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 INSTALLATION

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 Installation Sub-Contractor (Installer).

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 and installation 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 receipt and installation of glass processes and Point Supported Glass Hardware procurement.

This specification governs the installation of an artist-designed artwork (Those Who Carry Water by Walter Kitundu). While structural and performance requirements are as established by the Engineer of Record, installation shall also preserve the Artist's approved visual intent and the aesthetic integrity of the artwork.

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

Fabrication of the glass and installation are procured separately. The receipt and installation of the Artwork Glass and the procurement of the Point Supported Glass Hardware is a separate and independent contract under the General Contractor that includes these specifications for the Artwork Glass Installation Sub-Contractor (Installer).

The fabrication, shipping and delivery of the Artwork Glass by the Artwork Glass Fabrication Sub-Contractor (Fabricator) 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 Artwork Glass Installation Sub-Contractor (Installer) shall fully review the ARTWORK POINT SUPPORTED STRUCTURAL GLASS FABRICATION specifications and confirm their understanding of the ARTWORK POINT SUPPORTED STRUCTURAL GLASS FABRICATION specifications in writing to the General Contractor. The Installer and the Fabricator shall coordinate their respective scopes. The Installer shall notify the General Contractor of any comments concerning their scope and coordination of their scope with the Fabricator.

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. The Installer shall coordinate all communication through the General Contractor. Direct contact with the Artist shall occur only when authorized in writing by SFAC.

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 Installer should coordinate with the San Francisco Arts Commission (SFAC) Public Art Project Manager regarding all activities that affect the visual alignment and finish of the artwork. Artist and SFAC review should occur at the mock-up stage, first-piece installation, and substantial completion.

1.03 SUMMARY

A. This section relates to the Artwork installation, the procurement of the Point Supported Glass Hardware, and Artwork Glass handling (receipt and storage).

B. The Artwork Glass Installation Sub-Contractor (Installer) scope shall include, but not necessarily be limited to, Artwork Glass handling (receipt and storage), procurement of the Point Supported Glass Hardware, Artwork installation, and attachments to the Armature.

C. The Artwork Glass Installation Sub-Contractor (Installer) scope shall also include, but not necessarily be limited to, coordination with the Artwork Glass Fabrication Sub-Contractor (Fabricator), coordination with the Armature fabrication and installation, and coordination with the supporting building structure.

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

1. Procurement of the Point Supported Glass Hardware, and attachments to the Armature.
2. Glass handling (receipt and storage).
3. Coordination with steel Armature.
4. Coordination with the Fabricator for tolerances, the Point Supported Glass Hardware, shipping and delivery, handling, erection sequences and attachments to the Armature.
5. Erection by an installer approved by the Artist and SEOR.
6. Construct mock-up.
7. Include layout and measurement to achieve and verify visual alignment and consistent joint spacing across all installed glass panels.

E. Related Sections

1. Drawings, General and Supplementary Conditions of the Contract, Division 1 and the following Specification Sections, apply to this Section.
2. ARTWORK POINT SUPPORTED STRUCTURAL GLASS FABRICATION Specification.
3. ARTIST-DESIGNED ARTWORK GLASS FABRICATION AND DELIVERY RFP.
4. Applicable and relevant 2000 Marin project specifications.

1.04 REFERENCES

A. The Installer is responsible to adhere to the following references pertaining to Artwork Glass handling (receipt and storage), procurement of the Point Supported Glass Hardware, Artwork installation, and attachments to the Armature.
B. ARTWORK POINT SUPPORTED STRUCTURAL GLASS FABRICATION 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.

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 installed on the façade of the Infrastructure Facility employee Garage. 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 Installation 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: 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 Installation 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: 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 Fabrication Sub-Contractor (Fabricator), coordination with all of the components to connect to the supporting Armature, and coordination with the supporting Armature. The supporting Armature is under a separate contract.

A. Artwork Glass Installation Sub-Contractor: The Artwork documentation prepared by Danziger Engineering Collaborative and Tipping show the design, requirements and construction details. The Artwork Glass Installation Sub-Contractor shall receive and store the Artwork Glass, procure (or fabricate) the Point Supported Glass hardware, assemble and erect a complete system, 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 Artwork Glass and the Armature.
3. Review and verification of Artwork construction loads.
4. Point Supported Glass Hardware test reports and new Point Supported Glass Hardware tests, if required.

5. Procurement of the Point Supported Glass Hardware.
6. Assembly and installation of the Artwork, and all temporary works required.

B. The Client's approval of the Artwork Glass Installation Sub-Contractor's documents shall be limited to:
   1. Confirmation of all basic design parameters.
   2. The Artwork Glass Installation Sub-Contractor 's quality control program.
   3. The visual effect.

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

D. The Artwork Glass Installation Sub-Contractor shall provide all necessary fixing, bolts and the set out for fixings, for accurate installation into the Artwork Glass and supporting Armature. All fixings, fastenings, anchorages, lugs and the like shall be of an approved type. They shall transmit all imposed loads and stresses to ensure the rigidity of the assemblies. They shall be designed to accommodate generous on-site adjustment and thermal movement.

E. The Artwork Glass Installation Sub-Contractor shall be responsible for all means & methods of installation of the Point Supported Glass System.

1.06 PERFORMANCE REQUIREMENTS

A. The Installer is responsible to adhere to the following performance requirements pertaining to Artwork Glass handling (receipt and storage), procurement of the Point Supported Glass Hardware, Artwork installation, and attachments to the Armature. The Installer shall coordinate these performance requirements with the Artwork Glass Fabrication Sub-Contractor (Fabricator) and inform SFAC and the SEOR of any performance requirements that are not being met by either the Installer or the Fabricator.

B. Analysis: All requirements in this specification shall be analytically and mathematically proven for the Point Supported Glass Hardware, except for those requirements called for to be proven exclusively by physical testing methods.

C. The Point Supported Glass System, 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 surfaces and Point Supported Glass Hardware shall allow for installation and maintenance loading applied by installers, window cleaners and associated equipment.

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

E. The Point Supported Glass System shall be fabricated and installed to be able to accommodate temporary removal of individual glass panels during replacement.

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

G. Finished Tolerances:
   1. Glass: ±1mm in plan.
   2. Alignment between adjacent glass panels: ±1mm.

H. The Artwork Glass Installation Sub-Contractor shall be required to accommodate the building superstructure tolerances including the tolerances for the Armature and the Garage structure.

I. The Artwork Glass Installation Sub-Contractor shall allow for all movements and dimensional changes including long-term movements that may occur in the Garage, Armature and Artwork including thermal expansion and contraction. Use the worst combination of tolerances and construction inaccuracies as specified including the worst case position in any slotted hole provided. Allow for adjustments by small increments in all directions. Distribute dead loads accordingly if adjustments are to be made during erection.

J. The Point Supported Glass Hardware and all attachments to the Armature shall resist dead loads, live loads, wind loads and seismic loads and all building movements, individually and in combination. All fixings are to accommodate the worst combination of tolerances.

K. The Point Supported Glass Hardware attachments to the glass shall provide adequate restraint without constraining thermal expansion and thermal contraction of the glass. Reference 1/GLS1.1 for glass constraints and releases including glass support notes for performance requirements and Artwork Glass Installation Sub-Contractor requirements.

1.07 SUBMITTALS

A. Submit under provisions of Section 01 - Administrative Requirements.

B. Prior to commencement of fabrication, the Artwork Glass Installation Sub-Contractor shall obtain and submit to the General Contractor 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 Installation Sub-Contractor shall provide written confirmation that they have reviewed and understand the ARTWORK POINT SUPPORTED STRUCTURAL GLASS FABRICATION specifications.

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

E. For the Point Supported Glass Hardware specified, provide structural calculations stamped by a Structural or Civil Engineer licensed in the state or country where they practice and are qualified to provide engineering documentation to verify the capacity and compatibility of the Glass Hardware.

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

G. Provide written confirmation that the Point Supported Glass Hardware attachments to the glass shall provide adequate restraint without constraining thermal expansion and thermal contraction of the glass. Describe method, with structural detail drawings, of releasing the glass thermal expansion and thermal contraction movements with the written confirmation.

H. The Artwork Glass Installation Sub-Contractor shall prepare a schedule of materials to be used on the project. Materials schedule shall be updated and submitted to the General Contractor.

I. Point Supported Glass Hardware Test Data: Submit test reports from an independent laboratory certifying that the Point Supported Glass Hardware proposed for use has been tested. The Point Supported Glass Hardware tested must be similar in type of materials and design shown on the Contract Documents utilizing attachments through holes in the glass.

J. Proposed Testing: Submit a report with descriptive narrative and diagrams for proposed tests to be performed, if tests are required to supplement the information from previous testing.

K. Previous Testing: Submit copies of test reports and valid certifications previously performed on proposed systems. 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 Point Supported Glass Hardware proposed is comparable to the previously tested system 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. Restrict deflection to 3/4 inch (19 mm) maximum for individual glass panels.
    b. Parallel to wall deflection not exceeding 75 percent of glass edge clearance. Deflection limited 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. Temperature variation: 1/8” (3 mm) maximum movement between Armature supports.

L. 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.

M. 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 Point Supported Glass Hardware manufacturer and the Point Supported Glass System installer. Drawings should include details of all supports and data to show provisions for vertical and horizontal expansion and deflections.

N. 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 Installation 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 Installation Sub-Contractor.
7. the Artwork Glass Installation Sub-Contractor's statement or stamp on each shop drawing, verifying that it has examined and approved.

O. 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 erection.
3. Submissions shall be complete for the area of work including all relevant cross-referenced plans, elevations, details and calculations.

P. 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. Verify in field 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. Methods of installation, including fixings.
8. Material type, grade etc. (typically provided on the General Notes drawing).
9. Identification of type and extent of protective coating to be applied.
10. The type, size and spacing of welds (if welding is required).
11. Methods of assembly.
12. Type and location of attachments to be fixed onto the Armature.
13. Show dimensions, tolerances, profiles, product components, anchorages, and accessories.
14. Dimensions for fabricating individual components.
15. Method for support of glass with attachments that provide adequate restraint without constraining thermal expansion and thermal contraction.
16. Location and scope of mock-up.

Q. Where shop drawings, prepared by other (sub)-contractors or suppliers, indicate site dimensions which have not been taken, the Artwork Glass Installation 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 Installation 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 Installation Sub-Contractor shall note shop drawings with ‘dimensions will be verified on site’ before submitting.

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

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

T. Verification Samples: Coordinate with the Artist to determine samples. Coordinate with the Point Supported Glass Fabrication Sub-Contractor to supply the Artwork Glass and together make sample assemblies. As an example and minimum assumption of what might be required:

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. Point Supported Glass Hardware (Spider fitting) assembly with glass attachment, bolt and accessories.

U. Mock-Ups: See section 1.08.G. of this specification.

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

W. Installation Quality Control Plan: describing how alignment and registration will be verified and documented during installation.

X. Maintenance Manuals: Manufacturer's maintenance manuals. Include maintenance and repair procedures with concise written guidance from the installer and/or manufacturer describing safe methods for removing and reinstalling individual glass panels, including torque values and protective measures.

Y. As-Installed Alignment Record: photographs and measurements showing final panel locations and joint spacing for SFAC archival record.

Z. Closeout Submittals: At completion, submit to the Client:

1. Final as-built drawings.
2. Photographic documentation of the installation.
3. Completed and executed certificates of compliance.

1.08 QUALITY ASSURANCE

A. Pre-installation Conference and Inspection: After approval of submittals, but prior to beginning installation of the Works of this specification, the Artwork Glass Installation Sub-Contractor shall hold a meeting at the site attended by representatives of Owner, Architect, Main Building Contractor, Armature structural steel fabricator and erector to describe in detail the Point Supported Glass System to be installed, to establish agreement, coordination and responsibilities among involved trades, and to 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 installation 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. The Artwork Glass Installation Sub-Contractor shall prepare a detailed memo of this meeting and furnish copies to the Owner's Representative and all involved trades.

B. The Artwork Glass Installation Sub-Contractor shall inspect the Armature to receive the Works of this specification and report defective conditions to the Owner's Representative and Main Building Contractor for correction prior to the installation of Artwork.

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

1. Minimum of 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. Installer Qualifications: Provide installation by an installer experienced in performing the Works of this section that has specialized in installation of work similar in scope and complexity required for this project for a minimum of ten (10) years and is acceptable to the SEOR. The

installer shall be responsible for supplying Point Supported Glass Hardware and erecting the complete Point Supported Glass System, coordinating and maintaining tolerances between the Armature and Point Supported Glass system with individual component suppliers and manufacturers, and installation of the Point Supported Glass system. Installer should have demonstrated experience installing complex, architecturally integrated glass systems or artworks where precise alignment and finish are essential to the final presentation.

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

F. Quality Standards: In addition to Code, provide the Works of this Section so designed that glass installation conforms with ANSI Z97.1 and Federal Safety Standard 16 CFR 1201 for Category II materials.

G. Mock-Up: Construct a mock-up with actual materials in sufficient time for the Artist's review and to not delay construction progress. Coordinate with the Artwork Glass Fabrication Sub-Contractor for the supply of the Artwork Glass for the mock-up(s). Locate mock-up as acceptable to the Artist. The mock-up 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 on the as-built support structure for SFAC and Artist approval prior to production.
3. Refinish mock-up area as required to produce acceptable work.
4. Do not continue with remaining work until workmanship, color, and sheen are approved by Artist.
5. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
6. Do not alter or remove mock-up until work is completed or removal is authorized.
7. Retain approved mock-up until final completion as visual standard for comparison with completed work.
8. Incorporate accepted mock-up as part of the Work.

H. Glass Tests: Assume a minimum of three glass panels, with 6 point supports each, will be tested to failure by the Artwork Glass Fabrication Sub-Contractor. Provide Point Supported Glass Hardware to the Artwork Glass Fabrication Sub-Contractor for these tests. Eighteen (18) glass point fixings will be required including shipping to the Artwork Glass Fabrication Sub-Contractor.

1.09 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer’s instruction for receiving, handling, storing and protecting Point Supported Glass and Point Supported Glass Hardware.

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

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

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

1.10 PROJECT / SITE CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. Environmental Requirements: Installation of glass products at ambient air temperature below 40 degrees F (4.4 degrees C) is prohibited.

C. 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. Warranty for Point Supported Glass Hardware: Provide supplier’s and manufacturer's standard warranty for the design integrity, weatherability and durability of the Point Supported Glass System components for up to 10 years.

B. Installer Warranty

1. Warrant the installation for a period of 10 years for installation and repairs or failures. Provide written requirements for notification of installer and terms for maintaining warranty provisions in accordance with owner’s, or Client’s, rights in Division 1 of the specifications.

C. Provide manufacturers and installer’s 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. Note: Artwork Glass is procured by the Artwork Glass Fabrication Sub-Contractor under a separate contract with SFAC, not by the Installer under this contract. Artwork Glass specifications are provided here for the Installer's reference and coordination purposes only.

C. Acceptable Point Supported Glass Hardware Manufacturer and Supplier: C.R. Laurence Co., Inc. (CRL), or approved equal as determined by the SEOR.

D. Substitutions: only as approved by the Artist and the SEOR.

2.02 MATERIALS

A. Glass (procured by the Point Supported Glass Fabrication Sub-Contractor):

1. 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.)

2. All glass shall be ultra- clear (low iron) laminated glass with 5/16" (8 mm) fully tempered outer lite + 0.060" (1.52 mm) sentryglas ionoplast interlayer + 5/16" (8 mm) fully tempered inner lite with center of holes for point supports located as per Contract Documents.
3. 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.
4. Fully tempered (FT) glass: a flat, monolithic, glass lite of uniform thickness that has been subjected to a special heat treatment process where the residual surface compression is not less than 10,000 psi (69 MPa) or the 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).

B. 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.

C. Fittings (Point Supported Glass Hardware)

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 Installation 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. Artwork Glass to be reviewed by the Artwork Glass Installation Sub-Contractor including compatibility with the Point Supported Glass Hardware, installation sequences and coordination with allowances for tolerances and movements (translations and rotations). The Artwork Glass Installation Sub-Contractor shall provide written confirmation that the Artwork Glass, procured by the Artwork Glass Fabrication Sub-Contractor, is compatible with the Point Supported Glass Hardware.

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.

D. Stainless Steel: All fittings and fasteners to be stainless steel grade 316, unless noted otherwise.

1. The finish shall not discolor during its design life when subjected to normal atmospheric conditions.

2. Finish of exposed stainless sheet shall be in accordance with the Contract Documents and the Artist's requirements, modified with a surface roughness less than 0.5µm or otherwise in accordance with the Contract Documents. Refining operations shall use silicone cortide (SiC) 320 grit abrasives.

3. Ensure that all stainless steel components are free from risk of mild steel contamination. This may be achieved through an approved passivation process. Electropolish stainless

steel after carrying out any other finishing processes. Drilling, cutting, etc. should be done slowly and with sharp tools to prevent the build-up of heat.

4. Fully finish all visible welds to match adjacent surfaces. All stainless steel that is welded or machined/cut shall be re-passivated by an approved procedure.

E. Fasteners

1. All bolts visually exposed or subject to weather shall be grade 316 stainless steel.
2. All nuts and washers visually exposed or subject to weather shall be stainless steel ASTM F594.

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. Disassemble only to the extent necessary for shipping and handling limitations.

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

F. Welding, if required, is to comply with standards set forth by the American Welding Society.

G. Factory-grind exposed welds, if welding is required, smooth and flush with adjacent surfaces prior to finish application; restore mechanical finish.

H. Isolation membrane materials to be used to separate dissimilar metals to prevent galvanic corrosion/action between materials.

I. Fabricate components to allow for accurate and rigid fit of Point Supported Glass Hardware and Armature framing connections. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weather tight. Ensure slip joints make full, tight contact and are weathertight.

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

K. Reinforce components at anchorage and support points, joints, and attachment points for interfacing work.

PART 3 - EXECUTION

3.01 APPROVAL TO PROCEED

A. Do not proceed with the installation of the Works until receiving written approval relating to the shop drawings, relevant performance test report and the shop and on-site quality control procedures. The approval will be accompanied by a written statement that the Client has reviewed and accepted the test performance.

B. Prior to proceeding with full installation, review the first installed panel assembly with SFAC and the Artist to confirm visual alignment and joint appearance.

3.02 EXAMINATION AND ACCEPTANCE OF COMPLETED STRUCTURE

A. Examine surfaces receiving the work. Verify dimensions of in-place and subsequent construction. Follow the recommendations of GANA (Glass Association of North America) as to

inspection procedures. Do not begin work until unsatisfactory conditions have been corrected. Installation of work will constitute acceptance of the related construction.

B. Take all necessary site measurements and check all adjacent structure to the work required or from which the Contract Works are supported. Before the installation of the Artwork, undertake a survey of the preceding elements of work including the details of points of attachments for the Artwork to the Armature where appropriate. Do this as soon as possible and submit the results without delay. If the preceding elements of work are outside the stipulated tolerances, inform and coordinate with the Client to agree the remedial action that is to be taken, allowing sufficient time for rectification, so as not to delay the Contract schedule.

C. Verify that supporting structure and anchor layout match approved drawings and allow consistent spacing and registration of artwork imagery before installation continues.

3.03 PREPARATION

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

B. Pre-installation review: the representatives of the Artwork Glass Installation Sub-Contractor, the architecturally exposed Armature structural-steel fabricator and erector, the Artwork Glass Fabrication Sub-Contractor, the Artist, the SEOR, the architect's representative and the owner's representative shall review the installation procedure and schedule, including the method of delivering and handling glass, and installing the Point Supported Glass System materials. The chemical compatibility of all materials and framing with each other and with like materials used in glass fabrication will be confirmed.

C. If preparation is the responsibility of another installer, notify the Artist in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.04 INSTALLATION

A. Install in accordance with the Contract Documents and the Point Supported Glass System providers' requirements, the shop drawings, manufacturer's instructions, approved submittals and in proper relationship with adjacent construction.

1. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.
2. Provide attachments and shims to permanently fasten system to building structure.
3. Maintain dimensional tolerances and alignment with adjacent work.
4. Maintain consistent joint spacing and plane alignment across all panels to preserve the intended visual continuity of the artwork.
5. Perform alignment verification under even daylight or uniform lighting conditions.
6. Anchor securely in place, allowing for required movement, including but not limited to expansion and contraction.
7. Clean surfaces in accordance with sealant manufacturer's instructions and guidelines.

B. Coordinate with SFAC regarding visual checks during installation. SFAC or the Artist may request on-site review at defined milestones to confirm alignment and finish quality.

C. Employ only experienced glaziers who have had previous experience with the materials and systems being applied. Use tools and equipment recommended by the manufacturer.

D. Bolt torque: torque bolts to torques specified on shop drawings using a calibrated tool. Lock torque bolts into position to prevent back-off. Reset calibrations regularly to ensure an accurate torque.

E. Clean glazing connectors receiving Point Supported Glass System materials of deleterious substances that might impair the work. Remove protective coatings that might fail in adhesion or interfere with bond of sealants, if sealants are required. Comply with the manufacturer's instructions for final wiping of surfaces immediately before the application of any primer and/or glazing sealants. Wipe metal surfaces with an appropriate cleaning agent.

F. Inspect each unit of glass immediately before installation. Glass that has significant impact damage at edges, scratches, abrasion of faces or any other evidence of damage will not be installed.

G. Sealants: prime surfaces are to receive glazing sealants where required, in accordance with the manufacturer's recommendations, using recommended primers.

H. Set the glass in a manner that produces the greatest possible degree of uniformity in appearance. Face all glass per Artist's direction.

I. Installation tolerances for glass units: Install Contract Work to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; non-cumulative.
2. Level: 1/8 inch in 20 feet; non-cumulative.
3. Alignment: End-to-end or edge-to edge-offset of adjoining consecutive element 1/16 inch.
4. Location and Plane: Limit variation from plane to 1/8 inch in 12 feet; ½" over total length.
5. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.
6. Deviation between face of gasket on the fittings from ideal plane: + or – 1/16 inch.
7. Control plane and level of fittings such that any stress induced by planar or level offsets are minimized. Follow Glass fitting manufacturer's instructions.

J. Use masking tape or other suitable protection to limit the coverage of glazing materials on the surfaces intended for sealants, if sealants are required.

K. Tool the exposed surfaces of glazing materials, if required.

L. Clean excess sealant or other materials from the glass and support members immediately after the application, using solvents or cleaners recommended by the manufacturers.

M. Ensure that safety markings on glazing units are accessible for inspection.

3.05 CLEANING

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

1. Remove temporary coverings and protection of adjacent work areas.
2. Clean and dress sealant, if sealants are required, prior to installation completion.
3. Clean glass prior to installation completion.
4. Clean the entire enclosure one time at the completion of the installation. Cleaning to include surface cleaning of glass, hardware and cleanup of construction debris.

B. Clean excess sealant or compound from Point Supported Glass System and Armature framing members and connections immediately after application, using solvents or cleaners recommended by manufacturers.

C. 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.

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

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

F. Glass nicks and damaged edges will not be accepted. Replace glass with damaged edges.

3.06 COMPLETION

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

B. Maintenance Instruction: At a time mutually arranged, near substantial completion, provide for a meeting between the Client and permanent maintenance staff to review and instruct maintenance staff in the proper procedures for replacing any damaged glass and/or hardware.

C. Maintenance Inspection: Maintenance and inspection of the Artwork is regarded as an important factor in ensuring satisfactory long-term performance.

1. After substantial completion, carry out an inspection of the entire Artwork.
2. Provide the Client with sufficient guidance so that the Client could inspect the entire Artwork six months after the date of substantial completion. The Client should plan for subsequent inspections of the entire Artwork at two year intervals during the Warranty Period.
3. All inspections shall include at least one representative from the Client.

D. Operations and Maintenance Manual: Collaborate with the Artwork Glass Fabrication 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.

1. Include documentation describing safe removal, replacement, and cleaning procedures for future maintenance.
2. Provide a photographic record of final installation showing each elevation and panel numbering for SFAC’s archive.

G. On completion, but within 30 days of the date of substantial completion, provide three copies of the maintenance manual procedures to the General Contractor 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.

E. 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.

F. Record Drawings: Progressively produce and maintain 'as-built' drawings to accurately record positions and construction of all Artwork elements. Record drawings shall include revisions to hardware schedules. Such drawings shall be available for inspection and checking by the Client 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 the Client, 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.

G. Spares: At or before substantial completion, deliver spares as required by the General Contractor to site in strong, waterproof protective packages marked for identification, and store where directed.

END OF SECTION