WINDOW CONSERVATION AND REPAIR SPECIFICATIONS

John Greenwalt Lee
Architectural Materials Conservator
John Greenwalt Lee Company
Annapolis, Maryland

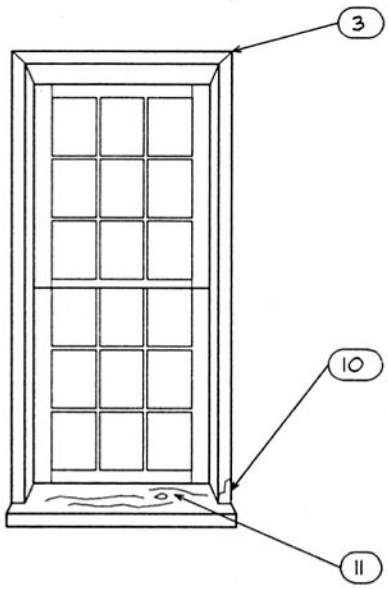
The author, an architectural conservator, assists architects in preparing specifications and, if non-traditional skills are needed, he requires that on-site training be provided. The following sample specifications, developed from over twenty years of work on historic sash, were prepared to supplement that on-site training.

These sample specifications were initially prepared for architect Gunny Harboe of McClier in Chicago, Illinois, for use at the Humboldt Park Stables. The Stables, designed by Frommann & Jebsen and constructed in 1896, is an important historic structure in one of Chicago's large parks. The work involved cleaning, conservation, and repair of woodwork and windows. The scope and budget of the Stables project did not allow for the inclusion of illustrations. However, the specifications were further developed by the author for use at the Wyck project, a house in the Germantown section of Philadelphia, Pennsylvania. In that revision, illustrations prepared by the author and David Clement of Phillips & Oppermann, P.A., of Winston-Salem, North Carolina, were added. Wyck, constructed in sections from circa 1690 through 1824 and owned by the same family until 1972, is an historic house museum with more than 100,000 documents and 10,000 artifacts in its collection. The project involved conservation of the exterior fabric of this historic house museum, including wood, stucco, stone, paint, and glass.

No specific instructions are provided about how to take the window apart because this type of detail is best worked out on the project with the craftsmen. Instead, the specifications provide a general sequence and structure for the work. The specifications continue to develop as new techniques for performing the work evolve.

The following sample specifications and drawings are copyright. © 1994 John G. Lee and Phillips & Oppermann, P.A.

GENERAL WINDOW INSPECTION & REPAIR



PROCEDURES

1. REMOVE STOP BEAD BEING CAREFUL TO RETAIN INTACT. NUMBER SECTION ON ITS BACK SIDE WITH PERMANENT INK AS TO ITS WINDOW OF ORIGIN AND SPECIFIC LOCATION. INSPECT FOR DAMAGE OR DETERIORATION AND SET ASIDE FOR CONSOLIDATION OR PATCHING WITH DUTCHMEN AS APPROPRIATE.
2. REMOVE SASH AND APPLY UNIQUE NUMBER WITH INDELIBLE INK. INSPECT GLASS AND TO EACH SALVAGEABLE GLASS LITE APPLY ITS UNIQUE NUMBER WITH INDELIBLE INK. REMOVE GLASS AND STORE IN A SECURE LOCATION FOR LATER REINSTALLATION.
3. INSPECT SASH FOR DAMAGE OR DETERIORATION AND SET ASIDE FOR CONSOLIDATION OR PATCHING WITH DUTCHMAN AS APPROPRIATE.
4. REMOVE WEATHERSTRIPPING BEING CAREFUL NOT TO DAMAGE SURROUNDING WOOD SURFACES. INSPECT FOR POSSIBLE REINSTALLATION. IF SALVAGEABLE, APPLY UNIQUE NUMBER AND STORE IN A SECURE LOCATION FOR REINSTALLATION.
5. REMOVE CAULKING USING PUTTY KNIVES AND DENTAL TOOLS WITH HEAT GUN IF NECESSARY.
6. REMOVE PAINT FROM WINDOW SILL, JAMB, HEAD, REVEAL, MOLDINGS, STUD AND PARTING BEADS. REMOVE ONLY ENOUGH PAINT TO REACH A SOUND PAINT SURFACE OR TO FULLY EXPOSE AREA OF DETERIORATION. USE ONLY HEAT GUNS WITH PUTTY KNIVES AND DENTAL TOOLS OR HAND SANDING TO REMOVE PAINT. IF SANDING, USE 120-150 GRIT PAPER WITH A BLOCK ON FLAT SURFACES AND GRIT PAPER WITH NO BLOCK ON CURVED SURFACES. BEFORE ANY PAINT REMOVAL ACTIONS, AN ASSESSMENT OF LEAD-BASED PAINT HAZARDS SHOULD BE UNDERTAKEN.
7. INSPECT FASTENERS. IF MISSING OR BADLY DETERIORATED, REPLACE AS APPROVED BY ARCHITECT.

8. IF TRIM JOINTS ARE OPEN ON APPLIED PIECES, REMOVE CAREFULLY TO KEEP THE PIECES INTACT AND RE-ALIGN.

9. INSPECT ALL WOOD SURFACES FOR ROT, CRACKS, SPLITS, INSECT DAMAGE AND OTHER FORMS OF DETERIORATION.

10. CHECK BOTTOM ENDS OF JAMBS, MOLDINGS AND PARTING BEADS AT SILLS FOR ROT. FOR MINOR DETERIORATION (ROT OF 1/3" TO 1/4" DEPTH), CONSOLIDATE WITH HIGH STRENGTH EPOXY RESIN. FOR DEEP DETERIORATION (1/4" OR DEEPER), EITHER IMMERSE THE DISASSEMBLED ELEMENT IN EPOXY RESIN OR DRILL 1/8" DIAMETER HOLES IN THE ELEMENT TO ALLOW SATURATION BY THE EPOXY RESIN. IF SECTIONS ARE MISSING, REPLACE WITH DUTCHMEN AFTER SURROUNDING ROT IS CONSOLIDATED.

11. ALL HOLES AND CRACKS DEEPER THAN 3/16" SHALL BE CONSOLIDATED WITH EPOXY RESIN THEN FILLED WITH AN EPOXY FILLER. SCRAPE AND SAND TO BE LEVEL WITH ADJOINING SURFACES; DO NOT FEATHER THE EDGES. CHECK ALL HORIZONTAL SURFACES, ESPECIALLY THE SILL, DUE TO THEIR SUSCEPTIBILITY TO ROT.

12. WHEN CONSOLIDATION (EPOXY RESIN) AND REPAIRS (DUTCHMEN AND EPOXY FILLER) HAVE BEEN COMPLETED, HAND SAND ALL WOOD SURFACES LIGHTLY WITH 120-150 GRIT PAPER TO REMOVE PAINT CHIPS, GRIT, OIL GLAZE, ETC. DUST USING A DRY CLOTH OR PAINT BRUSH. AND, LASTLY, WIPE DOWN ALL WOOD SURFACES WITH A DAMP CLOTH OF PAINT THINNER.

13. FOR DRY, WEATHERED WOOD WITH VERY MINOR SURFACE DETERIORATION, (LESS THAN 1/8"), BRUSH APPLY KYANOIL (PURE ALKYD RESIN) AT FULL STRENGTH. REPEAT APPLICATION UNTIL OIL REMAINS ON THE SURFACE THEN WIPE AWAY THE EXCESS. (THE INTENT IS TO LOAD THE WOOD FIBERS BUT NOT TO CREATE A SURFACE COATING.) ALLOW TO DRY. SAND LIGHTLY PRIOR TO PAINTING.

14. BRUSH APPLY ALKYD EXTERIOR PRIMER AT FULL STRENGTH TO ALL WOOD SURFACES. ALLOW FIRST PRIMER COAT TO DRY COMPLETELY.

15. APPLY EXTERIOR SPACKLE WITH SMALL PUTTY KNIFE (1" OR 2" WIDTH) TO ALL MINOR SURFACE CRACKS, VALLEYS, INDENTATIONS, ETC. ALLOW TO DRY TO A HARD CONDITION.

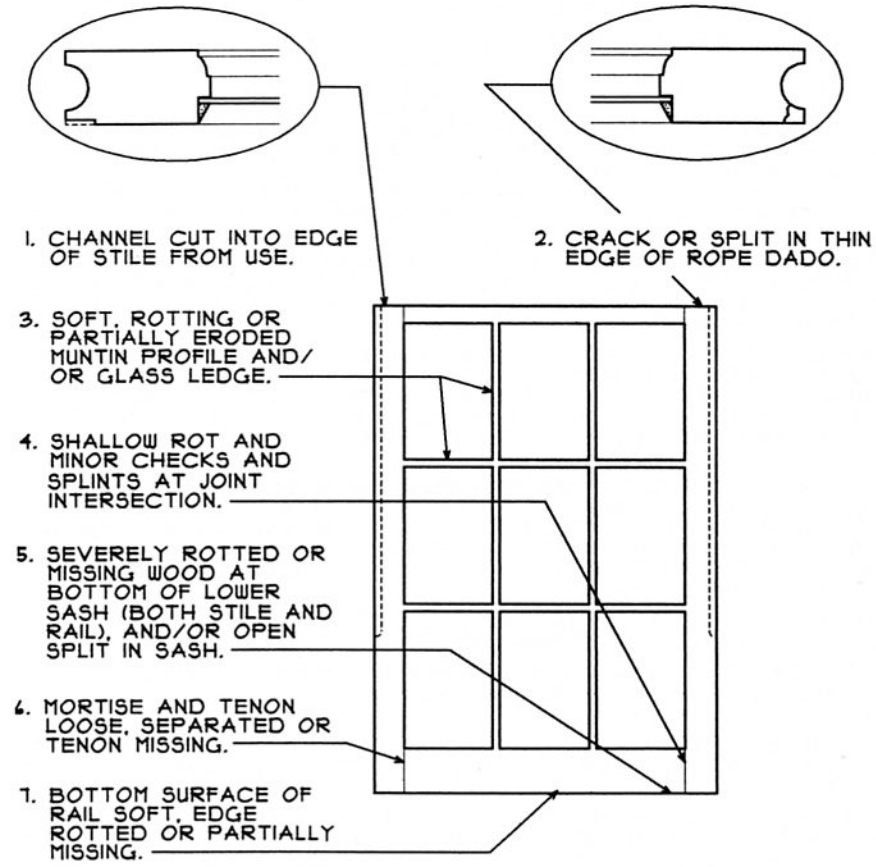
16. REMOVE EXCESS SPACKLE BY HAND SANDING WITH A 150 GRIT PAPER TO MAKE LEVEL WITH SURROUNDING SURFACE. AVOID SANDING THROUGH PRIMER COAT.

17. DUST ALL SURFACES WITH DRY CLOTH OR PAINTBRUSH. BRUSH APPLY SECOND COAT OF ALKYD EXTERIOR PRIMER AT FULL STRENGTH TO ALL WOOD SURFACES. ALLLOW SECOND PRIMER COAT TO DRY COMPLETELY.

18. REPEAT PROCESS OF HAND-SANDING AND DUSTING BETWEEN APPLICATIONS OF TWO FINISH COATS OF ALKYD PAINT.

GENERAL SASH REPAIR

TYPICAL PROBLEM AREAS



REMEDIAL ACTIONS

PROBLEM AREA #1

PLANE THE WORN AREA WITH A RABBET PLANE TO MAKE CHANNEL SMOOTH AND STRAIGHT WITH SQUARE EDGES. CUT A STRIP OF SIMILARLY GRAINED, SAME SPECIES WOOD TO FIT IN THE CHANNEL AS A PATCH OR "DUTCHMAN". GLUE THE DUTCHMAN IN PLACE WITH EPOXY GLUE. WHEN DRY, PLANE, SCRAPE AND SAND TO MAKE DUTCHMAN LEVEL WITH THE FACE OF THE STILE.

PROBLEM AREA #2

REMOVE DEBRIS FROM CRACK. BRUSH, POUR OR INJECT EPOXY RESIN GLUE. CLAMP UNTIL DRY. FOR LARGER POORLY FITTING CRACKS, GLUE CAN BE THICKENED WITH CABOSIL TO LESSEN RUN OUT.

PROBLEM AREA #3

FOR MINOR SURFACE DETERIORATION IN WOOD WHICH IS TO BE REPAINTED, FIRST BRUSH APPLY KYANOIL TO THE WOOD AND LET DRY TO HARDEN THE DETERIORATION.

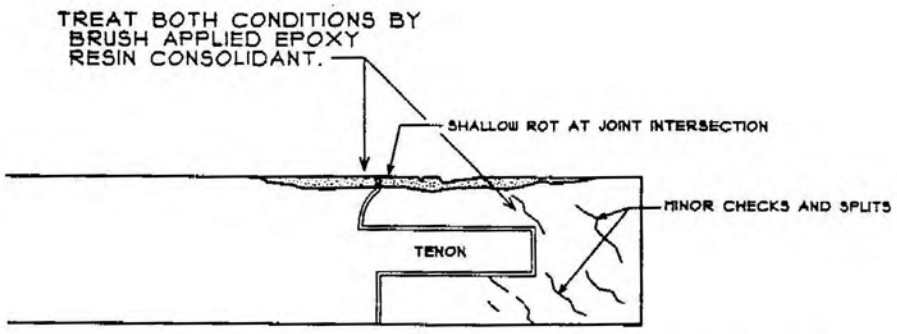
IF VERY SOFT OR LOOSE WOOD, USE BRUSH-ON APPLICATION OF EPOXY RESIN. DILUTE SLIGHTLY IF NECESSARY WITH MANUFACTURER RECOMMENDED SOLVENT TO ENHANCE PENETRATION. WHEN FULLY SATURATED, WIPE OFF EXCESS AND ALLOW TO DRY COMPLETELY. AVOID GLASSY OR SYRUPY COATING ON THE SURFACE.

PARTIALLY ERODED SURFACES CAN BE IN-FILLED (AFTER CONSOLIDATION WITH EPOXY RESIN) WITH EPOXY PASTE FILLER AND SHAPED AFTER DRYING.

LARGE MISSING AREAS OF THE MUNTIN PROFILE OR THE GLASS LEDGE ARE TO BE REPAIRED USING WOOD DUTCHMEN AS DESCRIBED IN THE REMEDY FOR CONDITION #1.

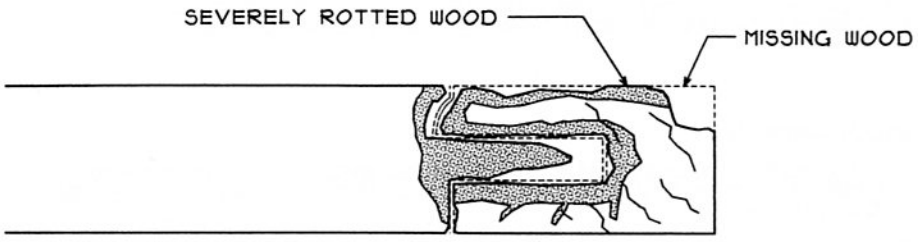
PROBLEM AREA #4

AFTER PAINT IS REMOVED FROM WOODWORK, TEST AREAS THAT FEEL SOFT OR APPEAR UNSOUND TO DETERMINE THE EXTENT OF THE DETERIORATION USING A SHARP, SMALL-BLADED KNIFE, ICE PICK OR AWL. IT IS MOST IMPORTANT TO DETERMINE THE DEPTH OF THE ROT. PROBE BUT DO NOT PRY OR SPLINTER THE WOOD. IF WOOD ROT IS SHALLOW OR CHECKS AND SPLITS ARE MINOR, THESE AREAS CAN BE CONSOLIDATED WITH BRUSH-APPLIED EPOXY RESINS.



HORIZONTAL SECTION : MINOR DETERIORATION OF RAIL AND STILE

PROBLEM AREAS #5, #6 AND #7



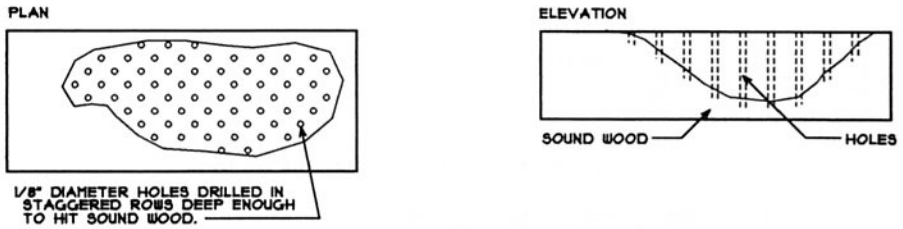
HORIZONTAL SECTION : SEVERE DETERIORATION OF RAIL AND STILE

UNENHANCED SURFACE APPLICATION OF EPOXY RESIN CONSOLIDANT IS NOT SUFFICIENT TO CORRECT THESE PROBLEMS.

AFTER REMOVAL OF PINS, CAREFULLY TAP USING A RUBBER MALLET TO DISASSEMBLE SEVERELY DAMAGED STILES, RAILS AND MUNTINS.

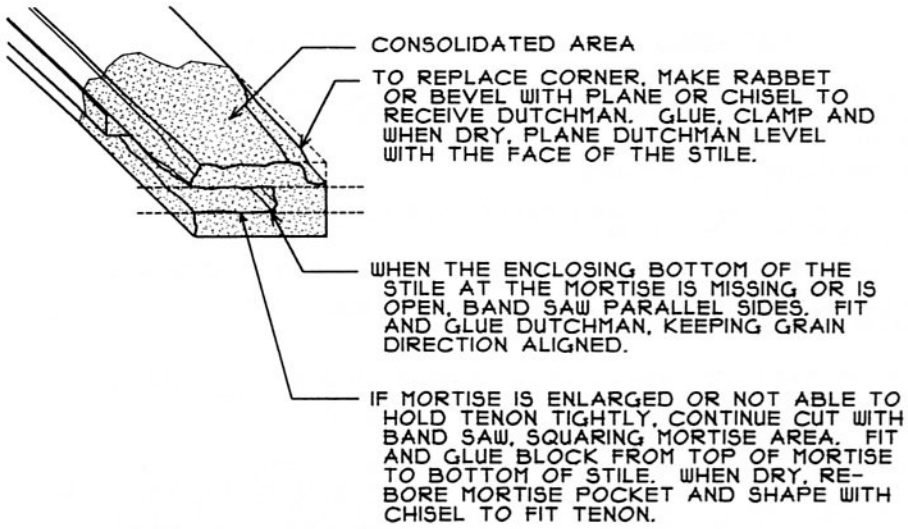
STAND THE ROTTED ENDS OF THE DISASSEMBLED PIECES IN A CONTAINER OF EPOXY RESIN CONSOLIDANT. THERE SHOULD BE ENOUGH RESIN IN THE CONTAINER TO COVER AT LEAST 1/2 TO 2/3 OF THE ROTTED AREA. ALLOW THE RESIN TO SATURATE THE ROTTED WOOD AND RISE UPWARDS BY CAPILLARY ACTION UNTIL THE ENTIRE DAMAGED AREA IS LOADED WITH RESIN.

IT MAY BE NECESSARY FOR SOME WOODS TO DRILL 1/8" DIAMETER HOLES APPROXIMATELY 1/2" ON CENTER IN ALTERNATING, STAGGERED ROWS TO PROMOTE STAURATION BY EXPOSING THE END GRAIN OF THE WOOD.

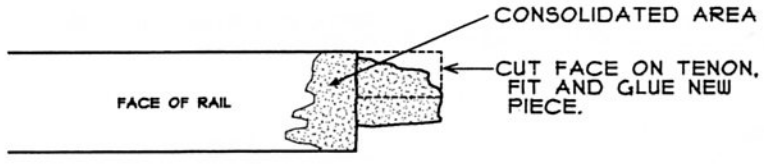


APPLY EPOXY RESIN CONSOLIDANT BY POURING OR BRUSHING, REPEATEDLY FILLING THE HOLES UNTIL ABSORPTION STOPS.

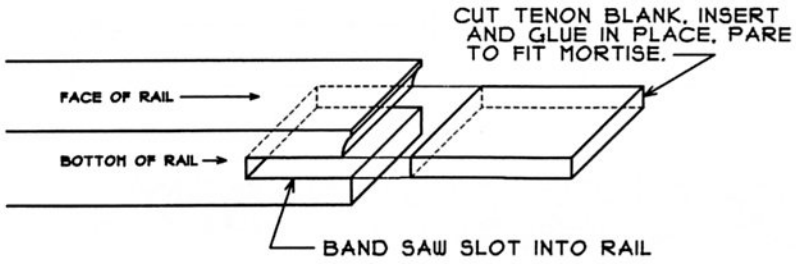
WITH EITHER TECHNIQUE, WHEN WOOD IS FULLY SATURATED, WIPE OFF EXCESS RESIN AND ALLOW TO DRY.



POST-CONSOLIDATION REPAIR OF MORTISE



POST-CONSOLIDATION REPAIR OF TENON



POST-CONSOLIDATION REPLACEMENT OF TENON

REMOVING PAINT AND PUTTY WITH HEAT GUN

USE A FORCED AIR HEAT GUN (MAKITA, WAGONER, ETC.) AND A SELECTION OF PUTTY KNIVES, SCRAPERS, PICKS, DENTAL INSTRUMENTS AND WOOD CHISELS.

TWO VERY USEFUL TOOLS ARE:

1.) 1 1/2" - 2" SEMI-FLEXIBLE PUTTY KNIFE (CORNERS SLIGHTLY ROUNDED WITH A FILE).

2.)RED DEVIL TYPE 3 SIDED SCRAPER (FLAT, CONVEX, CONCAVE).

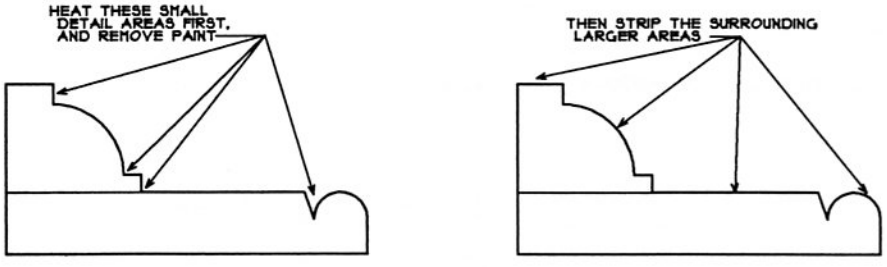
FOR LARGE PAINTED AREAS (MORE THAN ONE FOOT WIDE) A FLAT PLATE HEATING ELEMENT IS ALSO USEFUL.

STRIPPING PAINT WITH HEAT DOES NOT MEAN CHARRING THE WOOD, ALTHOUGH OCCASIONALLY SURFACE DARKENING MAY OCCUR DUE TO THE HEATED OIL RESIDUE REMAINING IN THE WOOD.

ON VERTICAL SURFACES, START PAINT REMOVAL AT THE BOTTOM AND WORK UP. IF ONE STARTS FROM THE TOP AND WORKS DOWN, THE RISING HEAT MAY CHAR THE BARE WOOD ABOVE. IF ONE STARTS FROM THE BOTTOM, THE RISING HEAT WILL PRE-SOFTEN THE PAINT ABOVE, MAKING THE PAINT REMOVAL GO MORE QUICKLY.

WHEN USING THE 1 1/2" - 2" PUTTY KNIFE, HOLD THE GUN SO THAT THE HOT AIR IS DIRECTED PARTIALLY ON THE BLADE AND THE AREA OF PAINT SEVERAL INCHES IN FRONT. PUSH THE KNIFE AT A SLIGHT DIAGONAL AND UPWARDS ACROSS THE GRAIN DIRECTION OF THE WOOD.

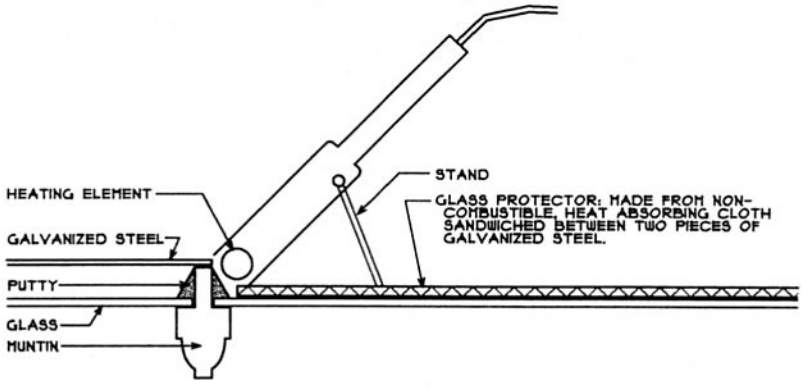
REMOVE PAINT IN THE RECESSES FIRST. THE REMAINING PAINT ON THE BROADER AREAS WILL PROTECT THEM FROM BURNING.



THE TRICK IN HEAT PAINT REMOVAL IS TO HEAT AN AREA EVENLY, ALL THE WAY THROUGH TO THE WOOD, AND REMOVE IT IN ONE PASS. INSUFFICIENT HEATING WILL ALLOW ONLY THE UPPER LAYERS TO COME OFF AND REHEATING WILL BE REQUIRED.

AFTER THREE OR MORE HEATINGS, THE PAINT WILL LOSE ITS ELASTICITY, AND MUST BE REMOVED BY SCRAPING OR SANDING.

PROCEDURES CONCERNING PAINT AND PUTTY REMOVAL FROM WINDOW SASH



1.) HEAT A SECTION OF GLAZING PUTTY UNTIL SOFT.

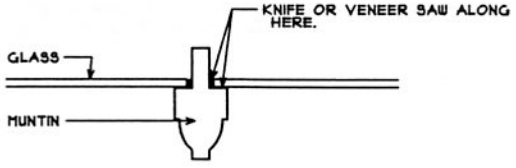
2.) MOVE THE HEATING ELEMENT ALONG TO ANOTHER SECTION.

3.) USING A 1/2" WOOD CHISEL OR THE BLADE OF A PUTTY KNIFE, SLIDE IT ALONG BETWEEN THE PUTTY AND THE WOOD EDGE, AND GENTLY ALONG THE SURFACE OF THE GLASS, SEPARATING THE PUTTY FROM THESE SURFACES.

4.) PULL THE GLAZING POINTS WITH NEEDLE NOSED PLIERS.

5.) RUN THE TIP OF A SHARP KNIFE OR A VENEER SAW ALONG THE EMBEDED GLAZING PUTTY AT THE EDGE OF THE GLASS INTIL THE GLASS IS NO LONGER BOUND.

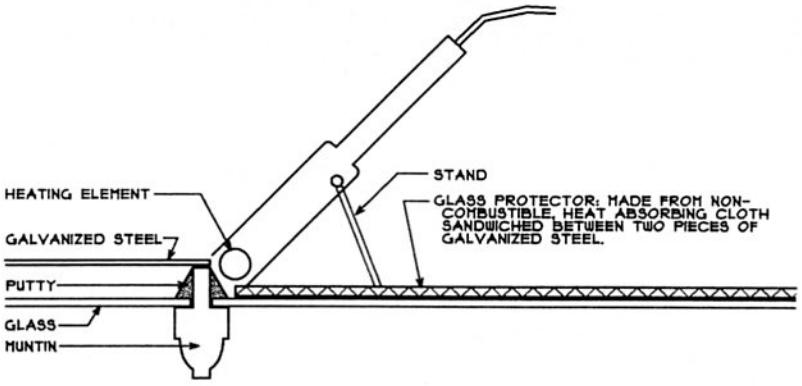
6.) GENTLY TAP THE INSIDE SURFACE OF THE GLASS UPWARDS UNTIL IT COMES FREE. IT MAY BE NECESSARY TO SLIDE THE KNIFE TIP ALONG THE INTERSECTION OF THE GLASS AND MUNTIN ON THE INSIDE.



7.) CONTINUE UNTIL ALL GLASS AND PUTTY ARE REMOVED.

8.) REMOVE PAINT FROM MUNTINS, RAILS, AND STILES.

PROCEDURES CONCERNING PAINT AND PUTTY REMOVAL FROM WINDOW SASH



1.) HEAT A SECTION OF GLAZING PUTTY UNTIL SOFT.

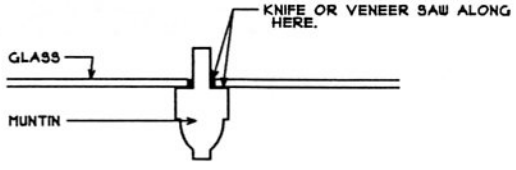
2.) MOVE THE HEATING ELEMENT ALONG TO ANOTHER SECTION.

3.) USING A 1/2" WOOD CHISEL OR THE BLADE OF A PUTTY KNIFE, SLIDE IT ALONG BETWEEN THE PUTTY AND THE WOOD EDGE, AND GENTLY ALONG THE SURFACE OF THE GLASS, SEPARATING THE PUTTY FROM THESE SURFACES.

4.) PULL THE GLAZING POINTS WITH NEEDLE NOSED PLIERS.

5.) RUN THE TIP OF A SHARP KNIFE OR A VENEER SAW ALONG THE EMBEDED GLAZING PUTTY AT THE EDGE OF THE GLASS INTIL THE GLASS IS NO LONGER BOUND.

6.) GENTLY TAP THE INSIDE SURFACE OF THE GLASS UPWARDS UNTIL IT COMES FREE. IT MAY BE NECESSARY TO SLIDE THE KNIFE TIP ALONG THE INTERSECTION OF THE GLASS AND MUNTIN ON THE INSIDE.

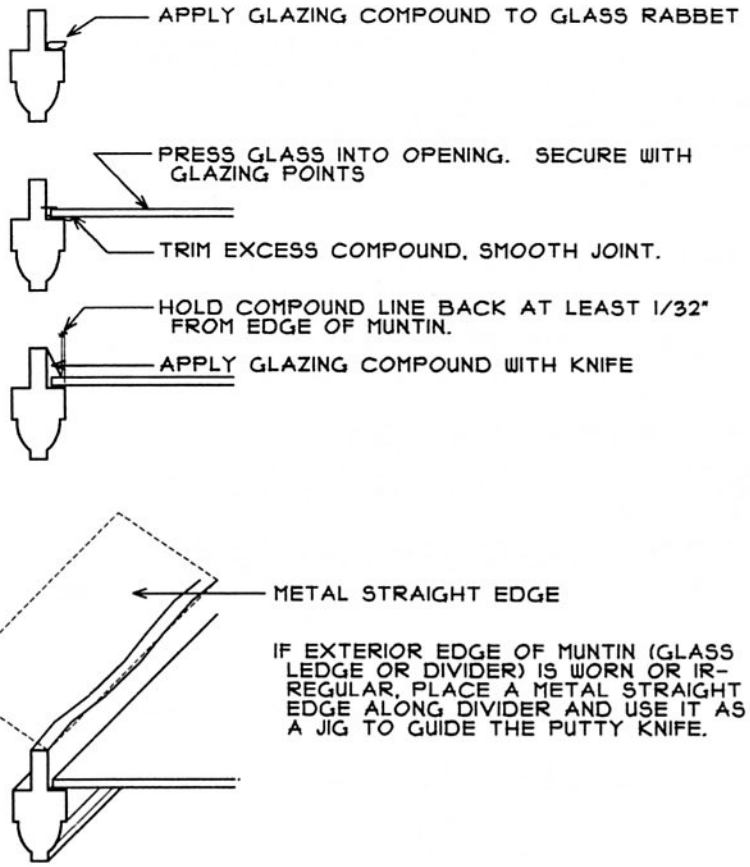


7.) CONTINUE UNTIL ALL GLASS AND PUTTY ARE REMOVED.

8.) REMOVE PAINT FROM MUNTINS, RAILS, AND STILES.

WHEN GLASS, PUTTY, AND PAINT HAVE BEEN REMOVED FROM A SASH CARRY OUT REPAIRS.

WHEN REPAIRS HAVE BEEN COMPLETED, LIGHTLY SAND INTERIOR AND EXTERIOR. DUST OFF. APPLY COAT OF KYANOIL OR PRIMER TO ALL SURFACES (INTERIOR AND EXTERIOR). ALLOW TO DRY. LIGHTLY SAND ALL SURFACES (EXCEPT GLASS RABBETS) TO REMOVE BUMPS, RAISED GRAIN, ETC. THE SASH IS READY FOR REGLAZING.

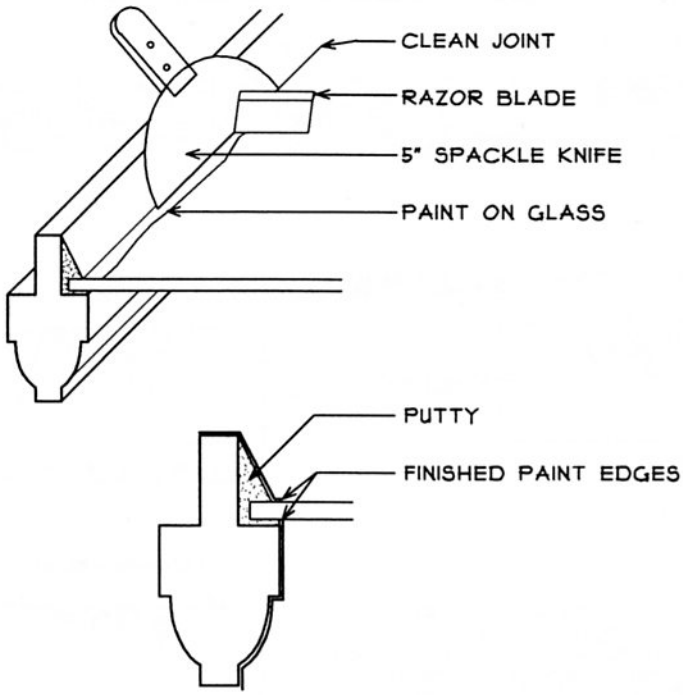


WHEN THE SASH IS GLAZED, WITH ALL PUTTY LINES CLEAN, STRAIGHT AND TRUE, SET ASIDE TO CURE. WHEN PUTTY HAS SET, APPLY FIRST PRIME COAT OF PAINT TO THE EXTERIOR.

DO NOT TRY TO CUT IN THE PAINT CAREFULLY ALONG THE EDGE WHERE THE PUTTY MEETS THE GLASS. ALLOW THE PAINT TO FLOW ONTO THE SURFACE OF THE GLASS, AT LEAST 1/8".

CONTINUE WITH OTHER COATS OF PAINT IN THE SAME MANNER. (INTERIOR AND EXTERIOR)

DO NOT REMOVE PAINT FROM THE GLASS BY SCRAPING WITH A RAZOR BLADE AGAINST THE PUTTY. RATHER, REMOVE THE PAINT USING A WIDE (APPROXIMATELY 5 INCHES) SPACKLE KNIFE AS A GUIDE IN THE FOLLOWING MANNER :



CONSOLIDATION OF FLAT WOOD SURFACES

ALWAYS PROBE THE DETERIORATED AREA WITH A SMALL KNIFE BLADE, ICE PICK OR AWL TO MAP THE AREA TO BE CONSOLIDATED AND TO DETERMINE THE BEST CONSOLIDATION TECHNIQUE.

A. FOR VERY MINOR SURFACE DETERIORATION - LESS THAN 1/8" DEPTH- SUCH AS COMMON WEATHERING, BRUSH APPLY KYANOIL.

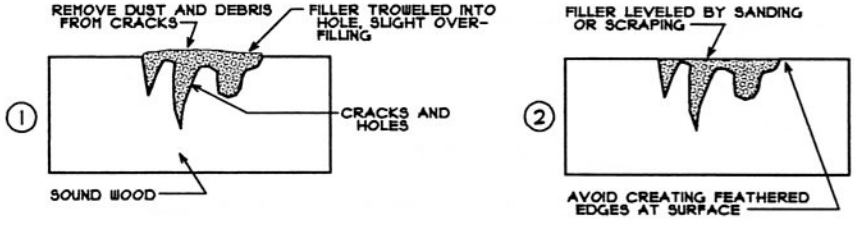
B. FOR MINOR SURFACE ROT - 1/8" TO 1/4" DEPTH - BRUSH APPLY EPOXY RESIN CONSOLIDANT.

C. FOR DEEP ROT - 1/4" OR GREATER DEPTH - IMMERSE DISASSEMBLED SASH UNITS IN CONTAINER OF EPOXY RESIN OR DRILL 1/8" DIAMETER HOLES IN STAGGERED ROWS AND ALLOW RESIN TO SEEP TO FULL SATURATION.

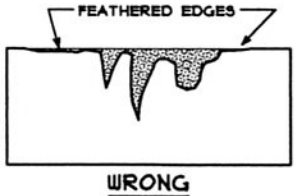
PROCEDURES CONCERNING EPOXY PASTE FILLER

FOLLOW MANUFACTURER'S DIRECTIONS FOR MIXING.

USE THIS PRODUCT FOR FILLING HOLES, GOUGES, CRACKS AND FOR REBUILDING MISSING SURFACE DETAILS OF ORNAMENTAL CARVINGS, MUNTIN PROFILES, ETC. DO NOT USE TO RECREATE MISSING DECORATIVE ELEMENTS OR MISSING SECTIONS OF STRUCTURAL ELEMENTS SUCH AS THE ENDS OF JOISTS OR STUDS.

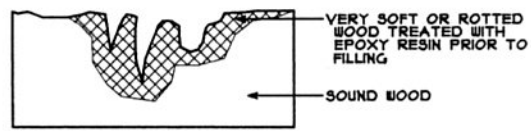


SAND OR SCRAPE TO REMOVE EXCESS FILLER UNTIL OUTLINE OF CRACK OR SPLIT IS VISIBLE. AVOID LEAVING THIN LAYERS OF FILLER ON THE SURFACE AROUND OR ALONG THE AREA OF REPAIR. AVOID FEATHERING THE EDGES.



WRONG

IF THE AREA TO BE FILLED IS SOFT OR ROTTED, DO NOT SCRAPE OUT MATERIAL. INSTEAD, APPLY BY BRUSH A THOROUGHLY MIXED EPOXY RESIN LIQUID TO THE WEAKENED AREA. THIN SLIGHTLY IF NECESSARY (NO MORE THAN 10%). REPEAT APPLICATIONS UNTIL THE FIBERS ARE SATURATED. WIPE OR BLOT OFF EXCESS. FILLER CAN BE APPLIED AT THIS TIME OR AFTER THE EPOXY RESIN CONSOLIDANT CURES. EPOXY PASTE FILLER APPLIED TO SOFT OR DETERIORATED WOOD WILL NOT HOLD.



FOR VERY MINOR SURFACE DETERIORATION OR SLIGHTLY SOFT CONDITIONS, KYANOIL (ALKYD RESIN) MAY BE BRUSH APPLIED AS A CONSOLIDANT.

EXTERIOR GRADE SPACKLE FILLER MAY BE APPLIED FOR MINOR SURFACE UNEVENNESS. IT SHOULD BE APPLIED WITH A PUTTY KNIFE AND SANDED SMOOTH.