

General Notes: All dimensions shown on sketches are in millimetres, unless otherwise noted. All described materials to be new unless otherwise indicated.

Sketch Note	Description
1	IGU type GL-1 – Sloped Glazing
2	IGU type GL-2 – Vertical Glazing
3	Snap Cap
4	Pressure Plate
5	Pressure Plate Fastener
6	Aluminium glazing seat extrusion
7	Setting block
8	Setting block support chair
9	Shimmed glazing tape, 3.8 mm thick
10	Shimmed glazing tape, 2.3 mm thick
11	Silicone sealant type 1 - weatherseal
12	Silicone sealant type 2 - structural
13	Foam tape
14	Infill rubber blocking
15	High density foam compression blocking / rigid insulation
16	Stainless steel fastener
17	New aluminium flashing
18	Polyethylene sheet
19	Grooved setting block
20	Backer rod
21	New glazing hook-stop
22	Lead-coated copper roofing
23	Self-adhesive membrane
24	16mm plywood
25	6mm plywood
26	Wood blocking
27	Custom galvanized steel joist/stud with 13mm ventilation holes
28	Internal galvanized roof edge flashing
29	Galvanized steel stud
30	Galvanized steel track
31	Galvanized steel Z-girt
32	19mm plywood
33	Existing Steel deck

34	Ventilation slots
35	Spray applied foam insulation
36	Galvanized metal closure
37	Galvanized steel anchor clip
38	Existing construction to remain
39	Wedge gasket

END OF NOTES

- 1. Time of Completion** .1 Commence the Work immediately upon notification of acceptance of your offer and complete the Work within the overall timeframe indicated by the Owner.
- 2. Minimum Standards** .1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association (CSA), the National Building Code of Canada, 2005 (NBC) and all applicable Provincial and Municipal codes. In the case of discrepancy or conflict, the most stringent requirement shall apply.
- 3. Scope of Work** .1 The Work generally includes:
- .1 Removal of existing insulating glass units from sloped glazing and vertical walls at the Colonnade and the main entrance.
 - .2 Removal of existing lead coated copper roof assemblies at the main entrance.
 - .3 Installation of new insulating glass units within sloped glazing and vertical walls, as defined in Section 088050. This work requires modification of the original framing by addition of extrusions to provide a new, extended glazing seat, as defined in Section 086300.
 - .4 Construction of new lead coated copper roof assemblies.
 - .5 Repairs to air barrier continuity below the vertical glazing.
- 4. Taxes** .1 Pay all taxes properly levied by law, including all Federal, Provincial and Municipal taxes.
- 5. Fees, Permits, and Certificates** .1 Pay all fees and obtain all permits. Provide authorities with plans and information as required for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.
- .2 Obtain required municipal Building Permit related to project, or written release (or proof of application) acceptable to Consultant, prior to commencement of work on site.
- 6. Fire, Health and Safety Requirements** .1 Comply with the National Building Code of Canada 2015 (NBC) for fire safety in construction and the National Fire Code of Canada 2015 (NFC) for fire

prevention, firefighting and life safety in building in use.

- .2 Comply with requirements issued by Fire Commissioner of Canada (FCC)
 - .1 No. 301 Standard for Construction Operations
 - .2 No. 302 Standard for Welding and Cutting
 - .3 No. 374 Fire Protection Standard for General Storage (Indoor and Outdoor)
- .3 If hot works are required in the performance of the Contract, the Contractor shall provide a hot work program plan and provide a copy to the Consultant.
- .4 Retain a copy of all fire safety documents and standards on site.
- .5 Comply with National Building Code 2015 (Part 8, Safety Measures at Construction and Demolition Sites) and Provincial Regulations for Construction Projects.

7. Fall Arrest Systems

- .1 Fall arrest systems to be designed in accordance with Performance Specifications for the design of the exterior and interior access systems.

8. Hazardous Materials

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS).
- .2 For work in occupied buildings, give the Consultant 72 hours' notice for work involving any of the following:
 - .1 Designated substances per Province of Ontario regulation 490/09;
 - .2 Hazardous substances per Canada Labour Code, Part II, Section 10;
 - .3 Painting;
 - .4 Caulking;
 - .5 Use of adhesives.

9. Temporary Utilities

- .1 Existing electrical and water services required for the work, excluding power required for space heating, may be used by Contractor without charge. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and

responsibility.

- .2 Notify Consultant and utility companies of intended interruption of services. Obtain requisite permissions.
- .3 Give 72 hours' notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Keep duration of these interruptions to a minimum. Carry out all interruptions after normal working hours of the occupants, preferably on weekends.
- .4 Maintain and protect existing services to building.

10. Removed Materials

- .1 Unless otherwise specified, materials for removal become Contractor's property and are to be taken from site.
- .2 Removed materials to be temporarily stored on site are to be kept tidy and protected from damage, theft or vandalism at all times.
- .3 All removed materials are to be removed from site within seven (7) days of removal date.
- .4 No construction materials can be removed from the site through the building.

11. Protection

- .1 Protect finished work against damage until take-over.
- .2 Protect adjacent work against the spread of dust and dirt beyond the work areas.
- .3 Protect operatives and other users of site from all hazards in accordance with Province of Ontario, Occupational Health and Safety Act and Regulations for Construction Projects, R. S. O. 1990.
- .4 Provide 19 mm plywood protection over any area of the roof that is to be used during the work (e.g. for access, temporary storage, etc.). Ensure that plywood is adequately weighted down to prevent uplift from wind.
- .5 Exercise extreme caution to avoid any damage to exterior finishes and landscaping elements. The Contractor must advise the Consultant of any existing damage BEFORE commencing work. Otherwise, assume responsibility for all costs associated with the repair of any damage.

- .6 Do not lean or store any materials against interior or exterior walls of building.
- .7 Do not commence any removal during any precipitation. Do not start the removal of any glazing if its replacement cannot be installed by the end of the work period. Ensure all glazing is watertight at the end of each work period.
- .8 Ensure that all work areas are watertight at the end of each work period.
- .9 Should work be closed down for any cause, assume responsibility for its protection during such period. Prevent deterioration of work in place and products in storage.

**12. Use of Site and
Facilities**

- .1 Execute work with least possible interference or disturbance to the normal use of the premises. Make arrangements with Consultant to facilitate work as stated. Work that must be done during “off hours” shall be in accordance with Scheduling in this Specification Section.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security would otherwise be reduced by work, co-ordinate with Consultant to ensure that security is maintained.
- .4 Closures are to be provided to protect work temporarily until permanent enclosures are completed.
- .5 During the Work, the entire premises, including building and grounds will be occupied and will remain in normal operation.
- .6 Building sanitary facilities are not available to Contractor’s personnel. Contractor is to provide own sanitary facilities. Contractor to ensure that sanitary facilities are regularly cleaned, maintained and protected from vandalism.

13. Site Storage

- .1 Site storage for products and materials is temporary only. Products and materials are to be stored on site for a maximum of seven (7) days. The contractor must allow for the “off-site” storage of all products until they are to be installed at the building.
- .2 Do not unreasonably encumber site with materials or

equipment during the work day.

- .3 Move products or equipment which interferes with operations by Consultant or other contractors.
- .4 There is no storage space available within the building.
- .5 Obtain and pay for use of all storage as well as any additional work areas needed for operations.
- .6 At all times when Contractor's personnel are not on the site, all tools, all products, all materials and all debris must be protected from theft or vandalism.

14. Cut, Patch and Make Good

- .1 Cut existing surfaces where indicated to accommodate new work.
- .2 Remove all items so shown or specified.
- .3 Patch and make good surfaces cut, damaged or disturbed, to acceptance by Consultant. Match existing material, colour, finish and texture.
- .4 Before undertaking any cutting or removals, examine all existing conditions. Where existing materials or finishes are found to be damaged, identify conditions to Consultant. Once cutting or removals have started, assume responsibility for the condition of all materials and finishes.
- .5 Carefully remove, without damaging, all existing materials identified to be re-installed. Assume responsibility for all costs associated with replacement of damaged materials with new to match existing.

15. Examination

- .1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.
- .2 The site will be accessible for examination at the time of the mandatory Job Showing. Site access at any other time shall be as approved by, and coordinated with, Consultant.
- .3 Submission of Bid at the time of Tender is deemed to be confirmation that Bidder has inspected site and is conversant with all conditions.

16. Signs

- .1 Provide common-use signs related to traffic control, information, instruction, use of equipment, public safety devices, etc., in both official languages or by

use of commonly understood graphic symbols, to acceptance by Consultant.

- .2 No advertising is permitted on this project.
- .3 Cover or remove anything deemed by Consultant to be advertising.

17. Access and Egress

- .1 Design, construct and maintain temporary “access to” and “egress from” work areas from the interior and exterior including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with all relevant municipal, provincial and other regulations.

18. Scaffold, lifts and Work Platforms

- .1 Design, install and inspect scaffold, lifts, hoists, ladders, conveyors and work platforms required for work in accordance with relevant municipal, provincial and other regulations.
- .2 Provide all lifts, hoists, booms, ladders and all access system and conveyors required on the exterior and the interior of the building for the work.
- .3 Support for all systems and equipment is to be independent of finished surfaces.

19. Site and Public Way Protection

- .1 The full exterior perimeter of the work area (or system installed to access the work area), is to be fully protected with a secure enclosure.
- .2 Where required, design, erect and maintain the exterior enclosure and covered pedestrian walkways, to support all loads, including wind loads, and provide protection, complete with signs and electrical lighting as required by authority having jurisdiction.
- .3 Protect the public from all hazards in accordance with Province of Ontario regulations. Coordinate all aspects of the work to restrict access to the work area.

20. Records

- .1 As work progresses, maintain accurate records of units installed. Just prior to Consultant’s inspection for issuance of Final Certificate of Completion, supply to the Consultant one (1) copy of records.
- .2 Include notations of all changed or concealed conditions, showing all components, materials, and dimensions as required for a full description.
- .3 Provide all other information specified in any Section

of this Specification for inclusion in the Records.

- .4 Rework records as directed and to acceptance by Consultant.
- .5 At completion of the work submit as-built drawings in electronic format.

21. Guarantees and Warranties

- .1 Before completion of the Work, collect all manufacturers' guarantees and warranties and deposit with Consultant.
- .2 Warranties are to show:
 - .1 Name and address of projects.
 - .2 Guarantee commencement date.
 - .3 Duration of guarantee.
 - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .5 Signature and Seal of Guarantor.

22. Clean Up

- .1 Clean up work area as work progresses. At the end of each daily work period and more often if directed by Consultant, remove debris and unused material from site and clean up generally.
- .2 Upon completion remove scaffolding, temporary protections and surplus materials. Make good defects noted at this stage.
- .3 As the last stage of work at each area of glazing, wash interior and exterior surfaces of new glass. Wash and clean all other areas under contract to a condition at least equal to that previously existing and to acceptance by Consultant.
- .4 Clean manufactured articles in accordance with manufacturer's directions.
- .5 On a continuous basis, monitor work area for loose construction debris, particularly that which is prone to be airborne in winds and that which could block roof drainage. Immediately clean up and remove all loose debris to maintain safe, clean, and tidy work site. It will not be acceptable to leave any debris or excess materials in any location on site.
- .6 As required, appropriately collect garbage and debris in each work area. Arrange for removal of garbage and removed glazing units from site on a daily basis.

- .7 Upon completion make good any damage to trees, sodding or exterior hard landscaping.
- 23. Contract Documents**
- .1 Drawings and Specifications are complementary. Items shown or mentioned in one and not in the other are deemed to be included in the contract work.
- .2 Contractor is responsible to obtain all field measurements for extent of work, material quantities and sizing. Do not rely on dimensions indicated in the drawings.
- .3 Pertinent details from the original shop drawings have been provided in the tender package as a reference where modifications to the existing framing are required. Upon request, all available original shop drawings for the sloped glazing and vertical glazing shall be made available to the successful bidder for reference purposes.
- .4 The details forming part of the contract documents sometimes illustrate and label one representative occurrence of specific components/requirements (e.g. fasteners, glazing tape, silicone beads, etc.). Other similar components/requirements are shown schematically in the sketches and are included in the work, but are not necessarily labelled.
- 24. Security Clearances**
- .1 All personnel employed on this project will be subjected to a security check. Obtain requisite clearance, as specified and as instructed, for each individual required to enter the premises.
- .2 All personnel are to carry valid identification (e.g. driver's license) for access to site, or may otherwise be denied admittance.
- 25. Security Escort**
- .1 The building operates in a security environment. Should it become necessary to enter the building, access must be arranged 48 hours in advance, and Contractor's personnel must be accompanied by a security guard whenever they are within the building.
- .2 Contractor is to take security escort requirements into account in the scheduling of the Work.
- 26. Building Smoking Environment**
- .1 Smoking is not permitted in the building. Obey smoking restrictions on building property.

27. Scheduling

- .2 All Contractor's personnel, including sub-contractors, suppliers and delivery people, are to obey all smoking restrictions of the building and property.
- .1 Complete and submit the designs of the temporary fall arrest and full exterior enclosure systems without delay following award of contract.
- .2 Within seven (7) days after notification of acceptance of offer, prepare and submit detailed work schedule.
- .3 Temporary fall arrest and full exterior enclosure systems must be installed before commencing remainder of work of this contract.
- .4 On award of contract, immediately make arrangements to obtain exact unit sizes and to identify required new glazing seat extrusions.
- .5 Provide advance notice to Consultant for co-ordination when all labour and materials are available for executing the Work.
- .6 Unless specifically permitted by Consultant upon written notice two weeks in advance, no work is to be carried out on the site at any of the following times:
 - .1 on Saturdays, Sundays or statutory holidays.
 - .2 before 07:00 hours and after 16:00 hours daily.
- .7 All work of the contract, including testing to demonstrate performance, must be completed on one entire, typical, face of each of the following before any work can commence on the remaining glazing faces:
 - .1 Rectangular sloped glazing.
 - .2 Triangular sloped glazing.
 - .3 Rectangular vertical glazing that spans between faces of sloped glazing.
 - .4 Rectangular vertical glazing that spans between ground level and lowest row of sloped glazing.
- .8 The testing to demonstrate performance, described elsewhere, will be conducted by the Consultant but will disrupt use of the work area for one day for each face of the sloped glazing and one day for each face of the vertical walls, provided the performance is found to be acceptable in the first test. If the first tests indicate unacceptable performance, further

disruption will be caused by the need for iterations of retesting until acceptable performance is demonstrated.

- .9 In addition to any other stoppage indicated in any Section of this Specification, assume that there will be up to 2 (two) separate occasions when the work will be closed down by Owner. On each occasion, the following will apply:
- .1 Contractor will be given 24 hours minimum notice of the start of the closure.
 - .2 closure will be for 24 hours maximum.
 - .3 Contractor is to assume responsibility for all costs associated with the closure.

28. Parking

1. There is no free parking available on site.

29. Site and Roof Protocol

- .1 The Site and Roof Protocol are included in the documents and are listed in the Index to Specifications and Drawings.
- .2 Provide a copy to all personnel on this site, review requirements in detail and ensure compliance.

30. Adjustments and Accessories

- .1 Work includes rehabilitation of existing construction. Include for adjustments to material quantities, provision of accessories and other measures as required to alleviate deviations in the layout of existing construction.

31. Supervision and Coordination

- .1 A Site Superintendent is to be readily accessible at all times when work is in progress at site.
- .2 Coordinate operations of those involved in the Work so that it progresses effectively and efficiently.
- .3 Ensure, before any trade or operation starts, that preceding or preparatory work is completed and that conditions are appropriate to receive work of such trade or operation.
- .4 Unless indicated in Contract Documents or instructed in writing by Consultant, do not allow any part of construction to be cut, drilled or modified.
- .5 Coordinate all noisy operations and deliveries with Consultant.

32. Review by

- .1 Ensure Consultant has access to the Work in all

Consultant

areas, at all levels and at all times. Co-ordinate operations and provide equipment and operating personnel as required to facilitate access by Consultant during any review of the work.

- .2 Give at least two (2) business days' notice requesting review if work is designated for special tests, review, or acceptance by Consultant.

33. Site Documents

- .1 Maintain at the site one copy of all required site documents. The documents are to be acceptably bound, protected and stored. Ensure Consultant and all representatives of Authority having Jurisdiction have access to the documents at all times.
- .2 Required site documents include:
 - .1 the "Site Protocol"
 - .2 all Contract Documents, including Drawings, Specifications and Addenda
 - .3 all Contemplated Change Notices, Change Orders, Site Instructions and Site Reviews
 - .4 all permits and notices required by authority having jurisdiction
 - .5 all inspection certificates issued by authority having jurisdiction
 - .6 WHMIS material safety data sheets for all materials used
 - .7 manufacturer's installation instructions for all products used
 - .8 all required logs of progress, weather or other conditions
 - .9 all fire safety documents and standards
 - .10 all health and safety documents required to be submitted or posted in accordance with Section 01 35 30.

34. Environmental Conditions

- .1 No work is to be carried out in unacceptable environmental conditions.
- .2 Unless otherwise specified, all product and substrate materials are to be minimum 5°C, frost free and dry.
- .3 Remove and replace work exposed to lower temperatures or other unacceptable conditions. Assume responsibility for all costs associated with replacement of unacceptable work.

END OF SECTION

- 1. References**
- .1 Canada Labour Code, Canada Occupational Safety and Health Regulations, latest edition.
 - .2 Canadian Standards Association (CSA) CSA S350, Code of Practice for Safety in Demolition of Structures, latest edition.
 - .3 Province of Ontario, Occupational Health and Safety Act and Regulations for Construction Projects, latest edition
- 2. Submittals**
- .1 Prior to commencement of work on site, and within seven (7) days after date of notification of acceptance of offer, submit site-specific Health and Safety Plan, with necessary information including the following:
 - .1 Site-specific safety hazard assessment.
 - .2 Hazard analysis for all site tasks and operations including all safety and health risks.
 - .3 Checklist for Health and Safety Site Inspection.
 - .4 On-site Contingency and Emergency Response Plan: including standard operating procedures to be implemented during emergencies;
 - .5 Emergency Exit Plan, including site and building plan showing exit paths and emergency assembly area;
 - .6 Emergency Route to nearest hospital emergency room, including street plan and driving directions.
 - .2 Prior to commencement of work on site: submit names of competent personnel and alternates who are to be responsible for the following:
 - .1 site safety and health.
 - .2 hazards present on site.
 - .3 use of personal protective equipment.
 - .4 verification of safety training for site personnel.
 - .3 As the work progresses, submit required Health and Safety documents including:
 - .1 Copies of incident and accident reports.
 - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 - .3 Material Safety Data Sheets (MSDS) for all materials.
 - .4 Completed Health and Safety Inspection Checklists.
- 3. Filing of Notice**
- .1 File Notice of Project with Provincial authorities prior to commencement of work on site.

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| 4. | Safety Assessment | .1 | Perform site-specific safety hazard assessment in accordance with the site-specific Health and Safety Plan. |
| | | .2 | Designated Site Superintendent is to carry out weekly Health and Safety Site Inspection and is to complete related Checklist. |
| 5. | Meetings | .1 | Attend health and safety pre-construction meeting. |
| 6. | Regulatory Requirements | .1 | Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations and Province of Ontario, Occupational Health and Safety Act and Regulations for Construction Projects, R. S. O. 1990. |
| | | .2 | Comply with specific standards and regulations to ensure safe operations at site containing hazardous or toxic materials. |
| 7. | Implementation | .1 | Continue to implement, maintain and enforce the accepted Health and Safety Plan until final demobilization from site. |
| | | .2 | Any request for relief from, or substitution for any portion or provision of minimum Health and Safety Guidelines specified herein or of accepted site-specific Health and Safety Plan, is to be submitted to Consultant in writing. Consultant will respond in writing, either accepting or requesting improvements. |
| | | .3 | Be responsible for safety of persons and property on site and for protection of persons off site and environment to the extent that they might be affected by performance of the Work. |
| | | .4 | Comply, and enforce compliance by site personnel, with safety requirements including: <ul style="list-style-type: none">.1 Contract Documents, including site-specific Health and Safety Plan..2 Canada Labour Code, Canada Occupational Safety and Health Regulations..3 Province of Ontario, Occupational Health and Safety Act and Regulations for Construction Projects..4 CSA 350 for demolition and removals..5 Applicable statutes, regulations and ordinances issued by authorities..6 Safety training as required by authorities and as recommended by manufacturers of products and equipment. |

- 8. Unforeseen Hazards**
- .1 For unforeseen or peculiar safety-related hazards or conditions arising in the course of Work: Immediately stop work. Advise Consultant verbally and in writing.
- 9. Posted Documents**
- .1 Provide and post on site documents as follows:
- .1 Health and Safety Representative and alternate – names and emergency contact information;
 - .2 General Requirements – Contractor’s name and emergency contact information;
 - .3 Notice of Project;
 - .4 Health and Safety Plan;
 - .5 Emergency Exit Plan;
 - .6 Emergency Route;
 - .7 Workplace Safety and Insurance Board of Province of Ontario (WSIB) Form 82;
 - .8 WSIB Form 1101;
 - .9 Province of Ontario, Ministry of Labour Orders;
 - .10 Province of Ontario, Occupational Health and Safety Act and Regulations for Construction Projects;
 - .11 WHMIS Material Safety Data Sheets;
 - .12 Regulations corresponding to Designated Substances which may be present.
- .2 Comply with Provincial general posting requirements.
- 10. Correction of Non-Compliance**
- .1 Immediately address all health and safety non-compliance issues, including those identified by Consultant.
- .2 Provide Consultant with written report of action taken to correct health and safety non-compliance issues identified.
- 11. Work Stoppage**
- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule consideration for the Work.
- .2 Consultant may stop the Work for health and safety considerations. Contractor is to assume all related costs.

END OF SECTION

PART 1 - GENERAL

- 1.1 Related Sections**
- .1 Lead Coated Copper Roofing Section 07 65 00
 - .2 Joint Sealing Section 07 92 00
- 1.2 Work Included**
- .1 The work of this Section shall include, but not be limited to, the following:
 - .1 Supply and installation of wood blocking related to the replacement of the lead clad copper roofs.
- 1.3 References**
- .1 Canadian Lumber Standards Administration Board (CLSAB)
 - .2 National Lumber Grading Authority (NLGA)
 - .3 Standard Grading Rules for Canadian Lumber (2014)
- 1.4 Handling and Storage**
- .1 Protect materials from moisture and weather. Do not allow plywood and lumber surfaces for application of membrane to become wet prior to membrane application.
- 1.5 Tolerances**
- .1 Align and plumb faces of components.
- 1.6 Source Quality**
- .1 Lumber identification: by grade stamp of an agency certified by CLSAB.
 - .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
 - .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grade mark in accordance with applicable CSA standards.
- 1.7 Protection**
- 1. During removals and installations, protect adjacent existing materials and finishes to remain.
- 1.8 Submittals**
- 1. Submit product data sheets for products used.
 - 2. Submit MSDS sheets for all products used.

PART 2-PRODUCTS

- 2.1 Lumber Material**
- .1 Lumber: to NLGA grading standards; Grade No. 2, Northern softwood species; S4S, moisture content 19% or less in accordance with CAN/CSA-O141, preservative pressure treated in accordance with CSA O80 Series to a net retention of 4.0 kg/m³.

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- .2 Provide minimum material sizes as required and as follows:
- .1 Framing lumber: 40 x 90 mm (2" x 4" nominal) as required.
- 2.2 Panel Materials**
- .1 Plywood: to CSA O121 or CSA O151 exterior grade, thickness 19 mm, solid one side; graded and marked to applicable CSA standards, preservative pressure treated in accordance with CSA O80 Series to a net retention of 4.0 kg/m³.
- 2.3 Accessories**
- 1. Fasteners are to be of size and length as required to suit material thickness and to provide secure anchorage.
 - 2. Nail fasteners for wood substrate: to CSA B111, galvanized steel spiral framing nails, exterior grade.
 - 3. Screw fasteners for wood substrate: galvanized steel wood screws with flat heads, exterior grade.
 - 4. Fasteners for steel substrate: galvanized hardened self-tapping steel screws, exterior grade, recommended for purpose by manufacturer.
- 2.4 Coatings**
- 1. Preservative for wood: Chromated Copper Arsenate (CCA) to CSA O80 Series; green colour.
 - 2. Galvanizing for fasteners: to CAN/CSA-G164.
- 2.5 Miscellaneous**
- .1 Provide miscellaneous items for work of other Sections.

PART 3 - EXECUTION

- 3.1 Workmanship**
- 1. Carry out work to required standards and as follows:
 - .1 In accordance with requirements of NBC.
 - .2 For proper support of other materials and assemblies.
- 3.2 Removals**
- .1 Carry out removals to achieve access in accordance with project drawings.
 - .2 Assume costs associated with repairs to adjacent surfaces damaged by removals.
- 3.3 Examination**
- .1 Before installation of materials, examine conditions as required and as follows:
 - .1 Conduct final examination of substrate for application of materials.
 - .2 Immediately inform Consultant of defects and arrange work to accommodate review.

- .3 At time of installations, ensure that conditions are as required and as recommended.

3.4 Preparation

- .1 Remove any existing dust and other foreign matter to allow proper contact to surfaces of substrate.
- .2 Allow for the nature of alterations to an existing structure. Cut, alter and repair adjacent construction as required to accommodate existing conditions and prepare for new work, as indicated and as follows:
 - .1 Refasten existing loose or unstable components.
 - .2 Alter existing components as required to achieve necessary profiles and support.
 - .3 Do not remove excess material or reduce structural integrity.

3.5 Cutting and Fitting

- .1 Cut components neatly to achieve square and tight fit at all joints. Cut plywood and sheet materials using a guide to achieve straight edges.
- .2 Allow for the nature of alterations to an existing structure. Cut, trim and shape new material as required to fit to adjoining existing surfaces.
- .3 For sloped, canted or tapered construction, angle-rip, bevel-cut and plane wood components, including framing, as required to provide close fit and continuous support.
- .4 Treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation. Saturate and maintain wet film on surface for minimum three (3) minute soak on lumber and one (1) minute soak on plywood.

3.6 Fastening

- .1 Fasten framing members with a minimum of two (2) fasteners per joint. Frame, tie and brace members to provide necessary strength and rigidity. Fasten as required and at 400 mm (16") maximum spacing.
- .2 Fasten plywood, furring, blockings and nailers to each other and to substrate at 300 mm (12") on centre maximum spacing in a staggered pattern.
- .3 Fasten to existing substrate using screw fasteners only.
- .4 Do not damage membrane on substrate. Immediately seal damage to membrane, including punctures, pilot holes and removed fasteners, with membrane seals including sealing compound and membrane patches according to the Related Section.

- .5 For plywood and similar sheets, provide continuous edge support. Fasten edges as required and at 150 mm (6") maximum spacing.
- .6 Countersink fasteners where necessary for good appearance or for clearance for other work.

3.7 Miscellaneous

- .1 Provide miscellaneous work for work of other Sections, including:
 - .1 Blocking, backing, nailers and shims.
 - .2 Temporary supports, bracing and forms.

3.8 Clean-up

- .1 Perform cleanup as work progresses. Leave work area clean end of each day.
- .2 Final cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment from site.

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 CAN/ULC S705.2-05: Standard for Thermal Insulation – Spray applied Rigid Polyurethane Foam, Medium Density – Application.
- .2 Canadian Urethane Foam Contractors Association, (CUFCA)"Manual for Installers of Spray Polyurethane Foam Thermal Insulation".
- .3 Workplace Hazardous Materials Information System (WHMIS).
- .4 Underwriters' Laboratories of Canada (ULC).

1.2 Protection

- .1 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .2 Protect workers as recommended by applicable Standards and manufacturer's recommendations.
- .3 Protect adjacent surfaces, particularly granite, hard landscaping/pavers, glass and window frame components, equipment and the site areas below application from damage by over spray, fallout and dusting of insulation materials.
- .4 Dispose of waste material in location approved by Consultant, and decontaminate empty drums in accordance with manufacturer's instructions.

1.3 Environmental Requirements

- .1 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 absolute limits.
- .2 Ventilate insulation application area in accordance with CAN/ULC S705.2-05 R2016.

1.4 Qualifications

- .1 Contractor and applicators performing work under this section must be licensed under the manufacturer's Quality Assurance Program. Provide proof of license and certification to the Consultant upon request.

1.5 Quality Assurance

- .1 .Installers must perform daily on site density and adhesion testing as directed by material manufacturer and applicable Standards. Test reports to be available to the Consultant on request.

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- | | |
|--|---|
| 1.6 Submittals | <ul style="list-style-type: none">.2 Maintain one copy of installation manual on site. |
| 1.7 Delivery, Storage and Handling | <ul style="list-style-type: none">.1 Submit MSDS sheets and product data for all materials before commencing work on site..1 Materials shall be delivered in manufacturer's original sealed containers clearly labelled with manufacturer's name, product identification, safety information, net weight of contents, and expiration date..2 Material is to be stored in a safe manner and where the temperatures are in the limits specified by the material manufacturer..3 Dispose of empty isocyanate and resin containers off site in accordance with CAN/ULC-S705.2 and federal, provincial or municipal regulations. |
| 1.8 Health and Safety Requirements:
worker protection | <ul style="list-style-type: none">.1 Protect workers as recommended by CAN/ULC S705.2 and manufacturer's recommendations..2 Ensure the safety of the workers in conformity with local and provincial regulations, standards and manufacturer's recommendations..3 Make sure that all personnel within 10m of the application site have respiratory protective equipment and personal protective equipment in conformity with provincial regulations and the CAN/ULC-S705.2 standard. Cartridge type respirators are not acceptable..4 Ventilate area receiving insulation to maintain non-toxic unpolluted, safe working conditions. |
| 1.9 Fire Protection | <ul style="list-style-type: none">.1 Open flame or welding is not permitted to be in contact with the Spray Polyurethane Foam in place. Use protection as required in CAN / ULC S705.2. |
| 1.10 Warranty | <ul style="list-style-type: none">.1 Warrant work of this section against defects and deficiencies for a period of two years from date work completion..2 Provide manufacturer's warranty for the field-applied product. |

PART 2 - PRODUCTS

2.1 Materials

- .1 Spray Applied Insulation: Two (2) component, spray in place urethane foam to meet CAN/ULC-S705.1.
 - .1 LTTR: RSI 1.05 per 25 mm thickness.
 - .2 Density: Minimum 28.9 kg/m³ as per ASTM D1622.
 - .3 Flame Spread Classification: <500 as per CAN/ULC S102-03.
 - .4 Compressive strength: Minimum 195 KPa as per ASTM D1621.
 - .5 Water absorption: Maximum 0.8% as per ASTM D2842 (96 hrs).
- .2 Primers: As per manufacturer recommendations and CAN/ULC-S705.2.

2.2 Equipment

- .1 Equipment shall be as recommended in CAN/ULC-S705.2 and approved by foam manufacturer for type of application.
- .2 Each proportioner to supply only one spray gun.

PART 3 - EXECUTION

3.1 Preparation

- .1 Verify that surfaces and conditions are ready to accept the work of this section. Application of work of this section shall be deemed as acceptance of existing work and existing conditions.
- .2 Surfaces to be covered with spray foam shall be free of an excess of moisture, frost, oil, rust, and any other foreign material that may have a negative effect on the adhesion of the product.
- .3 All oily metal surfaces shall be primed as described in CAN/ULC S705.2.
- .4 Mask and cover adjacent areas to protect from overspray.
- .5 Report in writing defects in substrates that may adversely affect the performance of the products installed under this section to the Consultant prior to commencement of work.

3.2 Application

- .1 Apply foam in strict accordance with manufacturer's written instructions, these specifications, or Consultant's recommendations. Use primer and/or bonding agents where recommended by manufacturer.
- .2 Apply foam only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.
- .3 Apply foam in consecutive passes (min. 15 mm, max. 50 mm) respecting manufacturer's recommended intervals between passes. Completed spray foam insulation to achieve an average thickness of 75 mm at the top roof and 38 mm at the lower roofs, except around perimeter of roofs where a solid block of insulation is required to fill the voids illustrated on the drawing details.
- .4 Where drawing details indicate solid fill of foam behind components that must be removable at the end of construction (e.g. behind flashings at head of sloped and vertical glazing) use polyethylene wrap around installed, removable components as bond breaker to permit foam application that will result in solid fill of profile indicated. Remove components and bond breaker after foam application.
- .5 Finished surface of foam insulation shall be free of voids and embedded foreign matter.
- .6 Do not allow products to cover or mark adjacent surfaces, particularly granite, aluminum framing and glass components. Use masking materials to prevent all such coverage or marking. Remove masking materials and any overspray from adjacent areas immediately after surface of applied material has cured to hard surface film.
- .7 Clean and make good surfaces soiled or damaged by work of this section. Consult with sections of work soiled before cleaning to ensure methods used will not damage their work. Repair damaged areas in accordance with manufacturer's guidelines.

3.3 Tolerances

- .1 Maximum variation from indicated thickness: -0/+6 mm. Where tolerance is exceeded, trim to achieve required thickness after foam has cured.

3.4 Review by Consultant

- .1 After completion of application, notify Consultant for review.
- .2 Consultant shall review a sample of each area and surface for quality of material, adhesion, lack of voids and minimum thickness.
- .3 Contractor must remove materials from areas judged unacceptable, clean and reprime substrate surfaces, and install a new application of product over the affected area.
- .4 No further work on the area shall be done until the Consultant has accepted the application work.

3.5 Clean-up

- .1 Perform cleanup as work progresses. Leave work area clean end of each day.
- .2 Final cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment from site.

3.6 Protection

- .1 Protect installed products and components from damage during construction.

END OF SECTION

PART 1 - GENERAL

1.1 Related Work

- .1 Rough Carpentry Section 06 10 13
- .2 Sealants Section 07 92 00
- .3 Glazing System Retrofit Section 08 63 00
- .4 Spray Applied Foam Section 07 21 29

1.2 Work Included

- .1 Provide labour, materials, products, equipment and services to carry out the retrofit work specified herein.
- .2 The work of this section shall include, but not be limited to, the following:
 - .1 Removal of all existing roof system materials to expose the top of the vapour barrier membrane (includes lead coated copper, self-adhesive membrane on 19 mm plywood, light gauge metal framing with batt or rigid insulation, roof hatch).
 - .2 Installation of new tapered wood framing to provide roof slope.
 - .3 Installation of new plywood lower deck.
 - .4 Installation of new self-adhesive vapour barrier membrane.
 - .5 Installation of new light gauge metal framing (with provision for cross ventilation) connected to lower plywood deck.
 - .6 installation of new built-up roof enclosures, including light gauge metal support framing, plywood over framing, self-adhesive membrane to cover plywood and light gauge metal framing (with provision for cross ventilation) connected to built-up plywood.
 - .7 Installation of new spray applied insulation.
 - .8 Installation of new upper plywood deck.
 - .9 Installation of new self-adhesive waterproofing membrane underlay.
 - .10 Installation of new lead coated copper roofing finish in standing seam pattern to match existing, including perimeter and intermediate fascia/flashing as detailed.

1.3 Reference Documents

- .1 ASTM B32-08 (2014) Standard Specification for Solder Metal.
- .2 ASTM B101-12 Standard Specification for Lead-coated Copper Sheet and Strip for Building Construction.
- .3 ASTM B370-12 Standard Specification for Copper Sheet and Strip for Building Construction.

1.4 Design Criteria

- .1 Comply with the design and performance requirements of applicable Building Code and industry standards covering the work of this section.
- .2 System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.
- .3 The intent of the work is to replace the roof system while rendering the completed project near visually identical to the existing assemblies. This intent is to be reflected in all supply and installation practices.

1.5 Submittals

- .1 Submit shop drawings to indicate the details of layout, seaming, joining and fastening requirements for the lead coated copper.
- .2 Submit samples consisting of 300 mm square specimens of specified copper roofing material.
- .3 Provide a sample length of the fascia at upper roof to demonstrate the method of fabricating the required ventilation slots.

1.6 Extended Warranty

- .1 Warrant all work of this Section against defects in materials and workmanship for a period of 60 months. Warrant that work will be water and weather tight, structurally sound and free from distortion and deformation under load, that materials and finishes will not crack, peel or otherwise deteriorate or corrode. The warranty coverage on water and weathertightness specifically means that the work of this Section will not permit air or water leakage, as determined at the sole discretion of the Consultant.
- .2 Warranty shall include the prompt remedy of defects upon written notification from the Owner that defects exist. Remedy shall include labour, materials,

equipment and services required to make good defective areas of the work, and in the case of factory-fabricated components, to supply and install new components, all at no cost to the Owner and at times convenient to the Owner. Warranties shall also include making good other building parts and finishes and other Owner's property damaged or disturbed in the course of remedying defects.

- .3 Warranty to be in a form acceptable to both the Owner and the Consultant.

PART 2 – PRODUCTS

2.1 Materials

- .1 Lead-coated copper: to ASTM B101, including 6.1 kg/m² cold rolled copper sheet with equal lead coating on each face for total weight of 6.5 kg/m², temper designation H00.
- .2 Solder, welding rods, and accessory items as recommended by copper sheet manufacturer.
- .3 Trim, fascia, clips, seam covers, battens, flashings all to match existing/original roof components, unless modified in drawing details.
- .4 Nails for roofing installation: Bronze, 2.76 mm diameter x 25 mm barbed.
- .5 Cleats: 454 g cold rolled copper, 50 mm wide x 75 mm long.
- .6 Rivets for roofing installation: 3.2 mm diameter solid copper.
- .7 Solder for copper roofing and flashing seams: to ASTM Standard Specification B32, with 60% tin and 40% lead composition.
- .8 Flux: Muriatic acid neutralized with zinc.
- .9 Screws, washers and other fasteners for new wood and steel framing/decking: 300 Series **Stainless steel** of austenitic grade for all connections.
 - .1 Fasteners for new tapered wood framing: #10, 150 mm long hexagonal head, self-drilling, self-tapping.
 - .2 Fasteners for new plywood decking to tapered wood framing: #10 x 63 mm long flat head wood screws.
 - .3 Fasteners for new steel joists and perimeter closures to new plywood decking: #10 x 25 mm pan-head wood screws.

- .4 Fasteners for new plywood deck to new steel joists, steel joists to hip track, back-to back hip tracks, anchor clips to steel joists and internal roof edge flashing to anchor clips: #10, Robertson head, self-drilling, self-tapping.
- .10 Sheet metal: ASTM A653/A653M, minimum 1 mm sheet steel, galvanized, minimum coating weight 380 g/m².
- .11 Self-adhesive membrane: Fully adhered and cold-applied, rubberized asphalt, integrally bonded to polyethylene, 1.0 mm thick.
- .12 Primers, liquid membrane and mastic for use with self-adhesive membrane, all as recommended by membrane manufacturer. All products to be supplied by the same manufacturer.
- .13 New steel joists: 1.52 mm thick galvanized steel with web dimension to suit and flange dimension of 41 mm, minimum galvanized coating weight 380 g/m².
- .14 New steel track: 1.52 mm thick galvanized steel with web dimension to suit and flange dimension of 30 mm, minimum galvanized coating weight 380 g/m².
- .15 Lumber and plywood: to NLGA grading standards, graded by agency certified by CLSAB, Grade No. 2, Northern softwood species, S4S, moisture content 19% or less in accordance with CAN/CSA-O141, pressure treated. Lumber to be nominal 50 mm wide x variable depth for taper.
- .16 Enhanced performance thermally broken roof hatch: Single leaf, pre-assembled from manufacturer. EPDM rubber gasket bonded to cover interior to ensure continuous seal when compressed to the top surface of the curb. Cover and curb to be insulated with polyisocyanurate, 75 mm thick. Lift and latch mechanisms as required to match remotely operated mechanical opening capability of existing roof hatches. Size to match existing.

2.2 Fabrication

- .1 As far as practical, execute cutting, fitting and assembly in the shop with the various parts ready for installation on site. Provide for thermal expansion and contraction. Form exposed copper work without excessive oil-canning or buckling, with all edges hemmed.

- .2 Form and fabricate sheets, strips, cleats, edge treatments, internal flashing and other components of roof system to profiles and layout necessary for permanent watertight construction.
- .3 Drill or punch cross ventilation holes along length of all new steel joists, 13 mm diameter @ 100 mm o/c, positioned just below upper flange.
- .4 For upper roof, fabricate new anchor clips for new internal roof edge flashing from 1.5 mm thick sheet steel. Clips to be angle cross section with 25 mm legs, 25 mm in length.
- .5 Fabricate new roof edge flashing from lead coated copper, to profile as detailed, in length that permits coping and overlap of adjacent lengths at end of new joists.
- .6 Custom form roof fascia and flashings from lead coated copper, providing ventilation slots (size and spacing to match existing) in underside of fascia where indicated in drawings.
- .7 Fabricate new galvanized sheet steel closure for connection of roof perimeter to upper purlin of sloped glazing system, as indicated in drawings.
- .8 Take field measurements and levels required for the proper layout and installation of the work. Coordinate and confirm dimensional tolerances in framing prior to commencement of the work.

PART 3 – EXECUTION

3.1 Preparation

- .1 Make all measurements necessary to avoid delays once work has commenced.
- .2 Report immediately in writing to the Consultant all discrepancies which will adversely affect the work of this Section. Report surfaces unacceptable to the Consultant before commencing work.
- .3 Install plywood protection on all adjacent roof areas to be used for access or temporary storage.
- .4 Obtain exact dimensions and location of existing roof enclosures to ensure that new roofing components have identical dimensions and location. Provide record of these dimensions and layout to Consultant before existing enclosures are demolished.

- .5 Remove existing roofing assembly to steel deck. All loose material and debris must be removed from the roof at the end of demolition and before any new construction commences.
 - .6 Remove existing roof hatch. Coordinate removal of remotely operated control systems with Owner's representative.
 - .7 Store all materials in a safe manner, in accordance with manufacturer's recommendations.
 - .8 Ensure substrates to receive new self-adhesive membrane are smooth, free of defects and dry.
- 3.2 Separation of Dissimilar Metals**
-
- .1 Use self-adhesive membrane applied to galvanized steel components to achieve separation from any attaching lead-coated copper components.
- 3.3 Installation of Steel Framing for Roof Enclosures**
-
- .1 New roof enclosures are to be placed in the same locations as the removed existing, and are to be of identical dimensions, including at the location where the existing interior ventilation fan is housed within the enclosure.
 - .2 Layout new steel track at level of original vapour barrier. Space track at maximum 300 mm o/c.
 - .3 Install fasteners in pairs through existing plywood to pierce and bite into existing structural steel deck. Space fastener pairs at maximum 150 mm o/c.
 - .4 Fasteners are to be sized to reach bottom face of fluted deck.
 - .5 Layout steel studs in track, spaced at maximum 300 mm o/c. Custom cut studs to provide pyramidal shape for top of enclosure, as indicated in drawing details.
 - .6 Install pairs of fasteners between flange of track and flange of stud.
 - .7 Layout steel joists at maximum 300 mm o/c and to maintain pyramidal shape of top of enclosure. Install fasteners in pairs at intersections of web of joists and web of studs.

**3.4 Installation of New
Tapered Wood
Framing**

- .1 Cut new lumber to achieve wood framing for new sheathing layer, with faces each sloping at 2% to roof edge as indicated in framing layout drawings. Minimum height of framing at roof edge to be 25 mm. Layout framing at spacing of 300 mm o/c maximum.
- .2 Install fasteners for new tapered wood framing at maximum 150 mm o/c along each length of framing. Counter sink top of framing at fastening locations so top of fastener head is flush to top of framing.
- .3 Install fasteners through new framing to pierce and bite into existing structural steel deck. Fasteners must be sized to reach bottom face of fluted deck – as installation progresses, conduct random uplift tests by gently prying new framing. Immediately advise Consultant if fasteners are not solidly anchoring new framing tight on top of existing roof vapour barrier.
- .4 Install new plywood to achieve continuous lower sheathing. Plywood to be fastened at 150 mm o/c along every supporting wood framing member. Treat all cut ends of plywood with preservative.

**3.5 Application of New
Vapour Barrier**

- .1 Install custom formed steel closure around full perimeter of roof, for connection to top of sloped glazing. Closures to be fastened directly to top of new plywood sheathing and to existing framing of sloped glazing at 150 mm o/c. Where closure connects to sloped glazing framing, place closure over glazing tape and sealant before installing fasteners at 150 mm o/c.
- .2 Prime all substrates in accordance with instructions provided by manufacturer. Prime only the area that will be covered with membrane within prescribed time limit.
- .3 Apply continuous layer of self-adhesive membrane over all surfaces of perimeter closures and plywood sheathing. Apply membrane in an overlapping shingle fashion to shed water away from the roof peak. Overlap seams 75 mm and use pressure to firmly bond the lapping membrane. Install membrane to provide continuity of air/vapour barrier with adjacent assemblies.
- .4 Apply mastic to all edges of membrane.

3.6 Roof Hatch

- .1 Install new roof hatch in accordance with manufacturer's instructions.
- .2 Install continuous layer of self-adhesive membrane on vertical surfaces around perimeter of hatch and tie-in with membrane on plywood sheathing.
- .3 Coordinate installation of remotely operated control systems with Owner's representative. Provide assistance as required to ensure proper operation of new hatch.

3.7 Installation of Steel Joists

- .1 Layout new steel joists at maximum 300 mm o/c spacing, to maintain roof slope(s).
- .2 Install fasteners for new joists into lower plywood sheathing at maximum 150 mm o/c along each joist length.
- .3 Create hip support for new joists using back-to-back steel track, fastened together with two rows of fasteners at 150 mm o/c. Install one line of fasteners through track web immediately adjacent to each flange. Drill 13 mm diameter cross ventilation holes in hip support at 100 mm o/c, immediately below upper flange tracks.
- .4 Fasten end of each steel joist to hip support with fastener driven through overlapping flanges of joist/track.
- .5 At upper roof, install clip anchors to both sides of every joist, at position along roof edge to suit profile of new internal roof edge flashing. Clip anchors must fall within depth of insulation to be spray applied over entire surface of roof.
- .6 Apply self-adhesive membrane on clip anchor as separator.
- .7 Install roof edge flashings between new joists, fastened to top of clip anchors, and cut to overlap adjacent lengths of flashing beyond end of joists.
- .8 Apply strips of self-adhesive membrane to cover vertical seams in edge flashing.

3.8 Application of Spray Foam

- .1 Spray apply foam over entire roof area, between roof joists and under roof edge flashing in accordance with Section 07 21 29 and drawing details.

3.9 Installation of Upper Sheathing

- .1 Install new plywood over top of steel joists at main roof level and at built-up roof enclosures, including vertical faces of roof enclosure, to achieve continuous upper sheathing. Maintain existing sloped faces. Plywood to be fastened to steel joists at 150 mm o/c along every supporting framing member. Treat all cut ends of plywood with preservative.

3.10 Application of New Waterproofing

- .1 Prime new plywood sheathing in accordance with instructions provided by manufacturer. Prime only the area that will be covered with membrane within prescribed time limit.
- .2 Apply continuous layer of self-adhesive membrane over all surfaces of plywood sheathing. Ship-lap membrane to shed water away from the roof peak. Overlap seams 75 mm and use pressure to firmly bond the lapping membrane.
- .3 Apply mastic to all edges of membrane.
- .4 Ensure continuity of new waterproofing membrane with adjacent assemblies.

3.11 Installation of Lead-Coated Copper

- .1 Install new lead-coated copper finished surface with 400 mm wide sheets to match existing, including standing seam pattern. Solder joints to provide continuous seal.
- .2 Conceal fasteners and locate so as to avoid leakage. Provide cleats at maximum 300 mm o/c.
- .3 Form seams in direction of water flow and make watertight.
- .4 All panel to panel seams along slope to be double lock standing seams to match existing.
- .5 Create transverse joints by overlapping metal 100 mm and soldering lap.
- .6 Construct all non-moving joints and seams between sheet metal panels of exposed flashing as 20 mm wide, flat-locked, S-lock style joints.
- .7 Mechanically clean all metal to be soldered with steel wool, apply flux and pre-tin to any uncoated copper surfaces to be seamed. Apply sufficient heat to drive solder fully through the entire seam width. All sloped and vertical seams shall be laced and soldered a second time.

- .8 Wipe and wash clean soldered joints to remove traces of acid residue from the flux.
- .9 Provide for thermal expansion and contraction of exposed sheet metal using expansion joints at 75 mm from all changes in flashing direction. Use loose-lock expansion seams filled with sealant for flat sheet, and cross-folded seams in any flashings bent to form right angles.
- .10 Finish exposed sheet metal terminations using continuous metal receiver strips installed over the termination using a solid fill of sealant within the strip.

3.12 Field Quality Assurance

- .1 The Consultant will carry out review of work of this section. This review does not replace any of the Contractors own quality control.
- .2 The Contractor will provide ready and clear access to the work to assist with the field quality assurance programme.

3.13 Adjusting

- .1 At completion of the Work and just prior to handing over to the Owner, or at a time as directed, inspect and adjust installations.

3.14 Cleaning

- .1 Keep installed work clean as work progresses.
- .2 Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Replace finishes or materials that cannot be satisfactorily touched up, cleaned or which have been damaged by improper cleaning materials and techniques.
- .3 At completion of the work remove all surplus materials. Remove all debris, equipment and excess material resulting from the work of this Section from the site.

END OF SECTION

PART 1 – GENERAL

1.1 Related Work

1. Glazing System Retrofit Section 086300
2. Glass and Glazing Accessories Section 088050

1.2 Work Included

- .1 Provide labour, materials, products, equipment and services to design, supply and install joint sealants and accessories specified herein.
- .2 The work of this Section shall include, but not be limited to, the following:
 - .1 Removal and safe disposal of all joint sealants associated with glazing replacement.
 - .2 Re-application of purlin spigot seals in sloped glazing framing.
 - .3 Installation of new sealant at modified butt-joints between sill rail framing members in vertical glazing.
 - .4 Removal and replacement of horizontal sealant beads at intermediate rail members in wall glazing.
 - .5 Installation of two new sealant beads around perimeter of framing at every glass opening.
 - .6 Installation of cap beading.
 - .7 Installation of weatherseals.

1.3 References

- .1 CAN/CGSB-19.13-M87 Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .2 ASTM C794-15a Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
- .3 ASTM C1087-16 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing.
- .4 ASTM D638-14 Standard Test Method for Tensile Properties of Plastics.

1.4 Design Criteria

- .1 All sealants are to be non-bleeding, non-staining and capable of sustaining their own weight and, if exposed to the exterior, UV resistant.
- .2 All sealants are to be compatible with all materials in contact with them. Sealants, cleaning solvents, primers, joint fillers and accessories are to be compatible with each other.

**1.5 Environmental
Conditions**

- .3 For structural silicone beads between glass and framing, sealant stress must be less than 138 kPa including a safety factor of 5:1.
- .1 Sealants and substrate materials are to be minimum 5°C.
- .2 On approval by Consultant, should it become necessary to apply sealant at ambient temperatures below 5°C, follow sealant manufacturer's specific recommendations.

1.6 Submittals

- .1 Submit product data on structural silicone sealant to be used complete with preparation and installation recommendations.
- .2 Submit sealant manufacturer's test reports on adhesion to the finished metal and glass production samples in accordance with ASTM C794, 7 day cure and 7 day water submersion, tensile strength at 100% elongation and required bite size for sealants.
- .3 Submit sealant manufacturer's sealant compatibility statement that all materials in contact with structural sealant are compatible with the sealant in accordance with ASTM C1087.

1.7 Warranty

- .1 Warrant the work of this Section against defects for a period of 60 months from the date of final completion of the contract. Warranty shall include, but not be limited to; sag and failure in adhesion or cohesion, bleeding and staining of adjacent materials.
- .2 Warranty shall include the prompt remedy of defects upon written notification from the Owner that defects exist. Remedy shall include labour, materials, equipment and services required to make good defective areas of the work, and in the case of factory-fabricated components, to supply and install new components, all at no cost to the Owner and at times convenient to the Owner. Warranties shall also include making good other building parts and finishes and other Owner's property damaged or disturbed in the course of remedying defects.
- .3 Warranty to be in a form acceptable to both the Owner and the Consultant.

PART 2 - PRODUCTS

2.1 Product Compatibility

- .1 All products are to be compatible with each other and with all other materials in contact with them.

2.2 Sealants

- .1 Type 1: Neutral cure, medium modulus, one component silicone with movement capability of +/- 50% and specifically developed for use in weathersealing joints, to CAN/CGSB-19.13, Colour: to match existing.
- .2 Type 2: Structural silicone adhesive for joints between new glazing seat extrusion and glass units: neutral cure, medium modulus silicone specifically developed for use in structural glazing applications, to CAN/CGSB-19.13, black colour.

2.3 Joint Fillers

- .1 For weatherseal joints between insulating glass units: 0.75 mm thick smooth linear low density polyethylene sheet to ASTM D638 as follows:
 - .1 Modulus of Elasticity – 310.3 MPa
 - .2 Tensile Strength at Yield – 99.8 N/cm.
- .2 All other joints: Polyethylene extruded foam, closed cell with non-absorbing outer skin and interior of non-gassing to ASTM D1752 e1. Foam joint fillers are to be oversized 30% to 50%.

2.4 Sealant Accessories and Other Materials

- .1 Joint cleaners: non-corrosive solvent types as recommended by sealant manufacturer.
- .2 Primers: to prevent staining, assist bond and to stabilize porous surfaces, as recommended by sealant manufacturer. Obtain manufacturer's recommendation for application to each substrate material.

PART 3 - EXECUTION

3.1 Examination

- .1 Prior to application of primers or installation of sealants, examine all conditions, including environmental conditions, likely to affect the timely completion of the work of this section.
- .2 Ensure that all conditions at time of installation, including ambient and surface temperatures, are as recommended by sealant manufacturer.

3.2 Removals

- .3 Notify Consultant of conditions which prevent proper installation of work of this section.
- .1 For all sealant removals, remove existing sealants, joint fillers, oil, grease, protective coatings, mortar, dust, scale and any other foreign matter. Do not grind or scrape aluminium framing, concrete or metal flashings/trims. Ensure that cleaning procedures for framing do not remove the painted finish on the aluminium. When cutting existing structural silicone adhesive beads, do not fully remove silicone from aluminium framing, but rather leave a thin film of the original silicone bead.
- .2 From the interior, completely remove large existing sealant bead applied around perimeter of all existing IG units. Use a solvent to fully remove residue and achieve clean aluminum framing. This sealant bead contributes to the blast mitigation characteristics of the existing glazing assembly and the bead is to be left in place until just prior to the removal of the IG unit, or no longer than one (1) day ahead of the scheduled IG unit removal date.
- .3 Remove all sealant at construction joints between glazing assemblies and the adjoining construction.
- .4 Remove all sealant at all glazing assemblies, including weather seals between glass units and cap beads at framing members.
- .5 Remove **all** sealant and residue from framing joinery seams, rafter notches for purlin spigots in sloped glazing framing and **all** glazing cavities. Use a solvent to fully remove residue and achieve clean aluminum framing.
- .6 Remove all sealant at butt-joints and ends of lengths of sill rail framing members within the wall glazing system.
- .7 Remove all horizontal sealant beads at intermediate rail members in wall glazing system, as indicated in drawing details.
- .8 Existing snap caps, pressure plates and related accessories and seals are to be removed in accordance with Section 08 63 00. Existing glass and related accessories are to be removed in accordance with Section 08 80 50.

3.3 Preparation

- .1 Ensure that all surfaces to receive sealants are dry, firm, sound, smooth, suitable for bond, and free from loose material, projections, ice, frost, grease, oil or other matter detrimental to bond.
- .2 Prepare all substrates: concrete, metal and glass, as recommended by sealant manufacturer.
- .3 Clean and prime all contact surfaces as recommended by sealant manufacturer and as follows:
 - .1 Use recommended joint cleaners and primers.
 - .2 Avoid excess application and mask adjacent surfaces as required for protection.
 - .3 Apply cleaners and primers with clean, soft, absorbent lint-free cloth; do not use brush.
 - .4 Use each piece of cloth only once for any application or wiping.
 - .5 Pour from container onto cloth; do not dip cloth into container.
 - .6 Dry wipe cleaners immediately with clean dry cloth to remove solvent before it evaporates and dries on substrate.
 - .7 Apply primers in a thin film in one pass and remove excess with clean dry cloth.
- .4 Protect all cleaned or primed surfaces from contamination. Re-clean and re-prime any contaminated surfaces.
- .5 Do not carry out final cleaning of surfaces where sealant cannot be installed within two hours. For primed surfaces, allow recommended curing time before installing sealant.

3.4 Common Procedures for All Applications

- .1 Unless otherwise specified, use joint fillers to ensure joint proportions are as follows:
 - .1 Minimum joint width, 6 mm;
 - .2 For joint widths 6 to 13 mm, sealant depth equal to 6 mm;
 - .3 For joint widths 13 to 25 mm, sealant depth equal to one half joint width to a maximum of 12 mm;
 - .4 Maximum joint width, 19 mm.
 - .5 Advise Consultant in all cases where joint proportions cannot be achieved.

- .2 Apply bond breakers as recommended by sealant manufacturer and where required to ensure joints do not bond to surfaces on three sides.
 - .3 Apply sealants to manufacturer's instructions and as follows:
 - .1 Do not exceed shelf life, pot life or work life.
 - .2 Employ gun-grade or knife-grade consistency to suit the joint condition.
 - .3 Use pressure operated guns, sizing gun nozzles to suit the width of each joint.
 - .4 Be prepared to fill the cavities completely.
 - .5 Where necessary, mask adjacent surfaces.
 - .6 Use sufficient pressure to fill voids and joints solid and to bond to all sides of joint.
 - .7 Ensure that sealant forms a watertight seal.
 - .4 Sealant profiles to be as indicated and as follows:
 - .1 All weatherseal joints between new insulating glass units to be 19 mm.
 - .2 Form surface of sealant with full bead, smooth, and free from ridges, wrinkles, sags, air pockets and embedded impurities.
 - .3 Neatly tool surface, achieving a slightly concave joint unless otherwise specified.
 - .4 Follow manufacturer's instructions for tooling procedures.
 - .5 As work progress, clean as follows:
 - .1 Clean adjacent surfaces immediately and leave work neat and clean.
 - .2 Remove excess sealant and droppings using recommended cleaners.
 - .3 Remove masking after tooling of joints and before sealants begin to cure.
- 3.5 Application of Sealant for Sealing Purlin Spigots**
-
- .1 After all original tape and/or sealant and residue has been removed from notches in rafters, apply Type 1 sealant as continuous bead around cleaned notch in rafter.
 - .2 Set purlin firmly into continuous bed of sealant in notch. Tool sealant neatly around purlin spigot, and remove excess sealant. Ensure that drainage cavity in rafter is unobstructed by sealant.

3.6 Application of Sealant at Sill Rail Butt-Joints

1. After sill rail framing member members have been notched in accordance with Section 086300, apply Type 1 sealant as a 'plug' at the notched butt-joint and at notched end (see Photos 079200-1 for example).
2. Ensure that glazing drainage cavities are unobstructed by sealant 'plug' and new sealant is tooled and sloped to promote drainage.
3. Sealant must achieve a permanent air and water tight seal at joinery of mullion and rail members.

3.7 Application of Sealant at Horizontal Joint at Intermediate Rails

1. Examine joint sizes and install joint filler to achieve correct joint proportions and sealant depth. Apply Type 1 sealant to fill joint. Neatly tool sealant to achieve slightly concave profile.
2. Sealant must achieve a continuous air and water tight seal.

3.8 Application of Sealant for New Glazing Seat Extrusions

1. Apply Type 1 sealant to original glazing plane on framing members immediately before installation of new glazing seat extrusions. Ensure all raceways in framing members are solidly filled with silicone, and that depth of applied sealant is at least 25% greater than depth of adjacent shimmed glazing tape.
2. Sealant must achieve solidly filled joint between framing and underside of new glazing seat extrusion, creating continuous air and water seal.
3. Apply Type 1 sealant across end of glazing surface of installed extrusions. Butt glazing surface of intersecting extrusions tightly into sealant and tool flush to seal joinery seam between adjacent glazing surfaces.
4. Apply Type 1 sealant across mitred seam between intersecting new extrusions at base of inverted triangular openings in sloped glazing. Sealant must achieve continuous water seal for entire mitre joint.
5. Immediately following installation of new glazing seat extrusion at 'uphill' side of each purlin (and before any extrusions are added to the rafters), apply Type 1 sealant around inner surface at both ends of extrusion to achieve watertight seal between extrusion and side of abutting rafter member.

**3.9 Application of
Structural Silicone
Beads**

- .1 Insulating glass units and related accessories are to be installed in accordance with Section 088050.
- .2 Install foam tape aligned with edge of new glazing seat extrusions as indicated on the drawings. The tape must be placed to allow for a silicone bead that measures at least 8 mm x 16 mm. Misaligned foam tape that prevents the required minimum silicone bead dimension will be rejected and will result in the requirement to remove the insulating glass unit and recommence the work of this paragraph.
- .3 Apply Type 2 sealant to the new glazing seat extrusions/glass unit joint, with all joints filled using techniques recommended by sealant manufacturer to achieve full adhesion of the glass units to the glazing seats. The minimum acceptable dimension of the structural silicone bead is 8mm x 16mm, solidly filled. Ensure that application technique achieves solid fill – no voids in the structural tensile bead are acceptable. The presence of any voids in this bead will result in rejection of the work and the requirement to remove the insulating glass unit to recommence the work of this paragraph.
- .4 Where structural silicone beads are situated along the outer edge the glazing units, allow the beads to cure for the full time recommended by sealant manufacturer before any weatherseal is applied.
- .5 Where structural silicone beads are applied from the interior, tool sealant to achieve smooth concave profile.

**3.10 Application of
Sealant at Closure
Connections**

- .1 Immediately before attachment of sheet metal closures to aluminum framing, install shimmed glazing tape and Type 1 sealant to full extent of closure contact area. Ensure depth of sealant is sufficient to achieve solid fill. After attachment of closure, tool edge of sealant to achieve continuous air and watertight seal between closure and framing.
- .2 Where closure from roof to sloped glazing passes across a rafter frame member, pay particular attention to achieving a solid sealant seal (plug) between underside of closure and top of rafter frame.

**3.11 Application of
Weatherseals
between Insulating
Glass Units**

- .1 Weatherseals may not be applied until end of full cure time for structural silicone (Type 2) beads as recommended by sealant manufacturer.
- .2 Weatherseals are to be installed with pressure plates removed, in order for sealant bead to continue beyond edges of pressure plates.
- .3 Form and install a joint filler at each weatherseal joint using the polyethylene sheet as follows and as depicted on drawing details:
 - .1 Cut sheet material into a strip and fold the strip to be "U" shaped in cross section.
 - .2 Insert "U" shaped strip into the joint so that the edges of the strip contact the back of the glazing cavity and the rounded surface faces outboard, thereby forming a glazing cavity under the strip for drainage.
 - .3 Size width of strip so that depth and profile of sealant joint placed over the rounded surface conforms to sealant manufacturer's recommendations.
 - .4 Size length of strip to suit insulating glass unit and to allow drainage of water from the cavity into the adjacent horizontal glazing cavities.
- .4 Apply Type 1 sealant over the joint filler to fill remainder of cavity. Do not obstruct the glazing cavities or restrict the drainage of water.
- .5 Neatly tool surface to a slightly concave joint to form a watertight seal.

**3.12 Application to
Pressure Plate
Joints**

- .1 Pressure plates and related accessories are to be installed in accordance with Section 08 80 50.
- .2 Apply Type 1 sealant over all joints between adjacent lengths of pressure plate.
- .3 Neatly tool surface of bead to a smooth surface forming a watertight seal between adjacent plates.

**3.13 Application of Cap
Beads**

- .1 Snap caps, flashings, trims, closures wedge-in gaskets are to be installed in accordance with Section 088050.
- .2 Mask glass surface to ensure straight and even sealant bead.

- .3 Apply Type 1 sealant cap bead in the following locations:
 - .1 On sloped glazing, along horizontal edges at the tops of all caps, but not at the bottoms of the caps.
 - .2 On sloped glazing along vertical edges of jamb caps.
 - .3 Over all joints in the snap caps, face trim, flashings and closures.
 - .4 Neatly tool surface of cap bead to a slightly concave joint to form a watertight seal.
- 3.14 Application of Weatherseals between Metal Flashing and Concrete**
-
- .1 After new bent sheet metal flashings have been installed against the glass in accordance with Section 088050, install new sealant bead between new flashing and concrete substrate as indicated in the drawing details, and as follows:
 - .1 Examine joint sizes and install joint filler to achieve correct joint proportions and sealant depth.
 - .2 Apply bead of Type 1 sealant to all construction joints at perimeter of glazing assemblies.
 - .3 Neatly tool surface of bead to a slightly concave joint.
- 3.15 Application of Sealant over Thermal Break at Intermediate Horizontal Rails**
-
- .1 Apply type 1 sealant in a 'smear' to fully cover the thermal break at all intermediate rails on the wall glazing system, as indicated in the drawing details.
 - .2 Neatly tool surface of sealant to achieve a smooth, flat bead. Ensure that sealant does not obstruct drainage.

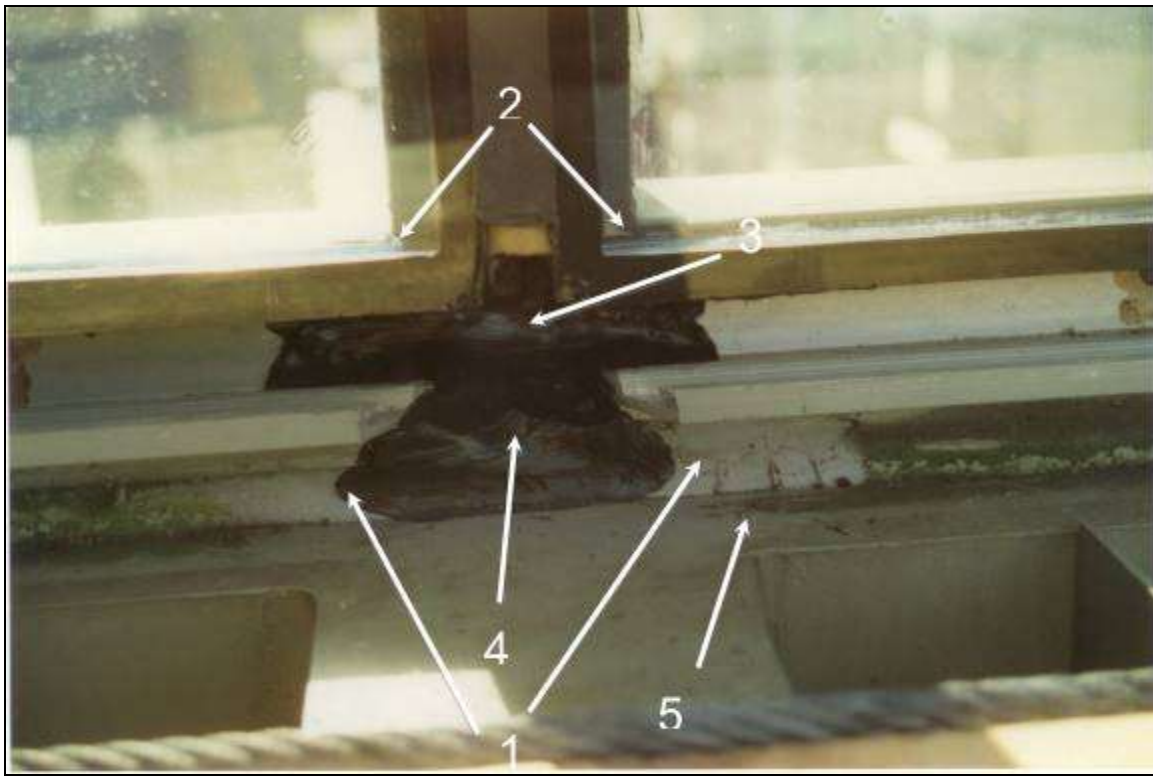


Photo 079200-1

Example of sealant to be applied at notched butt-joint at sill rail framing members on wall glazing system

Legend:

1. Notched sill rail framing members
2. Glass
3. Drainage cavity
4. New sealant 'plug'
5. Horizontal sealant bead

END OF SECTION

PART 1 - GENERAL

- 1.1 Related Work**
- .1 Sealants Section 07 92 00
 - .2 Skylight Repairs Section 08 63 01
 - .3 Glass and Glazing Accessories Section 08 80 50
- 1.2 Work Included**
- .1 Provide labour, materials, products, equipment and services to carry out the retrofit work specified herein.
 - .2 The work of this section shall include, but not be limited to, the following:
 - .1 Removal and safe disposal of all snap caps, pressure plates with associated gaskets and screws, flashings, trims and closures.
 - .2 Removal and safe disposal of all glass and associated glazing tapes/gaskets and sealants.
 - .3 Temporary removal and reinstallation of all diagonal and horizontal purlins in sloped glazing.
 - .4 Modification of wall sill framing members at butt-joints between adjacent lengths of sill rail at vertical glazing.
 - .5 Modification of existing glazing system at concrete substrates.
 - .6 Design, fabrication, supply and installation of new glazing seat extrusions for every glass unit opening.
 - .7 Fabrication and supply of new flashings, trims and closures.
 - .8 Supply and installation of new insulating glass units and associated accessories.
 - .9 Installation of new flashings, trims and closures.
 - .10 Installation of new weatherseals.
 - .11 Supply and installation of new hook-stops at all intermediate horizontal rails in wall framing.
 - .12 Installation of new pressure plates and snap caps.
- 1.3 Reference Documents**
- .1 ASTM B209-14 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - .2 ASTM B221-14 Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

- .3 CAN/CSA-S157-05/S157.1-05 (R2015) Strength Design in Aluminum

1.4 Design Criteria

- .1 Comply with the design and performance requirements of applicable Building Code and as specified, and design and engineer the work accordingly.
- .2 The intent of the retrofit work is to replace all insulating glass units in the sloped and vertical glazing with new insulating glass units while rendering the completed project near visually identical to the existing assemblies. This intent is to be reflected in all supply and installation practices.

1.5 Submittals

- .1 Submit shop drawings to indicate the exact profiles, layout and fastening requirements for the set of new glazing seat extrusions required.
- .2 Each shop drawing must bear the stamp and signature of a Professional Engineer with a valid license in the Province of Ontario.

1.6 Extended Warranty

- .1 Warrant all work of this Section against defects in materials and workmanship for a period of 60 months. Warrant that work will be water and weather tight, structurally sound and free from distortion and deformation under load, that materials and finishes will not crack, peel or otherwise deteriorate or corrode. The warranty coverage on water and weathertightness specifically means that the work of this Section will not permit air or water leakage, as determined at the sole discretion of the Consultant.
- .2 Warranty shall include the prompt remedy of defects upon written notification from the Owner that defects exist. Remedy shall include labour, materials, equipment and services required to make good defective areas of the work, and in the case of factory-fabricated components, to supply and install new components, all at no cost to the Owner and at times convenient to the Owner. Warranties shall also include making good other building parts and finishes and other Owner's property damaged or disturbed in the course of remedying defects.
- .3 Warranty to be in a form acceptable to both the Owner and the Consultant.

1.7 Mock-Ups

- .1 A mock-up, which consists of replacing all IG units and associated work within a glazing face, is to be completed at one (1) of each of the following typical glazing faces, as individually selected by the Consultant:
 - .1 Triangular face of the sloped glazing;
 - .2 rectangular face of the sloped glazing;
 - .3 rectangular face of the vertical skylight glazing;
 - .4 diagonal face of the wall glazing system.
- .2 Provide a minimum 48 hr notice of commencement of the mock-up work so that the Consultant may attend during the mock-up work.
- .3 Water testing to demonstrate performance must be completed on each mock-up face before any work can commence on the any of the remaining faces of the same type.

1.8 Demonstration Testing

- .1 The Consultant will undertake testing to assess the performance of the work. As depressurization of the work areas will not be possible, the testing will be undertaken under the following conditions:
 - .1 All new structural silicone beads must be completed and fully cured.
 - .2 No exterior pressure plates are to be installed
 - .3 No exterior snap caps are to be installed
 - .4 No exterior weatherseal sealant joints are to be installed.
- .2 The Contractor must assign at least one (1) glazier to act as the Contractor's dedicated testing supervisor throughout the duration of the testing phase of the project. The testing supervisor is to be present to assist with every test, and is to coordinate testing on behalf of the Contractor.
- .3 The Contractor must allocate at least one (1) additional worker to assist the Consultant with each and every test.
- .4 The water application will be maintained over the face of the test area for fifteen (15) minutes, throughout which time there shall be no leakage to the interior.
- .5 Tests will be repeated, as necessary, until all areas of the walls and skylight have been tested and demonstrated acceptable performance. Between iterations of testing, the Contractor is responsible to

investigate and repair all leakage identified in the previous testing.

- .6 The testing will be conducted by the Consultant but will disrupt use of the work area for one (1) day for each face of the sloped glazing and one (1) day for each face of the vertical walls, provided the performance is found to be acceptable in the first test. If the first tests indicate unacceptable performance, further disruption will be caused by the need for iterations of retesting until acceptable performance is demonstrated.

PART 2 – PRODUCTS

2.1 Materials

- .1 Extruded aluminum: ASTM B221, 6063 T54, T5 or T6 aluminum alloy and temper, minimum thickness 4 mm.
- .2 Aluminum sheet and plate: ASTM B209, suitable for purpose and finish required.
- .3 Pressure plates: Profile to match existing. Allow for increased length of new pressure plates to accommodate outward shift of glazing.
- .4 Snap caps: Profile and colour to match existing. Allow for increased length of new snap caps to accommodate outward shift of glazing.
- .5 Aluminum flashings: 2.5 mm sheet aluminum. Profiles and colour to match existing.
- .6 Stainless steel: ASTM A167, Type 304
- .7 Bolts, screws, nuts, washers and other fasteners: 410 or 300 Series **Stainless steel** of austenitic grade for all connections.
 - .1 Fasteners for new glazing seat extrusions to existing framing: self-drilling, self-tapping – size and length as per approved shop drawings.
 - .2 New pressure plate fasteners to be ¼-20, pan-shaped, Robertson head in length to suit outward shift in glass plane resulting from combination of final design of new glazing seat extrusions, silicone seal of glazing seat extrusions to original framing, new insulating glass (IG) units and structural silicone tensile bead for glazing of new IG units.

- .8 Sheet metal closures: ASTM A653/A653M, minimum 1 mm sheet steel, galvanized, minimum coating weight 380 g/m².
- .9 Self-adhesive membrane: Fully adhered and cold-applied, rubberized asphalt, integrally bonded to polyethylene, 1.0 mm thick and having an application range consistent with temperature during installation.
- .10 Primers, liquid membrane and mastic for use with self-adhesive membrane as recommended by membrane manufacturer.
- .11 Rigid insulation: Extruded polystyrene with thermal resistance value of not less than RSI=0.88 per 25 mm thickness, a water absorption capacity of no greater than 0.7% and a compressive strength not less than 275 kPa. Thickness to suit application.
- .12 Glazing tapes: Adhesive, butyl preformed tape with a continuous integral EPDM shim rod, thickness 2.3 mm or 3.8 mm as indicated.
- .13 Infill rubber blocking: Custom cut from 80 Durometer A hardness silicone rubber, length to match length of framing member receiving blocking, profiled to suit existing extrusion dimension as indicated in drawing details.

2.2 Fabrication

- .1 Fabricate new glazing seat extrusions in accordance with approved shop drawings and approved samples.
- .2 Fastening holes in new glazing seat extrusions are to be drilled and countersunk.
- .3 Fabricate new glazing hook-stops for installation at the intermediate horizontal rails of vertical wall glazing. New hook-stops are to have a longer hook leg to accommodate outward shift in the plane of the glass. Once installed, new hook-stops are to be visually identical to existing hook-stops.
- .4 Fabricate new flashings, trims and closures to accommodate outward shift in the plane of the glass, while maintaining profile and finish of original components.
- .5 Fabricate new bent aluminum flashings to be installed against exterior face of glass at wall glazing systems anchored to concrete substrates. Use rigid insulation to achieve required profile, as indicated in drawing details.

- .6 As far as practical, execute cutting, fitting and assembly in the shop with the various parts ready for installation on site.
- .7 Take field measurements and levels required for the proper layout and installation of the work. Coordinate and confirm dimensional tolerances in framing prior to commencement of the work.

2.3 Finishes

- .1 All new glazing seat extrusions, new stops, flashings, trims, facings, closures, snap caps, etc. are to be finished with a factory applied, two-coat, thermosetting fluoropolymer, in accordance with AAMA 605. The finish colour of the glazing seat extrusions must match the Duranar finish of the original framing members. The finish colour of new flashings, trims and closure must match that of the component being replaced. As per the existing shop drawings, the colour for the curtain wall framing is Duranar BK-20157/primer K30354.
- .2 The heads of all exposed fasteners must be pre-finished with primer and two (2) finish coats of exterior grade paint to match colour of material being fastened. Exposed fastener heads must also be touched up following installation to address any damage to the prefinish.

PART 3 – EXECUTION

3.1 Examination

- .1 Undertake a detailed site survey to identify the type and quantity of new glazing seat extrusions required and to verify all dimensions.
- .2 The combination of new glazing seat extrusions, structural silicone beads and new glass units will result in an outward shift in the plane of the glass. Undertake a detailed site survey to identify the requirement for new flashings, trims, closures, pressure plates, snap caps, etc. to accommodate this shift.
- .3 Report immediately in writing to the Consultant all discrepancies which will adversely affect the work of this Section. Report surfaces unacceptable to the Consultant before commencing work.
- .4 Examine the original shop drawings provided to understand the components of the original installation that must be cut and/or removed to

permit the work indicated in these contract documents.

**3.2 Design of New
Glazing Seat
Extrusions**

- .1 The drawings illustrate the concept developed for the new glazing seat extrusion design at each typical detail. Design and manufacture a set of new glazing seat extrusions generally conforming to the concept profiles indicated and meeting the following minimum requirements:
 - .1 All extrusions must provide a minimum 24 mm wide surface to receive structural silicone bead and associated spacer tape, but to also suit the constraint of a maximum 19 mm wide weatherseal sealant joint between edges of new glazing units.
 - .2 The glazing surface provided by the new extrusions must be continuous around each opening. At the corner of each opening, the glazing surface of one of the extrusions shall extend over intersecting framing to achieve this continuity with the glazing surface of the intersecting extrusion.
 - .3 In the sloped glazing system, the extrusions must incorporate condensation gutters to replace those abandoned in the original framing. The gutter at the 'uphill' side of each purlin must have a base parallel to the glazing plane of 50 mm to retain condensate. The minimum overall width of gutters on rafters is 25 mm. The minimum height of the gutter walls is 13 mm. The gutters along the rafters must lap over and drain into the gutter at the 'uphill' side of each purlin.
 - .4 In the sloped glazing system, the extrusions along the sides of inverted, triangular framing openings must incorporate condensation gutters with a base parallel to the glazing plane of 50 mm to retain condensate. At the bottom of these members, the new extrusions are to be mitered with a tight fit and sealed.
 - .5 The extrusions must not encroach into the original daylight opening by more than 50 mm.
 - .6 The extrusion profiles shall be appropriately coped to meet the layout requirements described in this paragraph.
 - .7 The extrusions must be sized to permit the specified glazing tape and sealant joint installation between the original framing and the

extrusion, with the sealant joint accessible from within the glazing cavity for the skylight, and accessible from the interior for the walls.

- .8 The extrusions must sit squarely on the original framing and not twist when fastened to the framing.
- .9 The extrusions must be a minimum of 4 mm thick and must be designed to carry a load acting along the structural silicone bead resulting from a 90 kPa loading on the sloped glazing and 30 kPa on the vertical glazing.
- .10 The extrusions must be designed so that the fasteners are installed without any interference or penetration of the glazing cavity on the top of the framing member.
- .11 For the vertical glazing, the new glazing seat extrusions are to be sized so that the visible width is consistent around the perimeter of all glazing units.

3.3 Preparation

- .1 Remove all snap caps, pressure plates, glazing stops and sealants, as well as any necessary trims, flashings and closures. Safely discard all components that will be replaced.
- .2 Cut away and/or remove system components, or portions of system components shown in the original shop drawings as required to permit the work required to achieve the retrofit details indicated. This includes cutting and removing part of the original glazing framing, as indicated in the drawing details.
- .3 Remove sealants in accordance with Section 07 92 00.
- .4 Remove glass in accordance with Section 08 80 50. Only remove glass if the replacement unit can be installed before the end of the same work period, or if an alternate temporary closure is available to close the openings at the end of the work period.
- .5 Ensure that all surfaces to receive sealants are dry, firm, sound, smooth, suitable for bond, and free from loose material, projections, ice, frost, grease, oil or other matter detrimental to bond.
- .6 Fabricate new flashings, trims and closures necessary to accommodate the outward shift in the plane of the glass resulting from the combination of

new glazing seat extrusions, structural silicone beads and new glass units.

- .7 In order to maintain interior environmental conditions the following limitations shall apply to this work
 - .1 When the temperature is between 8°C and 18°C no more than six (6) glazing units may be removed and the openings left open in the Colonnade and Main Entry Pavilion respectively (total of 12 units) at any given time.
 - .2 When the temperature is below 8°C or above 18°C, no more than three (3) glazing units may be removed and the openings left open in the Colonnade and Main Entry Pavilion respectively (total of 6 units) at any given time.
 - .3 At the Colonnade, the limit on the number of glazing units that can be removed at any given time shall include the vertical glazing as well as the glazing in SL11 and SL12.
 - .4 The Owner may reduce the number of glazing units that can be removed during periods of extreme hot or cold weather.
 - .5 The Contractor may remove additional glazing units provided that temporary closures are installed to allow glazing replacement to proceed expeditiously without affecting the operation of the building HVAC systems.

3.4 Installation

- .1 Install all work true and in proper alignment and relationship to established lines.
- .2 Following removal of original glass from sloped glazing system, temporarily remove purlins, clean receiving notches in rafters, apply sealant as per Section 079200 and reinstall purlins, ensuring watertightness at all rafter/purlin intersections.
- .3 Install new glazing seat extrusions using fasteners in accordance with approved shop drawings and applicable sealant requirements of Section 07 92 00. Ensure layout of extrusions in sloped glazing system provides new condensation collection system for each individual framing opening. New glazing seat extrusions MUST be applied over shimmed glazing tape and full bead of silicone to achieve continuous seal to existing framing. As indicated in the drawing details, custom cut and install strips of continuous rubber blocking to infill abandoned condensation troughs of existing framing in sloped glazing so as to

provide extended surface to receive shimmed glazing tape and silicone bead.

- .4 Install new glazing units in accordance with Section 08 80 50 and applicable requirements of Section 07 92 00.
- .5 At glazing framing anchored to concrete substrates:
 - .1 Install metal closure between existing framing and concrete as indicated on drawings. Metal closures shall be installed in one piece and sealed at the top and bottom to provide continuity of the air/vapour barrier.
 - .2 Install new custom bent aluminum flashings onto surface of new glass with two (2) rows of continuous glazing tape, as indicated in drawings details. Install weatherseal sealant beads between new metal flashings and concrete substrates in accordance with Section 079200.
- .6 Only **after** new weatherseal joints have been installed, install new pressure plates, flashings, trims and closures, using new fasteners.
- .7 Supply new flashings, trims and closures necessary to accommodate the outward shift in the plane of the glass resulting from the combination of new glazing seat extrusions, structural silicone beads and new glass units.
- .8 Custom cut rigid insulation into strips for compression blocking beneath pressure plates, etc. as indicated on drawing details. Where there is a requirement to allow drainage through the blocking (e.g. at bottom edge of sill purlin in sloped glazing), cut 19mm high triangular notches in bottom edge of blocking.
- .9 Supply and install preformed glazing tape with integral spacer rod on new pressure plates. Immediately notify Consultant if the integral rod is not a sufficient diameter to avoid entry into raceway of pressure plate.
- .10 Install new snap caps to pressure plates. Adjust and align caps as required. For caps located directly above spandrel or flashing panels, ensure a clear gap of at least 10 mm between underside of the cap and the top surface of the panel/flashing to permit free drainage from the snap cap.

**3.5 Notching of Framing
and New Hook-stops
at Intermediate
Horizontal Rails**

.11 At eave of all but the upper roof, install new lead-coated copper counter flashing fin onto pressure plate using preformed glazing tape, as indicated in the drawing details. Install preformed glazing tape with gaps for drainage between underside of counter flashing fin and new internal galvanized roof edge flashing.

.12 Install cap beads in accordance with Section 07 92 00.

.1 Remove existing glazing hook-stops that retain the top and bottom horizontal edges of the glass at the intermediate rails on the wall glazing system. Safely discard.

.2 After sealant has been removed in accordance with Section 07 92 00 at the butt-joints between adjacent lengths of sill rail framing members (see Figure 86300-1 for typical location), carefully cut a notch on a 45 degree angle at the end of each length of sill rail (see Photo 086300-1 for example). The notch is to span full width of framing member, including the thermal break.

.3 Install sealant 'plugs' at butt-joints and ends of sill rail members in accordance with Section 07 92 00.

.4 Cut rectangular notches in hook leg of each new glazing hook-stop, corresponding to length and location of new setting blocks and support chairs, to allow installation of new hook-stops.

.5 Cut both ends of hook leg of each new hook-stop on a 45 degree angle, to ensure that hook leg will not interfere with new sealant applied as 'plug' at butt joints and ends of sill rail members.

.6 After new structural silicone at IG units has cured, install new hook-stops and provide new wedge gasket in accordance with Section 08 80 50.

**3.6 Repairs at Base of
Wall (Colonnade)**

.1 At the base of the vertical glazing at the Colonnade, remove the precast concrete sill and safely store for re-use.

.2 Remove the support angle for the precast sill and safely store for re-use.

.3 Remove and dispose of existing insulation between base of vertical glazing and concrete curb below.

- .4 Cut away and dispose of "bird's mouth" at outside edge of existing metal closure.
- .5 Install wedge of rigid insulation between concrete curb and existing metal closure.
- .6 Install new metal closure as indicated on drawings and fasten in place.
- .7 Install new self-adhesive membrane lapping minimum 50 mm onto adjacent existing construction.
- .8 Install new rigid insulation to fill space beneath vertical glazing. Ensure that insulation is in full contact with all substrates.
- .9 Re-install support angle.
- .10 Re-install precast sill.
- .11 Install sealants as per Section 07 92 00.

3.7 Field Quality Assurance

- .1 The Consultant will carry out review of work of this section. This review is a service to the Owner and does not replace any of the Contractors own quality control.
- .2 The Contractor will provide ready and clear access to the work to assist with the field quality assurance programme.

3.8 Adjusting

- .1 At completion of the Work and just prior to handing over to the Owner, or at a time as directed, inspect and adjust installations.
- .2 Inspect all glass units for damage and correct same immediately.

3.9 Cleaning

- .1 Keep installed work clean as work progresses.
- .2 Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Replace finishes or materials that cannot be satisfactorily touched up, cleaned or which have been damaged by improper cleaning materials and techniques.
- .3 Wash exposed metal surfaces with a cleaning solution approved by manufacturers of glass and aluminum.
- .4 At completion of the work, remove protective coatings, labels, surplus compounds and sealant materials.

- .5 After completion of entire retrofit, undertake final cleaning of exterior of all glass and aluminum. Interior of all glass is to be cleaned immediately prior to installation.
- .6 At completion, remove all debris, equipment and excess material resulting from the work of this Section from the site.

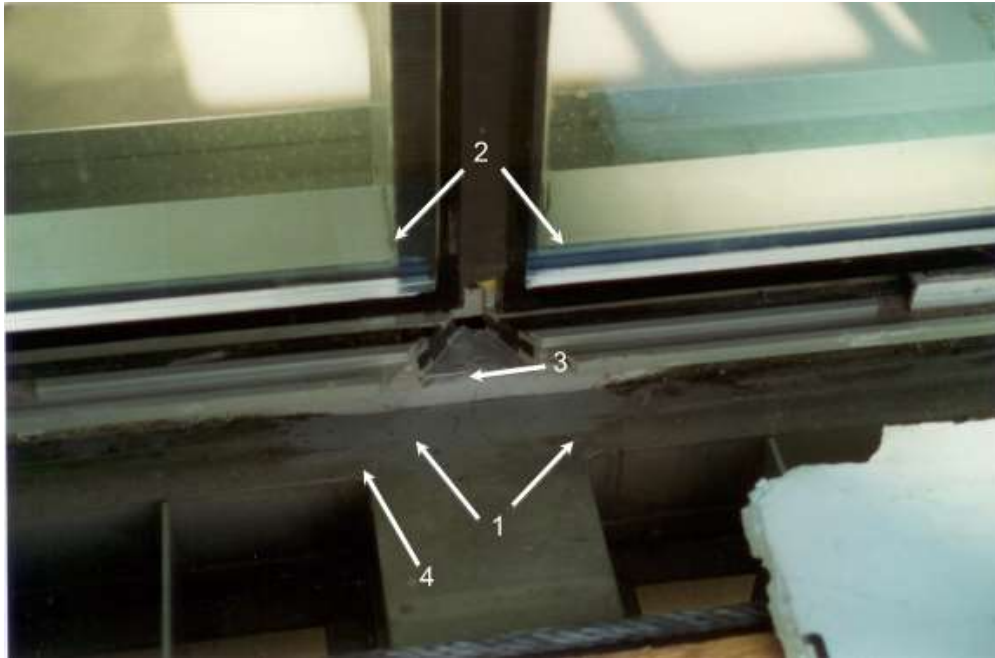


Photo 086300-1
Example of notch to be cut at butt-joints and ends of sill rail framing members
on wall glazing system

Legend:

- 1. Notched sill rail framing members
- 2. Glass
- 3. Drainage cavity
- 4. Horizontal sealant bead

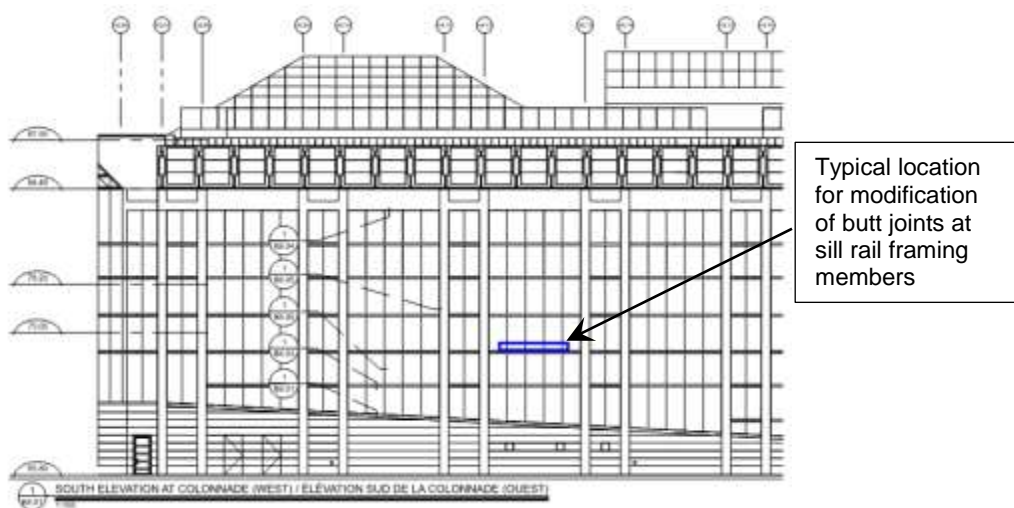


Figure 86300-1

END OF SECTION

PART 1 - GENERAL

- | | |
|--------------------------------|--|
| 1.1 Related Work | <hr/> <ul style="list-style-type: none">.1 Sealants Section 07 90 00.2 Glazing system Retrofit Section 08 63 00.3 Glass and Glazing Accessories Section 08 80 00 |
| 1.2 Work Included | <hr/> <ul style="list-style-type: none">.1 Provide labour, materials, products, equipment and services to carry out the skylight remedial work specified herein..2 The work of this section shall include, but not be limited to, the following:<ul style="list-style-type: none">.1 Removal and disposal of all snap caps, pressure plates with associated gaskets and screws (see also Section 08 63 00),.2 Removal and safe retention of all flashings, trims and closures..3 Reconstruction of waterproofing and drainage at the base of the structural ribs in SL11 including fabrication of custom backpan, application of new self-adhesive membrane and installation of new insulation..4 Re-installation of flashings, trims, closures,.5 Installation of new pressure plates and snap caps. |
| 1.3 Reference Documents | <hr/> <ul style="list-style-type: none">.1 ASTM A653 / A653M - 15e1: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process..2 ASTM E2178: Standard Test Method for Air Permeance of Building Materials..3 CGSB 37-GP-56M: Membrane, Modified, Bituminous, Prefabricated, and Reinforced. |
| 1.4 Design Criteria | <hr/> <ul style="list-style-type: none">.1 Comply with the design and performance requirements of applicable Building Code and as specified, and design and engineer the work accordingly..2 The intent of the work of this section is to install a continuous air/vapour barrier at the base of the structural ribs for skylight SL-11. |

1.5 Submittals

- .1 Submit shop drawings indicate the exact profiles, layout and fastening requirements for the new custom fabricated backpan.
- .2 Each series of shop drawings must bear the stamp and signature of a Professional Engineer with a valid license in Province of Ontario.

1.6 Extended Warranty

- .1 Warrant all work of this Section against defects in materials and workmanship for a period of 60 months. Warrant that work will be water and weather tight, structurally sound and free from distortion and deformation under load, that materials and finishes will not crack, peel or otherwise deteriorate or corrode. The warranty coverage on water and weathertightness specifically means that the remediation measures of this Section will not permit air or water leakage, as determined at the sole discretion of the Consultant.
- .2 Warranty shall include the prompt remedy of defects upon written notification from the Owner that defects exist. Remedy shall include labour, materials, equipment and services required to make good defective areas of the work, and in the case of factory-fabricated components, to supply and install new components, all at no cost to the Owner and at times convenient to the Owner. Warranties shall also include making good other building parts and finishes and other Owner's property damaged or disturbed in the course of remedying defects.
- .3 Warranty to be in a form acceptable to both the Owner and the Consultant.

1.7 Mock-Ups

- .1 Construct a mock-up for the installation of one new backpan complete with new air/vapour barrier membrane at a location selected in conjunction with the Consultant.
- .2 Provide a minimum 24 hr notice of commencement of the mock-up work so that the Consultant may review the mock-up.

PART 2 – PRODUCTS

2.1 Materials

- .1 Sheet metal: ASTM A653/A653M, minimum 1 mm sheet steel, galvanized, minimum coating weight 380 g/m².

- .2 Self-adhesive membrane: Fully adhered and cold-applied, rubberized asphalt, integrally bonded to polyethylene, 1.0 mm thick and having an application range consistent with temperature during installation.
- .3 Primers, liquid membrane and mastic for use with self-adhesive membrane, all as recommended by membrane manufacturer.
- .4 Insulation: Fibrous mineral wool semi-rigid board insulation with thermal resistance value of not less than $RSI=0.704$ per 25 mm thickness at a mean temperature of 24°C and a nominal density of 48 kg/m³.
- .5 For sheet metal; #8 cadmium plated self-tapping fasteners. All fasteners, length to suit material thickness and provide adequate anchorage.

2.2 Fabrication

- .1 Take field measurements and levels required for the proper layout and installation of the work. Coordinate and confirm dimensional tolerances in framing prior to commencement of the work.

PART 3 – EXECUTION

3.1 Examination

- .1 Report immediately in writing to the Consultant all discrepancies which will adversely affect the work of this Section. Report surfaces unacceptable to the Consultant before commencing work.

3.2 Preparation

- .1 Ensure that all surfaces are dry, firm, sound, smooth, suitable for bond, and free from loose material, projections, ice, frost, grease, oil or other matter detrimental to bond.

3.3 Installation - General

- .1 Install all work true and in proper alignment and relationship to established lines.

3.4 Reconstruction of Waterproofing and Drainage at Ribs in SL11

- .1 SL11 is a ridge skylight with two (2) gable ends and discrete sloped segments separated by a structural steel 'rib'. On the exterior, the ribs are clad with aluminum covers, purpose formed to match the profile of the underlying steel (see photo 08630-1 for reference). This special work requirement involves the reconstruction of waterproofing and drainage beneath the exterior aluminum sheet cladding at the base of the ribs between glazed portions of the

skylight. The work must be completed at the base of each rib on each side of the skylight. The repair procedure is generally as described below:

- .1 Remove the exterior aluminum cladding from the lower portion of each rib, (see photo 08630-2 for reference).
- .2 Remove and discard all batt insulation installed beneath the removed cladding.
- .3 Completely clean all dirt and residue from the backpan at the sill purlin (see photo 08630-2 for reference).
- .4 Install new insulation to fill the recess in the backpan exposed at the base of the rib.
- .5 install a new sheet metal backpan to fully cover the insulated backpan recess, lapping over the principal plane of the original backpan at the sides of the rib. Cut, fit and form the metal as required to accommodate conflicting framing and anchor connections. Fasten the new backpan to the side of the skylight framing on both sides of the rib. Provide dielectric separation between all dissimilar metals.
- .6 Install a new drainage flashing over the new backpan. The drainage flashing must provide a continuous substrate to support the new waterproofing membrane providing positive drainage from the plane of the new backpan to the sill purlin.
- .7 Drill three (3) new drainage holes through the screw port and bottom leg of the sill purlin framing (see photo 08630-3 for reference).
- .8 Clean and prime all metal surfaces to receive membrane.
- .9 Install new self-adhesive membrane, starting at the sill purlin and continuing up the new backpan until the base of the curved structural steel. The membrane must terminate on the side of the skylight framing on both sides of the rib (see photos 08630-3 and 08630-4 for reference).
- .10 Apply compatible mastic sealant to all edges of the new membrane to ensure a watertight seal at the membrane termination.
- .11 Allow Consultant to review membrane installation prior to installing insulation.
- .12 Install 100 mm thick new semi-rigid insulation over all new membrane, and all exposed

structural steel or back pan not covered by new membrane. Cut and fit insulation to be in full contact with all substrates.

- .13 Reinstall the exterior aluminum cladding.
- .14 Install new pressure plates and snap caps. Provided new spacer blocks as required under pressure plates.

3.5 Field Quality Assurance

- .1 The Consultant will carry out review of work of this section. This review is a service to the Owner and does not replace any of the Contractors own quality control.
- .2 The Contractor will provide ready and clear access to the work to assist with the field quality assurance programme.

3.6 Adjusting

- .1 At completion of the Work and just prior to handing over to the Owner, or at a time as directed, inspect and adjust installations.

3.7 Cleaning

- .1 Keep installed work clean as work progresses.
- .2 Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Replace finishes or materials that cannot be satisfactorily touched up, cleaned or which have been damaged by improper cleaning materials and techniques.
- .3 Wash exposed metal surfaces with a cleaning solution approved by manufacturers of glass and aluminum.
- .4 At completion of the work, remove protective coatings, labels, surplus compounds and sealant materials.
- .5 After completion of entire remediation, undertake final cleaning of exterior of all glass. Interior of all glass is to be cleaned immediately prior to installation.
- .6 At completion, remove all debris, equipment and excess material resulting from the work of this Section from the site.

Note that photos are not SL11 but of a skylight utilizing similar details.



Photo 08630-1

Legend:

1. Gable end
2. Typical sloped glazing segment
3. Typical rib between sloped segments
4. Curved cladding panel

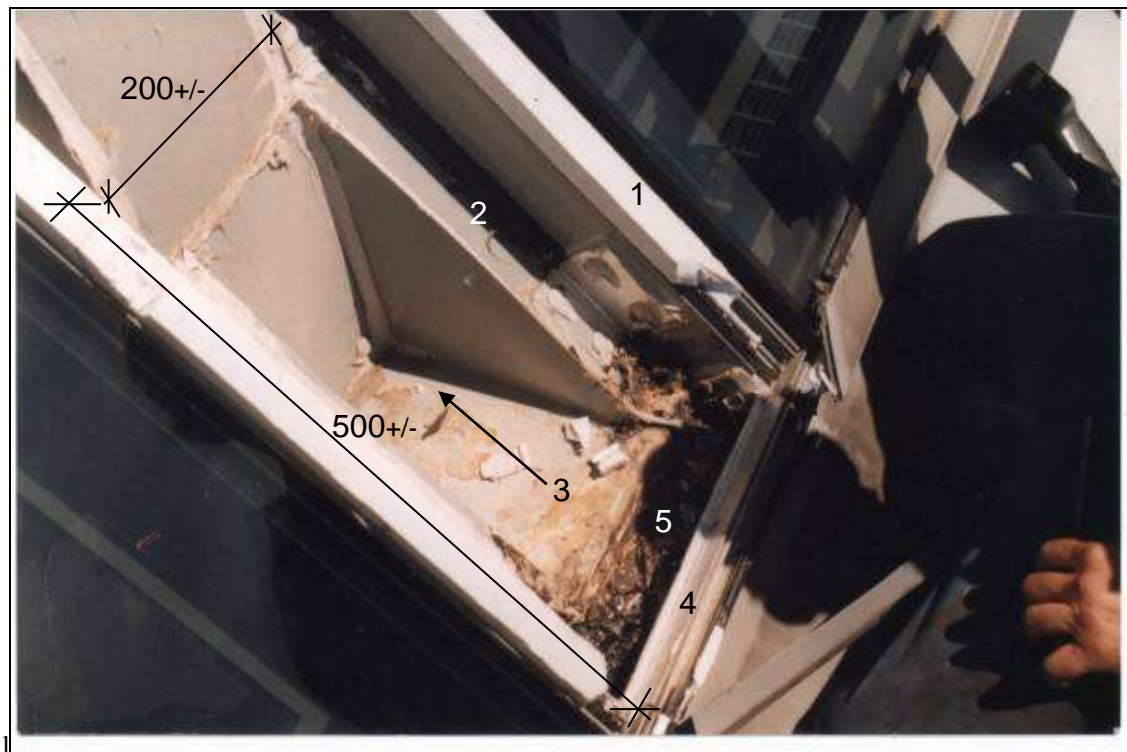


Photo 08630-2

View of typical rib – caps, plates, aluminum cladding and insulation removed to expose construction behind base of cladding

Legend:

1. Foam spacer
2. Principal plane of backpan
3. Recess in backpan
4. Sill purlin
5. Dirt accumulation at sill purlin

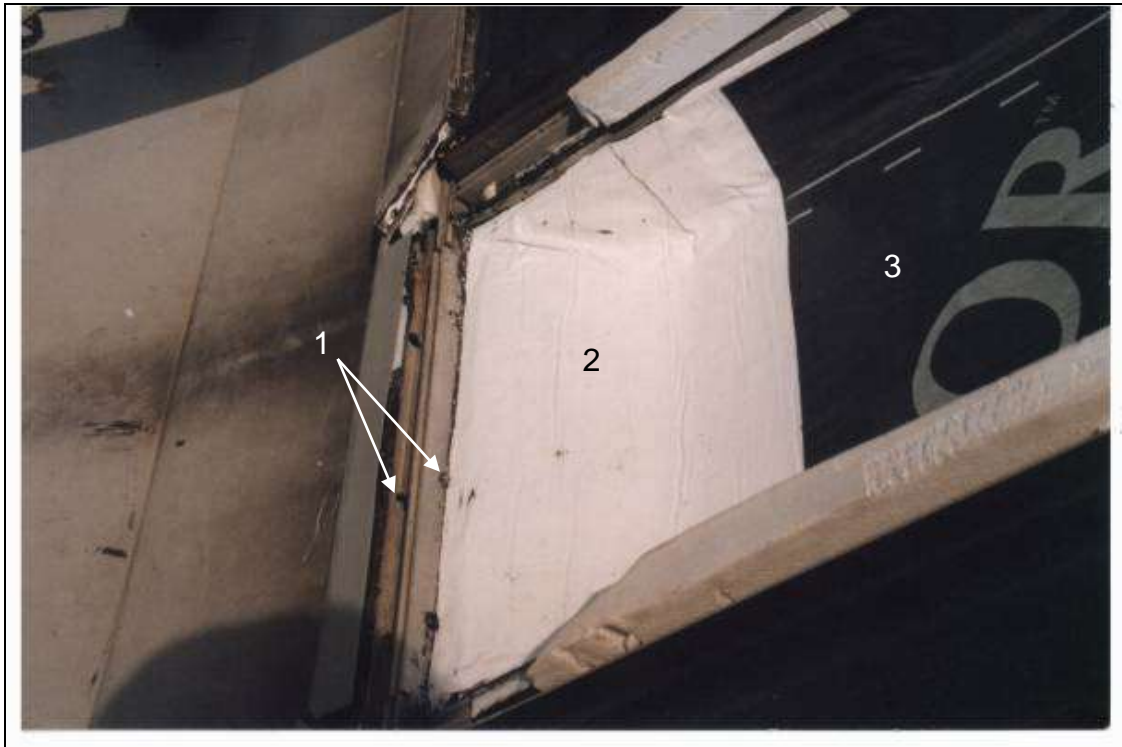


Photo 08630-3
**View of typical rib – new waterproofing applied over
drainage flashing and new backpan**

Legend:

1. New drainage holes drilled through screw port and bottom leg of sill purlin
2. New waterproofing on drainage flashing over new backpan
3. New waterproofing on principal plane of new backpan

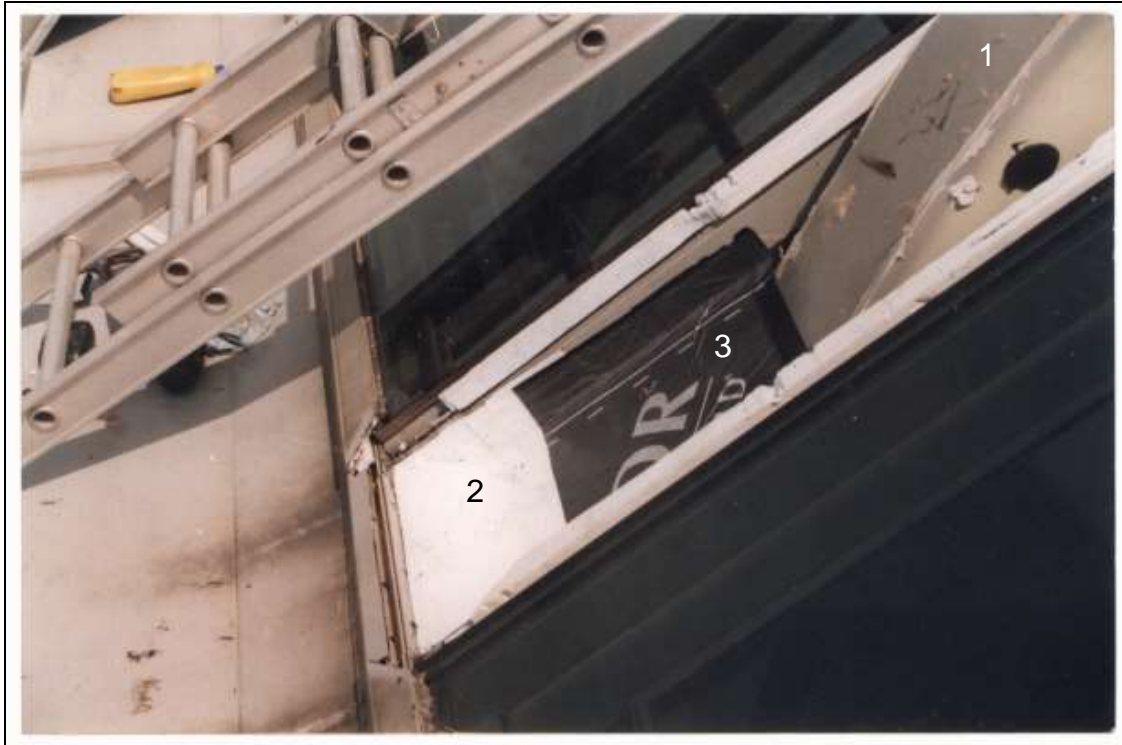


Photo 08630-4
**View of typical rib – new waterproofing extended
to base of curved structural steel.**

Legend:

1. Curved structural steel
2. New waterproofing on drainage flashing over new backpan
3. New waterproofing on principal plane of new backpan

END OF SECTION

PART 1 – GENERAL

- | | | |
|--------------------------|---|----------------|
| 1.1 Related Work | .1 Sealants | Section 079200 |
| | .2 Glazing System Retrofit | Section 086300 |
| 1.2 Work Included | .1 Provide labour, materials, products, equipment and services to design, supply and install glass and glazing accessories specified herein. | |
| | .2 The work of this section shall include, but not be limited to, the following: | |
| | .1 supply of insulating glass units as specified herein. | |
| | .2 supply of glazing accessories including but not limited to, setting blocks, setting block support chairs, side blocks, glazing tape, frame joinery sealants and new gaskets. | |
| 1.3 References | .1 ASTM C509-06 (2015) – Specification for Elastomeric Cellular Preformed Gasket and Sealing Material. | |
| | .2 ASTM C794-15a – Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants. | |
| | .3 ASTM D2240-15 – Test Method for Rubber Property – Durometer. | |
| | .4 ASTM B209M-14 Specification for Aluminium and Aluminium-Alloy Sheet and Plate. | |
| | .5 CAN/CGSB-12.1 M90 - Tempered or Laminated Safety Glass. | |
| | .6 CAN/CGSB-12.3-M91 Flat, Clear Float Glass. | |
| | .7 CAN/CGSB-12.8-97 Insulating Glass Units. | |
| | .8 CAN/CGSB-12.9-M91 Spandrel Glass. | |
| | .9 CAN/CGSB-12.20-M89 Structural Design of Glass for Buildings. | |
| | .10 CAN/CGSB-19.13-M87 Sealing Compound, One-component, Elastomeric, Chemical Curing. | |
| | .11 GANA – Glass Association of North America – Glazing Manual. | |
| | .12 IGMA – Insulating Glass Manufacturers Alliance. | |

1.4 Submittals

- .1 Submit two (2) 300 mm x 300 mm samples of each type of glass unit specified and fully representing the physical properties of the materials supplied.
- .2 Submit product data for all insulating glass units, clearly indicating the products to be supplied and showing all required performance information.
- .3 Submit certification from glass unit supplier that thermal stress analyses have been conducted and the unit designs (heat strengthening) reflect the results of the analysis.
- .4 Submit proof that the glass unit supplier is certified by the IGMA Certification Program for the CGSB 12.8 standard or the IGCC Certification Program for the ASTM E 2190 standard.
- .5 On completion of installation, supply to the Consultant three copies of instructions covering re-glazing, adjustments and other relevant maintenance data.

1.5 Design Criteria

- .1 Maintain the original design features for existing skylight and wall assemblies, unless specifically instructed otherwise herein.
- .2 Provide for structural silicone sealant manufacturer's requirements in accordance with Section 079200.
- .3 Concentrated building heating is provided at the glazing to reduce condensation. Allow for the following effects:
 - .1 temperature at the surface of any heating unit, maximum 70°C.
 - .2 air temperature at 150 mm from the surface of any heating unit, maximum 26°C.

**1.6 Sizing of
Replacement
Insulating Glass
Units**

- .1 Take all field measurements required for proper layout and installation of the work, including templates for special shapes, if required. Examine and confirm out-of-square and out-of-plane tolerances in existing frame components and assemblies. Verify all site measurements before proceeding with fabrication of glazing units.
- .2 Do not rely on approximate dimensions provided in the tender document. Obtain exact dimensions for each replacement unit by measurement on site.

- .3 Before obtaining exact site dimensions, temporarily remove snap caps and pressure plates at edges of a reasonable sample of typical units, to permit unobstructed view of true unit shape.
- .4 Make allowance in unit dimensions for minimum glass bite requirement of 24 mm on new glazing seat extrusions in accordance with Section 086300 and as depicted in drawings.
- .5 Size units so that weatherseal caulking joints between glazing units are 19 mm in width.
- .6 Contractor is to provide all access equipment for obtaining site dimensions and measurements and coordinate access with Owner's representative.

1.7 Labels

- .1 Deliver and store insulating glass units with all manufacturers' labels intact. Ensure all labels are correlated to insulating glass unit types specified.
- .2 Labels are to be left in place until final cleaning.

1.8 Extended Warranty

- .1 Warrant the insulating glass units against defects for a period of 120 months. Warrant that the insulating glass units be free from material obstruction of vision as a result of dust or film formation on the internal glass surfaces by any cause, under normal conditions, other than extrinsic glass breakage, but including breakage due to thermal shock and temperature differential due to inherent glass or glazing faults.
- .2 Warranty shall include the prompt remedy of defects upon written notification from the Owner that defects exist. Remedy shall include labour, materials, equipment and services required to make good defective areas of the work, and in the case of factory-fabricated components, to supply and install new components, all at no cost to the Owner and at times convenient to the Owner. Warranties shall also include making good other building parts and finishes and other Owner's property damaged or disturbed in the course of remedying defects.
- .3 Warranty to be in a form acceptable to both the Owner and the Consultant.

PART 2 – PRODUCTS

2.1 Product Compatibility

- .1 All products are to be compatible with each other and with all other materials in contact with them.
- .2 Materials in contact with silicone sealants are to be compatible with silicone sealants in accordance with Section 079200.

2.2 Glass

- .1 Float glass to conform to CAN/CGSB-12.3, clear glazing quality.
- .2 Tempered glass to conform to CAN/CGSB-12.1.
- .3 Heat-strengthened glass to conform to ASTM C1048, Kind HS.
- .4 Tempering and heat strengthening are to be performed using the horizontal tong-free method. If roller lines are apparent within acceptable limits as determined by Consultant, they are to be in horizontal direction after installation.
- .5 Type 1 glass lites shall be laminated, heat strengthened glass conforming to CAN/CGSB-12.1-M90, Kind HS, Type 1 Class B in total thickness of 11.5 mm, with two (2) layers of 0.76 mm thick, Saflex RB41 clear vinyl interlayer between layers of 5 mm thick, clear, heat strengthened glass.
- .6 Type 2 glass lites shall be fully tempered float glass conforming to CAN/CGSB-12.1-M91, Type 2, Class B in total thickness of 6 mm.
- .7 Type 3 glass lites shall be laminated, float glass conforming to CAN/CGSB-12.1-M90, Type 1 Class B in total thickness of 8.76 mm with one (1) layer of 0.76 mm thick, Saflex RB41 clear vinyl interlayer between layers of 4 mm thick, clear, float glass.

2.3 Low Emissivity Coating

- .1 The Low-E coating is to be neutral colour, sputter applied to the designated surface of glass in all insulating glass units. Apply coating so as to ensure maximum uniformity.
- .2 Emissivity of coated glass is to be 0.05 maximum.
- .3 Coating is to be applied to the glass surface **after** tempering/heat strengthening of glass is completed.
- .4 Coating is to be edge deleted over depth of primary and secondary edge seals.

**2.4 Insulating Glass
Units Fabrication**

- .1 Insulating glass units are to be manufactured to conform to IGMA or IGCC standards.
- .2 Fabricate units to requirements of CAN/CGSB-12.8 or ASTM E2190.
- .3 Edges of the glass are to be straight cut, free from nicks and other imperfections conducive to breakage.
- .4 Maintain specified separation of two lites of glass with desiccant filled, formed stainless steel metal spacer core having bent corners and welded joints. Core is to be straight and evenly set into glass units, with maximum variation in line of plus or minus 2 mm. **Spacer to be set into glass units so that face of spacer exposed to air space between lites is 19 mm from edge of glass.**
- .5 Dehydrate air space, fill air space with argon and hermetically seal inner and outer lites at periphery with continuous primary seal of polyisobutylene sealant. Primary sealant is not to extend past the inside edge of spacer core by more than 1mm. The primary seal must be continuous about full perimeter of spacer. ANY skip in primary seal will be justification to reject the unit, which must be replaced at no cost to Owner.
- .6 Provide continuous secondary seal using silicone sealant of a type which is compatible with structural silicone sealants. Prepare glass substrate as required by sealant manufacturer. **Note special requirement for depth of edge seal as determined by placement of spacer specified above. Completely fill void between lites of glass from spacer to glass edges.** Remove excess sealant from glass edges. Leave edges unbanded.
- .7 Label each glass unit with registered name of product and quality/type of glass components.
- .8 Accurately fit glass to openings with minimum edge clearances of 6 mm and minimum glass bite on new glazing seat extrusion of 24 mm.

**2.5 Insulating Glass Unit
Types**

1. Type GL-1: Insulating Glass Unit with following characteristics:
 - .1 Outboard Lite: Type 2 with Low-E coating applied to surface #2 after tempering
 - .2 13 mm argon filled airspace
 - .3 Inboard Lite: Type 1
2. Type GL-2: Insulating Glass Unit with following characteristics:
 - .1 Outboard Lite: Type 2
 - .2 13 mm argon filled airspace
 - .3 Inboard Lite: Type 3 with Low-E coating on surface #3

2.6 Glazing Accessories

1. Spacers (edge blocks) and setting blocks: 50 and 80 Durometer A hardness plus/minus 5, respectively, silicone rubber, profiled to allow drainage. Length 100 mm minimum, **width as required to support full overall thickness of glass units**, depth as required to suit new support points indicated in details.
2. Spacer tape: urethane foam tape for use with structural silicone glazing, colour black, 8mm thick x 8 m wide.
3. Setting block support chairs: Aluminum plate, custom bent as required to suit existing framing, new glass units and depth of new setting blocks. Thickness 4 mm, length 100 mm minimum, width and profile as required to provide full and uniform support for new setting blocks under full overall thickness of new glass units. Fabricate from aluminium plate to ASTM B209, suitable for purpose.
4. Discrete lengths of pressure plate and rubber wedges: Size(s) and shape(s) required to temporarily retain glass while structural sealant is curing.
5. Wedge gasket: silicone rubber, size and profile to match existing at horizontal hook stops.
6. Cleaning solvent and primer as recommended by sealant and tape manufacturers.

2.7 Glass Locations

1. Type GL-1: for all glass in sloped glazing faces (skylight).
2. Type GL-2: for all glass in vertical faces (skylight and walls).

PART 3 - EXECUTION

3.1 Examination

1. Prior to removal of any existing glass, examine all conditions, including environmental conditions, likely to affect the timely completion of the work of this section.
2. Only remove a glass unit if the replacement can be installed before the end of the same work period, or if an alternate temporary closure is available to close the openings at the end of the work period.
3. Ensure that all conditions at time of installation, including ambient and surface temperatures, are as recommended by manufacturers of glazing and sealant materials.
4. Verify that replacement glass units are correctly sized for the intended openings. Verify that edges of glass are free from nicks and other imperfections conducive to breakage.
5. Ensure that openings are free from distortion and that surfaces are free from protrusions that will obstruct face or edge clearances or distort the unit on installation.
6. Notify Consultant of conditions which prevent proper installation of work of this section.

3.2 Glazing Techniques

1. As a guide, the original shop drawings for the sloped and vertical glazing are referenced and included in the tender package to illustrate the different, existing techniques used for glazing the edges of the glass units in the sloped and vertical glazing.
2. The original shop drawing information is provided for guidance only. The contractor should verify the information independently if variations from the anticipated conditions will affect their costs. The contractor should also verify the glazing techniques originally used for the edges of glass units not illustrated in the drawings.

3.3 Preparation

1. Ensure aluminium framing and glass edges are free of dust, dirt, moisture, oil and other foreign matter detrimental to silicone adhesion.
2. In conjunction with manufacturer, conduct field adhesion tests for structural silicone sealant.
3. Develop technique at each unit for temporarily retaining new IG units in place while structural silicone is curing, including possible use of rubber wedges and/or discrete lengths of pressure plate along edges of units. Where discrete lengths of pressure plate are used, allow for remedial seal of framing penetrations once structural silicone has cured and fastening for temporary pressure plates is removed.

3.4 Removals

1. Existing weather seals and cap beads are to be removed in accordance with Section 07900. Existing caps, pressure plates, stops, trims, flashings, closures and any related accessories are to be carefully removed in accordance with Section 08 63 00.
2. Assume all glass has a continuous bead of silicone around the full perimeter, applied from the interior.
3. Assume all glass is sealed to the framing with continuous, shimmed glazing tape.
4. From the interior, cut the silicone seal between the glass units and the framing in accordance with Section 07 92 00.
5. From the exterior, cut the glazing tape between the glass units and the framing.
6. Remove existing glass and accessories including setting blocks, setting block support chairs, shims, spacer and glazing tape.
7. Carefully remove all existing interior gaskets. Remove all debris and sealant from existing gasket raceways.

**3.5 Preparation for
Installation**

1. Verify that all surfaces to receive glazing, as well as all gasket raceways and glazing cavities in existing framing components, are undamaged, free of obstructions and ready for preparation.
2. Ensure aluminium framing and glass edges are free of dust, dirt, moisture, oil and other foreign matter detrimental to silicone adhesion.
3. Remove all protective coatings. Verify that all surfaces to receive sealant, including glass edges, are prepared in accordance with Section 07 92 00.
4. Protect all cleaned surfaces. Re-clean any contaminated surfaces.
5. Do not clean surfaces that cannot be glazed within two hours.

3.6 Installation

1. Install insulating glass units as specified, in accordance with recommendations of GANA and IGMA, and according to material manufacturer's instructions.
2. Clean rabbets, stops and glass edges of all matter detrimental to sealant adhesion. Ensure drainage holes are not blocked.
3. Install preformed spacer tape ensuring complete contact on glazing seat. Make joints only at corners of frame. Fit tape accurately with tight joints, and in straight line along edge of glazing seat.
4. Clean surfaces to accept structural silicone glazing. Apply structural silicone sealant about full perimeter of glazing seat in accordance with Section 07 92 00. Tool edge of exposed sealant surface to avoid blockage of weep channels.
5. Completely clean the inside surface of the units immediately prior to installation, to avoid need for interior glass cleaning following completion of work.
6. Accurately fit glass to opening. Handle and install glass in accordance with manufacturer's directions. Prevent nicks, abrasion and other damage likely to develop stress on edges. Glass with damaged edge conditions will not be accepted. Replace glass which has nicked or otherwise damaged edges.

7. Use new setting block support chairs, new spacers and new setting blocks of proper size (and profile) to support and hold glass in position independent of the silicone sealant. Place two setting blocks, and associated support chairs, under each unit at the quarter points. Arrange setting blocks so as to avoid blocking water transfer inside frames.
8. Set glass properly centered in frame opening and resting on both setting blocks, maintaining minimum edge clearance of 6 mm. Ensure uniform bite and edge clearance. Ensure full contact of both outer and inner lites of glass on setting blocks and shims.
9. Temporarily retain glass using discrete lengths of pressure plate and/or rubber wedges. Ensure full contact to interior foam spacer tape, free from twist, warp or other distortion likely to develop stress.
10. Remove rejected, broken or damaged glass immediately and replace with new material. Units producing distorted vision shall be rejected and replaced at the reasonable discretion of the Consultant.
11. Apply structural silicone beads in accordance with Section 07 92 00. Install temporary restraint for glass unit during curing of silicone.
12. Once structural sealant has cured and testing has been completed, apply silicone weatherseals in accordance with Section 07 92 00.
13. Supply and install new wedge gasket at new hook stops at intermediate horizontal rails on wall glazing system.
14. After silicone weatherseals are completed, pressure plates, caps, flashings, trims and closures are to be reinstalled in accordance with Section 08 63 00. Cap beads are then to be installed in accordance with Section 07 92 00.

3.7 Clean Up

1. Keep installed work clean as work progresses.
2. Remove excess materials, including sealant and compound droppings, from finished surfaces.
3. Remove labels from insulating glass units after work is complete and accepted by Consultant.

4. Clean all interior and exterior glass to present a clean, dry, grease and oil free surface.
5. Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Replace finishes or materials that cannot be satisfactorily touched-up, cleaned or which have been damaged by improper cleaning materials and techniques.
6. At completion of the work of this Section, remove all debris, equipment and excess material from the site

END OF SECTION