

Method and Means Project Specific University of Michigan, Cook Law School Library

REFERENCE

- A. Department of Interior Preservation Briefs: 33, "The Preservation and Repair of Stained and Leaded Glass"
- B. Stained Glass Association of America, "Standards and Guidelines for the Preservation of Historic Stained Glass"

SUBMITTALS

Samples:

Submit samples of each new exposed material to be used for replacing existing materials. Include in each set of samples the full range of colors and textures for glass, lead came, bronze T-bars and accessories expected to be required in the completed Work.

Submit samples of replacement glass colors for medallions when required.

Submit samples of each type of cement and/or sealant expected to be required, including the perimeter sealant joint between the metal frame and the stone perimeter.

The Contractor shall submit 12"x12" releaded sample demonstrating: replacement field and border glass; tucked lead and soldering, and; copper-foil repairs; these three materials / techniques may be demonstrated in the same panel.

Manufacturer's Data

Glazing putty, perimeter sealant, paint coatings for steel saddle bars: for information only, submit 2 copies of manufacturer's specifications and other data for each material. (see provided product spec sheets.)

Submit a minimum of three references for stone-set stained glass windows of similar scale and complexity to the Cook Library windows.

1. St. Patrick's Cathedral, New York
2. Cathedral of St. John the Baptist, Patterson New Jersey.
3. Quigley Seminary, Chicago, IL

QUALITY ASSURANCE

Work shall conform to applicable Ann Arbor ordinances and University of Michigan guidelines.

Work shall only begin after all necessary permits are secured, which are the responsibility of the Contractor.

The Architect shall have access to inspect work in the field and studio for observation during normal working hours while work is in progress.

Botti Studio shall promptly correct Work rejected by the Architect for failing to conform to the Contract Documents, whether observed before or after Substantial Completion, and whether fabricated, installed or completed, and shall correct any Work found not to be in accordance with the Contract Documents within a period of one (1) year from the date off in all acceptance or by the terms of an applicable special warranty required by the Contract

Documents.

Botti Studio to warranty all stained glass restoration work from sagging, bulging, bowing, loss of glass or glass-paint failure for a period of ten years from the date of final acceptance. The original saddle bar placement may allow subtle deformation (<1/4") out-of-plane.

DOCUMENTATION

The stained glass medallions (only) shall be documented in-situ by photos. Once removed, the stained glass shall be transported to Botti Studio for further documentation, rubbings (of the medallions) and deconstruction. Botti Studio shall determine the authenticity of any suspect stained glass with the Architect after disassembly of each panel in its entirety.

The break-way borders are sacrificial given the exact match available through KOG; field glass shall be salvaged and re-used; new glass to be randomly alternated and phased per the original design. Other replacement glass to be approved by architect.

PROJECT CLOSE-OUT

Botti Studio shall provide a written warranty of the stained glass from leaks, bowing, bulging, failed solder joints, and "daylights" aside from physical impact, structural building movement, force majeure, or product warranty limitations—for a consecutive period often (10) years from the date of acceptance.

Botti Studio shall provide a copy of medallion rubbings and photo documentation.

PRODUCTS

MATERIALS

Field & Border Glass: The field & border glass may be replaced with random alternating colors of KOG#183, KOG #186 and KOG#33/33a where appropriate. Botti Studio shall reserve the field glass wherever possible but the break-away border glass is deemed sacrificial.

Medallion Glass: The original glass in the medallions shall be retained whenever possible; this glass has not been matched to stock colors, Kokomo, Wissmach, and Lamberts (or approved equals) may be utilized for the best match. The glass selected must match in texture, color, and tone to the original glass. Surface treatments, such as glass stains or surface paint may make up for problems in locating exact matches in the medallions.

Original cracked glass in the medallions shall be retained and repaired by copper foil as deemed appropriate by Botti Studio's conservators.

Lead Came: The size and profile of the replacement came should match the original. The composition of the came must be a high restoration grade. The came must be of an alloy of approximately .03% to .06% copper or silver, and between .5% and 1% each of tin and antimony. Custom dies shall be produced as required to match the original lead exactly. If custom dies are required, the dies shall become the property of the Owner upon completion of the project [Source: DHD Metals, Inc., Conyers, GA].

Solder: 60/40tin/lead solder and rosin products [Source: DHD Metals, Inc., Conyers, GA]

Copper Foil: Black-Backed copper foil to minimized internal reflection within the glass shall be employed [Source: Venture Tape Corp., Rockland, MA]. The minimal width must be that necessary for the thickness of the glass. Foil should be trimmed to 1/32" on each side, resulting in a 1/16" solder line.

Flux: The flux used as a part of the soldering of lead came shall be oleic acid. Flux for copper foil may be rosin dissolved in alcohol (no chloride flux). Excess flux may be removed with Isopropyl or denatured alcohol.

Solvents for Cold Paints: Acetone only.

Cleaning and Cleaning Agents: Acetone is approved as an agent to de-grease glass to be edge-glued. In instances of unstable paint, acetone may be used on cotton swabs to clean unpainted glass.

Naphtha (VM&P Naphtha or equivalent)
De-ionized water with soap lower in ph than 8.5
Triton X100 = PH7
Orvus =PH 7.8

Certain cleaning methods and materials are not acceptable: among them is application of or immersion in a lye bath. Any type of mechanical or air abrasive equipment, any acid, caustic or abrasive cleaners, scouring pads or steel wool, or use of steam or high pressure cleaning procedures.

Metal Cleaners, Primers & Paint Coatings: Metal reinforcement and steel casements shall be cleaned of rust and coated with Tnemec® Series 10-99, and Tnemec® Series 2H (colors to be determined) or approved equal. [Source: Tnemec Company, Kansas City, KS]

Poultice for Putty Removal: Methylene chloride or dimethyl formamid (DMF) mixed with methyl cellulose, fumed silica, or other filler, to appropriate consistency.

Glass Cleaning After Cementing: Whiting.

Glazing Putty: Nu-Puttie® (or approved equal) [Source: Nu-Puttie Corp. Maywood, IL]. / Or approved equal.

Temporary Crates: Stained glass shall be crated in sturdy, solid 3/8 plywood crates to prevent any glass damage or loss during transit/storage; each panel shall be separated by a 1" layer of rigid insulation board. / Or approved equal.

Bronze T-Bars: Fabricate new 1 ½ bronze T-bars to replace steel T-bars Note: existing are "1" (TBD)

Glass Paints: Fired vitreous glass paint shall be used for replacement segments requiring trace. [Source: Reusche Products, Newark, NJ](Or approved equal).

PRODUCT DELIVERY, STORAGE & HANDLING

Materials shall be delivered in new, unopened packages and stored in a dry, secure location. The labels shall clearly identify: 1) material, 2) manufacturer, 3) color name and number, 4) batch or lot number, 5) date of manufacture, 6) application directions.

Materials shall be stored within the manufacturer's allowable temperature range as directed by the Architect.

DOCUMENTATION

Photographic Documentation: Botti Studio shall take "before" photos of the medallions in transmitted and reflective light (76 photos).

Photographic Quality to be no less than equal to 300 DPI for digital; provide owner with two (2) sets of digital files of medallion photography.

STONE PERIMETER (GROOVE OR RABBET SETTING):

The border glass is deemed sacrificial but Botti Studio shall make every effort to minimize disruption of ACM glazing compound in lead came, the perimeter sealant and grout may be cut to chisel out the glass.

LABELING AND RECORDING

Make templates of stone openings; label glass with gummed labels upon removal.

Each medallion panel shall be documented by rubbings are to be made on acid free, 100% rag paper, with a hard wax rubbing stone. Additional rubbings on Kraft paper shall be made for the temporary storage and reglazing of the windows. Any changes in glass, design or structure shall be documented and delivered to the Owner. The following shall be recorded on the rubbings (to be submitted upon completion):

- **Lead lines, widths and designation as to flat/round came**
- **Cracked and missing pieces of glass**
- **Original support bar and / or tie-wire attachment points**
- **Previous repairs, to include: replacement glass; Dutchmen leads; silicone repairs, etc.**

ENVIRONMENTAL REQUIREMENTS:

Epoxies, sealants, primers, paints and other environmentally sensitive materials applied onsite shall be applied to dry surfaces only with surface temperatures between 50F and 90F. There shall be no precipitation (rain, snow, fog or mist) during application, or any forecast for precipitation within a 24-hour period, without complete encapsulation or protection of the work from moisture.

STAGING:

Botti Studio must perform the Work using scaffolding (no lifts); the Architect shall have free access to the scaffolding for inspections (with signed waivers as required).

Botti Studio shall protect the hardscape and landscaping, and cover interior floors, furnishings and finishes with hardboard and tarps as necessary to prevent damage.

Botti Studio shall also take necessary precautions to protect the flat roofs, limestone walls and jambs adjacent to the Work areas.

WINDOW REMOVAL & BOARD-UP

All stained glass shall be carefully cataloged and labeled prior to removal. The stained glass panels shall be sandwiched with protective packing materials and temporary crates as specified using the methods and care required to prevent any damage to the glass. Loose fragments shall be cataloged, and unstable pieces shall be stabilized with conservation tape, to assure that no historic glass is lost or moved from its original setting.

The condition of the stained glass shall be reviewed onsite during removal with the Architect prior to crating for safe transportation to the studio. The openings shall be enclosed with 3/8" painted plywood in the lancets and 1/4" Lexan in the traceries. The board up shall be firmly secured and caulked tight to prevent dislodging and infiltration of dust and debris during exterior stone restoration.

CLEANING

The stained glass shall be soaked in a solution of soft water and a non-ionic surfactant as required for entrenched grime. Putty, paint drips, etc. shall be removed with methylene chloride, thickened with cellulose, fiberglass brushes, steel woodland razor blades as required only after careful testing and verification that such products and mechanical actions **DO NOT** damage the original stained glass medallions.

Botti Studio shall stop work and inform the Architect immediately if any prescribed cleaning methods are causing any unanticipated damage to the stained glass. **Aged patina shall be left on the original glass as opposed to cleaning them to a "like-new" condition where such cleaning alters the glass paints or characteristics of the original glass.**

GLASS REPAIRS

Copper foil: This technique shall be used on glass repairs in the medallions, any cracked border or field glass shall be replaced in-kind. The meeting edges of glass shall be cleaned with acetone. Copper foil shall be folded over on to the front/back of glass and trimmed to within 1/32" of the crack to minimize the width of the repair line to 1/16". Where additional strength is required, a copper wire maybe sweated on top of the solder bead.

GLASS REPLACEMENT

Missing or severely damaged or decomposed glass shall be replaced to match the original in color, texture, translucency and value in both transmitted and reflected light. Replacements shall be reviewed and approved by the Architect prior to insertion in the restored panels. It has been determined that Kokomo Opalescent Glass carries excellent glass matches for the predominant field and border glass. Any new pieces of glass used in the medallions shall carry the date "2019" scratched into the edge (for identification in future restorations).

RELEADING & RECEMENTING

The stained glass shall be re-leaded with tucked-leads per the original design. New lead comes shall match the original in the visual width of the lead profile. After soldering, flux residue shall be carefully cleaned from the panel. A crowned solder bead may be employed to correct any gaps. The leading shall be **patinated** (darkened) to aesthetically blend with the aged leading found throughout the Library. Lamp black may be beaded the putty and buffed onto the leading to color all surfaces to a soft pewter patina. **DO NOT** over clean, buff or polish the solder joints to a high-polish. Glass shall be cemented on both sides with glazing putty. The putty must be forced

under the flanges of the leads by hand. Excess putty is to be cut flush to lead and cleaned from the panels with rags and whiting.

REINFORCEMENT

Final review of the original reinforcement is pending the removal of the stained glass panels and closer examination of the clean stone grooves. Changes to the existing structural system of the leaded glass (e.g. fins, braces, bars, wires, etc.) must be reviewed and approved by the Architect. New reinforcement introduced shall conform to the existing lead design and be imperceptible in transmitted light. The steel-bars shall be exchanged for slightly larger bronze T-bars (and reversed to facilitate exterior removal and shed water to the exterior on the **great east window**). The new T-bars shall be dulled or lightly **patinated** prior to installation.

GLASS INSTALLATION IN STONE

The stained glass shall be reinstalled with lead, silicone or neoprene shims and glazing putty, tooled to allow for bond-breaking tape or backer-rod and perimeter sealants. Lead, silicone or neoprene setting blocks may be employed at T-bars as required to be notched laterally ½” into the stone **rabbet** to a depth of ¼” to 3/8”. The panels shall be correctly sized to fit into each opening with 1/8" clearance to accommodate expansion/contraction.

Prepare Stone:

Stone Perimeter: Clean stone of dirt accumulation, mild soap/water applied in small area to test effects. Stronger cleaners maybe used once tested and approved by Architect.

Botti Studio to test cleaning procedure in an inconspicuous location, review with Architect prior to proceeding.

Prepare Stone for sealant –stone groove must be cleaned of existing sealant and other contaminants prior to reinstallation.

Install Glass into Stone Perimeter.

Low modulus, neutral cure silicone-based glazing sealant with backer rod or bond-breaker tape to prevent three sided adhesion. The sealant shall be tooled with a small brush and xylene.

GLASS INSTALLATION IN STEEL CASEMENTS

Steel frame preparation is a crucial step to the longevity of the protective coatings and the preservation of the original steel frames. The most severe corrosion occurs on the top side of the casement windows and in the bottom u-channel. The Contractor shall clean and remove visible dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPCSP2 (Hand Tool Cleaning) and SSPCSP3 (Power Tool Cleaning) methods according to The Society for Protective Coatings (SSPC).

Torches, grit-blasting, or acids cannot be used to clean the steel in place. The Contractor shall REPLACE any steel sections that are severely corroded where 20% or more of the original steel is lost, or pinholes occur.

Botti Studio may remove the frames and board-up the openings as desired for shop repairs, replacements or preparation. Operable window air conditioners shall be left operational in temporary board-ups where required. Once cleaned and repaired, the Contractor shall correct steel fabrication and repair defects revealed as follows: 1) remove weld splatter and slag; 2) round sharp edges and corners of welds to a smooth contour; 3) smooth-weld undercuts and

recesses; and 4) grind down porous welds. The Contractor shall pay special attention to water traps, sharp edges and crevices on horizontal members.

Casements shall be reinstalled (furnished by Owner) where air-conditioning units are designated for permanent removal.

Clean and polish bronze hardware and replace any missing components with parts available from Cook Library inventory.

Immediately following steel preparation, the steel frames shall be field-primed with the specified primer according to the manufacturer's specifications by brush to a DFT (dry film thickness) of 3.0mils. A second primer coat may be required on some vertical and inverted surfaces to achieve a DFT of 3.0 mils. Once the primer has fully cured, the steel shall be painted with a coat of the specified intermediate coat to a DFT of 3.0mils. A third "striping" coat shall be applied along edges as required to achieve a uniform DFT of 3.0 mils. A third and final coat of the specified finish coat shall be painted to a DFT of 3.0mils.

Reinstall leaded glass, restored to match original glass elsewhere, with steel glazing bars and putty per original design.