

**SECTION [08 44 28] [08972]****GLASS TENSION TRUSS STRUCTURES**

**\*\*\*\*\* Unique, custom designed, glass facades, entrances, storefronts, curtain walls, skylights, canopies, and other structures can add distinction, exceptional beauty, and expansive visibility to a construction project. However, these glass structures require meticulous engineering, extensive knowledge of materials and codes, broad experience, quality materials, and expert craftsmanship. Each design will have unique parameters and requirements which must be accurately addressed in order to provide a safe, functional, durable, weather-resistant glass structure which can withstand wind and seismic loads and thermal expansion and contraction. It is critical that unique glass structures be both designed and fabricated by a single, knowledgeable entity assuming complete responsibility. Piece-meal assembly of products from numerous manufacturers and fabricators without a comprehensive design and engineered solution is not a method for achieving a functional, safe, glass structure.**

**Innovative Structural Glass, Inc. can provide this essential sole source design and fabrication responsibility. They are a domestic company focused on the United States market. They provide glass luxury at affordable prices in a timely manner. Innovative Structural Glass, Inc. designs and fabricates a wide variety of glass structures including facades, entrances, storefronts, skylights, canopies, glass fin systems, and tension truss structures.**

**This specification guide can be used to specify a custom designed and engineered glass structure using Innovative Structural Glass's glass tension truss technology. With this method glass mainplates (panels) form the plane of the wall and are stabilized with vertical or horizontal stainless steel tension trusses eliminating the need for metal mullions. This light framing system provides much greater visibility. Glass tension truss technology can be used for many types of structures such as entrances, storefronts, curtain walls, monuments, sculptures, decorative features, balconies, elevated floors, roofs, skylights, and canopies. Glass tension truss assemblies can be used on the interior, exterior, or the envelope of a building.**

**In contrast to more typical descriptive specifications, this section is a performance type emphasizing the critical factor of design and engineering. It provides a convenient format that can be edited to reflect the unique glass structure envisioned by an architect and ensure that it is correctly engineered, carefully detailed, accurately fabricated, and properly installed.**

**Glass facades with entry doors, skylights, and canopies are specific uses of glass tension truss technology which can be specified using the following Innovative Structural Glass specifications. These sections also include other technologies for the construction of facades, skylights, and canopies.**

**SECTION 08 41 26 (08450) - GLASS FACADES  
SECTION 08 63 10 (08631) - GLASS SKYLIGHTS  
SECTION 08 44 29 (08973) - GLASS CANOPIES**

**This specification section is organized by placing information in three standard parts:**

**PART 1 - GENERAL**

**Describes the design and performance criteria for the glass tension truss structure and other administrative and procedural requirements.**

**PART 2 - PRODUCTS**

**Describes materials, products, accessories, and fabrication methods to be used for the glass tension truss structure.**

**PART 3 - EXECUTION**

**Describes how the components will be assembled and installed at the construction site.**

Throughout this product guide specification, references are made to other specification sections that might be contained in the project manual. These references are presented as examples and coordination reminders. For each project, these references will need to be revised to reflect actual sections being used.

The six-digit specification section numbers in this guide are based on classifications and numbers contained the 2004 Edition of MasterFormat published by the Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC). This is the industry standard for organizing construction specifications. Previous five-digit numbers from the 1995 Edition of MasterFormat have also been included in this guide and are listed in brackets following the 2004 Edition numbers.

Within the specification text, Imperial dimensions are presented first in brackets followed by System International Metric (SI) equivalents also in brackets. Depending on project requirements, either the Imperial or the SI metric equivalents will need to be deleted.

The specifier will need to edit this product specification for a specific project to reflect the options and applications being used. The guide section has been written so that much editing can be accomplished by deleting unnecessary requirements and options. Additional information describing the desired characteristics of the glass structure will need to be added by the specifier. Options are indicated by [ ]. Notes to assist the specifier in selecting options and editing the specification guide are printed in bold and indicated with **\*\*\*\*\***. For final editing, all brackets and notes will need to be deleted from the guide.

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**PART 1 - GENERAL**

**1.1 SUMMARY**

**\*\*\*\*\* Edit the following paragraph to reflect project requirements. \*\*\*\*\***

- A. Section includes: Functional design, structural engineering, custom fabrication, and site erection required for glass [walls] [curtain walls] [monuments] [sculptures] [decorative features] [balconies] [elevated floors] [roofs] constructed using glass tension truss technology.

**\*\*\*\*\* List other specification sections dealing with work directly related to this section such as the following. \*\*\*\*\***

**B. Related sections:**

1. Section [03 30 00] [03300] - Cast-in-Place Concrete: [Foundations and slabs] [concrete structural frame] to receive glass tension truss structure.
2. Section [04 05 10] [04800] - Masonry Assemblies: Masonry framing to support glass tension truss structure.
3. Section [05 12 00] [05120] - Structural Steel: Steel structural frame to receive glass tension truss structure.

**\*\*\*\*\* Glass may be specified in this section or in a separate section covering glass for all project glazing. If color tinted or reflective glass is required for various entrance, storefront, window, door, and curtain wall systems, it is important that glass be provided from a single glass manufacturer to ensure uniformity of appearance. However, supply and installation of glass must be part of this section to ensure sole source responsibility. Include the following paragraph if glass is specified in a separate section. \*\*\*\*\***

4. Section [08 80 00] [08800] - Glazing: Glass to be supplied and installed as part of this Section.

**1.2 REFERENCES**

**\*\*\*\* List by number and full title reference standards referred to in remainder of specification section. Delete non-applicable references. \*\*\*\***

- A. American National Standards Institute (ANSI): ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- B. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. American Society for Testing and Materials (ASTM):
  1. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  2. ASTM A276 - Stainless and Heat-Resisting Steel Bars and Shapes.
  3. ASTM C509 - Elastomeric Cellular Preformed Gasket and Sealing Material.
  4. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
  5. ASTM C920 - Elastomeric Joint Sealants.
  6. ASTM C1036 - Flat Glass.

7. ASTM C1048 - Heat Treated Flat Glass, Kind HS, Kind FT, Coated and Uncoated.
  8. ASTM C1115 - Dense Elastomeric Silicone Rubber Gaskets and Accessories.
  9. ASTM C1172 - Laminated Architectural Flat Glass.
  10. ASTM C1281 - Preformed Tape Sealants for Glazing Applications.
  11. ASTM E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under specified Pressure difference Across Specimen.
  12. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  13. ASTM E331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  14. ASTM E546 - Frost Point of Sealed Insulating Glass Units.
  15. ASTM E576 - Frost Point of Sealed Insulating Glass Units in Vertical Position.
  16. ASTM E773 - Accelerated Weathering of Sealed Insulating Glass Units.
  17. ASTM E774 - Classification of the Durability of Sealed Insulating Glass Units.
  18. ASTM E1300 - Determining Load Resistance of Glass in Buildings.
- D. Consumer Product Safety Commission (CPSC): CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- E. Glass Association of North America (GANA): GANA - Glazing Manual.
- F. International Code Council (ICC): ICC IBC - International Building Code.

### **1.3 GLASS TENSION TRUSS STRUCTURE DESCRIPTION**

- A. Glass tension truss structure to be custom designed, engineered, detailed, factory fabricated, and site assembled and erected.
- B. Type of glass structure: Glass mainplate [vertical] [horizontal] [sloping] panels stabilized and supported with stainless steel tension trusses attached with stainless steel connector fittings. Tension trusses shall be placed [in one direction] [in two directions] across glass surface.

**\*\*\*\*\* Many interesting and unique glass tension truss structures can be created by Innovative Structural Glass, Inc. Contact them for available options and assistance in planning and specifying. Edit the following paragraph to reflect basic configuration of glass structure. \*\*\*\*\***

- C. Basic configuration: [Straight] [curved] [multi-angled] [articulated] [\_\_\_\_\_] layout with [vertical] [sloped] [horizontal] glass surface stabilized and supported by tension trusses to provide architectural appearance and configuration shown on Drawings.
- D. Dimensions: Glass tension truss structure shall be nominal dimensions shown on Drawings. Minor variations to accommodate manufacturer's design and components are acceptable provided overall concept is maintained.

#### **1.4 DESIGN AND PERFORMANCE CRITERIA**

**\*\*\*\*\* Innovative Structural Glass, Inc. will provide structural engineering and design for support system, connections, anchors, seals, and other elements of glass tension truss structure. Edit this article to reflect project conditions and applicable codes. \*\*\*\*\***

- A. Design Requirements:
  - 1. Design Wind Load: [\_\_\_\_\_] pounds/square foot] [\_\_\_\_\_] kilograms/square meter]
  - 2. Snow Load (if applicable): [\_\_\_\_\_] pounds/square foot] [\_\_\_\_\_] kilograms/square meter]
  - 3. Seismic Zone: [\_\_\_\_\_] ]
  - 4. Live load deflection of supporting structure (if any): [\_\_\_\_\_] ]
- B. Design, size components, and install glass tension truss structure in accordance with ASTM E1300 to withstand these loads without breakage, loss, failure of seals, product deterioration, and other defects.
  - 1. Dead and live loads: Determined by ASCE 7 and calculated in accordance with applicable codes.
  - 2. Seismic loads: System shall be designed and installed to comply with applicable seismic requirements for Project location and Seismic Zone [0] [1] [2A] [2B] [3] [4] as defined by of ICC/IBC.
  - 3. Movement and deflection of structural support framing.
  - 4. Effects of applicable wind load acting inward and outward normal to plane of wall in accordance with ASTM E330.
  - 5. Thermal loads and movement:
    - a. Ambient temperature range: [[120] [\_\_\_\_\_] degrees F.] [[48] [\_\_\_\_\_] degrees C.]
    - b. Material surfaces range: [[180] [\_\_\_\_\_] degrees F.] [[82] [\_\_\_\_\_] degrees C.]
- B. Provide and install exterior gaskets, sealants, and other glazing accessories to resist water

and air penetration.

1. Air infiltration: Less than [[0.06] [\_\_\_\_\_] cubic feet/minute/square foot] [[1699] [\_\_\_\_\_] cubic centimeters/second] of fixed area tested in accordance with ASTM E283.
2. Water infiltration: No penetration at [15] [\_\_\_\_\_] pounds/square foot] [[73] [\_\_\_\_\_] kilograms/square meter] test pressure and [[5] [\_\_\_\_\_] gallons/hour/square foot] [[18] [\_\_\_\_\_] liters/hour/square meter] water rate tested in accordance ASTM E331.

## 1.5 SUBMITTALS

A. Submit in accordance with Section [01 33 00] [01330] - Submittal Procedures:

1. Product data for all proposed components, materials, products, and accessories.
  - a. For each type glass, provide maximum allowable stress in both horizontal and vertical directions.
  - b. Provide photographs or drawings for fittings and hardware.
2. Shop drawings:

\*\*\*\*\* **Edit the following list to reflect components required for glass tension truss structure.**  
\*\*\*\*\*

- a. Plans, elevations, and sections illustrating shape, configuration, and dimensions. For complex structures provide perspectives, renderings, or models.
  - b. Illustrate method of assembly, installation, and glazing.
  - c. Provide details for support framing, reinforcement, connections, joints, anchors, and other fabrication and installation conditions.
  - d. Indicate required tolerances and coordination with adjacent elements and work of other trades.
3. Calculations: Show compliance with performance criteria and applicable loads with stamp of Licensed Professional Engineer registered in the State of [\_\_\_\_\_].
  4. Samples:
    - a. [12 by 12 inches] [304 by 304 mm] minimum size for each type glass.
    - b. Tension truss fitting.
    - c. Metal finishes.
    - d. Sealant colors.

5. Manufacturer's installation and maintenance instructions.
6. Certificates or test reports demonstrating components and methods have been successfully tested by an independent laboratory in the United States certifying that the proposed system has been tested and as defined by Paragraph [1.4] [\_\_\_\_\_].
7. Data showing compliance with manufacturer's and installer's qualifications specified in Paragraphs [1.6.A and 1.6.B] [\_\_\_\_\_]. Provide descriptions, locations, photographs, references, and completion dates for previous projects.
8. Copies of warranties required by Paragraph [1.11] [\_\_\_\_\_] for review by Architect. Included with warranty shall be a letter certifying the proposed system will be manufactured from one source. Glass cannot be supplied by one manufacturer and hardware from another manufacturer to comply with this warranty. Letters signed by the subcontractors or installers for this section are not acceptable.

## **1.6 QUALITY ASSURANCE**

**\*\*\*\*\* To ensure that completed glass tension truss structure is structurally sound, weathertight, functional, durable, and safe; specify that design, engineering, fabrication, and supply of all components, materials, and products be the sole responsibility of an experienced single entity such as Innovative Structural Glass, Inc. It is critical that unique glass structures be both designed and fabricated by a single, knowledgeable entity assuming complete responsibility. Piece-meal assemblies of products from numerous manufacturers and fabricators without a comprehensive design and engineered solution is not a method for achieving a functional, safe, glass structure.**

- A. Single source responsibility: Design, structural engineering, and custom fabrication for glass tension truss structure and supply of all components, materials, and products shall be sole responsibility of single manufacturer. Provision of products from numerous sources for site assembly without complete single source design and supply responsibility is not acceptable. Components to be fabricated or supplied by single source are:

**\*\*\*\*\* Edit the following list to reflect components required for glass skylight. \*\*\*\*\***

1. Support framing.
  2. Glass [as specified in Section [08 80 00] [08800] - Glazing].
  3. Connectors, fittings, anchors, and installation accessories.
  4. Gaskets and sealants.
  5. All other components, products, and materials required for complete, functional glass tension truss structure.
- B. Single installation responsibility: All components listed in Paragraph [1.6.A] [\_\_\_\_\_] shall be installed by a single installer.

- C. Manufacturer qualifications: Company specializing in designing, engineering, and fabricating unique, custom designed, glass fin structures, entrances, storefronts, and other glazed structures. Glass cannot be supplied by one manufacturer and hardware from another manufacturer to comply with this warranty. Letters signed by the subcontractors or installers for this section are not acceptable.
1. Experience: 5 years minimum successful experience providing glass structures.
  2. Previous projects: Successfully completed 3 minimum glass structures of scope, type, and size as proposed Project.
- D. Installer qualifications: Company experienced in erecting custom designed, glass tension truss structures, entrances, storefronts, and other glazed structures and acceptable to manufacturer for installing proposed structure.
1. Experience: 3 years minimum successful experience erecting glass structures.
  2. Previous projects: Successfully completed 3 minimum glass structures of scope, type, and size as proposed Project.
- E. Design structural components and develop shop drawings under direct supervision of professional structural engineer experienced in design of glass structures. Calculations and shop drawings shall bear engineer's seal.
- F. Safety glazing: Comply with Consumer Product Safety Commission 16 CFR 1201, ANSI Z97.1, and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.

**\*\*\*\*\* For large, more complicated structures it is appropriate that Innovative Structural Glass, Inc. send a field representative to oversee installation. Use the following paragraph to require manufacturer's field representative. \*\*\*\*\***

- G. Manufacturer's field representative:
1. During installation, provide services of manufacturer's field representative knowledgeable of erection process for proposed glass fin structure.
  2. Manufacturer's representative shall observe installation, quality control, and certify work meets specified requirements.
  3. Manufacturer's representative shall submit report covering observations, procedures, noted deficiencies, corrective measures, and certification of proper installation.

## **1.7 MOCK-UP**

**\*\*\*\*\* For larger projects or complicated conditions a mock-up may be important to establish workability and performance of proposed glass tension truss structure. Include this article to request mock-up constructed on site separate from actual construction. \*\*\*\*\***

- A. In accordance with Section [01 40 00] [01400] - Quality Control, prepare separate mock-up illustrating construction method for glass tension truss structure. Mock-up shall demonstrate performance and establish workmanship quality standard.
- B. Provide concrete slab as mock-up base.
- C. Mock-up shall be segment of structure with two minimum tension trusses. Construct with all anchors, fasteners, sealants, and other components proposed for actual installation.
- D. Approximate size: [8 by 8 feet] [2.4 by 2.3 m] [\_\_\_\_\_].
- E. Test mock-up with [water hose to verify weathertightness] [[\_\_other test\_\_] to verify [\_\_type of performance\_\_]].
- F. Submit report describing tests, results, and any modifications made to correct deficiencies or to improve performance.
- G. Do not proceed with installation until mock-up has been inspected and accepted by Architect.
- H. Retain approved mock-up during construction as quality standard. Completely remove when work is accepted.

## **1.8 PRE-INSTALLATION CONFERENCE**

**\*\*\*\*\* Depending on project size, complexity of glass structure, and number of coordination items, a pre-installation conference maybe important. Include this article to specify pre-installation conference. \*\*\*\*\***

- A. In accordance with Section [01 31 00] [01310] - Project Management and Coordination, convene a pre-installation conference at site prior to commencing work of this Section.
- B. Require attendance of entities directly concerned with glass tension truss structure [including manufacturer's field representative].
- C. Review at meeting:

**\*\*\*\*\* Add to and edit the following list to reflect project conditions. \*\*\*\*\***

1. Construction of foundation and preparation of rough opening to receive glass tension truss structure.
2. Schedule, sequence, and method for installing glass tension truss structure and coordination with other work.
3. Safety procedures.
4. Availability of system materials.

5. Chemical compatibility of glass panels, sealants, adjacent construction materials, and other glazing materials.
6. Protection of adjacent items and finishes.
7. Approved mock-up to be used a measure of acceptance.
8. Other items related to successful execution of work.

## **1.9 PRODUCT HANDLING**

- A. Protect glass and other components during delivery, storage, and handling in accordance with manufacturer's instructions. Prevent edging chipping and other damage.
- B. Insulating glass units: Comply with fabricator's instructions for venting and sealing units exposed to substantial altitude changes.
- C. Do not store glass panels on site for extended time.

## **1.10 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install solvent curing sealants in enclosed building spaces without proper ventilation.
- B. During glazing, maintain [40 degrees F] [4 degrees C] minimum temperature.

## **1.11 WARRANTIES**

- A. Provide under provisions of Section [01 77 00] [01770] - Closeout Procedures:
  1. Manufacturer's 2 years warranty to cover design, fabrication, and materials against defects and failure to perform and remain weathertight. Warranty to provide for replacement of defective components.
  2. Glass fabricator's warranties:
    - a. 10 years warranty to cover replacement of insulating sealed glass units: in event of seal failure and interpane dusting, misting, and filming.
    - b. 5 years warranty to cover replacement of laminated glass units in event of delamination, edge separation, and blemishes.
  3. Installer's 5 years warranty to cover installation against defects and failure to perform and remain weathertight. Warranty to provide for required repairs.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE DESIGNER-MANUFACTURER**

- A. Glass tension truss structure shall be designed and fabricated by Innovative Structural Glass, Inc.
1. Address: 40220 Pierce Drive, Three Rivers, California 93271.
  2. Phone: 559-561-7000 / Fax: 559-561-7007.
  3. Website: www.structuralglass.com
- B. Requests to use design services and products of another manufacturer must be submitted in accordance with Section [01 63 00] [01630] - Product Substitution Procedures.

## 2.2 GLASS PRODUCTS

**\*\*\*\*\* Various glass types can be used for glass tension truss structures. Selection will be influenced by structural criteria, functional requirements, codes, aesthetics, and cost. Attributes such as visible and ultra violet light transmittance, U-value, shading coefficient, and solar heat gain coefficient will also influence glass types used for a specific project. Information and values for these attributes can be found in literature published by glass manufacturers.**

**Note for glass floors, roofs, and other applications where glass is installed at a slope of 15 degrees or more from vertical, glazing must be either fully tempered, heat-strengthened, wire glass, or laminated glass in accordance with most codes. Except for laminated glass, a protective screen must be installed below glass in these type applications.**

**As previously noted, glass products can be specified in this section or in Section 08 80 00 (08800) - Glazing with a reference in this section. Edit the following to indicate where glass is specified. \*\*\*\*\***

- A. Glass type and thickness shall be determined by glass tension truss structure manufacturer to accommodate Project design and performance requirements specified in Paragraph [1.4] [\_\_\_\_\_]. Types of glass shall [be as specified in Section [08 80 00] [08800] - Glazing.] [include the following.]

**\*\*\*\*\* If glass is being specified in this section, select types from the following paragraphs:**

- B. Primary glass products:

**\*\*\*\*\* Clear, color tinted, reflective, and low-E glass products can be used to fabricate the tempered, laminated, and insulating glass panels typically used for glass tension truss structures. Select required primary glass products from the following, \*\*\*\*\***

1. Clear glass: Clear, transparent, flat, annealed, float glass, conforming to ASTM C1036, Type I, Class 1, Quality q3.
2. Color tinted glass: [Blue] [Light green] [Dark green] [Light gray] [Medium gray] [Dark gray] [Bronze] [\_\_\_\_\_] color tinted, annealed, float glass conforming to ASTM C1036, Type I, Class 2, Quality q3.

**\*\*\*\*\* Metallic oxide coatings can be deposited onto color tinted glass during production provide a reflective appearance and increase solar control. \*\*\*\*\***

3. Reflective coated tinted glass: [ ] color tinted float glass with metallic oxide coating deposited during production and conforming to ASTM C1036, Type I, Class 2, Quality q3.

**\*\*\*\*\* Low emissivity (low-E) glass products are produced by applying a neutral coating which blocks a significant percentage of solar energy and greatly improves energy efficiency. \*\*\*\*\***

4. Low emissivity (low-E) glass: Clear glass with neutral coating pyrolytically applied to improve thermal performance and reduce solar heat gain.

C. Fabricated glass panels:

**\*\*\*\* Primary glass products can be heat treated to increase strength and resistance to thermal stress. There are two types of heat treatment - heat strengthened and fully tempered. Heat strengthened glass is approximately twice as strong as annealed glass of equal thickness. However, it does not qualify as safety glass. \*\*\*\*\***

1. Heat strengthened glass: Heat strengthened, annealed glass conforming to ASTM C1048, Kind HS.

**\*\*\*\*\* Fully tempered glass is approximately four times as strong as annealed glass of equal thickness. Tempered glass does qualify as safety glass and tends to break into small cubical pieces. Fully tempered glass is used for most glass structures fabricated by Innovative Structural Glass, Inc. \*\*\*\*\***

2. Fully tempered glass: Heat strengthened safety glass complying with ASTM C1048, Kind FT and ANSI Z97.1 and CPSC 16 CFR.

**\*\*\*\*\* Laminated glass is fabricated by bonding two or more glass panes with a transparent, flexible interlayer material. Laminated glass does qualify as safety glass. When broken, laminated glass tends to remain in place with glass particles adhered to interlayer. \*\*\*\*\***

3. Laminated glass: Fabricated by bonding two or more glass panes with transparent, flexible interlayer material in accordance with ASTM C1172. Laminated glass shall meet requirements of ANSI Z97.1 and CPSC 16 CFR to qualify as safety glass.

**\*\*\*\*\* Insulating glass is fabricated using two glass panes, referred to as lites, separated by an air space with the interpane space purged with dry hermetic air and sealed. The air space provides insulation and reduces heat transfer as well as limiting condensation and sound transmission. \*\*\*\*\***

4. Insulating glass units: Fabricate insulating glass units with two lites separated by air space. Seal edge and purge interpane space with dry hermetic air. Comply with ASTM E546, ASTM E576, ASTM E773, and ASTM E774.

**\*\*\*\*\* For glass tension truss structures glass is mechanical installed with stainless steel connectors and fittings. Mechanical attachment with fittings can also be used for installing glass panels directly to support substrate. These devices require accurately drilled holes in glass to receive fitting pins. Holes must be drilled prior to tempering glass panels. Include this paragraph if mechanically installed glass panels are required. \*\*\*\*\***

- D. For glass panels to be installed with mechanical connectors and fittings, provide holes to receive bolts and fitting pins. Holes shall be drilled prior to tempering glass.

## **2.3 TENSION TRUSSES**

**\*\*\*\*\* Tension trusses can be placed vertically, horizontally, or in a combination of vertical and horizontal members. \*\*\*\*\***

- A. Support mainplate glass panels with tension trusses consisting of:

**\*\*\*\*\* Tension members can be either stainless steel rope (cable) or stainless steel rods. \*\*\*\*\***

1. Tension members: [Stainless steel wire rope.] [Stainless steel solid rods complying with ASTM A276 with [brushed satin finish.] [reflective polished finish.]] Type, diameter, tensile strength determined by manufacturer to meet design criteria specified in Paragraph [1.4] [\_\_\_\_\_].
  2. Hardware: Provide connectors, turnbuckles, studs, and other hardware as shown on approved shop drawings and as required for fabrication of tension trusses.
  3. Tubing: Stainless steel complying with ASTM A269 with [brushed satin finish.] [reflective polished finish.]
  4. Fittings to join glass panels to tension trusses: Stainless steel complying with ASTM A276 with [brushed satin finish.] [reflective polished finish.]
- B. Placement: Trusses shall be installed perpendicular to glass surface and extend [vertically] [and] [horizontally] between supports.
- C. Truss configuration, dimensions, spacing, and component sizes: As designed by manufacturer and indicated on shop drawings to efficiently support glass structure and meet performance criteria specified in Paragraph [1.4] [\_\_\_\_\_].

## **2.4 FITTINGS**

**\*\*\*\*\* Innovative Structural Glass, Inc. designs and fabricates a broad range of stainless steel fittings for connecting glass panels together, to glass fins, and to other support systems and substrates. It is important that fittings be designed for specific project conditions and loadings and be provided by entity responsible for glass tension truss structure design. Stresses induced in glass panels by fittings must be compatible with glass strength. Innovative Structural Glass fittings have been independently tested to ensure quality and**

**structural performance. \*\*\*\*\***

- A. Provide structurally engineered and independently tested fittings by an independent laboratory in the United States for connecting glass panels and fins together and for attachment to supporting substrates.
- B. Material: Stainless steel complying with ASTM A276, Type 316 with [brushed satin finish] [reflective polished finish].]
- C. Types: Configuration, number of points, size, and spacing shall be determined by manufacturer and scheduled on shop drawings to accommodate project design and meet performance criteria specified in Paragraph [1.4] [\_\_\_\_\_]. Ensure that fitting-induced stresses do not exceed glass strength.
- D. Providing fittings with countersunk stainless steel bolts, Delrin bushings, and resilient gaskets.

**2.5 ACCESSORIES**

- A. Provide glazing accessories, anchors, and fasteners of type recommended by glass tension truss structure manufacturer and as required for complete, functional, weathertight installation.
- B. Anchorage devices: Clips, anchors, fasteners, and shims required for secure installation of glass tension truss structure. Type, size, and spacing as recommended by glass tension truss structure manufacturer.
- C. Cleaners and primers: Recommended by manufacturer to be compatible with substrate and glazing materials.
- D. Setting blocks: Neoprene or EPDM complying with ASTM C864.
- E. Edge blocks: Elastomeric material of hardness required to limit lateral movement of glass.
- F. Gaskets: Molded or extruded elastomeric type of profile and hardness required to maintain weathertight seal and complying with ASTM C509, ASTM C864, or ASTM C1115.
- G. Glazing tape: Preformed butyl compound, non-staining, non-migrating in contact with non-porous surfaces, coiled on release paper, complying with ASTM C1281.
- H. Glazing sealant: Chemically curing type complying with ASTM C920, compatible with materials and conditions, and capable of anticipated joint movement without watertight seal failure.
- I. Contact structural sealant: High performance, two component, non-sag, neutral cure, ultraviolet resistant, silicone sealant designed for structural glazing and complying with ASTM C920.

**PART 3 - EXECUTION**

**\*\*\*\*\* Edit this article to reflect type of glass tension truss structure and components being installed. Delete non-applicable items and requirements. \*\*\*\*\***

**3.1 COORDINATION**

- A. Coordinate provision of glass tension truss structure with casting of concrete [footings] [floor slabs] [walls] [structural framing] specified in Section [03 30 00] [03300] - Cast-in-Place Concrete. Ensure that [sleeves,] [inserts,] [anchor bolts,] [reglets,] [\_\_\_\_\_] and other embedded items are provided in sufficient time for embedment in cast concrete. Ensure that blockouts and pockets for glass tension truss structure components are provided, accurately placed, and properly sized.
- B. Coordinate provision of glass tension truss structure with structural framing specified in [Section [03 40 00] [03400] - Precast Concrete] [Section [04 05 10] [04800] - Masonry Assemblies.] [Section [05 12 00] [05120] - Structural Steel.] Ensure that provision is made for attachments and transfer of calculated loads.
- C. Field verify dimensions prior to fabricating glass tension truss structure components.

**3.2 INSPECTION**

- A. Prior to delivery of glass panels to site, verify that wall openings, support framing, and substrates are ready to receive glass tension truss structure. Verify alignment, support dimensions, and tolerances are correct.
- B. Report unacceptable conditions and deficiencies. Do not proceed with installation until corrective action has been performed.
- C. Inspect glass panels for chipped edges, scratches, abrasions, and other damage. Remove damaged panels from site and replace.

**3.3 GENERAL INSTALLATION**

- A. Site assemble and erect glass tension truss structure in accordance with approved shop drawings, manufacturer's installation instructions, and GANA Glazing Manual.
- B. Damaged glass: Do not install glass with edge damage or other imperfections.
- C. Allow for settling, expanding, and contracting to occur without breaking glass.
- D. Do not field cut or alter structural framing without written approval from manufacturer and Architect.

**3.4 GLAZING**

**\*\*\*\*\* If several types and thicknesses of glass are required for glass tension truss structure, a glazing schedule either in this section or on drawings may be required. \*\*\*\*\***

- A. Glazing schedule: Install types and thickness of glass in locations scheduled [below] [on Drawings] [on approved shop drawings].
1. Type 1: [\_\_thickness\_\_], [\_\_glass type\_\_], [\_\_color tint\_\_] glass installed in [\_\_location\_\_].
  2. Type 2: [\_\_thickness\_\_], [\_\_glass type\_\_], [\_\_color tint\_\_] glass installed in [\_\_location\_\_].
- B. Protect adjacent surfaces sealants and glazing materials with masking tape or other means.
- C. Install setting blocks and spacers as recommended by glass tension truss structure manufacturer and indicated on approved shop drawings.
1. Place setting blocks at quarter points. Maintain [6 inches] [152 mm] space from corners.
  2. Set blocks in sealant.
- D. Provide edge blocking as required to prevent sideways movement of glass in glazing channel.
- E. Ensure glazing channels and stops provide required bite on glass, minimum edge and face clearances, and adequate sealant thickness.

**\*\*\*\*\* Various glazing methods can be used depending on type of glass tension truss structure. Typically butt glazed joints using structural silicone sealant are used for glass tension truss structures. Other methods such as tape glazing, gasket glazing, and wet sealant glazing may also be required depending on project conditions. Consult with Innovative Structural Glass to determine required glazing methods. \*\*\*\*\***

- F. Glazing methods: [Type as determined by manufacturer and indicated on approved shop drawings.] [Use the following methods for applications indicated on Drawings.]
1. Structural silicone glazing: Use for butt glass joints.
    - a. Cleaning: Thoroughly clean all joints and glazing areas immediately prior to sealant application. Remove oil, dust, grease, water, surface dirt, contaminants, and other foreign matter. Vacuum or blow out dust and loose particles from joints. Do not use water cleaning treatments.
    - b. Use primers only as recommended by sealant manufacturer. Field test with and without primer before actual application.
    - c. Mask areas adjacent to joints to insure neat sealant line. Do not allow tape to touch surfaces to which sealant will be applied.
    - d. Install sealant back-up spacers as indicated on Drawings and approved shop

drawings.

- e. Apply silicone structural sealant in continuous operation. Tool sealant immediate before skin forms. Tool concave to ensure complete contact.
  - f. Post application test: After structural sealant has cured 14 to 21 days, conduct field test as prescribed by manufacturer to test sealant adhesion. Replace sealant not passing test.
2. Tape glazing.
  3. Gasket glazing.
  4. Wet sealant glazing.

### **3.5 MECHANICAL ASSEMBLED GLASS UNITS**

**\*\*\*\*\* Glass panels are typically mechanically attached to tension trusses with stainless steel fittings. \*\*\*\*\***

- A. Mechanically install glass panels and tension trusses with stainless steel fittings as designed by manufacturer and indicated on approved shop drawings.
- B. Tension trusses: Mechanically join tension trusses to mainplate glass panels with connector fittings to provide stabilization and support.
- C. Secure glass panels to fittings with bolts. Torque bolt to amount specified on approved shop drawings using calibrated tool. Lock torqued bolt into position to prevent backoff. Reset calibrations regularly to ensure accurate torquing.

### **3.6 CLEANING**

- A. Clean excess sealant from glass and other surfaces immediately after application. Use solvents or other cleaners recommended by manufacturer.
- B. Remove protective material from prefinished surfaces.
- C. Wash exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean cloths. Do not use abrasives. Take care to remove dirt from corners. Wipe surfaces clean.

**END OF SECTION**