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Guidance for the SGCC Quality Assurance Production Testing

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Summary

SGCC® requires licensees to have a working quality assurance program for the fabrication of safety glazing. Compliance to quality assurance requirements is validated at the first plant inspection after products are certified. Adherence is verified during twice per year plant visits. These requirements were adopted to improve the overall quality and reliability of safety glazing products in the program. These requirements are in addition to the ANSI, CPSC and CAN/CGSB 12.1 compliance testing required by the SGCC® certification program. The intent is to enhance the quality of products produced in the interim production periods between test cycles. Although a quality assurance program is a fundamental element of good fabrication practices, only successful testing to ANSI Z97.1, 16 CFR 1201 or CAN/CGSB 12.1 is valid proof of compliance with these standards.

As of **January 1, 2020**, a licensee's quality assurance program, as a minimum, must have the following elements (see page 18 of the *January Certified Products Directory* for the full detailed list):

- A Quality System Manual
- Designated Representative for Quality Assurance
- Process Control(s)
- Production testing
- Calibration

This Guidance document is to help further define and provide additional information on SGCCs “Production Testing” requirements. *Note: Where ANSI or ASTM test methods are referenced below, other like national or internationally accepted test methods (for example EN 12600) are acceptable.*

Production testing – Procedures shall describe testing of regular production and shall include SGCC requirements for safety glazing products. The SGCC auditor shall 1) review historical testing records ensuring procedures were followed if failure occurred 2) witness at least one production test and 3) review the method of evaluation during twice per year visits. When samples are not available, the manufacturer shall describe to the auditor how production testing is performed. Where ANSI or ASTM test methods are referenced below, other like national or internationally accepted test methods (for example EN 12600) are acceptable. Records of testing shall be maintained for a minimum of 10 years.

Tempered – ANSI Z97.1 Center Punch and/or Impactor Test - As a minimum, testing shall occur on the first of each product thickness per shift. Additional testing may be appropriate.

Laminated – ASTM F3007 and/or ANSI Z97.1 Impactor Test - During regular production periods, a minimum sample collection shall be performed weekly, and actual testing occur at least monthly. Sample collection must be traceable to specific production runs. For ASTM F3007 testing, sampling and testing shall occur as a minimum on the thinnest product(s) produced. Evaluation shall occur and drop height selection as a minimum shall be in accordance with ASTM F3006.

Production Testing – Tempered (*Center Punch*):

Reference Documents: *ANSI Z97.1 – 2015* For safety glazing materials used in buildings

Equipment: Sharp impactor¹, Specimen support frame (flat base with adjustable horizontal curbs), calibrated scale, calibrated micrometer

Additional Notes:

- ANSI Z97.1 paragraph 5.2.2 (1) references “ ... place curb lightly along the specimen edges ...”. It is recognized that it may not be practical to accomplish this for all shapes and sizes of production test samples. Generally testing with the absence of curbing is viewed as a “worst case” test, compared to the use of curbing.

- Because of the elevated temperature of tempered glass during the production process you may disregard the section of ANSI Z97.1 section 5.2 which speaks to the conditioning of the specimen prior to testing.

Steps for conducting ANSI Center Punch Test (ANSI Z97.1-2015 Section 5.2)

**Note: Review ANSI Z97.1-2015 specifications for details, the intent of this document is to be used as a Guidance tool*

- Specimen size - test sample(s) should be representative of normal production, at the discretion of the fabricator, **record**
- Specimen thickness / weight - specimen must be measured and/or weighed to determine ten square inches of the original specimen determined from the weight, width, length of that specimen, **record**
- Specimen must be from your production process, **record** date and time of specimen production
- Frequency as a minimum, testing shall occur on the first of each product thickness per shift (additional testing may be appropriate).
- Setup testing – Flat glass: place the specimen on the flat base and place the curb lightly along the specimen edges so the sample can elongate slightly.
- Test the Specimen – strike the test specimen 1 in. (25 mm) inboard of the longest edge at its midpoint until fracture occurs. (Figure 8 below can be found in the ANSI Z97.1-2015 Section 5.2.4)

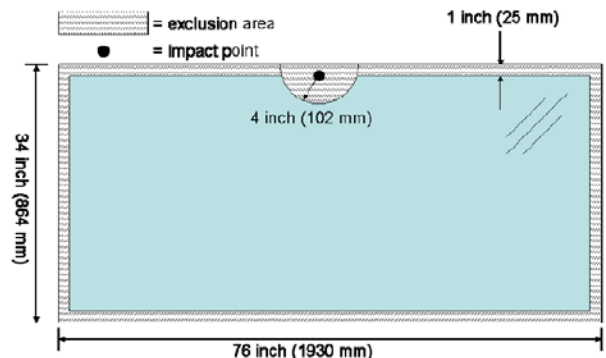


Figure 8: Center Punch Fragmentation

- Interpretation of Results. Following impact/fracturing, within 5 minutes collect and weigh the ten (10) largest crack-free particles. The total weight of the ten (10) largest crack free pieces shall weigh no more than the equivalent weight of 10 square inches of the original test sample. NOTE no one particle shall be longer than 4” (see ANSI Z97.1-2015 Section 5.2.4(2)). **Record** results. *See example Break Test Record Data Sheet.*
 - When selecting particles for evaluation, if any portion of a particle is outside the exclusion area, the entire particle would be considered for evaluation.

¹ Recommended spring loaded center punch Model: Starrett 818 Automatic Center Punch with Adjustable Stroke, 5” length, 5/8” diameter or Model: Starrett 18C Automatic Center Punch Heavy-Duty with Adjustable Stroke, 5 ¼” length, 11/16” diameter

Production Testing – Laminated (Ball Drop Impact):

Reference Documents: ASTM F3007-19 Standard Test Method for Ball Drop Impact Resistance of Laminated Architectural Flat Glass & ASTM F3006-19 Standard Specification for Ball Drop Impact Resistance of Laminated Architectural Flat Glazing.

Hazards: Warning It is the responsibility of the user of the standards listed above and discussed here on out to establish appropriate health and safety practices, and to determine the applicability of regulatory limitations prior to use.

Equipment: 2.3kg (+/- 0.1kg) 83mm diameter smooth solid steel ball, support frame (see Figure 1 ASTM F3007-19), mechanism for ensuring the unimpeded drop of the ball, calibrated micrometer. (See ASTM F3007-19 Section 6 for more details) (see attached Material list for more details)

Drop Height: Measurement shall be taken from the bottom of the ball to the surface of the glass.

CLASS A	3.66 m (+1.27 cm)	12 ft (+ ½ in)
CLASS B	0.75 m (+1.27 cm)	2.46 ft (+ ½ in)

Clamping: Only clamp a sample to prevent pull-through or sample displacement from impact frame, which will result in a non-test. Over clamping a sample may result in more a severe test which does not correlate to ANSI Z97.1 2015.

Sample Selection: Testing shall occur on the thinnest of each product produced for certification (based on SGCC #). Select at least 3 samples (with 4 being the maximum number of samples allowed for selection).

Spall Measurement: Spall measurement is not required as part of the QA in plant testing procedure. In the standard F3007 – 19 sections 9.3 and 9.7 may be disregarded. In the standard F3006 – 19 sections 7.4.3 and 8.1.7 – 8.1.10 may be disregarded.

Steps to setup and conduct the Ball Drop Impact test:

**Note - Frequency as a minimum collection shall be performed weekly and actual testing occur at least monthly*

Step 1 SAMPLE SELECTION: Specimen must be from your production process. Specimen size, 305 +/- 10mm by 305 +/- 10mm (12 +/- 0.4" x 12 +/- 0.4"). **Record** specimen glass configuration, date and time of specimen production.

Step 2 CONDITIONING: Condition the specimen for approximately 4hrs. at 24 +/- 5°C (between 66 - 84°F). **Record** the glass surface temperature.

Step 3 INITIAL MEASUREMENTS: Measure and **record** the **thinnest** thickness. *The thickness of the specimen shall be measured at the midpoint of the four sides within 1in. of the edge.*

Step 4 SETUP TESTING: Place specimen on the support frame (does not require clamping but recommended so as not to result in a “deemed non-test” if the specimen falls off the frame when impacted See ASTM F3007-13 Table 1 Note 1).

Step 5 DROP HEIGHT AND RELEASE: Using Table 2 ASTM F3006-19 to determine the drop height (note the 1st listed height 0.75m correlates with ANSI Z97.1 Class **B**). Release the steel ball from an at-rest position and impact the specimen within 25mm (1in.) of the center of the glass. If using a pull pin release system ensure to remove the pin with 1 rapid motion *Note: Recommend testing to what you are currently SGCC certified to (if you are certified to ANSI Z97.1-2015 Class A test drop height of 3.66m or to ANSI Z97.1-2015 Class B test drop height of 0.75m)*

Step 6 INTERPRETATION OF RESULTS: Following impact, within a 5sec interval determine the penetration resistance/retention characteristics of the specimen using ASTM F3007-13 Table 1. **Record** results.

Step 7 CONTINUED TESTING: Repeat this test on at least 2 (maximum of 3) additional specimens from the same production lot at the same or elevated drop height. **Record** results.

Step 8 REPORT RESULTS: Report **results**. See report requirements found in ASTM F3007-19 Section 11.

Suitable Alternatives for Production Testing

Production Testing:

Mandatory in-plant testing

Required by SGCC QA and Testing requirements to address consistency of production

Quality Assurance Testing:

Non-Mandatory in-plant testing

Recommended by suppliers and/or internal policies

(While SGCC does not require or endorse many forms of in-plant quality assurance testing, SGCC recognizes the value of such tests and supports testing beyond SGCC mandatory testing as a viable option for QA.)

NOTE: We are not suggesting these standards are equivalent for production control

Standard / Equipment	Title	Production Test	Suitable Alternate For	Requirements When Testing to This Standard
ANSI Z26.1	Standard for Safety Glazing Materials for Glazing Motor Vehicles	Penetration Resistance Test 20 (Section 7.20)	ASTM F3006 & 3007 Ball Drop Test laminated glass	<ul style="list-style-type: none"> - Use 3 Test Samples Only (Max 4) - Ball Drop height should reflect SGCC QA Guidance Document
EN 12600	Glass in Building Impact Test Method and classification of flat glass	Pendulum test	ANSI Z97.1 Impact Test Laminated or tempered glass	<ul style="list-style-type: none"> - Test up to 3 drop heights (Class 1,2,3) - Only for testing 34 x 76" - Penetration force is 25 N instead of 18 N - No Center Punch test on tempered sample if breakage doesn't occur - No particle weight determination
EN 14449	Glass in Building - Laminated glass and laminated safety glass	Ball Drop Test Annex C.2	ASTM F3006 & 3007 Ball Drop Test laminated glass	<ul style="list-style-type: none"> - Drop Height not Defined - Ball different dimensions - Samples Tested different dimensions
		Pendulum Impact Test Annex C.3	ANSI Z97.1 Impact Test laminated glass	<ul style="list-style-type: none"> - Specification for penetration resistance only
GANALD-100	Standard Test Method for Ball Drop Impact of Laminated Architectural Flat Glass	Ball Drop Test	ASTM 3007 Ball Drop Test laminated glass	<ul style="list-style-type: none"> - This is only the testing procedure; the specification should still refer to ASTM F3006

Laminated

Tempered

Standard / Equipment	Title	Production Test	Suitable Alternate For	Requirements When Testing to This Standard
Optical Scanner	See Manufactures Specifications	See Manufactures Specifications	Evaluation of ANSI Z97.1 Center Punch Fragmentation Test tempered glass	<ul style="list-style-type: none"> - Follow ANSI Z97.1 - 15 (R2020) section 5.2 Fragmentation Procedure (or suitable alternative) - Scanner to be used in place of sections 5.2.3 & 5.2.4
EN 12600	Glass in Building Impact Test Method and classification of flat glass	Pendulum test	ANSI Z97.1 Impact Test Laminated or tempered glass	<ul style="list-style-type: none"> - Test up to 3 drop heights (Class 1,2,3) - Only for testing 34 x 76" - Penetration force is 25 N instead of 18 N - No Center Punch test on tempered sample if breakage doesn't occur - No particle weight determination
EN 12150	Glass in Building - Thermally Toughened Soda Lime Silicate Safety Glass	Fragmentation Test (Section 8)	ANSI Z97.1 Center Punch Fragmentation Test tempered glass	<ul style="list-style-type: none"> - Test for Thermally Toughened Soda Lime Silicate Safety Glass - Size of specimen tested may be at discretion of participant - Particle evaluation is number of particles in 50mmx 50mm mask
EN 14179	Glass in building - Heat soaked thermally toughened soda lime silicate safety glass	Fragmentation Test (Section 10)	ANSI Z97.1 Center Punch Fragmentation Test tempered glass	<ul style="list-style-type: none"> - Test for Heat soaked thermally toughened soda lime silicate safety glass - Strike specimen 1" in from edge
GANA TD-101	Standard Test Method for Center Punch Frag. of Fully Tempered Flat Glass	Fragmentation Test	ANSI Z97.1 Center Punch Fragmentation Test tempered glass	<ul style="list-style-type: none"> - Curbing is not optional as stated in this standard - Adhesive tape is written to be equivalent of curbing in this standard
NOM-146-SCFI-2016	Glass products-safety glass used in construction-specifications and test methods	Section 7.3	ANSI Z97.1 Center Punch Fragmentation Test tempered glass	<ul style="list-style-type: none"> - Testing can be done on a single sample, size at discretion of participant - Strike should be 1" from glass edge, with 8" D exclusion area, and 1" perimeter exclusion area - 10 largest particles or written evaluation method - Level 1 (Type B) & Level 2 (Type A)
		Section 7.5	ANSI Z97.1 Impact Test Laminated or tempered glass	<ul style="list-style-type: none"> - 4lb force should be applied when evaluating tears - Particle Evaluation to be done as per ANSI Z97.1