SECTION 08 88 36.16 - ELECTRONICALLY CONTROLLED SWITCHABLE GLASS

PART 1 - GENERAL

1.1 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08, Section 08 40 00 “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.2 SUMMARY

A. Section Includes: Dynamic glass units **GL-01** which can change the appearance of the glass from clear to tinted based on controller commands. Work includes, but is not limited to glass, wiring, controls, programming of controls, and system commissioning.

B. Related Work:

1. Refer to Division 08 for Openings.
2. Refer to Division 26 for Electrical requirements.

1.3 REFERENCES

A. ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings.

B. ASTM C1036 Standard Specification for Flat Glass.

C. ASTM C1048 Standard Specification for Heat-Treated Flat Glass.

D. ASTM E2141 Standard Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units.

E. ASTM E2953 Standard Specification for Evaluating Accelerated Aging Performance of Electrochromic Devices in Sealed Insulating Glass Units.

F. ASTM C1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

G. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass.

H. ASTM E2141 Standard Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

I. ASTM E2188 Standard Test Method for Insulating Glass Unit Performance.

J. ASTM E2189 Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.

K. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.

L. ASTM E2953 Standard Specification for Evaluating Accelerated Aging Performance of Electrochromic Devices in Sealed Insulating Glass Units

M. IGMA TB-1201-89(05) Sealant Manufacturers Minimum Sealant Dimensions and Placement Survey.

N. IGMA TM-4000-02(07) Insulating Glass Manufacturing Quality Procedures Technical Manual.

O. American National Institute (ANSI) Z97.1-2009 Standard - Safety Glazing Materials Used in Buildings.

P. Consumer Product Safety Commission (CPSC) 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

1.4 DEFINITIONS

A. Refer to Division 08 for industry standard glass and glazing definitions. The following apply to this section:

1. Busbar: Electrically conductive metal strip to apply voltage across electrochromic surface of insulated glass units.
2. IGU pigtail: Wire extending from individual special function insulating glass units.
3. Tinted: Dynamic tint state with a lower visible light transmission.
4. Clear: Dynamic tint state with highest visible light transmission.
5. Inboard lite: Pane of IGU that faces interior of building
6. Outboard lite: Pane of IGU that faces exterior of building
7. 2-ply laminated glass: 2-sheets of monolithic glass bonded together with plastic interlayer by heat and pressure
8. Laminate inner-ply: Glass pane in laminated glass construction that faces exterior of building
9. Laminate outer-ply: Glass pane in laminated glass construction that faces interior of building
10. Normal thermal movement: Resulting from ambient temperature range of 120 degrees F (67 degrees C) and from consequent temperature range within glass and glass framing members of 180 degrees F (100 degrees C).
11. Laminated glass deterioration: Defects materially obstructing vision through glass including edge separation or delamination or loss of tinting function.
12. Insulating Glass Unit surfaces and coating orientation:

    a. Surface 1: Exterior surface of outer pane
    b. Surface 2: Interior surface of outer pane
    c. Surface 3: Exterior surface of inner pane
    d. Surface 4: Room side surface of inner pane

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer’s Dynamic Glass literature including data sheets, installation instructions, use restrictions and limitations.

B. Calculations

1. Provide structural calculations for Glazing.

    a. Submittal to the Structural Engineer of Record shall list the design loads used and be signed and sealed by a licensed Structural Engineer in Texas. Submittal shall include location, magnitude, and direction of imposed loads.
    b. Provide Glass producer/fabricator's certification that it has reviewed the Glazing details and thicknesses and finds same suitable for the purpose intended in accordance with its published literature and these Specifications. This includes, but is not limited to, a written analysis of stress due to all loads including wind loads, environmental conditions, and thermal factors showing a probability of failure no greater than amount specified at design wind loads and local environmental conditions, including altitude relative to location of manufacture, temperature variations, and barometric pressure variations anticipated at the completed Project.

2. Provide thermal calculations for Glazing to describe:

    a. U-value, SHGC, and VLT performance of Glazing.
    b. Condensation resistance of all elements of Glazing.

C. Shop Drawings: Prepared by subcontractor for dynamic glazing, not dynamic glazing manufacturer. Subcontractor must provide copies of shop drawings to Dynamic Glazing Manufacturer in PDF or CAD format.

1. Ensure shop drawings show cables, cable routing, components, location of connectors, and exit from framing.
2. Large scale drawings for fabrication, installation and erections including plans, elevations, details, anchorages, connections and accessories along with head, jamb, sill and joining details. Provide templates for work installed by others.
3. Field Measurements: Take accurate field measurements before fabrication and indicate same on shop drawings.

D. Samples: Provide Dynamic Glass IGU sample showing two end states.

E. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

    a. Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
    b. Materials Reuse: For products that are salvaged, refurbished, or reused, include a statement indicating costs for each product.
    c. Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

        1) Include statement indicating costs for each product having recycled content.

    d. Regional Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010 or v1.2 2017, using the applicable exposure scenario.

    a. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 1113-2011.
    b. Adhesives and Sealants: For wet applied on-site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of January 7, 2005.

F. Provide comprehensive engineering analysis signed and sealed by a qualified professional engineer, licensed in Texas, using performance requirements and design criteria indicated.

1. Provide work in compliance with specified standards, performance requirements, material selections, and requirements of this and related sections.
2. Provide glass to withstand thermal movement, design wind pressure, gravity loads, and movements of building structure without failure. Provide calculations listing the design loads used.
3. Conform with the requirements of the applicable Building Code as it pertains to engineering, design, fabrication and installation of system.
4. Structural Performance: Provide cladding systems capable of withstanding the effects of the applied loads, based on testing according to ASTM E1592.

1.6 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

    a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

    a. Material Ingredient Reporting: Submit documentation confirming chemical inventory of products to at least 0.1 % (1000pm) with at least one of the following:

        1) Submit published manufacturer inventory of ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
        2) Submit documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
        3) Submit Declare product label indicating that all ingredients have been disclosed down to 1000 ppm or designated as Red List Free or Declared
        4) Living Product Challenge
        5) Product Lens Certification
        6) USGBC approved program.

b. Material Ingredient Optimization: Submit documentation confirming chemical inventory of products to at least 0.01 % (100pm) and/or that has a compliant material ingredient optimization report with at least one of the following:

1) Submit GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Submit third-party verified documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
3) Submit third-party verified Cradle to Cradle v3 Material Health certificate at the Bronze Level or better
4) Submit third-party verified Declare product label indicating that all ingredients have been disclosed down to 100 ppm
5) Submit third-party verified documentation that product is Living Product Challenge certified with a Red List Free or LBC Red List Free Declare label.
6) Submit documentation that product has a manufacturer prepared action plan with material inventory to at least 1000 ppm.

1.7 QUALITY ASSURANCE

A. Base Glass Materials:

1. All base glass materials used in the fabrication of Dynamic Glass products shall meet or exceed the requirements of ASTM C1036-11e1 Standard Specification for Flat Glass: Type I Transparent Flat Glass; Class 1 Clear; and Quality Q3 (cut-size or stock sheets) for architectural glazing products including: coated glass, insulating glass units, laminated and other select glass products.

B. Heat-Treated Glass:

1. Glass requiring heat-treatment for greater resistance to mechanical and thermal stresses shall be heat-treated in accordance with and comply with the requirements of ASTM C1048-12 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated.

C. Coated Glass:

1. Electrochromic-Coated Glass products shall be fabricated to provide compliance with:

a. ASTM E2141 Standard Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units
b. ASTM E2953 Standard Specification for Evaluating Accelerated Aging Performance of Electrochromic Devices in Sealed Insulating Glass Units
c. ASTM C1376-10 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass (scratches, pinholes, and defects)

D. Laminated Glass:

1. Laminated glass products shall be outsourced from suppliers that fabricate product in accordance with the requirements of ASTM C1172-09 Standard Specification for Laminated Architectural Flat Glass.

E. Insulating Glass:

1. Sealed insulating glass units will be fabricated to meet or exceed the requirements of:

    a. ASTM E2188 Standard Test Method for Insulating Glass Unit Performance
    b. ASTM E2189 Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units
    c. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation
    d. IGMA TB-1201-89(05) Sealant Manufacturers Minimum Sealant Dimensions and Placement Survey
    e. IGMA TM-4000-02(07) Insulating Glass Manufacturing Quality Procedures Technical Manual

2. Sealed insulating glass units fabricated by Dynamic Glazing Manufacturer will be tested and certified in accordance with the highest industry standards as set forth by:

    a. Insulating Glass Certification Council (IGCC)
    b. Insulating Glass Manufacturers Alliance (IGMA)
    c. National Fenestration Rating Council (NFRC)

F. Safety Glazing Materials:

1. Glass for glazing applications requiring safety glazing materials will be fully tempered glass or laminated glass that meets:

    a. American National Standards Institute (ANSI) Z97.1-2009 Standard - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test, or the federal Consumer Product Safety Commission (CPSC) 16 CFR 1201 - Safety Standard for Architectural Glazing Materials, and will be marked and labeled accordingly

2. Fully tempered glass shall be certified as a safety glazing material through participation and testing in accordance with requirements of the Safety Glazing Certification Council (SGCC).

G. Mockups: Prior to installing exterior wall systems, construct structural sealant glazed curtain walls as part of composite testing mockup indicated on Mockup Elevation Sheets and specified in Division 08, Section 08 40 00 "Exterior Enclosure System Requirements".

1. Incorporate each type of exterior wall construction and finish to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Coordinate with Exterior Wall Contractor and each of the contractors listed in Summary Paragraph of "Exterior Enclosure System Requirements". Provide materials in this section to create the composite mockup indicated
2. Provide materials in this section to create the composite mockup indicated
3. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
4. Build mockup of typical wall area as shown on Drawings by full thickness, including supports, attachments, and accessories.

    a. Include four-way joint.

        1) Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
        2) Demonstrate the proposed range of aesthetic effects and workmanship

3) Obtain Architect's approval of mockups before start of Work

5. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Comply with mockup requirements specified in Division 08, Section 08 40 00 "Exterior Enclosure System Requirements".

1.8 DELIVERY, STORAGE AND HANDLING

A. Comply with product requirements, delivery storage and handling provisions of Division 01 and the following:

1. Do not deliver panels until job is ready for installation.
2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
3. Store materials in original packaging, protected from exposure to harmful environmental conditions including static electricity, and at temperature and humidity conditions recommended by manufacturer.
4. Exercise care to prevent edge damage to glass, wire, and coatings on glass.
5. If insulating glass units will be exposed to substantial altitude changes, avoid hermetic seal ruptures by complying with manufacturer’s recommendations for venting and sealing.

1.9 PROJECT CONDITIONS

A. Verify frame channel dimensions are adequate for wire runs as designed.

B. Environmental Requirements: Ensure that substrate surface and ambient air temperature are minimum of 40 degrees F (5 degrees C) and rising at application time and remain above 40 degrees F (5 degrees C) for at least 24 hours after application of sealants.

1.10 WARRANTY

A. Provide manufacturer’s standard limited warranty including the following:

1. Insulating glass units shall be free from material obstruction of vision as a result of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship.
2. The Electrochromic Coating shall perform the function of switching the tint level of such for the Limited Warranty Period specified below.

B. The warranty period shall commence on the date of delivery of insulating glass units by the dynamic glass IGU manufacturer.

C. Warranty period:

1. Insulating Glass Unit which does not include laminated glass or sloped glazing: 10 years
2. Insulating Glass Unit which does include laminated glass or sloped glazing: 5 years.

1.11 SYSTEM START-UP / OWNER INSTRUCTIONS / COMMISSIONING

A. Provide start up, commissioning and Owner instructions to ensure system functions and is used properly.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: View Dynamic Glass Insulating Glass Units (IGUs) Standard Construction as manufactured or supplied by:

1. VIEW Inc. View Gen 4 IGU
2. 195 S. Milpitas Blvd, Milpitas, CA 95035
3. Telephone: 408-514-6512
4. E-mail: sales@viewglass.com
5. http://www.view.com.

2.2 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design Data: Engage a qualified professional engineer, as defined in Section 01 33 16, “Fabrication Engineering Design Data,” to design dynamic glass units complying with requirements.

B. System Description:

1. Design Requirements:

a. Control system and control wiring: Provided by manufacturer; refer to Division 26 Sections.
b. Remote connectivity: Required for manufacturer’s commissioning, testing, performance monitoring and upgrades.
c. Framing and glazing for special function glass systems: Provided under other sections. Comply with the following:

1) Framing system: Approved by manufacturer of dynamic glazing.
2) Insulating glass unit clearances:

a) Edge: 1/4 inch (6 mm)
b) Bite: 5/8 inch (16 mm)
c) Face: 3/16 inch (5 mm)

d. Glazing materials: Compatible with manufacturer’s Dynamic Glass components.

2. Performance Requirements:

a. Glazing and framing systems: Capable of withstanding normal thermal movements, wind loads, and impact loads, without failure, permanent deformation or loss of system functionality.
b. Outdoor/Indoor Transmission Class (OITC): Minimum 27.
c. Glass products: Comply with ASTM E1300 and as follows:

1) Meet or exceed project loads and in-service conditions.
2) Minimum thicknesses to ensure probability of failure does not exceed:

a) 8 breaks per 1000 for glass installed vertically and under wind action.
b) 8 breaks per 1000 for glass sloped not over 15 degrees off vertical and under wind action.
c) 1 break per 1000 for glass installed 15 degrees or more from vertical plane and under action of wind, snow or both

2.3 MATERIALS

A. Provide materials complying with the following:

1. Base glass: ASTM C1036 Standard Specification for Flat Glass: Type I Transparent Flat Glass; Class 1 Clear; and Quality Q3 (cut-size or stock sheets) for architectural glazing product.
2. Heat treated float glass: ASTM C1048-12 Type I, Class 1 (clear), Quality Q3, Kind HS, coated and uncoated.
3. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
b. Heat-soak test all fully tempered float glass.

4. Coated, laminated, safety and insulating unit glass: Comply with reference standards above.
5. Electrochromic-Coated Glass: Coated glass products are fabricated to provide compliance with:

a. ASTM E2141 Standard Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units
b. ASTM E2953 Standard Specification for Evaluating Accelerated Aging Performance of Electrochromic Devices in Sealed Insulating Glass Units
c. ASTM C1376-10 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass (scratches, pinholes, and defects)

B. Low-Emitting Materials:

1. Architectural paints and coatings wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
2. All paints and coatings wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01 Section 01 81 13 "Sustainable Design Requirements - LEED v4 BD+C."
3. Adhesives and Sealants wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.

4. All adhesives and sealants wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01 Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C."

2.4 SURFACE APPLICATIONS

A. Electrochromic Coating: Dynamic tint state meeting ASTM E2141.

2.5 MANUFACTURED UNITS

A. Special function insulating glass units **GL-01**; comply with the following:

1. Insulating Glass Units (IGUs) - Standard Construction.
2. Outboard Lite:

    a. Glass Type: Clear float glass
    b. Glass Tint: Variable electrically
    c. Nominal Thickness: 0.25 in (6 mm) per industry standards
    d. Heat Treatment: Tempered
    e. Coating Orientation: Surface No. 2
    f. Busbar Location: Along the edge of the glass
    g. Dynamic glass to have full area tinting with no bus bars or scribe lines in the daylight opening (DLO) of the IGU

3. Air Space:

    a. Spacer Material: a triple seal design suitable for Structural Glazing, consisting of a thermoset foam spacer incorporating integral 3A desiccant, pre-applied adhesive for glass bonding, a captive polyisobutylene primary seal, and a structural seal. Edgetech Super Spacer TriSeal™ or approved equivalent.
    b. Nominal Thickness: 0.50 plus/minus 0.02 inch (12.5 mm plus/minus 0.5mm)
    c. Gas Fill: 90 percent argon

4. Inboard Lite:

    a. Glass Type: Clear float glass
    b. Glass Tint: Clear
    c. Nominal Thickness: 0.250 inch (6 mm)
    d. Heat Treatment: Tempered

5. Electronic Connector:

    a. Manufacturer’s custom cable as follows:

        1) Length: Approximately 14-17 inches (350-430mm)
        2) Termination: IP67 rated, environmentally sealed, 5/16” (8mm) circular connector.
        3) Minimum diameter hole through framing: 7/16” (11mm).

B. Standard insulating glass configuration performance:

1. Tint 1 Performance Characteristics (Center of Glass):

a. Tinting mode: Edge-to-edge uniform tinting for clear views
b. Visible Transmittance: Minimum 52 percent
c. Interior Visible Reflectance: Maximum 18 percent
d. Exterior Visible Reflectance: Minimum 12 percent
e. U-factor (U-value): Maximum 0.29 Btu/(h ft² °F)
f. Solar Heat Gain Coefficient (SHGC): Maximum 0.40.
g. Correlated Color temperature (CCT): Less than 10% variation from the modelled exterior daylight illuminant
h. Color Fidelity and Gamut: Greater than or equal to 90.

2. Tint 2 Performance Characteristics (Center of Glass):

a. Tinting mode: Edge-to-edge uniform tinting for clear views and window perimeter space comfort
b. Visible Transmittance: Minimum 31 percent
c. Interior Visible Reflectance: Maximum 17 percent
d. Exterior Visible Reflectance: Minimum 8 percent
e. U-factor (U-value): Maximum 0.29 Btu/(h ft² °F)
f. Solar Heat Gain Coefficient (SHGC): Maximum 0.28
g. Correlated Color temperature (CCT): Less than 10% variation from the modelled exterior daylight illuminant
h. Color Fidelity and Gamut: Greater than or equal to 90.

3. Tint 3 Performance Characteristics (Center of Glass):

a. Tinting mode: Edge-to-edge uniform tinting for clear views and window perimeter space comfort
b. Visible Transmittance: Minimum 6 percent
c. Interior Visible Reflectance: Maximum 16 percent
d. Exterior Visible Reflectance: Minimum 9 percent
e. U-factor (U-value): Maximum 0.29 Btu/(h ft² °F)
f. Solar Heat Gain Coefficient (SHGC): Maximum 0.12.

4. Tint 4 Performance Characteristics (Center of Glass):

a. Tinting mode: Edge-to-edge uniform tinting for clear views and window perimeter space comfort
b. Visible Transmittance: 0.5% percent for complete glare protection with daylight glare probability below 35% for occupant sitting 5ft away facing a direction parallel to window
c. Interior Visible Reflectance: Maximum 17 percent
d. Exterior Visible Reflectance: Minimum 6 percent
e. U-factor (U-value): Maximum 0.29 Btu/(h ft² °F)
f. Solar Heat Gain Coefficient (SHGC): Maximum 0.09.
g. Correlated Color temperature (CCT): Not to exceed 12000K @1% light transmission with edge-to-edge uniform tinting when using 5500K as exterior daylight illuminant
h. Color Fidelity and Gamut: Greater than or equal to 85 @1% light transmission with edge-to-edge uniform tinting

C. Fabrication:

1. Laminated glass: Fabricate in autoclave with heat and pressure, free of foreign substances and air pockets.
2. IGU units: Hermetically sealed IGU with dehydrated airspace sealed as follows:

a. Primary seal of polyisobutylene (PIB), color: black
b. Secondary seal of silicone, color: black

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site conditions and verify that:

1. Site conditions are acceptable for glass installation.
2. Openings for glazing are correctly sized and within tolerance.
3. Weep system is installed per GANA Glazing Manual specifications.
4. Face and edge required minimum clearances are met.
5. Verify that glazing channels and recesses are clear and free of obstructions, weeps are clear, and that channels and recesses are ready for glazing.

B. Correct conditions deemed unsatisfactory and do not proceed until required corrections are complete.

3.2 PREPARATION

A. Comply with manufacturer's recommendations and as the following:

1. Clean and prepare glazing channels and framing to receive glass and wire.
2. Remove coatings and other harmful materials that will prevent glass and glazing installation from meeting performance criteria specified.

B. Glazier installers will attend a minimum of (1) pre-installation training session conducted by Dynamic Glazing Manufacturer Project Manager either in person or via web hosted by Dynamic Glazing Manufacturer Project Manager prior to IGU installation into framing system. Attendance at training session to be confirmed by Dynamic Glazing Manufacturer Project Manager.

3.3 INSTALLATION

A. Install products using manufacturer's recommendations for glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, such as those referenced in the GANA Glazing Manual.

B. Verify IGU secondary seal is compatible with glazing sealants.

C. Install glass in prepared glazing channels and other framing members.

1. Comply with glass manufacturer's labels and instructions for glass orientation.

D. The active tint area shall reach edge to edge of the finished window system.

1. Verify there is no visible light along window perimeter or through center of glass.

E. Protect IGU pigtail from damage during installation.

1. Prepare Frames (drill holes, deburr hole edges or insert silicone grommet, and seal penetration with silicone) as needed to route Dynamic Glazing Manufacturer cable per Dynamic Glazing Manufacturer interconnect drawings.
2. If IGU pigtail connector is damaged during installation, notify manufacturer as soon as possible.

F. Install setting blocks in rabbets per specifications in the GANA Glazing Manual, IGMA Glazing Guidelines, and manufacturer's Glazing Guidelines. Setting blocks must be 100% silicone.

G. Use edge blocks for installed panes to prevent glass from walking post installation. Edge blocks must be 100% silicone.

H. Provide bite on glass, minimum edge and face clearances, and glazing material tolerances per GANA Glazing Manual, and as approved manufacturer.

I. Provide weep system per specifications in the GANA Glazing Manual.

J. Ensure weight of glass unit is distributed along entire edge, not at corners.

K. Provide expansion joints and anchors, thermal movement accommodations, glass openings, and installation of weep systems, setting blocks, glass spacers, and edge blocks per specifications of framing manufacturer and referenced industry standards.

L. Protect glass from edge damage during handling and installation.

M. Protect glass from contamination of contact with byproducts of construction operations such as weld spatter, fireproofing, or plaster.

N. Remove labels from IGUs within 30 days of exposure to sunlight or any UV light source following removal from manufacturer's packaging.

O. Install per specification of IGMA North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use TM-3000-90(04):

P. For dry glazed systems, adequate seal shall consist of:

1. 0.70 N/mm (4lb/in) minimum and not exceeding 1.75 N/mm (10 lb/in) applied to edges of glass unit by gaskets or other fastening systems.

Q. Label each end of IGU cables with their respective window controller (WC) ID number as specified on elevation drawings contained in Dynamic Glazing Manufacturer Glass interconnect drawings.

R. Notify Dynamic Glazing Manufacturer on As Built of any changes to cable routing or cable dimensions on Dynamic Glazing Manufacturer interconnect drawings.

3.4 ADJUSTING / CLEANING / PROTECTION

A. Adjusting: Remove and replace with new material broken, chipped, or otherwise damaged glass.

B. Clean glass inside and outside per manufacturer's instructions immediately following installation and curing of sealants.

1. Remove labels and markings from glass.
2. Clean glass inside and outside immediately following installation and curing of sealants per:

    a. GANA Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products
    b. GANA Glass Information Bulletin GANA TD-02-0402 - Heat-Treated Glass Surfaces Are Different

C. Protection: Protect assemblies until acceptance of the work of this section.

D. Protection during testing: Comply with the following:

1. Do not use a high-voltage spark gas analyzer such as the Sparklike Gasglass to evaluate gas content of Dynamic Glazing Manufacturer Dynamic Glass products.
2. Use of such device may damage film and controls, potentially voiding Dynamic Glazing Manufacturer product warranty.

3.5 COMMISSIONING

A. As part of the work of this section, perform the following

1. Conduct visual inspection to verify insulating glass units and corresponding pigtail cables are installed in the right orientation as specified in the Dynamic Glazing Manufacturer IGU product data sheet.
2. Verify that all IGU pigtails are accessible for connection to the main trunk line
3. Provide information requested by the commissioning agent for final commissioning documentation.
4. Utilize Dynamic Glazing Manufacturer provided hand held IGU testing device to complete Dynamic Glazing Manufacturer Site Installation and Verification Checklist requirements for glazing subcontractor to verify IGU cable integrity. IGU testing procedures are to be conducted after jobsite installation for field glazed framing system. IGU testing is to be completed for unitized framing system (shop glazed) after unitization and prior to jobsite installation.
5. Evaluate any performance irregularities and recommend corrective action for any IGU test failure to general contractor and Dynamic Glazing Manufacturer project manager.
6. Provide signed and dated Site Installation and Verification Checklist to general contractor verifying that all installed IGUs are functional based on Dynamic Glazing Manufacturer test procedures.
7. Provide Site Installation and Verification Checklist verifying that all installed IGUs are functional based on Dynamic Glazing Manufacturer test procedures signed and dated by General Contractor.
8. Provide means for the commissioning agent to access, visually observe, and confirm proper operation of the Dynamic Glazing Manufacturer Glass system.

END OF SECTION