SAN FRANCISCO ARTS COMMISSION
ARTWORK TECHNICAL SPECIFICATIONS
WALTER KITUNDU | *THOSE WHO CARRY WATER*
SAN FRANCISCO WATER DEPARTMENT AT 2000 MARIN

Specification: ARTWORK POINT SUPPORTED STRUCTURAL GLASS FABRICATION

PART 1 - GENERAL

1.01 STYLE AND NATURE OF THIS SPECIFICATION

This document is written in the directive style. Where an obligation is given and it is not stated who is to undertake these obligations, it is to be undertaken by the Artwork Glass Fabrication Sub-Contractor (Fabricator). This Specification governs the fabrication of an artist-designed permanent artwork commissioned by the San Francisco Arts Commission (SFAC). All obligations include preserving the aesthetic intent and visual integrity of the Artist's approved design.

This document shall be read as a whole. No one section should be isolated or read to be all inclusive of any information related to the topic of that section.

This Specification forms part of the Contract Documents of a supply package. This Specification together with the Drawings define the Scope of Work, mandatory geometry of the Artwork, performance parameters for the Point Supported Glass and Point Supported Glass Hardware, minimum acceptable standards and establishes a regime for verification of the fabrication and delivery of glass processes.

1.02 CLARIFICATION OF GLASS FABRICATION AND GLASS INSTALLATION SUB-CONTRACTOR ROLES

Fabrication of the glass and installation are procured separately. The fabrication, shipping and delivery of the Artwork Glass is a separate and independent contract under the San Francisco Arts Commission (SFAC) that includes these specifications for the Artwork Glass Fabrication Sub-Contractor (Fabricator).

The receipt and installation of the Artwork Glass and the procurement of the Point Supported Glass Hardware by the Artwork Glass Installation Sub-Contractor (Installer) is under a separate and independent contract that does not include these specifications.

It is assumed that the Installer and Fabricator may not be the same entity. The Fabricator shall fully review the ARTWORK POINT SUPPORTED STRUCTURAL GLASS INSTALLATION specifications and confirm their understanding of the ARTWORK POINT SUPPORTED STRUCTURAL GLASS INSTALLATION specifications in writing to SFAC. The Installer and the Fabricator shall coordinate their respective scopes. The Fabricator shall notify SFAC of any comments concerning their scope and coordination of their scope with the Installer.

The Artwork Glass Fabrication Sub-Contractor shall procure the Artwork Glass and be responsible for the shipping and delivery of the Artwork Glass including coordination with the supporting building structure to fully comply with the Contract Documents' requirements and the Artist's intent. The Fabricator shall coordinate all communication through SFAC Public Art Project Manager. Direct contact with the Artist shall occur only when authorized in writing by SFAC.

The Artwork Glass Installation Sub-Contractor shall procure the glass hardware, be responsible for the handling (receipt and storage) of the Artwork Glass, and be responsible for the erection of the Artwork

including coordination with the supporting building structure to fully comply with the Contract Documents' requirements and the Artist's intent.

1.03 SUMMARY

A. This section relates to the point supported glass Artwork design, fabrication, shipping, and delivery.

B. The Artwork Glass Fabrication Sub-Contractor (Fabricator) scope shall include, but not necessarily be limited to, Artwork Glass fabrication, Artwork Glass testing, Artwork Glass shipping, and delivery of the Artwork Glass (Point Supported Glass).

C. The Artwork Glass Fabrication Sub-Contractor (Fabricator) scope shall also include, but not necessarily be limited to, coordination with the Artwork Glass Installation Sub-Contractor (Installer), coordination with the Point Supported Glass Hardware, and coordination with the attachments to the Armature.

D. The scope includes Artwork Glass for the Point Supported Glass System including all labor, materials, engineering, equipment and services necessary to complete the structural wall as shown on the Contract Documents, including, but not limited to, the following:

1. Procurement of the Point Supported Glass.
2. Glass fabrication, testing, packaging and delivery approved by the Artist and SEOR.
3. Fabrication, color rendering, and surface finish shall maintain full fidelity to the Artist's approved imagery and samples.
4. Coordination with the Installer for tolerances, the Point Supported Glass Hardware, handling and storage, erection sequences and attachments to the Armature.
5. Coordination with the Installer for the mock-up.

E. Related Sections

1. Drawings, General and Supplementary Conditions of the Contract, and the following Specification Sections, apply to this Section.
2. ARTWORK POINT SUPPORTED STRUCTURAL GLASS INSTALLATION Specification
3. ARTIST-DESIGNED ARTWORK GLASS FABRICATION AND DELIVERY RFP.
4. Applicable and relevant Arts Commission project specifications.

1.04 REFERENCES

A. The Fabricator is responsible to adhere to the following references pertaining to Artwork Glass fabrication, Artwork Glass shipping, and delivery of the Artwork Glass (Point Supported Glass).
B. ARTWORK POINT SUPPORTED STRUCTURAL GLASS INSTALLATION specification.
C. ARTIST-DESIGNED ARTWORK GLASS FABRICATION AND DELIVERY RFP
D. The most current version of the codes and standards shall be used.
E. American Architectural Manufacturer's Association:
   1. AAMA 501 – Methods of Tests for Exterior Walls.
   2. AAMA TIR-A9 - Design Guide for Metal Cladding Fasteners

F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

G. ASTM International (ASTM):

1. ASTM A743 - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

2. ASTM C158 - Standard Test Methods for Strength of Glass by Flexure (Determination of Modulus of Rupture).
3. ASTM C162 - Standard Terminology of Glass and Glass Products.
4. ASTM C1036 - Standard Specification for Flat Glass.
5. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass -- Kind HS, Kind FT Coated and Uncoated Glass.
6. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
7. ASTM C1279 - Standard Test Method for Non-Destructive Photoelastic Measurement of Edge and Surface Stresses in Annealed, Heat-Strengthened, and Fully Tempered Flat Glass.
8. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
9. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
10. ASTM E1300 Standard Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.
11. ASTM F738 Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs.

H. ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

I. Consumer Product Safety Commission CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

J. European Standards (EN):

1. EN 572 – Glass in Building – Basic Soda Lime Silicate Glass Products.
2. EN 1288-3 – Glass in building — Determination of the bending strength of glass - Part 3 - Test with specimen supported at two points (four point bending).
3. EN 12150 Glass in building - Thermally toughened soda lime silicate safety glass.
4. EN 12543 – Glass in Building – Laminated Glass and Laminated Safety Glass.
5. EN 14179 – Glass in building - Heat soaked thermally toughened soda lime silicate safety glass.

K. Fenestration and Glazing Industry Alliance (FGIA).

L. Glass Association of North America (GANA): Glazing manual.

M. Glass Association of North America (GANA): Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.

N. Glass Association of North America (GANA): Glass Information Bulletin GANA TD-02-0402 – Heat-Treated Glass Surfaces Are Different.

O. National Accreditation and Management Institute, Inc. (NAMI).

P. National Glass Association (NGA).

DEFINITIONS

A. Annealed Glass: Glass in its unprocessed form without internal stresses caused by heat treatment, such as rapid cooling, or by toughening or heat strengthening.

B. Armature: Structural steel framing and connections to reinforced concrete Garage structure to support the Artwork.

C. Artist: A person that designs and fabricates the Artwork, under the supervision of the San Francisco Arts Commission.

D. Artwork: Vertical Point Supported Glass and Point Supported Glass Hardware with Artist-designed graphics integrated into architectural glass panels installed on the façade of the Infrastructure Facility employee Garage. The Artwork will include colored enamels digitally printed onto float glass. Color will be fired to the glass to form a permanent bond.

E. Artwork Glass: Vertical Point Supported Glass with Artist-designed graphics integrated into architectural glass panels by the Artwork Glass Fabrication Sub-Contractor for installation on the façade of the Infrastructure Facility employee Garage by the Artwork Glass Installation Sub-Contractor. The Artwork Glass will include colored enamels digitally printed onto float glass. Color will be fired to the glass to form a permanent bond.

F. Artwork Glass Fabrication (Fabrication): Includes the procurement, shipping and delivery of the Artwork Glass including coordination with the Artwork Glass Installation Sub-Contractor (Installer) and coordination with the Armature and supporting building structure.

G. Artwork Glass Fabrication Sub-Contractor (Fabricator): Sub-Contractor responsible for the procurement, shipping and delivery of the Artwork Glass including coordination with the Artwork Glass Installation Sub-Contractor (Installer) and coordination with the Armature and supporting building structure.

H. Artwork Glass Installation (Installation): Includes Artwork Glass handling (receipt and storage), procurement of the Point Supported Glass Hardware, Artwork installation, and attachments to the Armature including coordination with the Artwork Glass Fabrication Sub-Contractor (Fabricator) and coordination with the supporting building structure.

I. Artwork Glass Installation Sub-Contractor (Installer): Sub-Contractor responsible for the procurement of the glass hardware, handling (receipt and storage), and erection of the Artwork including coordination with the Artwork Glass Fabrication Sub-Contractor (Fabricator) and the coordination with the supporting building structure.

J. Artwork Review Sample: Full-scale glass test panel demonstrating color, translucency, and finish for Artist and SFAC approval.

K. City Representative: A person overseeing construction activity for the City and County of San Francisco.

L. Client: Otherwise known as the project Owner, the client is the end purchaser of the works, who holds the main building contract with the main building contractor.

M. Contract: For the purposes of this specification, the term “Main Contract” can be taken to mean “subcontract” or “Artwork Subcontract”. Also Refer to Artwork Glass Fabrication Sub-Contractor.

N. Contract Documents: Drawings and specifications, drawing notes, and construction administration documents (RFI responses, submittals and submittal responses, and approved substitutions) that define the scope for the point supported glass and the point supported glass hardware.

O. Float Glass: A sheet of glass made by floating molten glass on a bed of molten metal. This gives the glass uniform thickness and very flat surfaces. Float glass is slowly cooled to produce annealed glass.

P. Fully Tempered Glass: Glass that has been heat-treated using the horizontal (roller hearth) method and complies with ASTM C1048, Type I, Class 1 (clear).

Q. Garage: Infrastructure Facility employee parking structure.

R. Glass Lite: Individual glass element before lamination into glass panel.

S. Glass Panel: Laminated glass panel with integrated Artwork. For this specification, glass panel and glass unit are the same.

T. Heat Soaked Glass: Glass that has been tested using heat soaking. The heat soak test or heat soak process is used to minimize the risk of spontaneous breakage of tempered glass caused by nickel sulfide (NiS) inclusions.

U. Heat Strengthened Glass: Produced with surface and edge compression levels that are lower than fully tempered glass. Heat strengthened glass does not meet safety glazing requirements.

V. Infrastructure Facility: The new San Francisco Water Department campus at 2000 Marin Street, San Francisco, CA, 94124.

W. Laminated Glass: A type of safety glass that is made by bonding two or more layers of glass together with layers of polyvinyl butyral (PVB) or ionoplast (SentryGlas). This creates a single sheet of glass. When broken, the interlayer keeps glass layers bonded and prevents them from breaking apart. The added rigidity and stiffness of SentryGlas allows it to maintain its structural integrity even when fully broken.

X. Main Contract: The contract between the Client and the Artwork Glass Fabrication Sub-Contractor (or Main Building Contractor) for the entire project works defined by the scope of works detailed in this specification and the Contract Documents.

Y. Main Building Contractor: The contractor responsible for delivering the scope of work for the Garage structure and the Armature, in coordination with this specification. For this specification, Main Building Contractor and General Contractor are the same.

Z. Point Supported Glass: Structural Artwork Glass with corner and edge point fittings supported by the steel Armature that connects to the reinforced concrete Garage structure with laminated fully tempered (FT) glass continuously open gaps on all sides.

AA. Point Supported Glass Hardware: All the components (hardware) to capture the glass and to connect to the steel framing Armature including the spider fittings, glass attachments, gaskets, etc.

BB. Point Supported Glass System: Includes the Point Supported Glass, the Point Supported Glass Hardware and coordination with the connections to the Armature.

CC. Public Art Project Manager: The person that represents the San Francisco Arts Commission Public Art Program.

DD. Safety Glass: Glass that has been tempered or laminated and is less likely to cause injury due to its additional strength and break pattern.

EE. San Francisco Arts Commission (SFAC): The Charter-established City agency that has jurisdiction over all art belonging to the City and charged with the preservation and care of this Artwork.

FF. San Francisco Arts Commission Public Art Program: The department responsible for the commissioning of permanent public Artworks to be accessioned into the Civic Art Collection as required by the City's Art Enrichment Ordinance.

GG. SEOR: Structural Engineer of Record licensed in the State of California in responsible charge of the structural engineering content of the Contract Documents.

HH. SFAC Public Art Project Manager: City representative administering design intent, reviews, and acceptance for the Artwork.

II. Spider Fitting: 316 Grade stainless steel single, double, triple and four arm fittings used to attach glass panels to the supporting Armature.

JJ. Tempered Glass: A form of safety glass that has been heat-treated to have either a minimum surface compression of 10,000 psi or an edge compression not less than 9,700 psi in accordance with the requirements of ASTM C 1048.

KK. Toughened Glass: Alternative name for tempered glass, commonly used outside of North America. See tempered glass definition.

LL. Works (or Work): Entire Artwork scope and requirements including the Point Supported Glass, Point Supported Glass Hardware with all of the components to connect to the supporting Armature and coordination with the Armature.

1.05 SCOPE OF WORK

The Artwork consists of vertical Point Supported Glass with Point Supported Glass Hardware. The Artwork is comprised of multiple sections of variable widths distributed on the north, west, and south sides of the building. Each Artwork section is comprised of individual glass panels. The laminated glass panels have colored enamels digitally printed onto float glass designed by the Artist. Color will be fired to the glass to form a permanent bond. The scope for this specification includes the Artwork Glass.
Required coordination included in this specification scope are coordination with Artwork Glass Installation Sub-Contractor (Installer) and coordination with all of the components to connect to the supporting Armature. The supporting Armature is under a separate contract.

A. Artwork Glass Fabrication Sub-Contractor: The Artwork documentation prepared by Danziger Engineering Collaborative and Tipping show the design, requirements and construction details. The Artwork Glass Fabrication Sub-Contractor shall supply, fabricate, ship and deliver the Artwork Glass, in accordance with the design intent of the Contract Documents securing all necessary permissions and agreements for the Works included in this specification including, but not limited to, the following:

   1. Mock-ups, test samples, testing and test reports.
   2. Interfaces with the Point Supported Glass Hardware and the Armature.
   3. Review and verification of Artwork Glass construction loads.
   4. Glass test reports and new glass tests, if required.
   5. Fabrication, shipping and delivery of the Artwork Glass, including all temporary works required.
   6. One small-format sample panel or frit test tile shall be retained by SFAC for archival reference.

B. SFAC's approval of the Artwork Glass Fabrication Sub-Contractor's documents shall be limited to:

   1. Confirmation of all basic design parameters.

2. The Artwork Glass Fabrication Sub-Contractor 's quality control program.

3. The visual effect.

C. The Artwork Glass Fabrication Sub-Contractor shall meet the requirements for interfacing with the Point Supported Glass Hardware and the Armature as outlined in the Contract Documents.

D. The Artwork Glass Fabrication Sub-Contractor shall provide all necessary hardware for accurate and safe storage and handling of the Artwork Glass. They shall be designed to accommodate generous on-site adjustment and thermal movement to protect the Artwork Glass prior to installation.

1.06 PERFORMANCE REQUIREMENTS

A. The Fabricator is responsible to adhere to the following performance requirements pertaining to Artwork Glass fabrication, Artwork Glass shipping, and delivery of the Artwork Glass (Point Supported Glass). The Fabricator shall coordinate these performance requirements with the Artwork Glass Installation Sub-Contractor (Installer) and inform SFAC and the SEOR of any performance requirements that are not being met by either the Fabricator or the Installer.

B. Testing: All requirements in this specification shall be proven exclusively by physical testing methods per the testing requirements in this specification.

C. The Artwork Glass, as erected, shall meet or exceed the following structural and weather resistance requirements:

1. 25 years with minimum maintenance (apart from regular cleaning).

2. Glass to have a minimum factor of safety of 2.5 with a maximum probability of breakage of 8 lites/ 1000 lites at design wind loading.

3. Glass surfaces shall allow for installation and maintenance loading applied by installers, window cleaners and associated equipment.

D. All Point Supported Glass shall be fabricated such that effective maintenance and replacement of these elements can be carried out without damaging adjacent components.

E. Each of the glass panels is to be supported by spiders and glass attachments positioned with edge distance as per Contract Documents.

F. Finished Tolerances:

1. Glass: ±1mm in plan.

2. Alignment between adjacent glass lites: ±1mm.

G. The Artwork Glass Fabrication Sub-Contractor shall be required to coordinate with the Artwork Glass Installation Sub-Contractor for the building superstructure tolerances including the tolerances for the Armature and the Garage Structure.

H. The Artwork Glass Fabrication Sub-Contractor shall be required to coordinate with the Artwork Glass Installation Sub-Contractor to allow for the worst combination of tolerances.

I. All visible surfaces of the glass shall be free of roller wave, scratches, or optical distortion when viewed in natural daylight at 10 ft. Color variation shall be within agreed variation from approved sample(s).

1.07 SUBMITTALS

A. Submit under provisions of the ARTIST-DESIGNED ARTWORK GLASS FABRICATION AND DELIVERY RFP requirements.

B. Prior to commencement of fabrication, the Artwork Glass Fabrication Sub-Contractor shall obtain and submit to the San Francisco Arts Commission (SFAC) certification from the manufacturer of each material that the material is of the correct grade, strength, size, finish etc., and that all applied coatings, finishes and the like have been applied to the relevant standards and requirements specified herein.

C. The Artwork Glass Fabrication Sub-Contractor shall provide written confirmation that they have reviewed and understand the ARTWORK POINT SUPPORTED STRUCTURAL GLASS INSTALLATION specifications.

D. The Artwork Glass Installation Sub-Contractor shall provide written confirmation that the procured Artwork Glass meets the requirements of the specification and all associated codes and standards, in a form acceptable to the SEOR.

E. Provide written confirmation that the Point Supported Glass Hardware, procured by the Artwork Glass Installation Sub-Contractor, is compatible with the Artwork Glass.

F. The Artwork Glass Fabrication Sub-Contractor shall prepare a schedule of materials to be used on the project. Materials schedule shall be updated and submitted to SFAC.

G. Provide a copy of safety marking and proposed location on glass. Safety markings need to be legible for the building inspector.

H. Provide breakage rates and certification for the heat-soak testing per 2.02.H. of this specification.

I. Proposed Testing: Submit a report with descriptive narrative and diagrams for proposed tests to be performed to supplement the information from any previous testing and to comply with the testing requirements of this specification

J. Artwork Glass Test Data: Submit test reports from an independent laboratory certifying that the Artwork Glass proposed for use has been tested.

K. Previous Testing: Submit copies of tests and valid certifications previously performed on proposed systems. The Point Supported Glass previously tested must be similar in type of materials and design as that shown on the Contract Documents utilizing attachments through holes in the glass. Include statement of any differences between the proposed system and the tested systems for which previous tests and valid certifications are submitted. Provide evidence of structural performance testing that the Artwork Glass proposed is comparable to the previously tested glass considering the following project specific loads, environment, and performance requirements:

1. Service loads:
    a. Live load 5 psf (lbs/square foot) applied normal to the glass surface and 200 lbs point live load applied anywhere (construction, access and maintenance loads to be confirmed).
    b. Wind Load 35.3 psf (lbs/square foot) applied normal to the glass surface.
    c. Seismic Loads 180%g.
2. External Environment:
    a. Temperature Range Ambient: 0°C to 40°C.
    b. Surface Allowance: -5°C to 80°C.
    c. Structural Members: ±25°C from ambient at installation.
3. Structural performance as tested in accordance with ASTM E330, or other approved method, with no glass breakage or permanent damage to fasteners, anchors, hardware, or actuating

mechanisms. All loads and thermal expansion forces for the in-service conditions with the following maximum deflections:

a. Normal wall deflection not exceeding 1/175 of clear span for span lengths of 162 inches (4115 mm) or less and 1/240 plus 1/4 inch (6 mm) for others. Deflection limited to 3/4 inch (19 mm) maximum for individual glass panels.

b. Parallel to wall deflection not exceeding 75 percent of glass edge clearance. Restrict deflection to L/360 or 1/8 inch (3 mm) maximum.

c. Deflection of the entire assembly, including, but not limited to, glass, not to exceed 1-1/2 inches (38 mm).

d. Acceptable evidence of these deflection limits for any proposed substitutions to the Contract Documents shall be by calculation submitted to the SEOR.

4. Supporting Structure Movements: The Artwork Point Supported Glass System shall accommodate movements of the supporting structure of the Garage and the Armature for the Artwork relating to the following loading conditions:

a. Dead Load: span/240 maximum, where the span is between Garage columns.

b. Live Load: span/360 maximum, where the span is between Garage columns.

c. Earthquake Load: 1" (25 mm) maximum interstory drift between Garage levels.

d. Wind Load: span/175 and ¼" (6 mm) maximum, where the span is between Armature supports.

e. Temperature variation: 1/8" (3 mm) maximum movement between Armature supports.

L. Glass manufacturer to submit QA/QC procedures and efforts to minimize anisotropy ahead of production. See section 2.02.F.3. of this specification.

M. Product Data:

1. Manufacturer's data sheets on each product to be used.
2. Provide test reports indicating products meet or exceed specified requirements.
3. Preparation instructions and recommendations.
4. Storage and handling requirements and recommendations.
5. Typical installation methods.

N. Shop Drawings: Prepare shop drawings in a professional manner by a person experienced in this type of drafting and submit in accordance with this Specification. 'Mark-ups' and 'overnotes' on the Contract Documents drawings will not be accepted as Shop Drawings. Shop drawings shall clearly indicate materials and methods, indicate coordination with other trades and bear signed approval of the Artwork Glass manufacturer. Drawings should include all supporting structures.

O. Shop drawings shall be submitted in .pdf format via electronic means that are fully referenced to marking plans and elevations and reviewable as an independent package. Drawing quality and density shall be clear, legible and to scale. A maximum of two reviews of each drawing have been allowed for. Unless indicated otherwise in the Contract Documents, provide the following information on the title block:

1. project identification.
2. the Artwork Glass Fabrication Sub-Contractor's name.
3. date of preparation of submission, and of revision where applicable, issue status.
4. shop drawing number and title of item to which the shop drawing refers.
5. relevant Drawing numbers and Specification clauses.
6. names of person or firm preparing shop drawings, if different from the Artwork Glass Fabrication Sub-Contractor.
7. the Artwork Glass Fabrication Sub-Contractor's statement or stamp on each shop drawing, verifying that it has examined and approved.

P. Shop Drawings shall be issued for both Design-in-Principle and Full documentation as outlined below:
   1. Design-in-Principle Documentation: Prepare shop drawings to demonstrate the typical systems and interfaces prior to the preparation of full shop drawings.
   2. Full Documentation: Once the design-in-principle drawings have been reviewed and modified as deemed necessary by all parties, prepare clear and complete details of each assembly, component and connection together with all information relative to their fabrication, material, surface treatment and packaging for shipment and storage on site.
   3. Submissions shall be complete for the area of work including all relevant cross-referenced plans, elevations, details and calculations (if calculations are required).

Q. The shop drawings shall include, but not be limited to:
   1. Marking plans, elevations and sections showing the location of and marking proposed for each element, including any secondary support system.
   2. Sectional details of all typical and non-typical elements and associated elements including interfaces with adjacent work.
   3. Surrounding structure and relevant conditions.
   4. Details of materials, construction, finish, fastener locations, Artwork Glass, Point Supported Glass Hardware and fixings arrangements and relationship with adjacent construction.
   5. Schedule identifying each unit, with marks or numbers referencing Drawings.
   6. Method of fabrication.
   7. Material type, grade etc. (typically provided on the General Notes drawing).
   8. Identification of type and extent of protective coating to be applied.
   9. Show dimensions, tolerances, profiles, product components, and accessories.
   10. Dimensions for fabricating individual components.
   11. Location and representation of safety marking.
   12. Location and scope of mock-up.

R. Where shop drawings, prepared by other (sub)-contractors or suppliers, indicate site dimensions which have not been taken, the Artwork Glass Fabrication Sub-Contractor shall take such site dimensions before submitting shop drawings, and enter them on all copies of the shop drawings. Where dimensions are given and marked 'verify' or 'verify on site', the Artwork Glass Fabrication Sub-Contractor shall verify dimensions and indicate that they are verified (or corrected) before submitting shop drawings. Where site conditions do not yet exist for taking or

confirming of site dimensions, the Artwork Glass Fabrication Sub-Contractor shall note shop drawings with ‘dimensions will be verified on site’ before submitting.

S. Do not commence fabrication until the shop drawings have been reviewed and permission to proceed has been obtained from SFAC. If materials are required to be ordered or fabricated by the Artwork Glass Fabrication Sub-Contractor in order to maintain the Construction schedule, prior to the issue of ‘For Construction’ shop drawings, the Artwork Glass Fabrication Sub-Contractor shall obtain the approval from SFAC.

T. Keep current, approved copies of shop drawings on site.

U. Verification Samples: Coordinate with the Artist to determine samples. Coordinate with the Point Supported Glass Installation Sub-Contractor to supply the Point Supported Glass Hardware and together make sample assemblies. As a minimum, verification samples required shall include:

1. A minimum of three (3) samples of Artwork Glass with Point Supported Glass Hardware (glass attachment and spider fittings) assembled with glass, bolts and accessories. Each sample shall not be larger than 24" × 24".
2. One small-format sample panel or frit test tile shall be retained by SFAC for archival reference.

V. Submit digital proofs of printed artwork imagery showing color calibration data (ICC profile).

W. Submit high-resolution photographs documenting approved samples for SFAC archive.

X. Mock-Ups: See section 1.08.F. of this specification.

Y. Maintenance Manuals: Manufacturer's maintenance manuals.

Z. Warranty: Manufacturer's warranties as described in section 1.11.

AA. Closeout Submittals: At completion, submit to SFAC:

1. Final as-built drawings.
2. Digital production files (editable format).
3. Maintenance instructions.
4. Photographic documentation of each panel prior to crating.
5. Completed and executed certificates of compliance.

BB. Conservation Document Package: As required by the ARTIST-DESIGNED ARTWORK GLASS FABRICATION AND DELIVERY RFP including (see RFP for descriptions):

1. Production files.
2. Color profiles and targets.
3. Panel layout files.
4. Glass and materials specifications.
5. Certificates of conformance.
6. Kiln firing records.
7. Test reports.
8. Reference samples.
9. Panel schedule.

10. Re-fabrication files.
11. Handling, storage, and cleaning guidance.

1.08 QUALITY ASSURANCE

A. Pre-installation Conference and Inspection: After approval of submittals, but prior to beginning fabrication of the Works of this specification, the Artwork Glass Fabrication Sub-Contractor shall attend a meeting at the site attended by representatives of Owner, Architect, Main Building Contractor, Armature structural steel fabricator and erector, and the Artwork Glass Installation Sub-Contractor to describe in detail the Point Supported Glass system to be installed, to establish agreement, coordination and responsibilities among involved trades, and review the Artwork installation procedure and schedule including the methods of delivering and handling glass and installing the Point Supported Glass. The chemical compatibility of all glass materials and framing materials, including sealants if required, with each other and with like materials used in glass fabrication shall be established. The Artwork Glass Fabrication Sub-Contractor, if based outside of California or in another country, may attend this meeting remotely by videoconference.

B. The Fabricator shall submit a written Quality Control Plan describing in-process inspection methods for enamel application, color accuracy, lamination quality, and glass edge finishing. Provide SFAC with a minimum of 21 days advance notice prior to 50% and 90% completion milestones to allow SFAC and Artist to conduct production inspections at the fabricator's facility.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten (10) years documented experience in fabrication and shipping of glass structures for projects of similar scope.

1. Minimum 10 years experience in the manufacture and fabrication of laminated glass.
2. The Point Supported Glass Hardware (attachments and spider fittings) must be domestically produced and assembled in the USA. This requirement applies to hardware only and does not restrict the location of glass fabrication, provided the contracting entity is a US-based business.
3. Manufacturer must be recognized by NAMI. Manufacturers who do not hold NAMI recognition but who hold equivalent international accreditation or certification may submit documentation of such credentials for review and approval by the SEOR prior to award.
4. Manufacturer must be a member in good standing of the National Glass Association (NGA). Manufacturers who are not members of the NGA but who hold equivalent international industry credentials may submit documentation for review and approval by the SEOR prior to award.

D. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

E. Quality Standards: In addition to Code, provide the Works of this Section so designed that glass installation, by Artwork Glass Installation Sub-Contractor, shall conform with ANSI Z97.1 and Federal Safety Standard 16 CFR 1201 for Category II materials.

F. Mock-Up: The Artwork Glass Installation Sub-Contractor shall construct a mock-up with actual materials in sufficient time for the Artist's review and to not delay construction progress. Supply the glass panels and coordinate with the Artwork Glass Installation Sub-Contractor for the supply of the Point Supported Glass Hardware for the mock-up. These panels shall be selected to represent the final installation in terms of attachment of glass to support structure.

1. Intent of mock-up is to demonstrate surface preparation techniques, quality of workmanship and visual appearance.
2. Provide a full-scale mock-up, minimum four (4) of the largest six point supported panels, with Point Supported Glass Hardware representing imagery, color, and finish installed (by the Installer) on the as-built support structure for SFAC and Artist approval prior to production.
3. Do not continue with remaining work until workmanship, color, and sheen are approved by Artist.
4. If mock-up is not acceptable, the Artwork Glass Installation Sub-Contractor shall rebuild the mock-up until satisfactory results are achieved.
5. Incorporate accepted mock-up as part of the Work.

G. All tempered glass shall have a permanent mark with the origin and type of the glass. The marking shall be discreetly located in a position visible in the final construction and consistent throughout the assembly.

H. All laminated glass shall have a safety stamp (bug) certifying safety and durability.

1.09 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer’s instruction for shipping, delivering and protecting the Point Supported Glass.

B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Follow manufacturer’s recommendations to maintain environmental conditions (temperature, humidity, and ventilation) within limits for optimum results and manufacturer’s recommendations for the limits of environmental conditions for shipping and storage of products.

D. Exercise exceptional care to prevent edge damage to glass and damage/deterioration to coating on glass.

1.10 PROJECT / SITE CONDITIONS

A. Field Measurements: When construction schedule permits, verify field measurements with drawing dimensions prior to fabrication of glass products.

1.11 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship commencing at Substantial Completion and transfer of ownership to the City and County of San Francisco.

1. Laminated Glass: Provide a twelve (12) year warranty to include coverage for delamination, including replacement of failed units.
2. Tempered Glass: Provide a five (5) year warranty to include labor and material to replace any glass that spontaneously breaks due to nickel sulfide inclusions.

3. Provide a twelve (12) year warranty to include labor and materials for coated glass to replace unit deterioration including peeling, cracking, color fade, enamel failure and other indications of deterioration or corrosion in glass coatings.

B. Provide manufacturers certificates that all of the Works are in accord with approved shop drawings and specifications and are free from defects in materials and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer is used in this section to refer to a firm that produces primary glass or fabricated glass and Point Supported Glass Hardware as defined in the referenced standards.

B. The Glass Manufacturer shall be capable of producing ultra-clear (low iron) fully tempered laminated architectural glass with ceramic enamel digitally printed imagery fired to a permanent bond, meeting all technical requirements set forth in this specification. Proposed manufacturers shall be submitted to SFAC in writing with sufficient documentation to demonstrate equivalency with these requirements. The burden of demonstrating equivalency rests with the proposer. Final approval of the proposed glass manufacturer rests with SFAC, the Artist, and the SEOR.

C. Acceptable Point Supported Glass Hardware Manufacturer and Supplier: C.R. Laurence Co., Inc. (CRL), or approved equal as determined by the SEOR. Note: Point Supported Glass Hardware is procured by the Artwork Glass Installation Sub-Contractor under a separate contract with the General Contractor, not by the Fabricator under this contract. Point Supported Glass Hardware specifications are provided here for the Fabricator's reference and coordination purposes only.

D. Substitutions: only as approved by the Artist and the SEOR. Substitutions require written approval by the Artist and SFAC Public Art Project Manager prior to submission to the SEOR.

2.02 MATERIALS

A. All glass must be ultra- clear (low iron) laminated glass with two plies of fully tempered (FT) float glass and structural interlayer laminated glass. Laminated glass is to be produced using laid-in place interlayer bonded via an autoclave heat and pressure process with vacuum bag. Minimum interlayer thickness is to be 0.060". (Poured or cast resin laminates will not be permitted.)

B. All glass units shall be manufactured as follows with dimensions, size and center points of holes for point supports located as per Contract Documents:

1. Outer lite: 5/16" (8 mm) fully tempered (FT) low iron glass with decorative enamel on face #2:
2. Interlayer: 0.060” (1.52 mm) sentryglas ionoplast interlayer, laminated in vacuum-bag process.
3. Inner lite: 5/16" (8 mm) fully tempered (FT) low iron glass.

C. The Artwork Glass will include Artist-designed graphics integrated into the glass panels with colored enamels digitally printed onto float glass. Color will be fired to the glass to form a permanent bond.

D. Ultra-Clear (Low Iron) Float Glass:

1. ASTM C1036, Type I, Quality-Q3, Class I or equivalent to EN 572 with visible light transmission not less than 91 percent for 1/4 inch (6mm) thick monolithic glass.
2. In order to reduce the possibility of glass color range rejection, the supplier of ultra-clear glass products shall provide glass for the entire project from a single facility using stockpiled batch run materials from a single source for the entire project.

3. Float Glass quality imperfection limitations: In addition to the limitations included under ASTM C1036, all Glass shall be supplied meeting the following quality standards:
    a. Point Blemishes - Seeds/ Stones with distortion, Stain Spots, Dirt, Surface Damage shall be limited to 0.06 inch (1.5 mm) maximum separated by ≥ 12 inch (300 mm).
    b. Glass Scratch / Rubs shall be rejected if detectable at 10 ft (3050 mm).
    c. Water blow off stains, tag residue, and handprints will not be permitted.
4. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Saint Gobain; Diamant.
    b. AGC/Interpane; Planibel Clearvision.
    c. Vitro Architectural Glass; Starphire.
    d. Guardian Industries Corp.; UltraClear.
    e. Pilkington; Optiwhite.

E. Cutting, Edgeworking and holes:
1. All perimeter glass edges to be mirror polished as agreed with Artist through samples.
2. Glass holes shall be fabricated in accordance with the guidelines established in ASTM C1048 for Heat Treated Flat Glass.
    a. Glass holes to have seamed edges at a minimum and comply with glass fitting manufacturer's requirements.
    b. The edge quality of drilled holes shall be ground and at least equal to a seamed edge.
    c. Raw water-jet cut hole edges are not allowed.
3. All edgework, holes and notches in the tempered glass panels shall be completed before tempering.
4. Coordinate with Artist to determine edge profile.

F. Fully Tempered Type (reference ASTM C1048, Kind FT):
1. Heat treat by horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. Glass manufacturer shall control heating and cooling of glass to be as homogeneous as possible.
3. Glass manufacturer to submit QA/QC procedures and efforts to minimize anisotropy ahead of production. Acceptability of level of anisotropy to be established and verified as a baseline standard at the time of VMU/PMU at the sole discretion of the SEOR.
4. Fully tempered (FT) glass shall have a residual surface compression not less than 10,000 psi (69 MPa) or edge compression not less than 9,7000 psi (67 MPa) as defined in ASTM specification C1048.
5. Approximate maximum allowable edge stress (allowable) for glass lites associated with a maximum probability of breakage (P_b) less than or equal to 0.008 for a 3-s load duration for tempered glass is 10,600 psi (73.0 MPa).

G. Fully Tempered Safety Glass shall comply with ANSI Z97.1 and CPSC 16 CFT 1201 fabrication tolerances criteria:

1. Edge Dimensions and Squareness: ASTM C 1036 and ASTM C1048.
2. Diagonal/Squareness: ASTM C1036 and ASTM C1048.
3. Warp Tolerance: Rectangular glass to be 1/32 inch (0.8mm) over any 12 inches (305mm) but limited to 5/16 inches.
4. Wave Distortion Tolerance for lites 5/16 inch thick and more: Not to exceed 0.003 inches (0.076mm) from peak to valley in the center of lites, and a maximum of 0.006 inches (0.15mm) within 10.5 inch (267mm) of the leading or trailing edge.
5. Millidiopter: 90 percent of surface not to exceed plus or minus 120 millidiopters.
6. General warp and bow: Not to exceed 0.2% of edge length.

H. Heat-Soak Testing: All tempered glass to be heat soak tested with a minimum holding time at 500deg F glass temperature of 2 hours. Heat soak process shall comply with EN 14179.

1. Tempered (toughened) glass shall be free from Nickel Sulphide inclusions.
2. After the heat-soak testing, the probability of failure in service should be less than one in 130 tonnes, or 5,000m^2 of 8 mm tempered glass.
3. Glass identification: All glass shall be marked prior to heat soaking (HST Check marker or stamp by Boraident) to allow HST to be confirmed for each individual lite.
4. Record and submit breakage rates in heat soaking oven for information.
5. Provide certification for the heat soaking process.

I. Laminated Glass: Float glass laminated in accordance with ASTM C1172:

1. Laminated Safety Glass: Comply with Class A of ANSI Z97.1 or 16 CFR 1201 test requirements for Category II.
2. Unless permitted by the Artist, use only interlayers which have been proven by test to demonstrate the specified quality, performance and durability when the adhered glass surfaces carry the frit type, color, pattern and density described by the Artist.
3. Store interlayer material dry and control moisture content for every batch.
4. Where the edge of laminated glass is to be exposed, the interlayer material must be shown to be resistant to the effects of moisture absorption, including clouding and delamination.
5. No hazing or clouding due to improper fabrication of the laminate layers is permitted.
6. Use ionoplast-type interlayer such as SentryGlas (SGP) where specified or where laminated glass edges will be exposed to direct wetting or elevated relative humidity conditions greater than 60% RH.
7. Use Vacuum-Bag method for lamination.
8. Do not splice interlayer material.
9. Clean glass immediately before lamination, using an automated washing process or carry out 100% visual inspection if glass is cleaned manually.
    a. Carry out regular testing of glass cleanliness prior to lamination and keep records of water quality and visual inspections for every batch.
10. Laminate units in autoclave and follow Interlayer supplier's instructions for:

a. Autoclave settings for pressure, temperature and time.

b. Vacuum bag pressure and pre-vacuum times.

c. De-airing procedure.

d. Glass flatness and glass condition.

11. Limit permanent deformation of the glass during lamination such that debonding stress is limited to 1/100 of the bond strength of the laminate to prevent delamination along the glass perimeter.

12. Laminate with excess interlayer along edges and hot-knife cut interlayer flush with surface of glass edge after lamination. There shall be no recessed interlayer at the top glass edge.

J. Ceramic-Coated Glass.

1. Heat treated lites to comply with ASTM C1048, Condition C and specified requirements for heat treated float Glass.

2. Ceramic enamel applied by digital print or silk-screened processes complying with Specification No. 95-1-31 in GANA's Tempering Division's "Engineering Standards Manual" and with other requirements specified.

3. Ceramic Coating Color and Pattern as defined by Artist.

4. Verify compatibility of frit with Interlayers.

5. Enamel pigments and interlayers shall be UV-stable and non-yellowing under direct sun exposure for minimum 12 years in marine environment.

K. Finishes

1. All exposed surfaces will be free of scratches and other serious blemishes.

2. Surface finish and gloss level shall match approved mock-up panel.

L. Fittings (Point Supported Glass Hardware procured by the Point Supported Glass Installation Sub-Contractor)

1. “Spider” type attachment fittings for walls are predominately manufactured from Stainless Steel Grade 316.

2. The finish of all fittings shall be brushed stainless.

3. Glass attachments by CRL, or approved equal as determined by the SEOR, shall be HSF14BS Swivel Head Cap Mount or equivalent with the following spider fittings:

a. FMH2BS double arm for:

1. Vertical edges (two points).

2. Intermediate middle points (for 6 points supported glass panels).

b. FMH1BS single arm (one point) for:

3. Top & bottom corners.

4. Vertical edges at the double horizontal tubes (separation joint at the Armature HSS vertical post splices).

5. Middle points (for 6 points supported glass panels) at top and bottom edges.

6. Middle points (for 6 points supported glass panels) at the double horizontal tubes (separation joint at the Armature HSS vertical post splices).

c. FMH4BS four arm “V” for:

7. Typical four glass panel connections (four points).

d. FMH2VBS double arm “V” for:

8. Single-double arm (two points) for the top & bottom edges and for the intermediate (two points) at the double horizontal tubes (separation joint at the Armature HSS vertical post splices).

4. Point Supported Glass Hardware shall meet the requirements of the Contract Documents. Any proposed substitutions for the Point Supported Glass Hardware shall be approved by the SEOR and shall be shown by the Artwork Glass Fabrication Sub-Contractor to be in compliance with this specification in all respects and shall be demonstrated by calculation and tests that the stresses induced in the glass by these fittings are compatible with the strength of the glass.

5. Point Supported Glass Hardware shall provide a tolerance capability that will cope with the full range of movements shown in the Contract Documents:

a. Thermal movements occurring as a result of differential coefficients of thermal expansion within the range specified. The components used within the system will noiselessly withstand all thermal movements without any buckling, distortion, cracking, failure of joint seals or undue stress on the glass or fixing assemblies.

b. Deflection of the Armature due to loading applied after the erection of the Point Supported Glass system to the magnitude specified.

c. Maximum side sway of the structure due to wind load and/or seismic occurring to the magnitude specified or seismic movement to the degree specified.

d. Deflection due to self-weight of the Point Supported Glass system.

e. Inward and outward movements due to the design wind loads and/or seismic loads specified.

6. Point Supported Glass Hardware to be reviewed by the Artwork Glass Fabrication Sub-Contractor including compatibility with glass fabrication and allowances for tolerances. The Artwork Glass Fabrication Sub-Contractor shall provide written confirmation that the Point Supported Glass Hardware, procured by the Artwork Glass Installation Sub-Contractor, is compatible with the Artwork Glass.

7. Point Supported Glass Hardware (caps, ball joints, bolts, washers, articulated swivel bolts, etc.) shall be machine finished stainless steel grade 316, or conventional glass attachment system assemblies.

8. Bushings will be UV-resistant nylon.

9. Gaskets will be fully vulcanized fiber, neoprene or pre-cured silicone.

10. All fittings and fasteners to be stainless steel grade 316 unless noted otherwise.

2.03 FABRICATION

A. Fabrication methods shall maintain visual fidelity to approved samples and avoid any process that alters color tone or transparency of the Artist's imagery.

B. Fabricate components in accordance with approved Shop Drawings.

C. Major fabrication must done at the manufacturing location.

D. Manufacturer is to be notified of any field modification prior to the activity commencing.

E. Fabricate components true to detail and free from defects impairing appearance, strength or durability.

F. Cut glass clean and carefully. Nicks and damaged edges will not be accepted. Replace glass with damaged edges.

2.04 GLASS TESTING

A. Subject to approval by SFAC and the SEOR, test reports from a recognized laboratory may be acceptable in lieu of testing for some elements.

B. The method of testing is to be submitted and agreed with SFAC prior to commencement of testing.

C. As a minimum, all load tests should include:

1. Inspect each sample. Make a record of all chips and spalls along all edges of the test specimens.
2. Provide record of surface compression of each sample (tin side) checked using Grazing Angle Surface Polarimeter (GASP) prior to testing. Surface stress measurements are to map local stress changes accounting for the effects of corners and holes.
3. For all full sized specimens, surface stress measurements are to be recorded at regular loadings throughout the test.
4. Load and deflection during each test are to be monitored and recorded.
5. The performance of the glass attachment fittings is to be monitored throughout each test.

D. Test to ASTM C158 or EN 1288-3 for bending (flexure) strength:

1. As a minimum, test three samples of the largest 6 point supported glass panels.
2. The composition (glass thickness, glass type, laminate, frit, etc.) of the test samples is to be the same as proposed for the final product.
3. Each of the glass panel test samples is to be supported by the same Point Supported Glass Hardware as proposed for the final product positioned with edge distance as per the Contract Documents. Coordinate with the Artwork Glass Installation Sub-Contractor for the supply of the Point Supported Glass Hardware for the bending tests.
4. Test to failure with uniform load applied normal to the glass surface incrementally increasing the uniformly distributed load on the glass from zero load to working, then to 1.5 times working and finally to failure of the glass or the glass attachments. Configure the test specimens and loads so that the maximum stress produced by this loading is at the middle edge point fixing holes.
5. Alternative bending test configuration and methods may be proposed by the Artwork Glass Fabrication Sub-Contractor for review and approval by the SEOR.

6. Test results must confirm that the minimum glass strength as specified in this specification section 2.02.F. are verified prior to failure.

E. The test results are to be presented in a report to SFAC prior to commencement of fabrication.

F. During production, provide Surface and Edge Compression examinations per ASTM C1048 and ASTM C1279:

1. Examine specimens by the polariscopic or light refraction methods for surface or edge compression.

2. Test the first Glass Lite of every run, at the start of each production shift, whenever tempering furnace settings are altered and the first Glass Lite of machine operator changes.

3. Surface stress results recorded for the test specimens are to be used as quality control levels for production.

PART 3 - EXECUTION

3.01 APPROVAL TO PROCEED

A. Do not proceed with the Artwork Glass fabrication until receiving written approval relating to the shop drawings, relevant performance test report(s) and the shop and on-site quality control procedures. The approval will be accompanied by a written statement that SFAC has reviewed and accepted the test performance. Written approval from SFAC is required prior to Notice to Proceed with fabrication.

3.02 PREPARATION

A. Protect glass and equipment from damage caused by work of this Section.

B. The chemical compatibility of all materials and framing with each other and with like materials used in glass fabrication shall be established.

C. Notify the Artist in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.03 DELIVERY, STORAGE, AND HANDLING

A. The Fabricator shall store and transport Artwork Glass with extreme care in strict accordance with the requirements of SFAC.

B. Inspect each unit of glass before shipping. Glass that has significant impact damage at edges, scratches, abrasion of faces or any other evidence of damage will not be accepted.

3.04 CLEANING

A. Clean and protect products in accordance with the manufacturer's recommendations.

B. Glass to be cleaned according to:

1. GANA Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.

2. GANA Glass Information Bulletin GANA TD-02-0402 – Heat-Treated Glass Surfaces Are Different.

C. Use only neutral-pH cleaners; ammonia, abrasive, and acidic products are prohibited.

D. Do not use scrapers or other metal tools to clean glass.

3.05 COMPLETION

A. Certification: At the completion of the work, and as a precondition to final payment, submit completed and executed certificates of compliance.

B. Operations and Maintenance Manual: Collaborate with the Artwork Glass Installation Sub-Contractor to develop and submit for approval a strategy in the form of a maintenance manual and log book to ensure that elements likely to deteriorate significantly can be replaced or rectified. Identify maintenance in terms of routine (e.g. cleaning) and in terms of component repair/replacement. Analyze each system to define the sequence under which components are likely to fail. The maintenance manual procedures shall be submitted to SFAC for the satisfactory long-term care and regular maintenance of the Artwork (and associated works), including:

1. Data reference sheets and a general description of the system, which shall identify all elements incorporated in the Artwork, list all items supplied and installed, provide a reference to appropriate drawings and trade literature included and identify different areas served by the system.
2. A detailed description of specific items with product names, types, serial numbers, etc.
3. The name, address and telephone number of each firm and / or Contractor involved in the supply or fabrication of materials, components, assemblies and finishes.
4. Schedule for future inspection and testing of the Artwork, which shall set out the procedures to be followed for future inspection, testing and planned preventative maintenance procedures together with a suggested time program.
5. A method statement showing the means of access to all parts of the Artwork with recommended safe loadings.
6. Copies of manufacturers' warranties, service manuals, brochures, recommendations, etc.
7. Copies of test and approval certificates,
8. A list of replacement parts recommended to be held on site, with the names of suppliers.
9. Realignment and adjustment instructions where relevant.
10. Procedures for dismantling and reassembling.
11. Finishes and their architectural description.
12. Cleaning and general maintenance instructions, which shall provide complete details of all cleaning and general maintenance requirements for the Artwork.

C. Include in the Manual a Logbook, with pages set up for recording the times of performance of the above procedures, sufficient in number to receive the entries for three years. Show examples of typical entries by recording any maintenance procedures (such as cleaning) performed during the contract and defects liability periods. The Manual and Logbook shall be 8.5 x 11 size, printed or typed on durable printing paper, each page consecutively numbered, neatly bound in durable vinyl or similar hard covers, and permanently labelled with the project name and date of issue. Supply any word processing files in Adobe Acrobat PDF format on a flash drive.

D. Record Drawings: Progressively produce and maintain 'as-fabricated' drawings to accurately record fabrication of the Artwork Glass. Record drawings shall include revisions to the Artwork Glass. Such drawings shall be available for inspection and checking by SFAC from time to time. Obtain approval on the form of presentation of record drawings before preparing final drawings. Unless other requirements are specified or given in writing by SFAC, record drawings shall consist of:

1. Legible and high quality black and white drawings on a reproducible medium (plain paper photocopy), and.
2. One flash drive, containing a copy of each shop drawing, ‘AS BUILT DRAWING’, and the like relevant to the installation, in .pdf or .dwg format.

E. Final digital production files of artwork imagery shall be submitted in editable archival format (PSD or TIFF) to SFAC for preservation in the Civic Art Collection.

F. Spares: At or before practical completion, deliver spares as required by SFAC to site in strong, waterproof protective packages marked for identification, and store where directed. One small-scale sample glass panel representing final artwork color and finish shall be delivered to SFAC Collections for archival use.

END OF SECTION