

September 9, 2020

AAFC SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE
CONTRACT NO. 23 – SKYLIGHT GLAZING REPLACEMENT
CONTRACT #465-1-29-C24

Addendum No. 2

1. QUESTIONS & ANSWERS

- Q1: The skylights were built prior to 1996, has there been a hazmat assessment completed as per Worksafe BC? If not, will the building owner be undertaking the costs of this testing procedure and any additional costs resulting from it?
- A1: AAFC conducted hazmat testing on a variety of materials used in the construction of the building including the black rubbery caulking on skylight seams and bolts from the lower west roof, lower skylight. 6 Samples were taken and tested in 2016 for asbestos and none was detected. AAFC will not be undertaking additional testing related to the caulking or sealant. Any costs borne by the contractor in managing the risks associated with these materials are to be included in their bid price.
- Q2: Please define scope of work for this project more clearly.
- A2: Please refer to the clarifications in this addendum.
- Q3: Specification 08 44 33, Section 2.1, Sentence 7.1: Max U factor not to exceed 1.42 Wm²K or 0.25 Usip. ASHRAE 90.1 2019 specifies max Zone 5 Usip not exceed 0.5 or 2.839 Wm²K and an SHGC not to exceed 0.40. To achieve the max u factor specified the IGUs would need to be triple pane into a thermally broken framing system which this is not based on its age.
- A3: The thermal performance in the spec is intended to be restricted to the IGU itself, and not the overall system. Refer to revisions in this addendum.
- Q4: Specification 08 44 33, Section 2.1, Sentence 2.1: Existing Framing: Existing aluminum framing and mullions to remain. Contractor shall examine conditions and advise.... The current framing system is site welded steel I-beams with horizontal steel tube, (looks to be 3" x 3", though we were not able to get close enough on the interior to confirm), with what looks like a veneer glazing system applied to the structural members.
- A4: The exact materials of the existing framing system are unknown. It may be structural steel or aluminum. The structural framing system is existing and is intended to remain. Evaluating the thermal performance of the framing system is not required.
- Q5: Specifications 08 44 33, Section 2.1, Sentence 7.4: Glazing and framing performance, would be nearly impossible without confirming material composition of; i. Structural member and thickness, ii. Finish coating to interior members and thickness, iii. Actual system, (if any), fastened to the structural steel.
- A5: The thermal performance of the framing system is not required to be evaluated.

- Q6: Specification 08 44 33, Section 2.1, Sentence 7.4: this type of report is typical under the purview of the acting consultant to coordinate with a project designated thermal modeling engineer.
- A6: The thermal performance of the framing system is not required to be evaluated.
- Q7: Specification 08 44 33, Section 2.4, Sentence 4.4: Low-e coating on #2? What low-e coating? Do you want reflective glass, such as Vitro Solar Cool grey or blue, to the exterior pane to reduce SHGC values even further given that the windows face South West?
- A7: This addendum includes an IGU composition that is considered to be an acceptable product. The contractor is permitted to submit a Request for Alternative to use an alternate IGU system that meets the performance requirements.
- Q8: The Overall performance request (Specification 08 44 33, Section 2.1, Sentence 7.1) will be virtually impossible to meet. The 1.13 W/m² without having a HP glazing system (of which we do not have any thermal performance for) as it's 40 years Lord & Burnham segmented curtain wall system but very old design.
- A8: The thermal performance in the spec is intended to be restricted to the IGU itself, and not the overall system. Refer to revisions in this addendum.
- Q9: We can get you a sealed unit that performs to 1.41 W/m² Center of Glass but that number will increase when the overall system is run for performance
- A9: We have revised the thermal performance of the IGU (center of glass at 45 degrees) to be between 1.50 and 1.75 W/m² x K and for SHGC to be between 0.3 and 0.35.
- Q10: We cannot locate new pressure plate 's (custom design) and L&B no longer have those dies. This may also relate to the thermal break and glazing gaskets.
- A10: The existing pressure plates are to be carefully removed, and salvaged for re-installation. The pressure plates shall be sand-blasted and powder coated prior to reinstallation. Refer to revisions in this addendum.
- Q11: Can you provide any record drawings showing details of the skylight?
- A11: Access to these drawings can be made by separate request to Wayne Carlson, wayne.carlson@canada.ca
- Q12: Can you provide the initial replacement study document?
- A12: Access to this document can be made by separate request to Wayne Carlson, wayne.carlson@canada.ca

2. DRAWINGS:

a. Refer to Drawing 20-0217-001 B01.

i. Delete “INSTALL NEW PRESSURE PLATES AND CAPS TO MATCH EXISTING” from Construction Keynote 1 and replace with “ALL EXISTING PRESSURE PLATES TO BE CAREFULLY REMOVED, SLAVAGED, SANDBLASTED, POWDERCOATED, AND RE- INSTALLED”

b. Refer to Drawing 20-0217-001 B02.

i. Delete the word “PRESSURE PLATES, CAPS” from Note 2 under Glazing Replacement.

ii. Delete Note 1 under Existing Condition and replace it with Sentence 2.1 from Section 2.1 of the revised specification Section 08 44 33 that is attached to this addendum.

iii. Add the following Note 2 under Existing Condition; “ALL EXISTING PRESSURE PLATES TO BE CAREFULLY REMOVED, SLAVAGED, SANDBLASTED, POWDERCOATED, AND RE- INSTALLED. REFER TO SPECIFICATION.”

3. SPECIFICATIONS:

a. Delete the spec Section 08 44 33 - Sloped Glazing and replace it with the revised Section 08 44 33 - Sloped Glazing (Rev 1) that is attached to this addendum.

9 septembre 2020

CENTRE DE RECHERCHE ET DE DÉVELOPPEMENT DE SUMMERLAND D'AAC
CONTRAT N^o 23 – REMPLACEMENT DES VITRAGES DE LANTERNEAUX
CONTRAT N^o 465-1-29-C24

Addenda n^o 2

1. QUESTIONS ET RÉPONSES

- Q1 : Les lanterneaux ont été construits avant 1996. Est-ce qu'une évaluation relative aux matières dangereuses a été effectuée conformément aux exigences de WorkSafe BC? Dans la négative, est-ce que le maître de l'ouvrage se chargera des coûts de ces essais et de tout coût additionnel en découlant?
- R1 : AAC a effectué une évaluation relative aux matières dangereuses sur divers matériaux utilisés dans la construction du bâtiment, y compris le calfeutrage caoutchouteux noir sur les joints des lanterneaux et les boulons du lanterneau inférieur du toit ouest inférieur. Six échantillons ont été prélevés et testés en 2016 pour l'amiante et les résultats ont été négatifs. AAC n'effectuera pas d'autres essais sur le calfeutrage ou le scellant. Les coûts assumés par l'entrepreneur pour gérer les risques associés à ces matériaux doivent être inclus dans son prix soumissionné.
- Q2 : Pouvez-vous préciser la portée des travaux pour ce projet?
- R2 : Se référer aux précisions du présent addenda.
- Q3 : Phrase 7.1 du paragraphe 2.1 de la section 08 44 33 du devis : Le facteur U maximal ne doit pas dépasser $1,42 \text{ W/m}^2 \times \text{K}$ ou $0,25 \text{ Usip}$. La norme ASHRAE 90.1 2019 précise que l'Usip maximal de zone 5 ne doit pas dépasser $0,5$ ou $2,839 \text{ W/m}^2 \times \text{K}$ et que le CARS ne doit pas dépasser $0,40$. Pour obtenir le facteur U maximal indiqué, les vitrages isolants doivent avoir trois couches dans un bâti à rupture de pont thermique qui ne correspond pas à son âge.
- R3 : La performance thermique dans le devis vise le vitrage isolant seulement et non l'ensemble du système. Se reporter aux révisions dans le présent addenda.
- Q4 : Phrase 2.1 du paragraphe 2.1 de la section 08 44 33 du devis : Bâti existant : bâti existant en aluminium et meneaux à conserver. L'entrepreneur doit examiner les conditions et faire des recommandations. Le système de bâti actuel se compose de poutres en I en acier soudées sur place avec des tubes horizontaux en acier (il semble qu'il s'agisse de tubes de 3 po x 3 po, mais nous n'avons pas pu nous approcher assez à l'intérieur pour confirmer), avec ce qui semble être un système de placage appliqué aux éléments de structure.
- R4 : Les matériaux exacts du système de bâti existant sont inconnus. Il peut s'agir d'acier de construction ou d'aluminium. L'intention est de conserver le système de bâti de montage existant. Il n'est pas nécessaire d'en évaluer la performance thermique.

- Q5 : Phrase 7.4 du paragraphe 2.1 de la section 08 44 33 du devis : Performance du vitrage et du bâti, serait presque impossible sans confirmer les éléments suivants : i. la composition du matériau des éléments de structure et son épaisseur, ii. le revêtement de finition des éléments intérieurs et son épaisseur, iii. le système (le cas échéant) fixé à l'acier de construction.
- R5 : Il n'est pas nécessaire d'évaluer la performance thermique du système de bâti.
- Q6 : Phrase 7.4 du paragraphe 2.1 de la section 08 44 33 du devis : ce type de rapport est typiquement du ressort de l'expert-conseil en ce qui a trait à la coordination avec l'ingénieur en modélisation thermique désigné pour le projet.
- R6 : Il n'est pas nécessaire d'évaluer la performance thermique du système de bâti.
- Q7 : Phrase 4.4 du paragraphe 2.4 de la section 08 44 33 du devis : Revêtement à faible émissivité au n° 2? Quel revêtement à faible émissivité? Voulez-vous un vitrage réfléchissant, comme le vitrage Vitro Solar Cool gris ou bleu, pour le vitrage extérieur pour réduire encore plus les valeurs CARS étant donné que les fenêtres sont exposées au sud-ouest?
- R7 : Le présent addenda comprend la composition des vitrages isolants considérés comme acceptables. L'entrepreneur peut présenter une demande de matériel de remplacement pour utiliser un autre système de vitrage isolant qui respecte les exigences de performance.
- Q8 : Il sera pratiquement impossible de respecter l'exigence relative à la performance globale (phrase 7.1 du paragraphe 2.1 de la section 08 44 33 du devis) de $1,13 \text{ W/m}^2$ sans un système de vitrage haute performance (dont nous ne connaissons pas du tout la performance thermique), car il s'agit d'un système de mur-rideau segmenté Lord & Burnham qui a 40 ans et dont la conception est très vieille.
- R8 : La performance thermique indiquée dans le devis vise seulement le vitrage isolant, et non l'ensemble du système. Se reporter aux révisions du présent addenda.
- Q9 : Nous pouvons vous fournir une unité scellée qui offre $1,41 \text{ W/m}^2$ au centre de la vitre, mais cette valeur augmentera lors de l'essai de performance sur l'ensemble du système.
- R9 : Nous avons révisé la performance thermique du vitrage isolant (centre de la vitre à 45 degrés) à entre $1,50$ et $1,75 \text{ W/m}^2 \times \text{K}$ et la valeur CARS à entre 0,3 et 0,35.
- Q10 : Nous ne pouvons pas trouver de nouvelles cales (conception sur mesure) et L&B n'a plus ces matrices. Cela pourrait également avoir une incidence sur la rupture thermique et les joints du vitrage.
- R10 : Les cales existantes doivent être enlevées avec précaution et récupérées pour être réinstallées. Elles doivent être nettoyées au jet de sable et enduites d'un revêtement en poudre avant d'être réinstallées. Se reporter aux révisions du présent addenda.
- Q11 : Pouvez-vous fournir des dessins d'archive montrant les détails du lanterneau?
- R11 : L'accès à ces dessins peut être demandé à Wayne Carlson, wayne.carlson@canada.ca.
- Q12 : Pouvez-vous fournir l'étude initiale de remplacement?
- R12 : L'accès à ce document peut être demandé à Wayne Carlson, wayne.carlson@canada.ca.

2. DESSINS

a. Se reporter au dessin 20-0217-001 B01.

i. Supprimer le passage « INSTALLER LES NOUVELLES CALES ET LES CAPUCHONS ASSORTIS À CEUX EN PLACE » de la note de construction 1 et remplacer par « TOUTES LES CALES EXISTANTES DOIVENT ÊTRE ENLEVÉES AVEC PRÉCAUTION, RÉCUPÉRÉES, NETTOYÉES AU JET DE SABLE, ENDUITES D'UN REVÊTEMENT EN POUDRE ET RÉINSTALLÉES. ».

b. Se reporter au dessin 20-0217-001 B02.

i. Supprimer les mots « CALES, CAPUCHONS » de la note 2 sous Remplacement du vitrage.

ii. Supprimer la note 1 sous Conditions existantes et la remplacer par la phrase 2.1 du paragraphe 2.1 de la section 08 44 33 révisée du devis qui est jointe au présent addenda.

iii. Ajouter la note 2 suivante sous Conditions existantes : « TOUTES LES CALES EXISTANTES DOIVENT ÊTRE ENLEVÉES AVEC PRÉCAUTION, RÉCUPÉRÉES, NETTOYÉES AU JET DE SABLE, ENDUITES D'UN REVÊTEMENT EN POUDRE ET RÉINSTALLÉES. SE REPORTER AU DEVIS. »

3. DEVIS

a. Supprimer la section 08 44 33 – Vitrage incliné et la remplacer par la section 08 44 33 – Vitrage incliné (Rév. 1) jointe au présent addenda.

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .2 Section 07 92 00 - Joint Sealing

1.2 REFERENCE STANDARDS

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International
 - .1 ASTM B209-07, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM B221-08, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .3 ASTM E283-04, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .4 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
 - .5 ASTM E331-00(2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
 - .6 ASTM E1105-00(2008), Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
 - .7 ASTM D2240-05, Standard Test Method for Rubber Property - Durometer Hardness.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.108-M89, Bituminous Solvent Type Paint.
 - .2 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .3 CAN/CGSB-12.8-97, Insulating Glass Units.
 - .4 CAN/CGSB-12.8-97 (Amendment), Insulating Glass Units.
 - .5 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
 - .6 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.
- .4 CSA International
 - .1 CAN/CSA-S157/S157.1-05, Strength Design in Aluminum/Commentary on CAN/CSA-S157, Strength Design in Aluminum.
 - .2 CSA W59.2-M1991(R2008), Welded Aluminum Construction.

- .5 Environmental Choice Program (ECP)
 - .1 CCD-045-95(R2005), Sealants and Caulking Compounds.
- .6 Glass Association of North American (GANA)
 - .1 GANA Glazing Manual - 2008.
 - .2 GANA Laminated Glazing Reference Manual - 2009.
- .7 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 If requested, arrange for site visit with Departmental Representative prior to start of Work to examine existing site conditions adjacent to demolition Work.

1.4 PRE-INSTALLATION MEETING

- .1 If requested, convene a pre-installation meeting at Project site minimum two weeks before commencing work of this Section.
- .2 Include parties directly affecting work of this Section, including, sloped glazing manufacturers technical representative, installer's job foreman.
 - .1 Review sloped glazing system drawings, specifications, and other contract documents affecting work.
 - .2 Review submittals, completed and yet to be completed.
 - .3 Review materials, shop and site fabrication, and installation requirements.
 - .4 Review required inspections, operational testing, and certifying procedures.
 - .5 Review and finalizing of construction schedule related to other work affecting sloped glazing installation and verification of availability of materials, installer's personnel, equipment, and facilities required to make progress and avoid delays.
 - .6 Review preparation and installation procedures and coordination and scheduling required with related work.
 - .7 Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
 - .8 Tour, inspect, and discuss conditions, connections to building structure, and other preparatory work performed by other installers.
 - .9 Record and submit copies of minutes including discussions, decisions, agreements, and disagreements to each party attending and concerned parties not in attendance.

1.5 SUBMITTALS FOR REVIEW

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instruction, printed product literature and data sheets for glass, sealants, and glazing accessories. Provide component dimensions, describe components within assembly, anchorage and fasteners, glass, finish coating, internal drainage details, water flow drainage diagrams, and performance criteria.

- .3 Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to adjoining work. Indicate the following:
 - .1 Design parameters, material ordering, fabrication, and erection, assemblies, materials, finishes, methods of joining and anchoring, types of sealants, gaskets, insulation, infill panels, thermal breaks, provision for expansion and contraction, drainage, pressure equalization compartments, and adjacent construction, and:
 - .2 Dimension limits of movements for moving joints and provisions for expansion and contraction.
 - .3 Show relative layout of adjacent assemblies including existing skylight framing, beams and slabs with dimensions noted.
 - .4 Perimeter sealant joint sizes, including tolerances and minimum/maximum joint sizes required.
 - .5 Detailed requirements for insulation materials, air/vapor barriers and their installation.
 - .6 Clear designation showing the path of water drainage from the system.
 - .7 Installation instructions for the project.
 - .8 Joinery details.
 - .9 Glass thermal and wind load stress analysis documenting adequate glass thickness and/or heat treatment to meet stresses generated. Thermal stress analysis to include effects of exterior and interior shading, conduction at glass edge, and contribution of low-e coatings.
 - .10 Spacers and Setting Blocks: Data indicating compliance with requirements for resistance to sunlight, weathering, oxidation and permanent deformation under load.
 - .11 Prepare Shop Drawings under direct supervision of a professional engineer.
 - .1 Include framing member and support layout.
 - .2 Each shop drawing to bear seal and signature of the professional engineer registered in British Columbia, Canada.
- .4 Samples.
 - .1 If requested, submit two samples 300 x 300 mm in size illustrating prefinished aluminum surface, specified glass, glazing materials illustrating edge and corner.

1.6 SUBMITTALS FOR INFORMATION

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Qualifications Data: For manufacturer, professional engineer, and Installer.
- .3 Installation Data: Special installation requirements.
- .4 Product Test Reports:
 - .1 For sloped glazing, substantiating engineering data, test results of previous tests by independent laboratories which purport to meet performance criteria and other supportive data.
- .5 Source quality control reports.
- .6 Field quality control reports.

- .7 Sealant Manufacturer's Certificates.
- .8 Certification from Glass and Gasket Manufacturer: Include statement certifying that glass and glazing materials and requirements indicated on Shop Drawings have been reviewed and approved for use relative to their specific applications, dimensional design and profile parameters, compatibility with adjacent materials, and conformance with Contract Documents. Include relevant drawing numbers, dates, and revision numbers.

1.7 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Maintenance Data: For sloped glazing, to include in maintenance manuals. Include instructions for re-glazing.

1.8 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience, and employing a professional engineer.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience, approved by manufacturer.
- .3 Professional Engineer's Qualifications: Structural engineer experienced in design and installation of the specified sloped glazing systems, and licensed in the Province where the Project is located.

1.9 DELIVERY, STORAGE, AND PROTECTION

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.
- .3 Protect glass with a protective film.
- .4 Replace defective or damaged materials with new.

1.10 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install sealants when ambient temperature, and surface temperature of the area to receive the sealant is outside the sealant manufacturer's acceptable range.
- .2 Maintain acceptable temperature range during and after installation of sealants until cured.

1.11 WARRANTY

- .1 Correct defective Work within a five-year period after Substantial Performance of the Work.
- .2 Manufacturer's Assembly Warranty: Provide a ten-year warranty to include coverage for complete system for failure to meet specified requirements or that fail in materials or workmanship, including:

- .1 Structural failures including, but not limited to, excessive deflection.
 - .2 Noise or vibration created by wind and thermal and structural movements.
 - .3 Deterioration of metals, metal finishes and other materials beyond normal weathering.
 - .4 Water penetration through fixed glazing and framing areas.
- .3 Insulating Glass Unit Warranty: Provide ten-year manufacturer warranty for glazed units.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Ensure continuity of building enclosure vapour and air barrier throughout assembly.
- .2 Structural:
 - .1 Existing Framing: Existing aluminum framing and mullions to remain. Contractor shall examine existing conditions and advise Departmental Representative in writing if any unsuitable conditions exist to prevent the existing framing for re-use with new glazing system. Provide written documentation of any component that is not fit for service. Investigate existing system for:
 - .1 Plumbness and trueness
 - .2 Levelness
 - .2 System Design: Design and size components, including glass, to withstand dead loads and live loads caused by positive and negative wind and snow loads acting normal to plane of sloped glazing, as calculated in accordance with applicable code, as measured in accordance with ASTM E330.
- .3 Effects of Combinations of Loads: Design new components to withstand the most unfavorable combinations of loads.
- .4 System Assembly Movement: Accommodate without damage to system, components or deterioration of seals, movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, deflection of structural support framing, tolerance of supporting components, column shortening, long-term creep of structural members, interstorey drift, and deflection from uniformly distributed and concentrated live loads.
- .5 Joint Movement Capability between System and Adjacent Construction: Design expansion joints with movement capability as required, but not less than plus or minus 50 percent of joint width, without detrimental effects to assembly and adjacent construction.
- .6 Energy Performance:
 - .1 Thermal Transmittance (U-factor): Provide U-factor for fixed glazing (center of glass at 45 degree tilt) based on largest areas of glass as calculated in accordance with referenced standards, and between 1.50 W/sq. m x K and 1.75 W/sq. m x K.
 - .2 Solar Heat Gain Coefficient (SHGC): to be between 0.30 and 0.35.
- .7 Air Infiltration and Exfiltration:

- .1 Limit air infiltration and exfiltration through sloped glazing area including interface with adjacent construction to maximum 0.15 L/sec/sq. m at a 300 Pa static pressure difference when measured in accordance with ASTM E283.
- .8 Water, Vapor and Moisture
 - .1 Provide for positive drainage of water entering sloped glazing assemblies, to exterior face of building in accordance with Rain Screen Principle (NRC), if applicable.
 - .2 Comply with requirements of the Rainscreen Principle (NRC), if applicable:
 - .1 Demonstrating pressure-equalization and compartmentalization of the drainage path.
 - .2 Compartmentalization seals to be air and water tight, capable of supporting design air pressure differences.
 - .3 Two stage weather tightening with a vented/weeped outer layer and a sheltered inboard air/vapor barrier primary layer.
 - .4 Provide drainage path to exterior face of assembly for water entering at joints and condensation occurring within the building envelope assembly.
 - .3 Design system to provide resistance to water entry at a pressure difference of 600 Pa when tested in accordance with ASTM E331.
 - .4 Installed assembly to remain watertight under the interior and exterior design conditions in combination with movements occurring due to imposed loads.
 - .5 Provide an air barrier and vapor barrier in same plane in the building envelope design, unless otherwise indicated.
- .9 Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.
- .10 Service Life: Comply with recommendations of CSA S478.

2.2 MATERIALS

- .1 Extruded Aluminum: ASTM B221/B221M.
- .2 Sheet Aluminum: ASTM B209/B209M.
- .3 Fasteners: Stainless steel.

2.3 SLOPED GLAZING ASSEMBLY

- .1 Existing Framing: Provide written documentation of any component that is not fit for service. Replacement components to be designed in accordance with performance criteria and subsequent requirements.
- .2 Description: Existing aluminum framing, site-assembled, vision glass, dual pane, argon-filled units with Low-E coating; related flashings, anchorage and attachment devices.
- .3 Sloped Glazing Framing:
 - .1 Profile: to match existing, or as required to meet performance criteria.
 - .2 Framing: Existing aluminum framing with exterior pressure plate.

- .3 Glazing Stops and Pressure Plates: Of sufficient size and strength to provide adequate bite on glass; aluminum pressure plate.
- .4 Glazing Method: Retained mechanically with gaskets on four sides with aluminum pressure plate
- .5 Drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system.
- .4 Reinforced Framing, if required: Same profile and dimensions as unreinforced framing with internal reinforcement of shaped steel structural section.
- .5 Air Barrier Flashings: Materials as required to tie new glazing system into existing construction.
- .6 Low-Expansion Detailing Foam Insulation: Materials as required to tie new glazing system into existing construction.

2.4 GLASS AND GLAZING MATERIALS

- .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Design glass and glazing in accordance with performance requirements of this specification, and with glass thicknesses not less than 6 mm.
- .3 Flat Glass:
 - .1 Safety glass: to CAN/CGSB-12.1,
 - .1 Type 2 - Tempered
 - .2 Class B - Float
 - .3 Category 2.
 - .4 Glass Thickness: To meet performance criteria, and not less than 6 mm.
 - .5 Edge treatment for exposed edges: ground and polished.
 - .6 Edge profile for exposed edges: square with chamfer edges.
- .4 Insulating Glass Units:
 - .1 Insulating glass units: to CAN/CGSB-12.8, double unit
 - .1 Glass: to CAN/CGSB-12.1
 - .2 Glass thickness: To meet performance criteria, and not less than 6 mm. Overall IGU thickness to not exceed thickness allowed by existing framing. Existing thickness estimated to be 25mm.
 - .3 Inter-cavity space thickness: as required above.
 - .4 Glass coating: Low emissive sputter vapor deposition coating(s) as required to meet IGU performance requirements under Section 2.1, Sentence 7.1. Provide units by single manufacturer and of same color rendition between glass units. Acceptable products: Solarban 60, Solarban 70, and Sunguard AG50 or approved equal.
 - .1 Edge delete coated glass in contact with spacers to ensure maximum spacer to glass seal.
 - .5 Inert gas fill: 90% argon, 10% air, for all units.
 - .2 Sealed units shall be certified by Glass Association of North America (GANA).

- .5 Glazing Materials: Type to suit application to achieve weather, moisture, and air infiltration requirements, and as follows:
 - .1 Shims: Pressure sensitive resilient extruded heat cured silicone rubber, and as recommended by the insulating glass unit manufacturer.
 - .2 Spacers (Edge Blocks) and Setting Blocks: 50 and 80 Durometer A hardness plus/minus 5 respectively, silicone rubber; designed to resist sunlight, weathering, oxidation and permanent deformation under load.
 - .3 Glazing Tape: Macro-polyisobutylene preformed glazing tape, compatible with silicone sealant.
 - .4 Continuous Exterior Glazing Gaskets:
 - .1 All glazing gaskets to be new closed-cell foam to match existing and wet sealed. Acceptable product: DOWSIL 795 Silicone Building Sealant or approved equal.
 - .5 All fasteners to be new stainless steel fasteners with gaskets.

2.5 SEALANTS MATERIALS

- .1 Sealants: As specified in Section 07 92 00 – Joint Sealing.
- .2 Sealant Used within System (Not Used for Glazing): Type as recommended by sloped glazing manufacturer, and with VOC content less than 100 g/L.

2.6 AUXILIARY MATERIALS

- .1 Flashings and Trim:
 - .1 General: Fabricate in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim.
 - .2 Brake-Formed Flashings and Trim: Provide brake-formed flashings as required.

2.7 FABRICATION

- .1 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- .2 Assembled systems to permit re-glazing of individual glass units without requiring removal of sloped glazing framing.
- .3 New or replaced sloped glazing assembly components to be fabricated square and true, free from distortion, waves, twists, and buckles.
 - .1 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof. Machine cut joints; miter corners. Use plated screws or back weld; seal with non-hardening sealant.
 - .1 Accurately shape framing and cover cap intersections with minimal width hairline joints, sufficient to permit thermal movements.
 - .2 Prepare components to receive anchor devices. Install anchors.
 - .3 Arrange fasteners and attachments to ensure concealment from view. Drill and notch members to drain without permitting air infiltration.

- .4 Reinforce concealed framing members as required for external imposed loads with loads transferred directly to structure.
- .4 Provide flexible, continuous gasket air/vapor barrier seals within framing assemblies, for attaching air/vapor transition strips to adjoining construction.
- .5 Fabricate and install glass and glazing materials with appropriate glazing method to achieve performance requirements.
- .6 Facings and Closures: Provide facings, closure pieces to complete the assembly as required to seal against weather and to provide finished appearance; minimum 2 mm thick extruded aluminum; same finish as adjoining sloped glazing framing.
- .7 Flashings and Trim: Fabricate in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim.
 - .1 Provide brake-formed flashings as required.
- .8 Ensure framing and connections accommodate structure and sloped glazing framing deflection.
- .9 Isolate aluminum from dissimilar metals, other than stainless steel, with rubber isolation pads. Bituminous paint not permitted.

2.8 FINISHES

- .1 Exposed Aluminum Surfaces of Mullions or Framing: To match existing.
- .2 Existing Aluminum Pressure Plates: To be carefully removed, salvaged, and re-installed. Tag pressure plates with permanent marking during removal process to ensure plates are re-installed in the same locations. Develop schematic showing tags and locations of all pressure plates. Sandblast to a low profile of up to 1 mil and apply powder coat to a thickness of 2.5 to 3.5 mils. Choose color of powdercoating from manufacturer's standard color palette to match existing color and sheen as close as possible. Provide sample for approval. Acceptable product: PPG Envirocron Powder Coat PCT75119 or approved equal.
- .3 Concealed Aluminum Surfaces: To match existing.
- .4 Concealed Steel Items: Galvanized in accordance with ASTM A123, 610 g/sq. m.
- .5 Touch-Up Primer for Galvanized Steel Surfaces: SPCC Paint 20 zinc rich.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine existing glazing system to determine if it is a face-sealed or rain screen system. Remove pressure plates to expose glazing and framing system for examination. Provide details and photographs of framing system to Departmental Representative for review.
- .2 Examine existing aluminum framing and mullions and verify against criteria in Section 2.1 of this specification. Provide written documentation of any component that is not fit for service.
- .3 Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- .4 Verify dimensions, tolerances and method of attachment with other work.
- .5 Verify openings and adjoining air and vapor barrier materials are ready to receive the work of this section.
- .6 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INSTALLATION

- .1 Install sloped glazing system in accordance with manufacturer instructions and the reviewed shop drawings
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 If replacing existing framing members, provide alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .4 Align assemblies plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Conceal fasteners except where unavoidable for structural anchorage.
- .6 Provide thermal isolation where components penetrate or disrupt building insulation. Install gap-filling spray foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .7 Trim: Install flashings and other trim. Brake trim to shape as required; accurately cut and fit with hairline joints.
- .8 Coordinate attachment and seal of perimeter air barrier materials. Ensure integrity of and lap and seal. Provide solid backing at self-adhered membrane connections.
- .9 Install perimeter sealant as required to achieve performance criteria.
- .10 Metal Protection:
 - .1 Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - .2 Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 GLAZING INSTALLATION: EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- .1 Perform work in accordance with GANA Laminated Glazing Reference Manual and GANA Glazing Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, 6mm below sight line. Seal corners by butting tape and dabbing with sealant.
- .3 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.
- .4 Place setting blocks at ¼ points, with edge block maximum 150mm from corners.

- .5 Rest glazing on setting blocks and push against tape with sufficient pressure to attain full contact at perimeter of light or glass unit.
- .6 Install pressure plates with gaskets and secure to framing with new stainless steel fasteners.
- .7 Apply heel bead of sealant along pressure plate to provide a fully sealed system. Tool or wipe sealant surface smooth.
- .8 Review glazing installation procedure with the Departmental Representative and original manufacturer prior to installation.

3.4 ERECTION TOLERANCES

- .1 Maximum Variation from Plumb 1.5 mm/m or 12 mm/30 m, whichever is less.
- .2 Maximum Misalignment of Two Adjoining Members Abutting in Plane: 0.8 mm.
- .3 Maximum sealant space between sloped glazing and adjacent construction: 13 mm.
- .4 Location: Limit variation from plane to 3 mm in 3.5 m; 2 mm over total length.
- .5 Joint Width Between Components: Maximum 1.5 mm; each joint of uniform width.
- .6 Racking on Face: Plus/minus 6 mm.
- .7 Tolerances shall not be cumulative.

3.5 FIELD QUALITY CONTROL – CONSTRUCTION INSPECTION

- .1 Testing Agency Services: Contractor shall engage an independent qualified inspection company to perform inspections during installation of sloped glazing assemblies, including:
 - .1 Verification of vapor retarder, and air barrier installation.
 - .2 Checks of interfaces and termination seals with other elements.
 - .3 Review of panel to panel air seals, review of roof/wall interface.
 - .4 Review of panel fastening, exterior sealants and similar items.
 - .5 Checks of air and vapor seals/barriers for continuity, penetrations and correct orientation.
 - .6 Checks for continuity of insulation plane.
 - .7 Verification of flashing placement and continuity.

3.6 FIELD QUALITY CONTROL – TESTING

- .1 Testing Agency Services: Contractor shall engage an independent qualified testing agency to perform tests and inspections.
- .2 Water Spray Test: Before installation of interior finishes has begun, Departmental Representative will designate two areas to be tested according to AAMA 501.2 and shall not display evidence water penetration.
 - .1 Test Area: Representative areas of sloped glazing assemblies including tie-ins to adjacent assemblies. Possible locations include areas of intersection between 4

- glazing units, or the upper corner of the glazing replacement where it ties into the adjacent construction.
- .2 Perform tests in each test area as directed by Departmental Representative. Perform at least three tests at each location, as required, prior to 10, 35, and 70 percent completion.
 - .3 Tests: Static air infiltration and static water penetration, to the same performance requirements indicated, except to ASTM 501.2 and ASTM E783 test requirements.
 - .4 Thermographic Inspection: An infrared scan of the building envelope at the completion of the envelope construction, identifying thermal anomalies to be investigated.
- .3 Make adjustments necessary to comply with performance requirements, acceptable to Departmental Representative.
 - .4 Sloped glazing assemblies will be considered defective if they do not pass tests and inspections. Make necessary acceptable adjustments to achieve compliance with requirements.
 - .5 Do not proceed with tests in succeeding locations until work complies with specified requirements.

3.7 CLEANING

- .1 Remove protective material from prefinished aluminum and glass surfaces.
- .2 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- .3 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.8 PROTECTION OF FINISHED WORK

- .1 Protect installed products and components from damage during construction.
- .2 Protect adjacent construction and existing conditions from damage during construction.
- .3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION