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AAMA TIR-X-XX
DRAFT #2
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Structural Test Deflection and Permanent Deformation Gauge Placement for Folding Doors

DRAFT

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0.0 INTRODUCTION

The intent of this Technical Information Report (TIR) is to establish criteria for deflection and permanent deformation gauge device locations in order to meet uniform deflection and structural load test specifications and requirements specific to ~~horizontal and vertical sliding windows and~~folding doors.

1.0 SCOPE

1.1 This TIR describes the correct placement of deflection measurement devices, and calculations for determining deflection and permanent deformation when performing structural testing of folding door products under uniform static air pressure difference per ASTM E330 and/or AAMA/WDMA/CSA 101/I.S.2/A440.

1.2 The proper use of this TIR requires knowledge and training in the principles of fenestration testing.

1.3 In this document, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the specification; “shall be permitted” is used to express an option or that which is permissible within the limits of the specification; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express possibility or capability. Notes accompanying sections do not include requirements or alternative requirements; the purpose of a note accompanying a section is to separate explanatory or informative material from the text.

Notes to tables and figures are considered part of the table or figure and shall be permitted to be written as requirements. While Section 0.0 and ~~any~~ Notes not attached to figures and tables are non-mandatory, such notes provide important guidance, interpretation and clarification of the subjects noted.

1.4 The primary units of measure in this document are metric. The values stated in SI units are to be regarded as the standard. The values given in parentheses are for reference only.

1.5 This document was developed in an open and consensus process and is maintained by representative members of FGIA as advisory information.

2.0 SIGNIFICANCE AND USE

2.1 The recording of maximum deflection and permanent deformation is a mandatory requirement when testing products for structural performance per ASTM E330 and/or AAMA/WDMA/CSA 101/I.S.2/A440.

2.2 The intent of the referenced specifications is to ensure that deflection and permanent deformation measurements are taken in a consistent manner during every uniform load deflection and structural load test. The specifications also require

that these measurements be recorded in the test report, and, if the particular product type and performance class requires a deflection limit, that the report shows whether or not this limit is met by the product type being tested.

2.3 To satisfy this requirement, unsupported, sash and frame members are measured for deflection and permanent deformation at their longest unsupported span or the longest span between anchor points. This means that if the product type has two or more frame or sash members which have the same cross-sectional design and properties, only the member with the longest unsupported span needs to be measured for deflection and permanent deformation.

2.4 The testing laboratory must exercise discretion and judgment in determining if the fabrication or reinforcement details of the product necessitate additional measurements. The intent of the specifications has never been that ALL members of the assembly be measured, but that a worst-case representative of each unsupported leaf or frame section be measured, and these values reported in the test report as representative of the worst case for the assembly being tested.

2.5 The product configurations documented within this TIR are schematic representations used to demonstrate typical sash and panel conditions. The configurations were chosen to represent multiple sash and frame conditions likely to be encountered at the test lab within each drawing.

3.0 REFERENCED DOCUMENTS

3.1 References to the standards listed in this section shall be to the edition indicated. Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3.2 **AAMA, Fenestration and Glazing Industry Alliance (FGIA) Standards**

FG-24, FGIA Glossary

AAMA/WDMA/CSA 101/I.S.2/A440-22, North American Fenestration Standard/Specification for windows, doors, and skylights

3.3 ASTM

ASTM E330/E330M-14(2021), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

4.0 DEFINITIONS

Please refer to the most current FGIA Glossary for all definitions except for those appearing in this section which only apply to this TIR.

Unsupported Member (U_m): Any frame, leaf, or glass supporting component that is unrestricted from bending along its length when lateral forces are applied.

Unsupported Span (U_s): The length of the unsupported member between support points

5.0 DEFLECTION MEASUREMENT DEVICES

5.1 At a minimum, deflection measurement devices should have the following features:

- The ability to take an instantaneous reading
- The ability to take a minimum/maximum reading
- Able to be safely read by the test technician

5.2 The following devices are commonly used to record deflection measurements:

- Dial Indicators
- Linear transducers
- Lasers

5.3 Other devices may be acceptable. It is ultimately at the discretion of the test laboratory to determine if the deflection measurement device meets all the requirements of the test specification.

6.0 DETERMINATION OF UNSUPPORTED MEMBERS

6.1 Reference figures under each operator type for guidance in selecting typical gauge measurement locations. It must be understood that if during testing, a member not being measured shows excessive deflection under load, then this member must be measured as well.

6.2 Each unique cross section, loading condition, or meeting/joining condition must be considered when determining the spans to be measured.

NOTE 1: It may be helpful to conduct a low-pressure preload to help determine what frame or sash members may be unsupported. By observing the product during the application of this preload, test laboratories can assess where deflection will be experienced before the actual loads are applied.

7.0 DEFLECTION GAUGE LOCATIONS

7.1 The testing laboratory is ultimately responsible for determining the member(s) that must be measured for deflection and permanent deformation in accordance with the standard or building code requirement. At a minimum, measurement of the longest unsupported member using the gauge locations in this TIR shall be mandatory.

7.2 Whenever feasible, use a 3-point measurement system (ends and center of unsupported span). In situations where measurements on a cantilevered member are necessary, refer to Table 1, 2, or 3 as applicable.

7.3 Gauges should be placed at the indicated locations per the following tolerances:

- Endpoints of unsupported span: within 25 mm (1 in)
- Midpoint of unsupported span: +/- 3 mm (1/8 in)

Calculation of the maximum deflection and/or permanent deformation of the unsupported member shall use the measured distance between the end gauge points.

NOTE 2: it is recommended to place the gauges as close as possible to the endpoints of the unsupported span.

7.4 Folding Doors

1) Reference Figure 1 for length and gauge locations.
2) Measure the indicated lengths (L1, L2, L3, L4) and determine which is the longest unsupported span for each unique cross section and hinge condition.
    - If more than one of the indicated lengths have the longest span and the same hinge condition, it shall only be required to measure the deflection and permanent deformation of one of those lengths. The length used shall be selected at the discretion of the testing laboratory in accordance with Section 2.
    - The conditions shown in the product (Figure 1) include the following conditions:
        L1: Free endpoint condition
        L2: Captive/sliding endpoint condition
        L3: Joining/locking condition
        L4: Panel to jamb condition on the stile
3) Based on only the longest length, refer to Table 1 for calculations of deflection and permanent deformation.

Longest Length	Deflection Gauge Locations	Calculation of Deflection or Permanent Deformation	Length of Span
L1	G1, G2, G3	G2 – [(G1+G3)/2]	L1
L2	G4, G5, G6	G5 – [(G4+G6)/2]	L2
L3	G7, G8, G9	G8 – [(G7+G9)/2]	L3
L4	G10, G11, G12	G11 – [(G10+G12)/2]	L4

TABLE 1: Calculation of Deflection of Folding Doors

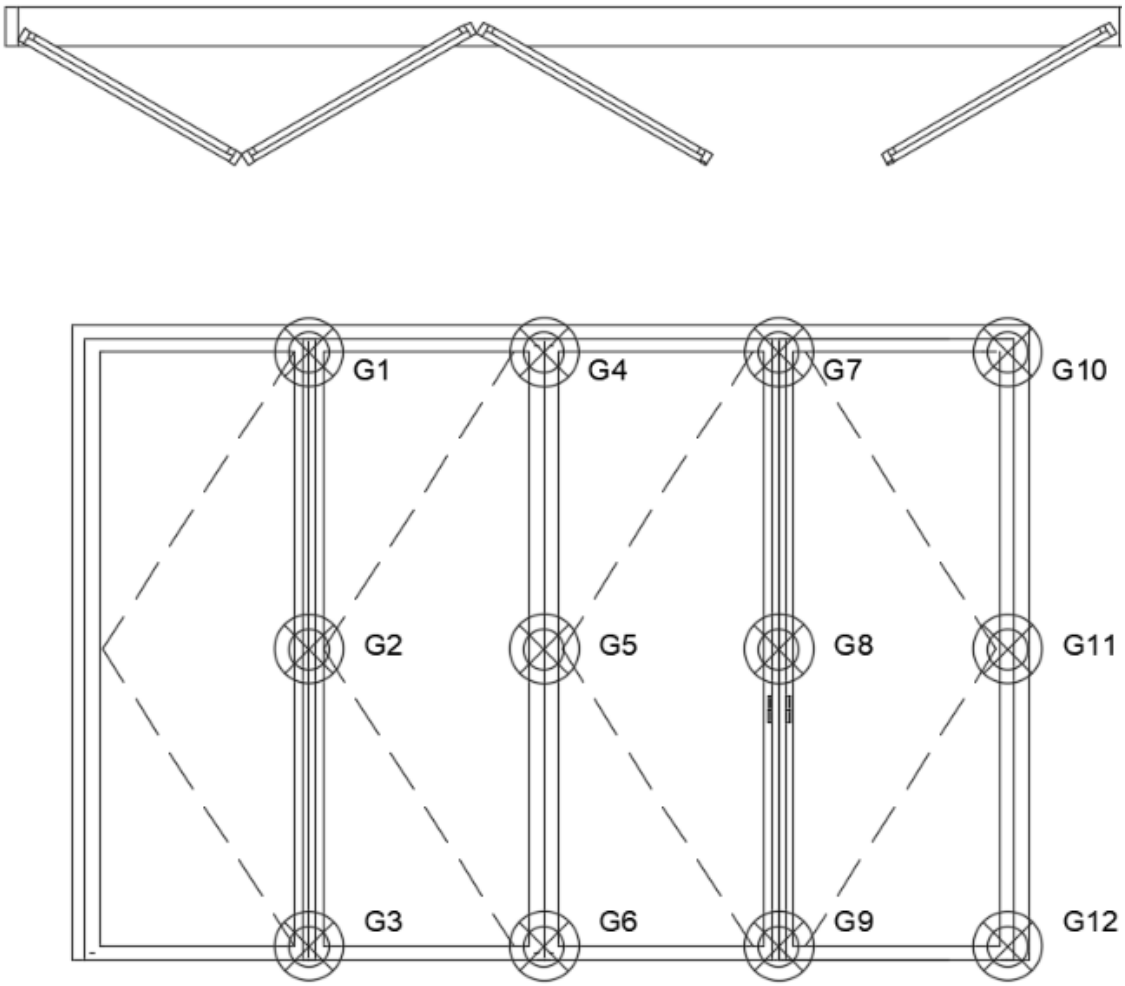

FIGURE 1: Folding Door Gauge Layout

Deflection Gauge Locations

G1: Located at the top corner of the stile.
G2: Located at the midpoint of the stile between G1 and G3.
G3: Located at the bottom corner of the stile.
G4: Located at the top corner of the stile.
G5: Located at the midpoint of the stile between G4 and G6.
G6: Located at the bottom corner of the stile.
G7: Located at the top corner of the astragal.
G8: Located at the midpoint of the astragal between G7 and G9.
G9: Located at the bottom corner of the astragal.
G10: Located at the top corner of the ~~jamb~~stile.
G11: Located at the midpoint of the ~~jamb~~ stile between G10 and G12.
G12: Located at the bottom corner of the ~~jamb~~stile.

Note: additional gauge locations may be necessary based on specific hardware configurations (ex. snubbers on the jamb).