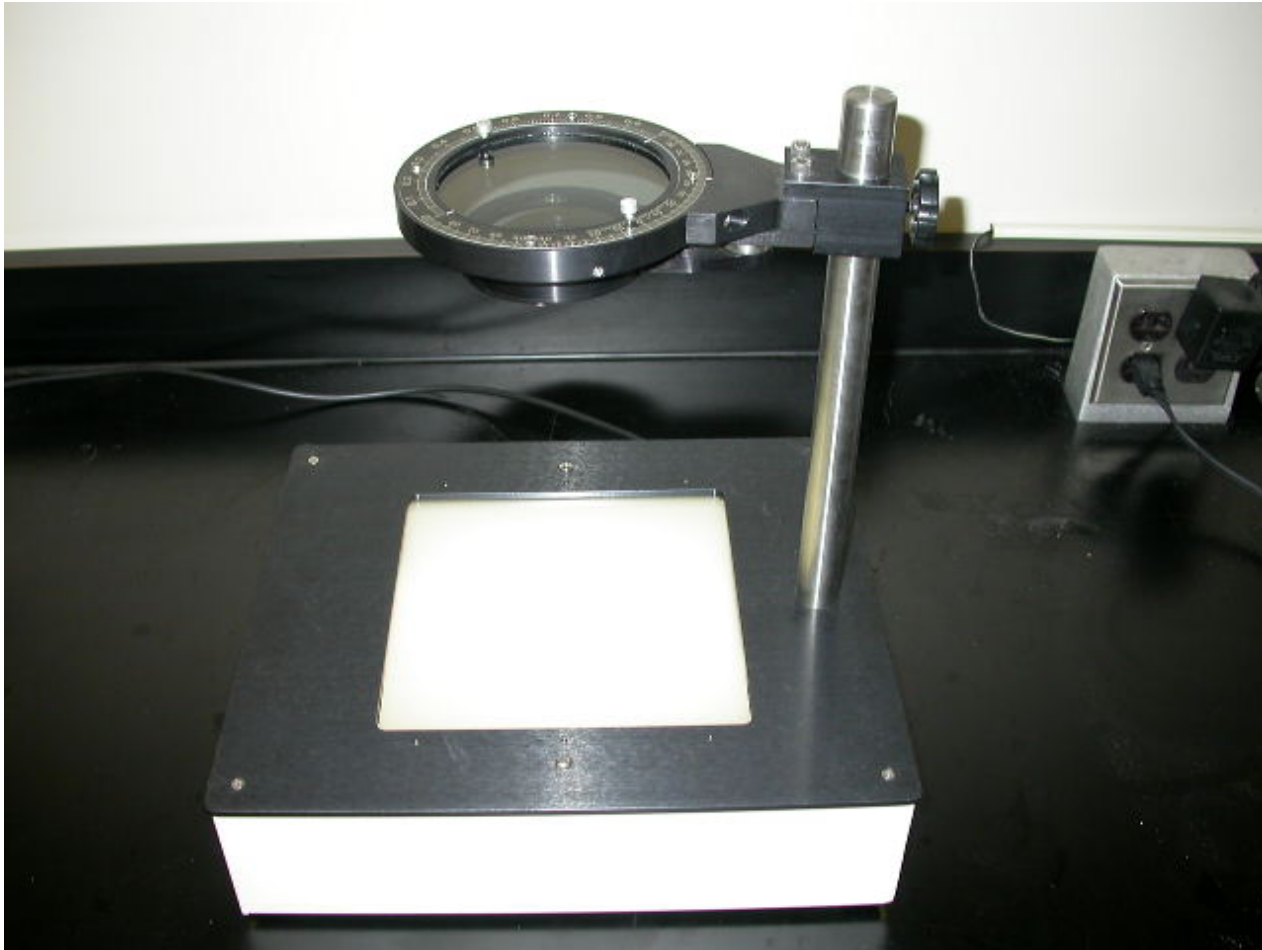
Thermal Shock Testing Libbey Glass



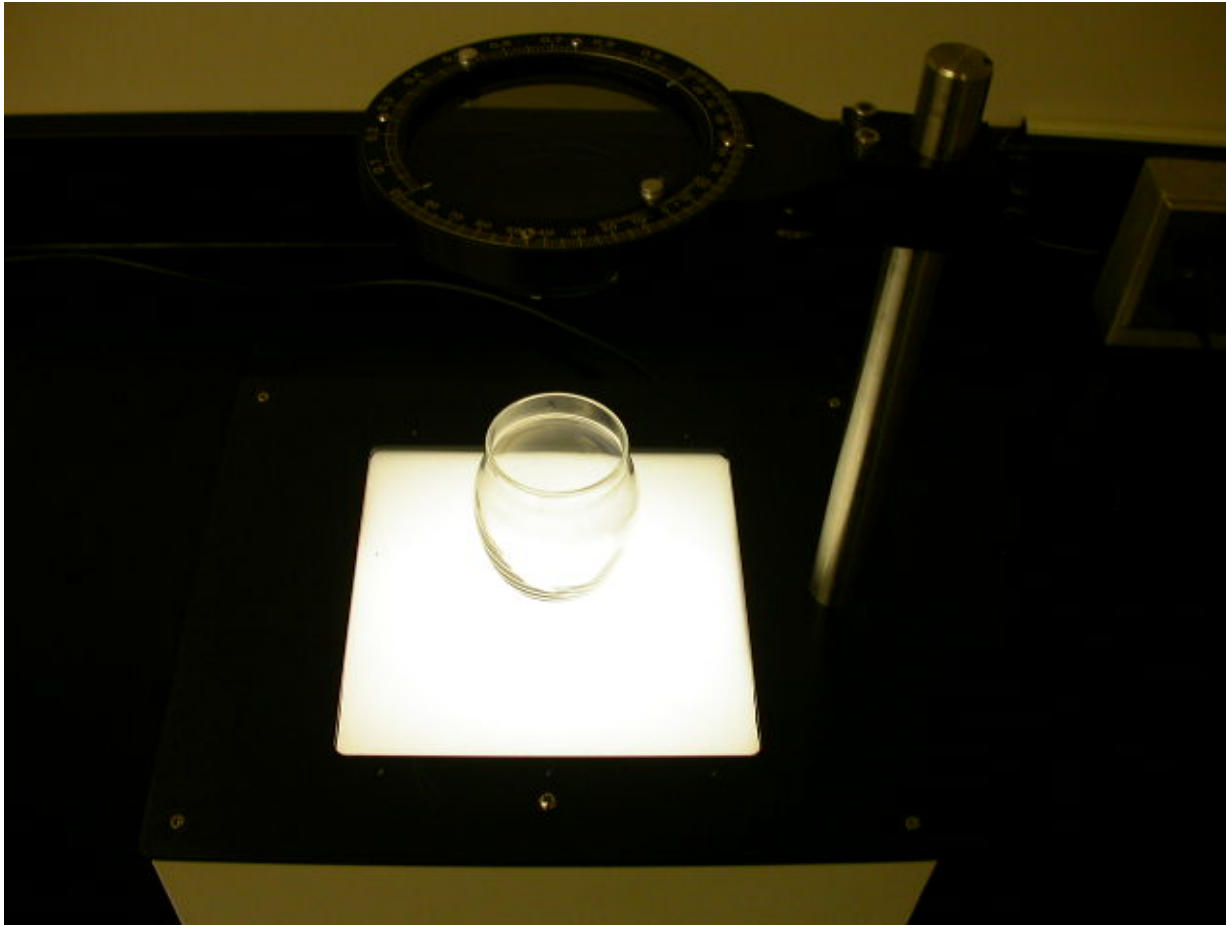
Thermal Shock Testing



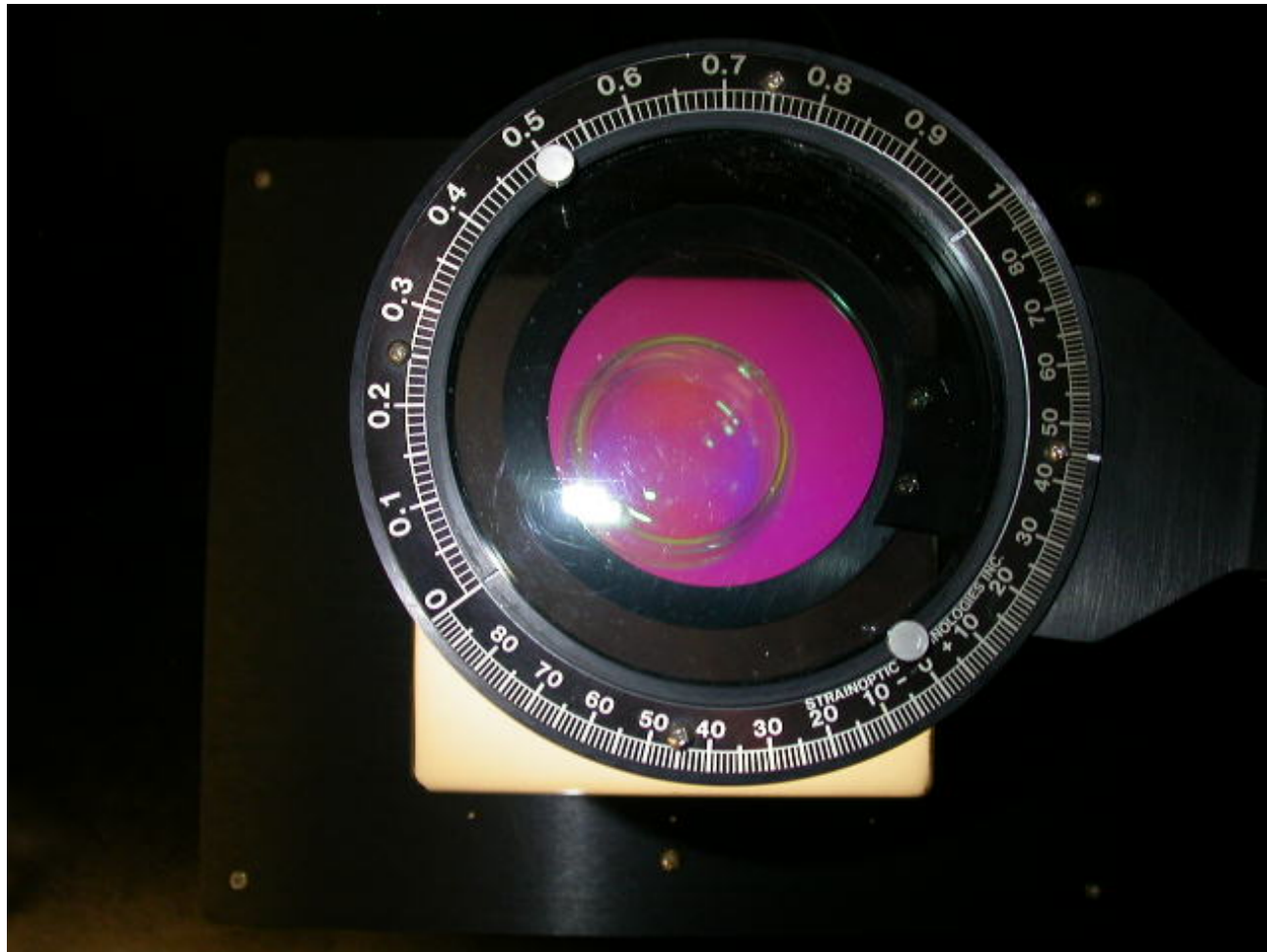
Polariscope and Annealing



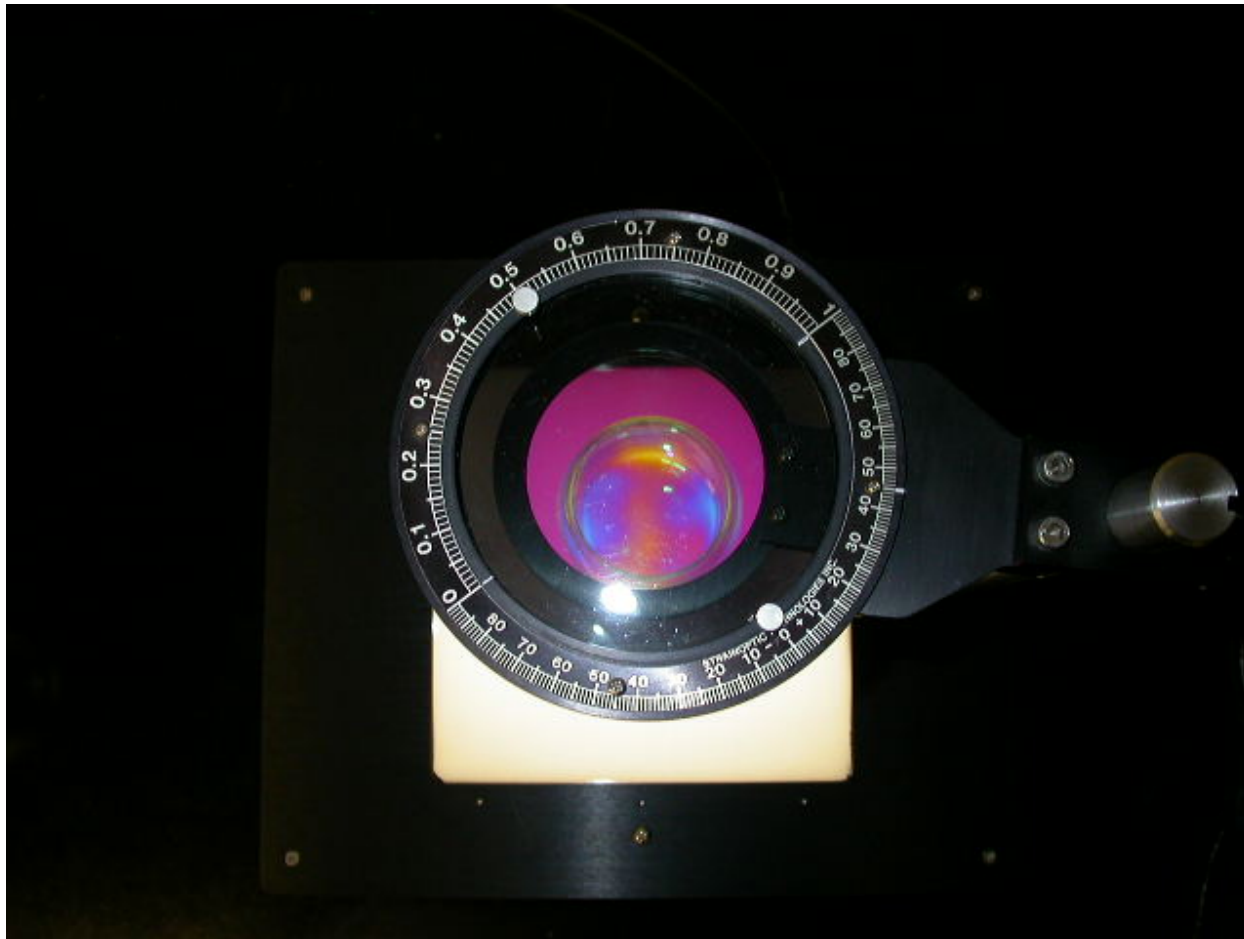
Polariscope and Annealing



Polariscope and Annealing



Polariscope and Annealing



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THAT ARE PRODUCED FOR USE AS CANDLE CONTAINERS***

Annealing requirements

- **Scribe test method – containers bottoms are scribed or sanded around the knuckle at the base with an X scribed in the bottom.**
- **Containers are filled with room temperature water and allowed to stand for 15 minutes.**
- **Containers are emptied and examined for cracks and breakage.**

F 2417- 09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLES

- Burn Test parameters:
 - Candles burned in 4-hour burn cycles until end of useful life except tea lights and gel candles
 - Wicks to be trimmed to manufacturer's label instructions
 - Burned in laboratory with minimum draft
 - Laboratory temperatures between 68°F to 86°F
 - Candles spaced a minimum of 20 cm apart
 - Flame heights observed at periodic intervals and recorded at the end of each burn cycle

F 2417- 09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLES

- Maximum Flame height requirement
 - UP TO 3 INCHES (MOST CANDLES)
 - UP TO 3.75 INCHES (CERTAIN RELIGIOUS CANDLES)
 - Candles intended to be burned outside are exempt
- No secondary ignition
- No container failures
- For pillar candles no flame impingement of flame on the supporting surface at end of life

Flame Height Measurement



Flame Height Measurement



Flame Height Measurement Novelty Candle



Secondary Ignition Example

Carbon Balls and Glass Failure



Secondary Ignition Example Flash Over



Secondary Ignition Flammable Coating



Container Failure



F 2417- 09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLES

- **STABILITY**
- Initially candles must remain stable when tilted to 10° off level
- Tilt stability of candles while in test
 - **“BURNING CANDLE SHALL NOT TIP OVER DURING BURN TESTING” WHICH APPLIES TO FREESTANDING CANDLES ONLY**

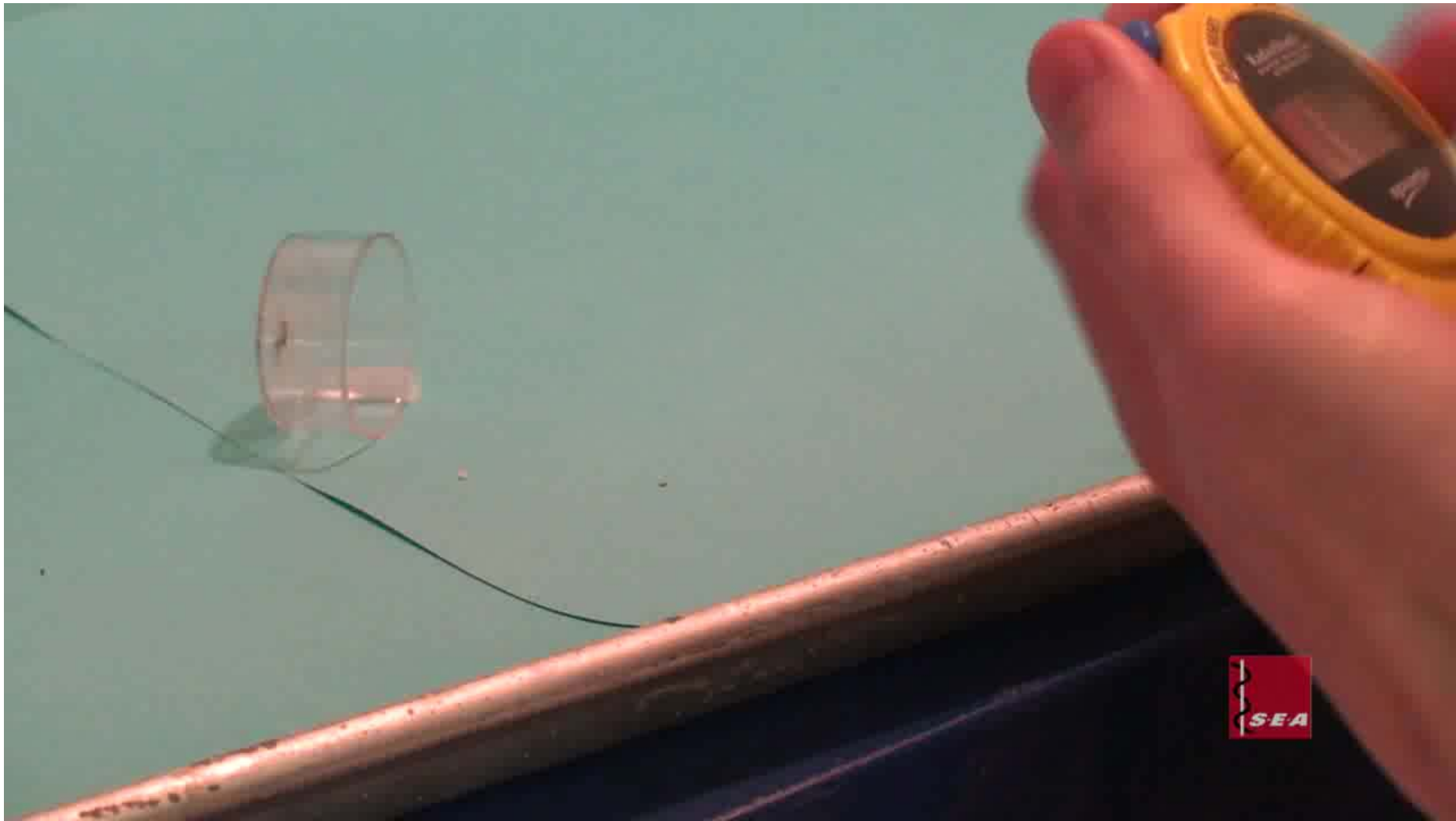
Test For Stability



F 2417- 09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLES

- **PLASTIC TEALIGHT CUP FLAMMABILITY**
 - 10 CUPS ARE TESTED FOR FLAMMABILITY ON THEIR SIDES
 - BUTANE FLAME APPLIED TWICE TO EACH CUP FOR 10 SECONDS EACH APPLICATION
 - MEASURE THE CUMULATIVE AMOUNT OF TIME OF COMBUSTION AFTER EACH APPLICATION FOR ALL 10 CUPS
 - TOTAL CUMULATIVE TIME CANNOT EXCEED 300 SECONDS
 - NO SINGLE TEST BURN CAN EXCEED 30 SECONDS
 - NO TEST SPECIMEN CAN BE COMPLETELY CONSUMED BY THE FLAME

Plastic Tealight Cup Flammability Test



F 2417-09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLES

- Gel appendix guidance for gel candle manufactures
 - **ADDED FLASH POINT GUIDELINES FOR RAW MATERIALS AND FINAL FORMULATION**
 - **MINERAL OIL – MINIMUM 395° F**
 - **FRAGRANCE – MINIMUM 180° F**
 - **FINISHED CANDLE FORMULATION - 375°F**
 - **RECOMMENDS EXTENSIVE TESTING BE DONE**
 - **RECOMMENDS WORKING CLOSELY WITH RAW MATERIAL SUPPLIERS**

F 2601-09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLE ACCESSORIES

RING FLAMMABILITY REQUIREMENTS

- **TEST TRIPLICATE SAMPLES OF EACH MATERIAL ON THE CANDLE RING**
- **FLAME APPLIED FOR UP TO 60 SEC.**
- **AVERAGE COMBUSTION TIME FOR THE THREE TESTS CANNOT EXCEED 30 SEC. WITH NO ONE TEST SAMPLE BURNING MORE THAN 60 SEC.**

Trim Ring Flammability Test



F 2601-09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLE ACCESSORIES

- **CANDLE HOLDER REQUIREMENTS**
 - **FLAMMABILITY REQUIREMENTS FOR ALL CANDLE HOLDERS**
 - **TRIPLICATE SAMPLES OF EACH MATERIAL IN THE HOLDER TESTED**
 - **FLAME APPLIED FOR UP TO 60 SEC.**
 - **AVERAGE COMBUSTION TIME FOR THE THREE TESTS CANNOT EXCEED 30 SEC. WITH NO ONE TEST SAMPLE BURNING MORE THAN 60 SEC.**

Candleholder Flammability Test

F 2601-09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLE ACCESSORIES

- **CANDLE BURNER REQUIREMENTS**
 - **THREE IDENTICAL SAMPLES BURNED EIGHT TIMES EACH**
 - **NO EXCESSIVE FLAME HEIGHTS, SECONDARY IGNITION OR END OF USEFUL LIFE PROBLEMS AS DEFINED IN F 2417**
 - **BURNERS SHALL BE TESTED WITH A SCENTED TEALIGHT OR OTHER SPECIFIED OR SUPPLIED CANDLE**
 - **POTPOURRI BURNERS SHALL BE BURNED WITH THE SPECIFIED MATERIAL OR SCENTED WAX IF NO MATERIALS ARE SPECIFIED**

Candle Potpourri Burner Set-Up



Candle Potpourri Burner Test



Candle Burner Test



F 2601-09 STANDARD SPECIFICATION FOR FIRE SAFETY FOR CANDLE ACCESSORIES

- **STABILITY WARNING**
 - **IF THE ACCESSORY IS INTENDED TO BE USED WITH A CANDLE OTHER THAN THOSE SPECIFIED IN THE STANDARD, A WARNING MUST BE INCLUDED**
 - **“WARNING: TO PREVENT FIRES DUE TO TIPOVER, DO NOT USE A CANDLE GREATER THAN “X” INCHES TALL”**

Candle Accessory Tilt Test



***F 2326 - 04 (REAPPROVED 2009) STANDARD
SPECIFICATION FOR COLLECTION AND ANALYSIS OF
VISIBLE EMISSIONS FROM CANDLES AS THEY BURN***

- Same burn requirements as ASTM F2417
 - Candles burned in 4-hour burn cycles except tea lights and gel candles
 - Wicks to be trimmed to manufacturer's label instructions
 - Burned in laboratory with minimum draft
 - Laboratory temperatures between 68°F to 86°F
 - Candles spaced a minimum of 20 cm apart

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SPECIFICATION FOR COLLECTION AND ANALYSIS OF
VISIBLE EMISSIONS FROM CANDLES AS THEY BURN***

- Candle allowed to burn for 15 minutes to develop a wax pool and a stable flame.
- Glass slide positioned 4 inches (10 cm) above the wax pool.
- Candles burned for 4 burn cycles (total burn time typically 16 hours).
- Glass slides evaluated using an optical densitometer for opacity.
- Method does not have a pass/fail criteria – does provide a numerical indicator for the concentration of smoke collected on the slide.
- Method intended for manufactures in wick selection.
- Method developed when the market had predominately single wick candles.
- Method is good for dark smoke does not work well for white smoke produced by some vegetable wax candles.

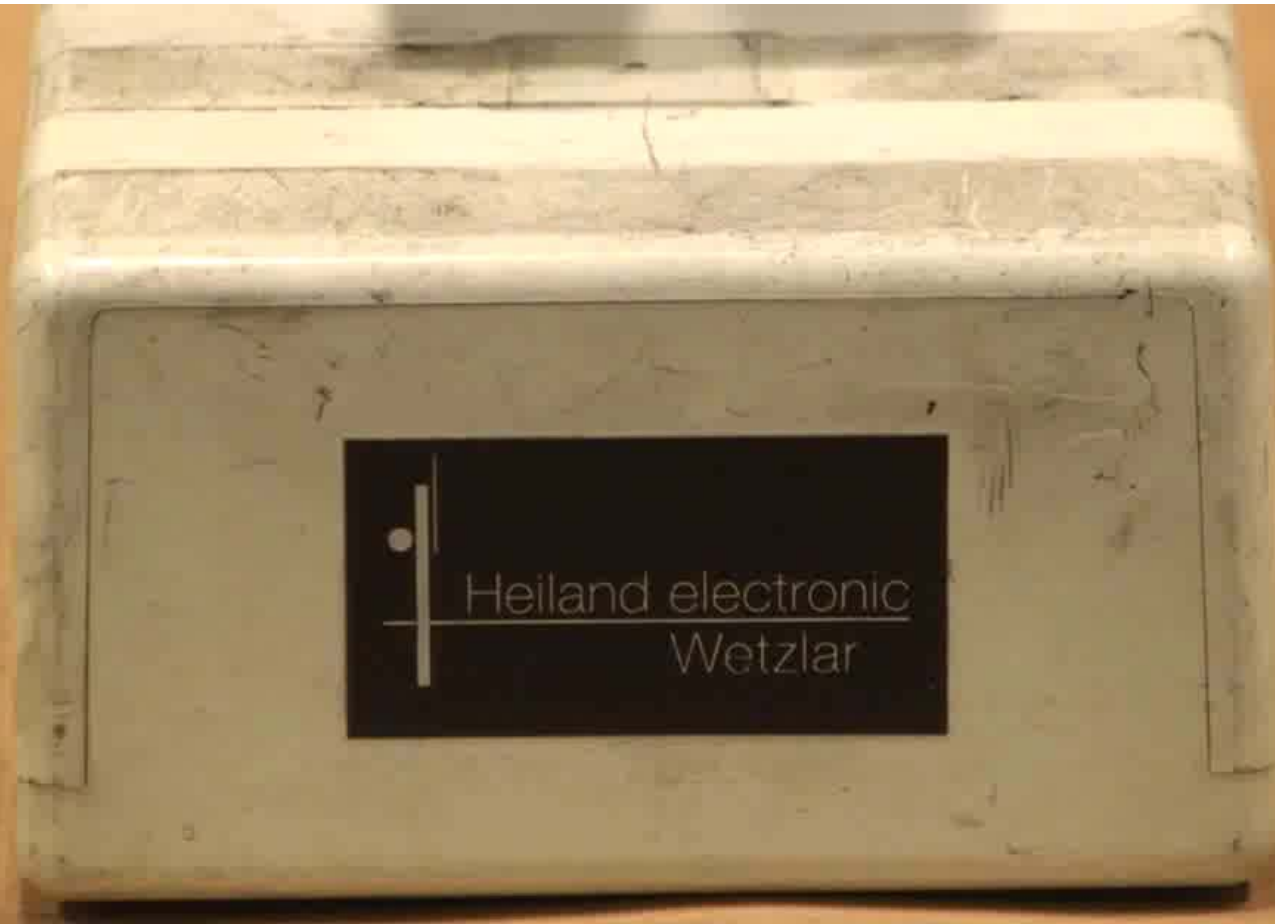
Set up For ASTM F2326



“Harvesting the Slide”



Verifying Calibration of the Densitometer



Measuring Visible Emissions With Densitometer

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Special Thank You to

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