



A. INTRODUCTION

- A.1 The purpose of this outline is to set forth the minimum requirements for in-plant quality control which participants in the IGMAC Insulating Glass Certification Program are expected to perform in order to maintain certification. An example of an acceptable quality management system is IGMA TM-4000-02(07), Quality Manual for the Manufacture of Insulating Glass Units. Copies of this publication can be purchased from the FGIA website (www.fgiaonline.org).
- A.2 The minimum requirements consist of process control techniques and record keeping functions which will assure the manufacturer that his product is a reasonable facsimile of the samples tested and approved for certification.
- A.3 The most advantageous approach for this quality control program is to have it performed by an individual not directly concerned with actual production who will report directly to management. Recognizing that with some manufacturers this is not possible, it will be acceptable to designate production personnel to perform the quality control function with supervision by management. In either case, any discrepancy in materials or workmanship should be reported to management immediately upon determination.
- A.4 The IGMAC Certification Program recommends that each manufacturer evaluate his own operation and determine quality control checks to satisfy his own requirements for producing satisfactory Certified Products.

Company	Plant ID:	Date Report Printed:
Plant Location:	Audited By:	Revised Date:
Primary Contact:	Auditor Contact:	Phone:

PLANT QUALITY ASSURANCE PROGRAM CONSIDERATIONS

Requirements/Description	Previous Audit Observations	Current Audit Observations
Audit Date		
1. Quality Systems Manual Does a manual exist and is it used and maintained		
2. Designated Person A person shall be designated responsible for the quality function		
3. Process Control Do written procedures exist for the fabrication of IG		
4. Inspection and Testing Identify the component or product test or inspection and the frequency performed. Verify records are up to date and current.	Connector/Spacer	
	Primary Seal	
	Secondary Seal	
	Desiccant	
	Gas Filling	
	Finished Products/Other Glass	
5. GCIA Inspection (As of June 23, 2010, the 4 additional production size units are no longer required.)	Does the fabricator have a written procedure for gas filling units? (Yes, if no - explain)	
	Gas Fill Equip. type (single/dual lance, vacuum chamber)	
	Is the equipment calibrated for gas fill level? (Yes,if no - explain)	
	Date of Calibration/Frequency	
	What gas or gases are being used? (argon, krypton, mix, other)	
Is the same equipment used to fill all gases?		

	Previous Audit Observations	Current Audit Observations
6. Calibration Is equipment used for measurements calibrated?		
7. Non-Conforming Products/ Corrective Action Does a procedure exist to address non-conforming material or product		
8. Storage/Handling Is a process defined for the handling and storage of products and materials to prevent damage or deterioration?		
8a. Expiration Dates If any material (sealant, spacer, desiccant) expiration dates have expired, are procedures being followed to address?		
9. Field Service Does a system exist to resolve customer complaints		
10. Internal Quality Audits Are quality system reviews being conducted and documented at least annually?		
11. Training Does a system exist to identify and document personnel training?		
12. Statistical Techniques Are statistical techniques used to ensure consistent quality?		
13. *Check for unauthorized use of certification label		
13a. Permanent Label (CPD Label):		
14. **Validate last inspection issues resolved Review prior audit worksheet findings		

Comments:

Findings and Corrective Action Requests:

B. ORGANIZATION

- B.1 The manufacturer shall designate a person who is to be responsible for the quality control function in each manufacturing facility including recording the required information.
- B.2 If the responsibilities of the quality control designate are confined wholly or substantially to the quality control function, he/she should report to management independently from any person responsible for production.
- B.3 If the quality control designate is also responsible for some aspects of production, there must be adequate arrangement for this person to bring quality control problems to the attention of management at a level which is responsible for quality as well as production.
- B.4 Management should provide supervision to ascertain that the quality control designate is performing his function.

C. PROCEDURES

- C.1 The quality control designate shall provide a list of acceptable components which may be used in making the Certified Product. This list should include a statement that no changes to the approved list are acceptable.
- C.2 Purchase orders may stipulate that the supplier will state on either the invoice or shipping document that the component is within mutually accepted tolerance and is of the same generic composition as the material received when the test samples were made. Any greater deviation shall be reported to the manufacturer.
 - C.2.1. The type of statement which would be acceptable would be "the material supplied in this shipment is the same as the material designated batch # and is within the
 - C.2.2. mutually accepted tolerances for this material." Any similar statement presenting the same type of assurance would also be acceptable.
- C.3 Representative samples of component materials shall be checked regularly in accordance with the following minimum requirements

C3.1 SEALANTS:

1. The sealant shall be checked to assure that the appropriate type is being used as stipulated on the list of acceptable components. See C.1.
2. The accelerator, when required, shall be checked to determine that the corresponding batch number is being used as required for the base material.
3. Whenever a drum of two-part sealant is changed, the approximate amount of remaining base and accelerator material shall be noted and recorded. If both containers are not properly empty, the mix ratio may not be correct and adjustment to the mixing machine may be necessary.
4. When hot melt sealants are used, the temperature of the hot melt material as delivered from the gun shall be recorded.
5. When two-part sealant systems are used, the mixed sealant shall be examined in accordance with the supplier's recommendation. Any striations in the mixed sealant shall be recorded and corrective action should be instituted to obtain uniform mixing.
6. When organic spacer is being used, each new drum of material should be checked for adhesion in accordance with the supplier's recommendations.
7. When any drum of sealant, base material, accelerator, or organic spacer has an abnormal appearance upon opening or does not pass the supplier's recommended tests for adhesion, the abnormality shall be recorded. The drum shall not be used, and the occurrence reported immediately to the supplier. Management and the supplier shall determine if the drum is acceptable or should be rejected and shall instruct the quality control designate of the action to be taken.
8. Forms Q.C. - 1 (a), (b), (c) and (d) are sample quality control forms which may be used.
9. Minimum requirements for testing frequency are shown on these forms.

C.3.2 DESICCANT:

Desiccant quantity for certification is based on an ACPF number = Adsorption Capacity per Perimeter Foot. While your IGMAC Auditor will assist you in establishing this number, which will be documented in your certification paperwork, we encourage you to establish a procedure to monitor this value.

$$\text{ACPF (grams/ ft.)} = \frac{\text{Weight of Desiccant Product (g)} \times \text{Adsorption Capacity (wt \%)}}{\text{Perimeter (Feet)} \times 100}$$

Weight of Desiccant (g) = the desiccant shall actually be weighed from a test unit (for foam spacer and like product weigh a 5.66 ft spacer).

Adsorption Capacity (wt%) = This shall be obtained from the desiccant supplier, from either a specification sheet or certificate of analysis.

Perimeter (feet) = For all 14 x 20 inch test specimens the perimeter is 5.66 feet (use 5.66 feet for consistency even though actual length may be somewhat less due to offset for sealant depth).

In preparation the manufacturer will need:

- 1) Desiccant supplier's specification showing the minimum equilibrium water adsorption capacity (wt. %) specification at 50% R.H. and 25° C. and
- 2) An appropriate scale to weigh desiccant and/or spacer. Below are suggestions for adequate scales:
 - Denver Instrument MAXX Top loading Balance Model MXX-412; Capacity 412grams; Readability 0.01grams; price: <\$500
 - OHAUS Scout Top loading Balance Model SP402; Capacity 400grams; Readability 0.01grams; price: < \$500

When testing tempered safety glass, the scale used to weigh tempered glass particles may likely work.

1. The desiccant shall be checked to assure that the appropriate desiccant is being used as stipulated on the list of acceptable components.
2. The desiccant shall be checked for activity in accordance with the supplier's recommended method and charts. The temperature rise shall be recorded on the quality control form.
3. When organic spacer is being used the supplier's recommended test for desiccant activity must be performed at least once per week and whenever a new drum is opened.
4. Form Q.C. -2a & b and Q.C. -1 (d) are sample quality control forms which may be used.
5. Minimum requirements for testing are shown on these forms.

C.3.3. SPACER

1. The spacer in use shall be checked to assure that the appropriate spacer type and finish is being used as stipulated on the list of acceptable components. See C.1.
2. The connector, if used, shall be checked to determine that the appropriate type is used as stipulated on the list of acceptable components.
3. The spacer and connector shall be checked for the presence of oil by a visual and sensory perceptive technique. The presence of oil on either component shall be noted in the quality control report and appropriate corrective action taken.
4. The width of the spacer shall be measured and compared with the supplier's stated tolerances. Out of tolerance spacer should be recorded and reported to the supplier.

5. The fit of the connector to the spacer shall be observed for tightness and measured for increased width, ridges, etc. on the glass bearing surfaces.
6. Form Q.C. -3 is a sample quality control form, which may be used.
7. See Q.C. -3 for minimum frequency of test.

C.3.4 **GLASS** (no documentation required)

1. The glass shall be checked after cutting to size for:
 - a) correct size and thickness as per Standard
 - b) surface and metal defects
 - c) accuracy of size
 - d) condition of cut edges

Any light which deviates from the Standard or the mutually accepted tolerances on defects shall be set aside and recorded.

2. The glass shall be visually checked after washing for cleanliness and again for condition of the cut edges. Any lite which is not clean shall be rewashed. Any lite with weak edges shall be set aside and recorded.
3. Form Q.C. -4 is a sample quality control form which may be used.

D. GAS FILLING

- D.1 Each day representative samples shall be inspected for gas fill concentration (See form QC-5, Gas Filling Inspection. Included in the information to be recorded are the following:
- a) Date
 - b) The number of units to be inspected per period (i.e. Shift, day, week etc.)
 - c) The number of units rejected per period
 - d) Initials of the individual responsible for this section of the quality assurance system
 - e) IGMAC Certification Identification
 - f) Product configuration [connector, spacer, desiccant, sealant(s)]
 - g) Procedure for determination of gas fill concentration (gas chromatograph, oxygen analyzer, GasGlass, other)
 - h) Current and previous instrument calibration dates

D.2 Quality Assurance Requirements

- a) The insulating glass (IG) manufacturer will construct representative samples of each product line to be verified. These representative samples will be nominal 355 mm x 505 mm (14" X 20") and be fully representative of the manufacturer's production.
- b) The IG manufacturer will construct two separate representative samples and fill these samples to 90% (for certification samples) and the manufacturer's specified field production requirements (e.g. 70%, 80%). These samples will be used to verify that the measurement device is reading accurately. For manufacturers who have developed an in-house verification system for gas filling of production units, measurements will be taken on the control samples at the beginning and end of each shift.
- c) For manufacturers who have developed an in-house verification system for gas filling of production units, each day the IG manufacturer will select representative samples from each of the gas-filled production units and verify that the gas fill is to the manufacturer's specifications. This procedure will be added to the "Final Inspection" criteria and the number of samples to be selected is as specified in Section E.2 under Section E, Finished Product Inspection.
- d) At a minimum, the IG manufacturer shall follow the instrument's manufacturer's recommendations for routine maintenance and at a minimum the instrument shall be

verified for accurate measurement as specified by the instrument's manufacturer's recommendations or their authorized representative or when the IG manufacturer's control samples do not measure accurately. Manufacturers are required to maintain quality control records on equipment routine maintenance.

- D.3 Quality Control Form: The following information is required for each insulating glass unit tested:
- a) Length
 - b) Width
 - c) Position of spacer
 - d) Glass thickness
 - e) Airspace
 - f) Glass Edges
 - g) Primary and secondary sealant
 - h) Glass coatings
 - i) Percentage gas fill required and achieved
- D.4 Form Q.C. -5 is a sample quality control form that may be used.

E. CALIBRATION

- E.1 Effective October 2009, a calibration log must be maintained for measuring and testing equipment. Actual calibration records for each instrument will be maintained as proof of the information recorded on the Calibration Log.
- E.2 Measuring and testing equipment to be recorded in the Calibration Log are any equipment or device that requires or under goes regular maintenance by the equipment or device supplier. Examples of this are gas filling equipment, automated machinery, and maintenance on glass washers.
- E.3 Form QC-7, Calibration Log is a sample quality control form that may be used.

F. TRAINING RECORDS

- F.1 Effective October 2009, a training log for plant personnel must be maintained to record specific training.
- F.2 Type of training to be recorded includes equipment specific training, manufacturing processes, quality processes and record keeping, health & safety and other training relevant to the employee's position within the company.
- F.3 Form QC-8, Employee Training Log is a sample quality control form that may be used.

G. NON CONFORMING AND FINISHED PRODUCT INSPECTION

- G.1 Each day representative samples shall be inspected for workmanship for at least the following characteristics:
- a) overall unit size and thickness
 - b) alignment of glass lites
 - c) cleanliness of airspace
 - d) sealant bond to glass and to itself at corners
 - e) sealant minimum vapor transmission path
 - f) spacer position (sight line) relative to the unit edge

- G.2 The recommended number of finished units to be inspected shall be randomly selected as determined from the following:

<u>Production</u>	<u>Inspection sample quantity</u>
up to 25	3
26 - 100	4
101 - 500	5
501 - 1000	7
over 1000	10

- G.3 The inspected insulating glass units with rejectable defects shall be set aside for repair or replacement and recorded and an additional sample shall be selected for inspection.
- G.4 Actions for non-conforming products should be recorded. Examples of actions are use as is (if appropriate for intended use, recycled, replacement and destruction).
- G.5 Form Q.C. -6 is a sample quality control form which may be used.

H. INSPECTION RECORDS

- H.1 The quality control designate shall keep on file: records, forms, logbooks, etc. of all regular inspections of components and finished products.
- H.2 The records shall be kept for a period of not less than two years.
- H.3 The records shall be made available to the auditor during his audit to verify compliance with the Certification Program requirements.

I. QUALITY CONTROL FORMS

- I.1 The quality control forms attached are samples only and manufacturers are encouraged to design their own which will suit their particular components and product design.
- I.2 The forms may be in book or card format or sheets for filing in manila folders or three ring binders.
- I.3 As a minimum, forms shall be used for the following records:
- | | |
|-------|------------------------------------------------|
| QC-1a | Primary sealant |
| QC-1b | Two-part sealant |
| QC-1c | Hot melt sealant |
| QC-1d | Organic spacer adhesion and desiccant activity |
| QC-2 | Desiccant |
| QC-3 | Spacer (and control if used) |
| QC-4 | Glass (cut sizes) |
| QC-5 | Gas Filling |
| QC-6 | Non-Conforming and Finished Product Inspection |
| QC-7 | Calibration Log |
| QC-8 | Employee Training Log |