Technical Design Requirements for Alberta Infrastructure Facilities

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Version 7

August 2022

Alberta Infrastructure

Classification: Public

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0.1 Introduction

The purpose of the *Technical Design Requirements for Alberta Infrastructure Facilities* (TDR) document is to provide architects, engineers, contractors, client groups, facility administrators and operators involved in designing and building facilities with a comprehensive set of requirements.

The requirements have been developed by Alberta Infrastructure Technical Services and Procurement Branch by consolidating best practices information, from the position of knowledgeable owner, as well as national and international subject matter experts. They are based on components and systems which have proven to be reliable and efficient, to meet the needs of the users, and to have acceptable life cycle costs.

The requirements are intended as a minimum for planning new facilities and renovating and operating existing facilities. Innovative designs, products, systems and technology are encouraged after thorough evaluation of potential benefits and risks, value analysis and life cycle cost. Early and regular involvement by Technical Services staff is recommended when proposing alternatives.

The Crime Prevention through Environmental Design (CPTED) Principles of natural access control, natural surveillance, territorial reinforcement and maintainability shall be applied to all Alberta Infrastructure projects. At the request of Alberta Infrastructure, a written CPTED Assessment may be required. See Section 12.0 for more information.

The *Technical Design Requirements for Alberta Infrastructure Facilities* is a “living document” and will be updated to address ongoing changes in facilities design and technology. The latest version can be viewed or downloaded in electronic format, through the Infrastructure Technical Resources (ITR) website. (https://www.alberta.ca/infrastructure-technical-resources.aspx)

Your input to the progressive updating of this document is invited. Please direct comments to the undersigned:
Standards and Specifications Specialist
Technical Services and Procurement Branch
Alberta Infrastructure
3rd Floor, 6950 - 113 Street
Edmonton, AB T6H 5V7
T | 780-422-7456
infras.trc@gov.ab.ca

Publication Version: v7

Effective Date of Publication: August 26th, 2022

Design Principles

Introduction

Infrastructure is responsible for the provision of public facilities that meet stakeholder requirements, as well as the Province's environmental, social, and economic values. Regardless of building type, the overall mandate of Infrastructure is to design, construct, and operate publicly funded facilities in a manner that is valuable and accountable to Albertans.

This document is comprised of three sections that outline the broad design priorities of the Government of Alberta (GoA), and establishes specific criteria for a project-appropriate design response. Infrastructure seeks to inform project teams of these expectations in order to deliver efficient, functional buildings and to avoid time, cost, and quality concerns.

.1 Design Principles for Publicly Funded Infrastructure

All GoA projects shall receive a high degree of design consideration; however, distinctions must be made between signature, above average, and more routine buildings*. Design Principles for Publicly Funded Infrastructure* provides an overview of the outcomes required for the design, construction, operation, and maintenance of all GoA funded facilities. The purpose of this disciplined planning approach is to achieve balanced and holistic outcomes that are mutually beneficial to the short term goals of the Project Team and the long-term requirements of the Owner.

.2 Functionality Standards

As a knowledgeable owner, Infrastructure has extensive experience with the design, construction, and operation of its facilities. Based on this experience, Infrastructure has developed a set of *Functionality Standards* that provide specific planning, technical, and operational strategies for the guidance of Project Teams. These strategies serve to ensure that the facility performs optimally throughout its lifecycle.

.3 Statement of Design Objectives (SDO)

The SDO is developed by the Owner for inclusion in the project Request for Proposals (RFP) and Project Charter. It states the Owner's design and functional priorities for the Project Team, including the Project Manager, Consultants, and key stakeholders. The SDO should be included and responded to by the Consultant in the Schematic Design and Design Development phases, through written narrative and graphic representation.

0.2 Design Principles for Publicly Funded Infrastructure

The Infrastructure *Design Principles* are intended to influence the design, construction, operation, and maintenance of all GoA funded projects. They guide the level of design for each project to be appropriate for its purpose, place, and use. The Design Principles are outcome focused to ensure an integrated approach is adopted by all stakeholders throughout each design phase.

Background

The design, delivery, operation, and maintenance of quality infrastructure is central to the Government's commitments to Albertans. Infrastructure is responsible for the provision of public facilities that meet stakeholder needs in a cost effective and efficient manner, consistent with the Province's environmental, social, and economic values. In collaboration with boards, agencies, and industry, the Ministry aims to enhance the value of building infrastructure by leveraging the collective technical experience of all related subject areas, including planning, design, construction, acquisition, and renovation.

The design process offers opportunities to reduce emissions and to optimize energy efficiency and climate resilience. Facilities should be flexible and adaptable over the long-term, well integrated into their context, and accessible to all Albertans.

Consistent with the Government's priorities, Infrastructure projects must achieve effective and efficient program outcomes within the parameters of time, budget, scope, and quality. The optimization of infrastructure and asset management requires overarching principles to align practices, standards, and programs in order to deliver effective, affordable, and sustainable publicly funded facilities.

The Design Principles emphasize building performance and use over the life of a facility; this fosters innovative solutions that are fiscally responsible, functionally appropriate, and operationally efficient. A clear understanding of the functional, physical, and operational requirements of a project is essential to ensuring its success. The principles are: functionality; sustainability; flexibility and adaptability; affordability; accessibility; and form.

Functionality

Every design is expected to perform a primary function. Most functions can be achieved in a variety of ways, but there are some basic elements that must be taken into account in order to create a solution that best fulfills the building's intended function. The intent to develop a project is derived from an endorsed need, purpose, or mission, and a desired outcome. When the design of a facility satisfies the technical, operational, emotional, cognitive, cultural, and accessibility needs of the people who use it, the project is functionally successful. One of the key indicators of a quality building is the ability to function as intended over its life span.

Functional design is both a process and an outcome. As a process, functional design is a set of practices guided by the principles that produce a positive outcome; as an outcome, it describes facilities that work well in the performance of their required tasks. Functionality must be considered in conjunction with all other principles to ensure that the overall approach is fully integrated and effective, even when faced with the certainty of compromises and trade-offs.

Sustainability

Low-carbon design and planning is a priority. Sustainable designs reduce negative impacts on the environment, promote the health and comfort of building occupants, and optimize the life-cycle operation and maintenance of a facility, thereby improving the building's performance. Approximately 90% of a building's life-cycle cost can be attributed to operation and maintenance; strategically invested capital premiums may be offset many times over a building's lifespan.

Sustainable design principles include:

- Optimize site selection: the location, orientation, and landscaping of a building affects local ecosystems, transportation methods, and energy use. Soil condition, proximity to flood plains, geography, and availability of offsite services can all impact the cost and complexity of construction. Consider and give priority to the reuse or rehabilitation of existing buildings and sites over new construction.

- Minimize energy consumption: it is essential to reduce energy loads, increase efficiency, and replace conventional energy sources with renewables where possible. Minimize energy use in new buildings and improve energy performance in existing buildings to reduce environmental impacts; targeting net zero energy use may be appropriate for certain projects. Close the gap between design energy targets and actual energy consumption through integrated monitoring to inform the evolution of future design standards.

- Protect and conserve water: the environmental and financial costs of water and sewage treatment, as well as stormwater management are significant. Sustainable buildings (and sites) use water efficiently and reuse or recycle water for on-site use wherever feasible.

- Responsibly manage materials: it is critical to achieve an integrated and intelligent use of materials that maximizes their value, prevents upstream and downstream pollution, conserves resources, and minimizes water consumption; tools are readily available for this purpose. The use of forest, wood or engineered wood products locally manufactured under all recognized certification systems is encouraged. Certified wood products can fulfil LEED requirements for the Material & Resources credit Building Disclosure and Optimization Sourcing of Raw Materials.

- Optimize operational and maintenance practices: consider the life-cycle operation and maintenance of a building and its systems during the preliminary design phase to contribute to the improvement of working environments, higher productivity, reduced energy and resource costs, and prevention of system failures.

- Enhance indoor environmental quality: the indoor environmental quality of a building has a major impact on occupants, productivity and outcomes. A building that is highly sustainable maximizes and controls natural light, has appropriate enhanced ventilation and moisture control, avoids the use of materials with high emissions, and optimizes acoustic performance. Occupant comfort and quality of experience is a priority.

- The intent of a sustainable design approach is to encourage decisions at each phase of the design process that reduce negative impacts on the environment and occupant health, and do not compromise the affordability nor the long-term operation and maintenance of a building.
- Integrate sustainability in a collaborative, consistent manner from the outset of a project, and take a holistic approach that evaluates all design options for practicality, economy, and best value to the project and to the environment. A meaningful, holistic approach to sustainability should result in an integrated solution that positively impacts all phases of a building's life-cycle. Sustainability principles are most effective and valuable when integrated from project initiation.
- Consider the durability of the building and its various systems and utilities, so that degradation and obsolescence is minimized. Compare the incremental cost and associated life-cycle of more durable materials to the availability, cost, resource implications, and maintenance for less durable items. For a durable structure it is possible to reconfigure, retrofit, and adapt for future program needs to avoid the energy and waste associated with traditional demolition and new construction. The deconstruction (systematic removal, sorting, and reuse of materials, systems, and fixtures) of a building is a more sustainable alternative than traditional demolition.

Flexibility and Adaptability

While most major public infrastructure is intended to have a very long lifespan, it is nearly impossible to anticipate what social, technological, or functional requirements a facility will need to respond to in the future. As a result, today's well-intentioned design decisions may not appropriately address the changing demands of a facility over its expected lifespan. The key principles of designing for the long-term are adaptability, flexibility, and durability; apply these principles to a new building to ensure that the building and its systems remain functional and effective throughout their expected service lives. A flexible design effectively permits the reconfiguration of space to support a similar use; an adaptable design supports a change of building use (e.g. school to office). *Incorporate flexibility and adaptability where cost-effective to promote future-proofing.*

Two examples of effective strategies for designing for future flexibility are the use of modularity and standardization in the planning of program spaces. Modularity allows the duplication of building spaces and provides adaptability, while standardization creates common spaces that can be used or reconfigured easily for multiple uses. Wherever possible, design flexible floor plans to allow for multiple uses and easy reconfiguration.

In order to evolve with changes in technology and new programs, a facility must be able to adapt to different uses and needs over its lifetime. Open floor plans, grid layouts, and adaptable systems all assist in enabling a facility to be reconfigured or renovated over its service life. Select furniture, movable modular walls, and other smaller scale components with dimensional logic that is harmonious with the architectural form. Operating systems need to allow portions of a building to be used efficiently, while others are unoccupied or closed, thus permitting a variety of uses and functions over the building's anticipated life-cycle. Floor plans should be valued as much for their flexibility as for their overall area.

Affordability

Alberta continues to be one of Canada's fastest growing provinces; between 2004 and 2014, Alberta's population increased by 27%, the highest increase of any province or state in North America. Today, Alberta is home to just over four million people, and by 2040 that number is expected to jump to more than six million. It is crucial that the expansion and replacement of the Province's infrastructure is done in a fiscally responsible and environmentally sustainable way to ensure that the best quality outcomes can be delivered with the limited resources available.

Financial comparisons involve more than initial construction costs. Projected annual operating and maintenance costs, component life cycle costs, and ease of operation and maintenance all directly impact the long term cost and performance of a facility. Operating and maintenance costs alone may be many times greater than the initial capital investment; by ensuring that life-cycle costs are considered early in the design and planning phase, a project's total cost can be minimized, and scarce resources (environmental, human, and financial) can be used more efficiently. Design energy modeling and verification of building performance post-construction provides comparison metrics that improve the accuracy of model data, thereby improving the accuracy of both capital and operational costs.

Accessibility

The term *accessibility* has traditionally referred to the physical access and circulation of people into and within a building. While accessibility has typically focused on Barrier-Free and Universal Design guidelines, this definition has been expanded to encompass other definitions of inclusivity, such as gender (e.g. inclusive washroom design), cultural (e.g. smudge rooms), and religious identity (e.g. prayer rooms).

Form

A well-designed building reflects the site, climate, culture, and materials of the location in which it is constructed. Accessibility, circulation, solar orientation, program, and topography may all affect the design of a project; the building form should respond to each in a meaningful fashion.

All GoA projects are to receive a high level of design consideration; however, important distinctions are to be made between three key typologies: 1) *Signature* buildings, such as museums and capital buildings, are those where form, materials, scale, and public profile are to be best in class; 2) *Above average* buildings, such as hospitals and university facilities, are ones where the form, materials, and scale of the project are of above average aesthetics and quality; and 3) *Routine* buildings, such as schools and offices, are those where the values of functionality and durability are key. Building form needs to be appropriate to its typology, and should favour simple, efficient designs that maximize durability, economy, efficiency, and operations.

Reflect a uniquely Albertan 'pride of place'. Historical, cultural, and physical features, existing buildings and patterns, and the scales of neighbourhood and city inform a good fit and identity for new interventions. Design teams are to create attractive and engaging public spaces that complement the building and enhance the community.

Landscaping should incorporate native, resilient vegetation and include public art in the project scope where possible, or enable future art through proactive identification of natural focal points and provision of structural or utility rough-ins.

Pursue value through innovation; not every building requires a completely custom design. With a standardized approach (e.g. modularity and prefabrication), unique and site-specific features can be incorporated without incurring additional costs. A refined, limited selection of materials (utilizing local materials where possible), provides a facility with a lower carbon footprint and better fit within its surroundings. A *re-use, not replace* approach, whereby existing facilities are incorporated into a new project, may feasibly and functionally enhance the overall outcome and improve the ability of the facility to meet the needs of its users.

Summary

Good design is a process that delivers long-term value, function, innovation, and inspiration. Design provides value by delivering high quality, sustainable facilities that enhance the quality of lives while meeting the challenges of user requirements. This can be through:

- Functional value – meets and adapts to the long-term needs of all users;
- Environmental value – efficient and responsible use of resources;
- Viability – provides good value for money;
- Social value – develops a positive sense of identity and community; and
- Physical value – enhances a setting.

Optimizing life-cycle costs while ensuring the long life of building and site components, designing features with easy access to systems and equipment for routine maintenance, repairs, and replacement, and providing durable and low-maintenance design elements are all crucial to the longevity, sustainability, and affordability of a facility over its full life cycle.

These Design Principles will typically apply to GoA funded projects, and are intended to guide the development of facility design and operation for the benefit of the Province’s environmental, social, and economic goals. While it is not possible that they can address every potential condition or eventuality, the Design Principles attempt to identify key factors that must be considered from the outset of a project to ensure an integrated and sustainable solution. The Principles enhance, but do not replace, all contracted Consultant’s professional responsibilities, duties or due diligence; they must be used in conjunction with professional judgment to ensure they are followed to the extent appropriate for each specific project.

0.3 Functionality Standards

Preamble

As a knowledgeable owner, Infrastructure has extensive experience with the design, construction, and operation of its facilities. Based on this experience, the following *Functionality Standards* provide specific planning, design, technical, and operational strategies for the guidance of Project Teams. Consistent with the Ministry's objective of Project Delivery Standardization, these standards are intended to be universal, ensuring that new construction and modernization projects perform optimally throughout their lifecycles. It is expected that Consultants review and apply the Functionality Standards to Infrastructure projects in conjunction with professional judgement and Owner consultation.

Each Standard consists of four parts:

A Principle (a general subject or theme)

1) Its Concepts (project specific elements that support the broad scope of the Principles)
    - Its Routine Applications (the common strategies that achieve the intent of the Concept)
        - Any Relevant Standards (or recommended actions)

This document comprises part of the Technical Design Requirements for Infrastructure Facilities, available at:
https://www.alberta.ca/assets/documents/infra-technical-design-requirements.pdf

.1 Health and Wellness of Building Users

1) Democratization of office space
    - Fair access to light and view for the majority of users
    - Flexibility in work areas to suit focused vs social tasks
        - LEED, WELL Building Standard (all points above)

2) Long corridors
    - End in light and view (or art feature)
    - Visually group zones or areas to assist wayfinding
        - WELL Building Standard
    - Enable future expansion (e.g. modular classrooms)

3) Light Quality

- Electric Light and Sun Glare Control, shading, and dimming
- Use photo cells to harvest daylight near window areas and motion sensors (occupancy and vacancy)
- Daylighting Fenestration – appropriate window sizes
  - WELL Building Standard (all points above)

4) Comfort Features

- Ergonomics
- Acoustics
- Thermal comfort – including individual control
  - WELL Building Standard (all points above), TDR

5) Air Quality

- Air quality standards, VOC reduction, pollution control, filtration
  - LEED, WELL Building Standard, TDR
- If provided, designate smoking areas away from public entrances and air intakes; prioritize smoke and scent free zones

.2 Flexibility/Adaptability

1) Loose fit plans; general vs specific fit

- Adaptive grids and geometries using planning modules
- Rectilinear rooms: various furniture orientation and layout options
- Have a greater focus on functionality than on gross area

2) Indicate future growth

- Consider site drainage and uniform tie-in of floor levels (e.g. accommodation of modular classrooms)
- Siting for future growth for both building and parking

.3 Sustainability

1) Integrated Design

- Engage project stakeholders early to determine the project requirements and goals
- Explore opportunities to achieve high performance building energy goals and promote the health and well-being of the end users
    - LEED
    - WELL Building Standard
    - Zero Carbon Building – Design Standard

2) Prioritize Building Envelope

- Through the preliminary energy modelling explore options with building massing and orientation
- Consider the impact of improved envelope performance on the operation of the facility

3) Optimize HVAC System Design

- Perform life-cycle cost analysis of system options, such as Ground-Sourced Heat Pumps and Variable Refrigerant Flow where applicable
- This should include the carbon pricing metrics
    - $170/tonne carbon price target in place for 2030,
    - $300/tonne forecast price for 2050, as used on Federal projects
- The building maintenance costs should be considered

4) Consider Incorporating Renewable Energy

- If the owner has expressed interest in a Net-Zero building, explore options of incorporating Solar PV panels into the design

5) Consider the Life-Cycle Embodied Carbon

- There is increased focus on material selection in the construction industry
- There are tools available to projects to optimize material selection
    - Athena Impact Estimator

6) Support greener transportation options

- Provide or plan for future electric vehicle parking and charging stations
- Provide secure, supervised, sheltered bicycle storage

7) Consider education and communication strategies in concert with technologies

.4 Durability

1) Strengths and Properties of Materials

- Know and practice using inert materials: metal, glass, stucco, stone, concrete
- Avoid plastics and unusual composites: no face sealed approaches (no foam or sealant)
- Understand metallurgy and dissimilar materials
- Avoid sole sourced and unproven technologies
- Understand the effects of Alberta’s climate on exterior materials; flood and wildfire

2) Vandalism, weather, and maintenance will damage inappropriate materials

- Use robust, durable materials (e.g. masonry, concrete, etc.) at grade
- Avoid climbable features
  - Understand and practice Crime Prevention Through Environmental Design (CPTED)

Alberta Flood and Wildfire risk: low combustibility roofing, materials, and details; flood resilient design

- ITR white papers on flood and wildfire mitigation
- Resilient Design Institute
- Institute for Catastrophic Loss Reduction

3) Material redundancy

- Protect sensitive materials and finishes (e.g. rubber nosings, metal corner guards, etc.)
- Understand user behaviour and select materials accordingly (e.g. plywood millwork, masonry at grade, reinforced drywall, etc.)

.5 Constructability

1) Seek order and value through repetition and modulation

2) Enable modularity and pre-fabrication

- Repetitive design elements
- Rational (e.g. conventional grid) building layout: coordination with modular components for dimensional compatibility and flexibility

3) Maintainability

- Common component sizing (e.g. rectangular vs. raked windows)
- Rectilinear geometries

    - Accessibility (provide stairs to roof, not ladders)
    - Ease of component replacement: consider access, cleaning, and future maintenance (e.g. re-roofing)

4) Component Design

- Standardized vs. customized components (minimize waste, maximize flexibility)

.6 Rational Planning

1) Purposeful (rectilinear) geometries in plan and in massing

2) Constructible systems and details

- Understand (imagine) the rational sequence of the construction process

3) Avoid over articulation of forms (needless complexity and cost)

4) Use site to inform building layout and form

    - Solar direction, prevailing winds, site geometry and topography
    - Pedestrian, bicycle, passenger, and service vehicle access
    - Shadow studies with correct solar orientation
    - Positive drainage away from building: avoid natural low-points of site
    - Favour natural light at building entrances (e.g. schools)

.7 Roofing

1) Design roof/parapet details to facilitate future roofing replacement

2) Design roof to promote longevity

    - Uniform insulation, sloped structure
    - Redundant drains and scuppers to handle normal and extreme rainfall events
    - Direct water away from walls/parapets, walks/ramps, sensitive landscaping, etc.
    - Steep flashing slopes over porous materials for shedding (e.g. brick sills)
    - Wear surfaces in traffic areas, stair access for servicing
        - Reference ARCA standards

- ☐ Wildfire risk: low combustibility materials and details
    - ITR whitepapers on flood and wildfire mitigation
- ☐ Avoid cascading roofs and waterfall roof edges.
    - ARCA, ITR

3) PV standards for best practice, efficiency, warranty, safety, and durability

    - ARCA, ITR

4) Design for safety of workers

- ☐ Design controls for snow slides, icicle prevention, and over-flowing water at gutters

5) Avoid complexity in roof design

- ☐ Two-way slopes with counter-slopes rather than four-way structural
- ☐ Avoid curves in multiple directions

.8 Building Science for Life Cycle Value

1) Membrane continuity

- ☐ Achieve mechanically fastened and air-tight tie-ins
- ☐ Provide details for penetrations, avoid spray foam
- ☐ Use rain screen and PERSIST methods

2) Insulation continuity

- Spray foam contracts, leading to air barrier failure
- ☐ Design cold (vented) soffits vs. conditioned soffits
- ☐ Minimize thermal bridging at penetrations (canopies, balconies, etc.)
- ☐ Detail assemblies that can be realistically constructed

3) Control unwanted air ingress with careful detailing

4) Control unwanted water ingress

- ☐ Grading and grade separation
- ☐ Control water run-off from downspouts or scuppers
- ☐ Flashing considerations
- ☐ Rainscreen method for management of water penetration

5) Clerestory

- No sloped glass or sloped walls (unless designed like a roof)
    - Some exceptions (e.g. modernizations - TSPB approval required).

6) Window in wall vs. full curtainwall

- Full height glazing wastes energy and materials while reducing durability
- Strategic window sizing and placement, prioritize long-term performance (e.g. triple glazed or better) over short-term capital savings
- Tie-in membranes (do not spray foam), no structural silicone glazing
    - NECB
    - Test with air pressure and infrared thermography
    - Request and test-commission envelope mock-ups

Passive Climatic Response

1) Orientation for energy conservation, possible harvest of renewables

2) Building-defined outdoor microclimates

- Outdoor instructional areas, defensible space

3) Minimal glazing to prevailing winter winds

- Open up to southerly exposures: protect against winter winds
    - NECB and energy modelling

.9 Community

1) Appropriate response, in scale, material, and cadence, to the community served

2) Appropriate (dignified) sense of entrance, circumstance, and occasion

- Include (secure) opportunities for after-hours uses by community
- Provide plenary spaces: coats, concession, queueing, etc.
- Prioritize naturally-lit east, south, east, or west entrances vs. northern orientation

3) Vertical elements (shapes) engaging the sky/breaking the horizon for distinction

- Distinguish places of gathering and assembly, entrances, etc.

4) Develop hard and soft landscape features connecting the building to its community

- Provision of flags, signage, furnishings
- Follow GoA signage standards

  - Rational circulation paths for pedestrians, cyclists, and vehicles
  - Covered, secure bicycle parking near entrances and sightlines
  - Specify landscaping for durability and ability to thrive with minimal maintenance
    - CPTED , LEED

5) Accessibility

  - Gentler ramps, assisted doors
  - Featured stairs/hidden elevators
    - Active Design Guidelines and WELL standards
    - 7 Principles of Universal Design

.10 Responsible Architecture

1) Aspire to good design: appropriate to typology, notable in community (e.g. school)

- Promote values of social progress and public betterment
- Not world class or spectacle of design, unless directed

2) Restrained elegance

- Refined, disciplined, and purposeful in material use, form, and detailing
- Valuable and accountable to Albertans served by its design

3) Evaluate the merits of reusing existing structures

- Understand cultural values of existing facilities to community identity
  - Determine the environmental impact of demolition and landfilling materials vs. adaptive reuse
  - Provide a fair evaluation of the pros and cons of building retention (beyond immediate concerns of budget and schedule)
- Consider opportunities to enhance project outcomes through careful integration of old and new

.11 Value by Design

1) Consider first cost, life-cycle cost (e.g. 50 year), GHG, and energy metrics

2) Design/construction is a fraction of lifecycle

- Ensure sufficient time to understand (pre-plan) and optimize design
- Know the long-term impacts of short-term gains

3) Early involvement can integrate systems and save first cost

- Develop sustainability strategies in-step with design
  - MacLeamy curve of time/influence/costs

.12 Codes/ Life Safety

1) For GoA *Tier 2 or 3* projects, do not *grandfather* non-complying safety issues

- Scope of work may need to adapt
- Affected areas could include: sprinklering; alarm systems; firewalls; fire compartments; egress widths; door count; and door swing direction, etc.

.13 Universal, Active and Accessible Design

1) Consider Universal Design Principles, Active Design, and Barrier Free Principles

- Provide equal, dignified access to all users
- Promote physical activity through building and site design
- Implement best practices for barrier-free access
  - The 7 Principles of Universal Design
  - Alberta Safety Codes Council – Barrier Free Design Guide - 2017
  - Active Design Guidelines
  - WELL Building Standard
  - Fitwel

2) Diversity and Inclusivity

- Policy, procedure, and best practice are in evolution

3) Go beyond legislated minimums (e.g. NBC); TDR exceeds code minimum.

- On the good-better-best scale, aim for the best (e.g. ramps use 1:20 (best) vs 1:16 (better) or 1:12 (good)

.14 Inspiration

1) Experience

- Envision how the end user will cognitively, socially, emotionally, and physically experience the building and site, and design to enhance this experience
- Inspire students and teachers (for example)

  - Community fit and pride (e.g. views from and towards)

2) Beauty and Delight

- Value beauty, art, and nature, and incorporate where possible
- Know the Architectural expression of public institutions and their buildings
  - WELL Building Standard
- Celebrate culture, spirit, and beauty
  - Living Building Challenge (LBC) - Beauty and Inspiration petals

.15 Acoustics

1) Non-Progressive Moveable Walls

- Not suitable for quiet spaces requiring high levels of speech privacy/sound isolation
- Leaks in construction joints at ceiling, floor, and wall intersections are common
- Costlier than “standard” construction; requires specialized technicians for relocation

2) Operable Partitions

  - Minimize use: challenging to properly install, require routine maintenance, limit future use of the space, and are expensive
  - Avoid use where sound isolation is a priority

3) Glazing in Interior Walls

  - Minimize size, maximize pane thickness
  - Use laminated glass and double glazing with maximum air space thickness
  - Correct design will provide acoustic separation and allow light/views

4) Mechanical Room Locations

  - Typically the loudest sources of noise in a facility
  - Do not locate above or adjacent to quiet spaces (e.g. classrooms, patient rooms)
  - Mechanical equipment sound and vibration can be challenging and expensive to attenuate post-construction

5) Acoustically Absorptive Building Materials

- Integrate surfaces with high acoustical absorption properties into the architectural design. This can reduce acoustical reverberation, decrease noise, and create comfortable environments with good speech communication
- Provide ceiling tiles with high sound absorption, acoustical roof deck, and sound absorbing block wall. These surfaces are typically easy to refresh, are abuse-resistant, and cost-effective
- Open plan spaces (e.g. classrooms, offices) require ceilings with very high sound absorption; minimum standards may be too low for some situations
- Provide high quality flanking walls and ceiling baffles. This mitigates against future acoustic degradation if acoustic panels are replaced with conventional construction

.16 Security

1) Sightlines

- Integrate passive security, views to main entrances by frontline staff
- Utilize landscaping features to direct visitors towards desired entrances
- Locate vulnerable fixtures and features (e.g. bike racks) in highly conspicuous, supervised, and well lit locations

2) Physical security

- Where necessary, incorporate hardening of site and building into architectural and landscape design
  - CPTED

Links

1. Infrastructure Technical Resources
   https://www.alberta.ca/infrastructure-technical-resources.aspx
2. Technical Design Requirements for Infrastructure Facilities
   https://www.alberta.ca/assets/documents/infra-technical-design-requirements.pdf
3. Leadership in Energy and Environmental Design (LEED)
   https://www.usgbc.org/
4. WELL Building Standard
   https://www.wellcertified.com/
5. Technical Services and Procurement Branch Solar Guidelines
   https://www.alberta.ca/assets/documents/tr/tr-solar-energy-for-alberta-final.pdf

6. Zero Carbon Building – Design Standard
   https://www.cagbc.org/
7. Crime Prevention Through Environmental Design (CPTED)
   http://www.cpted.net/
8. Technical Services and Procurement Branch Flood Guidelines
   https://www.alberta.ca/assets/documents/tr/tr-floodriskmgmt.pdf
9. Technical Services and Procurement Branch Wildfire Guidelines
   https://www.alberta.ca/assets/documents/tr/tr-wildfireprotection.pdf
10. Resilient Design Institute
    https://www.resilientdesign.org/
11. Institute for Catastrophic Loss Reduction
    https://www.iclr.org/
12. Alberta Roofing Contractors Association
    https://arcaonline.ca/
13. Active Design Guidelines
    https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/active-design-guidelines/adguidelines.pdf
14. 7 Principles of Universal Design
    http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/7-Principals-.pdf
15. Athena Impact Estimator
    http://www.athenasmi.org/our-software-data/impact-estimator/
16. Barrier Free Design Guide 2017
    http://www.safetycodes.ab.ca/Public/Pages/Publications.aspx
17. Fitwell
    https://fitwel.org/

0.4 Statement of Design Objectives (SDO)

The SDO provides the Project Team with a concise summary of the fundamental values that will inform the eventual design solution. The sample SDO that follows is to be adapted by the Owner to state each project's unique design and functional priorities. The SDO should be included and evaluated in the RFP and Project Charter, and should be included and responded to by the Consultant in the Schematic Design and Design Development phases through written narrative and graphic representation.

Technical Services and Procurement Branch is available as a planning and architectural resource to the Project Team as the design develops.

Contact:

Standards and Specifications Specialist

Technical Services and Procurement Branch

Alberta Infrastructure

3rd Floor, 6950 - 113 Street

Edmonton, AB T6H 5V7

T | 780-422-7456

infras.trc@gov.ab.ca

Sample Statement of Design Objectives

Date

Infrastructure is responsible for the provision of public facilities that meet stakeholder requirements as well as the Province's environmental, social, and economic values. The design of the <Project> must meet these objectives in a refined, responsive, and publicly defensible manner. This document outlines the design priorities of the <Project> and establishes criteria for an appropriate architectural response.

Functionality

The <Project> must prioritize operational efficiency. Efficient building layout and circulation will facilitate and enhance the ability of users to effectively communicate, collaborate, and perform tasks.

Flexibility, Adaptability, and Durability

Applying the principles of flexibility, adaptability, and durability to the <Project> will ensure that the facility functions optimally throughout its expected service life. Designing for flexibility allows the building and site to anticipate future user needs and unexpected events (future proofing). Evaluate design decisions based on a cost benefit analysis of the capital vs. life-cycle cost of materials and systems, incremental costs for increased durability and innovative approaches to design, construction, and sustainability.

The <Project> must adapt to changes in technology and new programs, both immediate and future. Open floor plans, grid layouts, and adaptable interiors support quick and economical reconfigurations to serve single or multiple/concurrent functions. Zoning of building systems and floor plans permits expansion and contraction of building operation and energy footprint relative to peak and baseline use.

Ensure resilience. Incorporate redundant systems and grid-independence for uninterrupted use during extreme circumstances such as weather events and utility outages. Apply appropriate hardening of the building and site for security, and *post-disaster building* requirements. Consider the durability of the facility, its systems and utilities, to minimize degradation, maintenance, and obsolescence over time.

Sustainability

Low-carbon design is a priority. Integrate sustainability in a collaborative, consistent, and holistic manner. Explore innovative methods for reducing the carbon footprint of the <Project> through *Deeper Greening*; evaluate options for practicality and value to the project and to the environment.

Architectural Approach

The <Project> must achieve a high level of functionality, flexibility, adaptability, durability, and sustainability. A careful design approach can meet these goals and can create quality architecture that is appropriate for the building typology and respectful of the limitations of budget and schedule.

The <Project> should respond to its site, climate, and context. Accessibility, circulation, solar orientation, program, and topography may inform the design approach; the building form should respond to each in a meaningful and appropriate way*. Favour simplified, rational designs that maximize the project values*. Utilize a refined selection of materials and design details. The Consultant should provide multiple options based on a sound understanding of the functional program, site, and GoA standards.

End of Design Principles

1.0 Sustainability

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1.1 References

.1 Green Building Standards. Harvard University (2016). Retrieved from: https://green.harvard.edu/topics/green-buildings/green-building-standards

.2 LEED v4.1 Building Design and Construction Getting Started Guide for Beta Participants, 2021 Edition, U.S. Green Building Council

.3 LEED v4.1 Interior Design and Construction Getting Started Guide for Beta Participants, 2021 Edition, U.S. Green Building Council

.4 ASHRAE Advanced Energy Design Guides (2011,2012). American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta,

.5 ASHRAE/IES 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers Atlanta, GA.

.6 ASHRAE 209-2018, Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers Atlanta, GA.

.7 National Energy Code for Buildings (NECB). 2017 National Research Council Canada, Ottawa, ON.

1.2 General

.1 The Appendix 'G': Green Building Standards has been moved into the Sustainability Section of the Technical Design Requirements. The project requirements and deliverables are detailed for each project Tier within this section.

.2 The Green Building Standards were originally developed by Technical Services and Procurement Branch (TSPB) by consolidating best practices information, from the position of knowledgeable owner, as well as by adapting portions of Harvard University's Green Building Standards (Harvard University, 2016) – [used with permission]. They are based on components and systems that have proven to be reliable and efficient, to meet the needs of users, and to have acceptable life cycle costs. They build upon the TDR and will be formally updated periodically as required.

.3 For additional resources regarding projects with unique requirements or projects that do not fall into the Tiers as defined above, contact the TSPB (780-422-7456).

.1 Project Tier

.1 Alberta Infrastructure projects, including new building, building additions, major renovations, building modernizations, interior fit-outs, and limited scope projects both with energy and limited energy impacts, shall meet our prescriptive sustainable requirements as defined in the project Tier descriptions that follow.

.2 **Tier 1**: New Buildings, Major Building Additions, and Major Renovations
  .1 New Buildings, Major Building Additions and Major Renovations with energy and GHG impacts, including Building Envelope, Mechanical and Electrical Systems, and Occupant Density.

.3 **Tier 2**: Renovations, Minor Building Additions, and Interior Fit-outs
  .1 Partial Building Renovations and Building Additions with one or more Mechanical and Electrical System or Building Envelope within the project scope, as well as Interior Fit-Outs.

.4 **Tier 3**: Limited Scope System Upgrades with an Energy and GHG Impact
  .1 Limited Scope Projects with Energy impact but are focused on those systems such as Energy Management Control System upgrades, HVAC replacement, lighting replacement, etc.

.5 **Tier 4**: Limited Scope with No or Limited Energy/GHG Impact
  .1 Limited Scope Projects with no or Limited Energy and GHG Impacts such as a Landscape project or a project that only renovates finishes and furnishings.

.2 LEED v4.1 Certification

.1 New construction and major renovation projects (Tier 1) are required to register and achieve Silver certification using version 4.1 of the U.S. Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED®) green building rating system (LEED v4.1).

.2 The Province requires a number of LEED v4.1 credits to be mandatory credits for its projects. For the mandatory LEED v4.1 credits, the focus is to reduce GHG emissions through optimizing energy performance with commissioning and metering, to track and monitor this energy reduction/performance, as well as further reduce GHG emissions by sourcing regional and environmentally responsible materials.

.3 Integrated Design Process

.1 The Integrated Design Process is a collaborative team approach with the client group, including occupants and operating staff, and a multi-disciplinary design team, focusing on the design, construction, operation, and occupancy of a building over its complete life cycle. The Integrative Process credit is mandatory for Tier 1 projects and should be reviewed for applicability to Tier 2 projects based on the project scope.

.4 Energy Modeling

.1 Design teams are expected to follow the 7-step guide defined in the Optimize Energy Performance credit section of the LEED Reference Guide. The preliminary energy model is now required with the Mandatory credit Integrative Process.

.2 The Optimize Energy Performance credit has been updated to divide the points awarded based on energy cost reduction and GHG emissions reduction as defined by the Performance Cost Index in accordance within Section 4.2.1.1 of ASHRAE Standard 90.1-2016. Project teams that wish to use NECB 2017 in the LEED v4.1 submission must use the Alternative Compliance Path for this credit, Zero Energy Performance Index.

A. Specific Requirements for Healthcare Facilities

.1 For new health facilities, the goal is to build with improved sustainability throughout the planning, design, construction, and operations and maintenance practices that are consistent with the purpose of the facility, to provide services that aim to improve human health and health of the environment.

.2 Integrated Project Planning and Design is a prerequisite for all LEED v4.1 Healthcare projects. The Integrative Process credit is Mandatory in addition to this established prerequisite. Design Healthcare projects are typically very complex with diverse user groups providing services to the broad public. The Integrated Design Process promotes a stronger incorporation and definition of project goals through ongoing discussions achieving increasing levels of specificity, and optimally integrated solutions.

1.3 Tier 1 – New Buildings, Major Building Additions and Major Renovations

.1 Integrated Design

.1 It is mandatory that project teams adhere to the requirements of LEED v4.1 BD+C Integrative Process credit. Projects must analyze Energy-Related Systems and Health & Well-Being as two required areas for the credit.

.2 For the Energy-Related Systems, the project team must establish an energy cost per square meter-year target. This energy cost target must include the current 2030 commitment for carbon pricing of $170/tonne as well as the forecast 2050 target of $300/tonne.

.3 The term “simple box” should be interpreted as per the ASHRAE Standard 209, Appendix C: “where design parameters are known, those should be used”. This includes building form.

.4 For LEED certification, the design team registering the project through GBCI shall add infras-leed@gov.ab.ca (TSPB Review) to the LEED Online project database.

.2 Energy Modeling

.1 Design teams are expected to follow the 7-step guide defined in the Optimize Energy Performance credit section of the LEED Reference Guide. The preliminary energy model is now required with the Mandatory credit Integrative Process.

.2 The Optimize Energy Performance credit has been updated to divide the points awarded based on energy cost reduction and GHG emissions reduction as defined by the Performance Cost Index in accordance within Section 4.2.1.1 of ASHRAE Standard 90.1-2016.

.3 Projects that wish to use NECB 2017 in the LEED v4.1 submission must use the Alternative Compliance Path for this credit, Zero Energy Performance Index.

.3 LEED Certification

.1 Project performance must meet the requirements of select LEED v4.1 BD+C rating system and achieve at least LEED v4.1 Silver certification. For LEED v4.1 credits listed below, refer to the Reference Guide for detailed credit requirements.

.2 MANDATORY CREDITS:

.1 The following credits are mandatory based on the project type and corresponding certification (*BD*+*C*).

Cat.	***Required Credit***		**BD+C NC**	**BD+C MR**	**Additional Guidance**
ID	*Integrative Process*		1*	1*	This credit is now mandatory for all Tier 1 projects.
WE	*Water Metering*		1	1	For metered systems, consider recommendations from the building's operations team.
Energy & Atmosphere	*Enhanced Commissioning* Option 1, Path 2 and Option 2		6	4 or 6	The project's Commissioning (Cx) Plan should determine the system monitoring that is required for the project goals and address recommendations from the building's operations team. Enhanced, monitoring-based and building envelope commissioning are mandatory for new construction and major renovations if envelope upgrades are included in scope.
	Optimize Energy Performance	*Office/ School*	12	8	The minimum point requirements are based on the established cost model. Projects are encouraged to review the LEED v4.1 Alternative Compliance Path Zero Energy Performance Index pilot credit.
		Healthcare	11	7	
	Advanced Energy Metering		1	b	If included in the project, consider with recommendations from the building's operations team, separate metering for parking garages, large kitchens, data centres, large data closets, and other unique space types.
Material & Resources	*Building Disclosure & Optimization (3 credits)*		3	3	In addition to the 3 of 6 points available, project teams are encouraged to prioritize use of products within 160km of project site.
	Construction & Demolition Waste Management		1	1	Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives.
IEQ	*Low-Emitting Materials*		2	2	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.

*** For elementary school projects and other small scope projects, this requirement can be discussed with TS if the project team feels there is limited value.**

.3 RECOMMENDED CREDITS:

.1 To meet the minimum credit requirements to achieve LEED v4.1 Silver, projects teams are encouraged to review the list of recommended credits below and consider if these can be achieved for their project.

Cat.	***Potential Credits***	**BD+C NC**	**BD+C MR**	**Rationale**
Sustainable Sites	*Rainwater Management*	1	1	With a focus on resilience to the changing climate, review the feasibility to incorporate green infrastructure and low impact development strategies into the site design.
	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	*Outdoor Potable Water Use Reduction*	1	1	Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, Alberta Infrastructure recommends this be included as a sub-metered system in the Water Metering credit.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.
Energy & Atmosphere	*Renewable Energy Production*	>1	>1	Consider including renewable technologies into the project scope.
Indoor Environmental Quality	*Thermal Comfort*	1	1	The requirements of this credit are in line with the TDR Mechanical Design Criteria.
	Acoustic Performance	1	1	The acoustic performance in school projects provides an optimal space for learning.

.4 Deliverable Requirements

.1 SCHEMATIC DESIGN

.1 Access to the LEED-Online project been provided to TSB.

.2 LEED v4.1 scorecard demonstrating minimum Silver certification and Mandatory Credits.

.3 Integrative Process credit report highlighting the analysis and outcomes for Energy Systems and Health & Well-being

.4 Preliminary energy model report, as per the Integrative Process credit guidance. This report should identify the options available to the project to further reduce the energy use in the building.

.2 CONSTRUCTION DOCUMENTS – 60% COMPLETE

.1 Updated LEED v4.1 scorecard demonstrating minimum Silver certification and Mandatory Credits.

  - .2 Energy model report that identifies the HVAC options available and perform a life-cycle cost assessment. This should follow Step 4: Model potential HVAC system types, as per the Optimize Energy Performance Guidance.
  - .3 Confirm a third party commissioning agent been has been engaged.
  - .4 LEED related Specification sections are included for review.

.3 PRE-TENDER DOCUMENTS
  - .1 Updated LEED v4.1 scorecard demonstrating minimum Silver certification and Mandatory Credits.
  - .2 Final energy model report must include the 'Required Documentation' from the Optimize Energy Performance credit, including the energy model inputs, input-output reports, exceptional calculations (including thermal bridging), the energy consumption and demand for each building end use, and the fuel rates (including the source for those rates).
  - .3 Provide the Commissioning Plan for review.
  - .4 LEED related Specification sections are included for review.

1.4 Tier 2 – Renovations, Building Additions, and Interior Fit-outs

The following requirements and recommendations apply to the project unless the affected system or strategy is specifically excluded from the scope of the project.

.1 Integrated Design

.1 If LEED certification is pursued, the design team registering the project through GBCI to add infras-leed@gov.ab.ca (TSPB Review) to the LEED Online project database.

.2 LEED Certification Goal Setting: During the charrette, Project Teams are required complete the LEED feasibility assessment for pursuing LEED v4.1 BD+C or LEED ID+C, to be submitted with the initial design.

.3 For LEED v4.1 BD+C projects, the USGBC recommends that a 40/60 rule, where the percentage of floor area associated with the project exceed 60% of the gross floor area. Additionally, enough system components must be in the scope make certification practical to pursue.

.4 If the Project Team decides that LEED certification is not within the project scope, projects are still to comply with the requirements identified in the appropriate LEED v4.1 Guidelines.

.2 Energy Modeling

.1 Project Teams are to assess the scope of the project to determine energy modelling is required. If no energy modeling is required for the project, the design shall follow the ASHRAE 50% Design Guidelines for the appropriate project scope as prescribed in Option 2 of the LEED v4.1 Minimum Energy Performance prerequisite and the Optimize Energy Performance credit

.3 LEED Certification/ Sustainability Requirements

.1 Projects teams are to review the LEED scorecard and the Reference Guide to determine the pre-requisites and credits that apply to the project scope. Projects are to comply with the requirements identified in the appropriate LEED v4.1 Reference Guide.

.2 MANDATORY CREDITS

.1 The following credits are mandatory based on the project type and corresponding certification (*BD+C* or *ID+C*).

Cat.	***Required Credit***		**BD+C MR**	**ID+C CI**	**Additional Guidance**
Energy & Atmosphere	*Enhanced Commissioning* *Option 1, Path 2* *Or* *Option 1, Path 1 & Option 2*		4	5	The project's Commissioning (Cx) Plan should determine the scope of the project: • Projects that impact the mechanical systems should identify the system monitoring for the project goals, addressing input from the building's operations team. • Projects that primarily impact the building envelope pursue the Envelope Commissioning credit in lieu of Monitoring Based Commissioning.
	Optimize Energy Performance	*Office/ School*	8/a	8/a	The minimum point requirements are based on Option 1, using the established cost model. For projects pursuing Option 2, the points achieved shall reflect the scope of the project.
		Healthcare	7/a		
Material & Resources	*Building Disclosure & Optimization* *(3 credits)*		2	2	In addition to the 2 of 6 points available, project teams are encouraged to prioritize use of products within 160km of project site.
	Construction & Demolition Waste Management		1	1	Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives.
IEQ	*Low-Emitting Materials*		2	2	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.

a. Where energy modelling is outside the scope of the project, the project must meet the prerequisite and credit requirements of Option 2: Prescriptive Compliance: ASHRAE Advanced Energy Design Guide, as applicable to the project scope.

.3 RECOMMENDED CREDITS

.1 Projects teams are encouraged to review the list of recommended credits below and consider if these can be achieved as project scope, budget, and other considerations allow for their project.

Cat.	***Potential Credits***	**BD+C MR**	**ID+C CI**	**Rationale**
	Integrative Process	1	1	In addition to the two design charrettes required for Tier 2 projects, teams are encouraged to formalize the integrated design process that focuses on energy and water analysis.
Sustainable Sites	*Rainwater Management*	1	1	With a focus on resilience to the changing climate, review the feasibility to incorporate green infrastructure and low impact development strategies into the site design.
	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	*Outdoor Potable Water Use Reduction*	1	1	Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, AI recommends this be included as a sub-metered system in the Water Metering credit.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.
Energy & Atmosphere	*Advanced Energy Metering*	1	1	If this level of sub-metering is not part of the project scope, teams are encouraged to design systems that sub-metering may be utilized at a later date to help identify utility demand and consumption by end use.
	Renewable Energy Production	>1	>1	Consider including renewable technologies into the project scope.
IEQ	*Acoustic Performance*	1	1	The acoustic performance in school projects provides an optimal space for learning.

.4 Deliverable Requirements

.1 SCHEMATIC DESIGN

.1 If applicable, access to the LEED-Online project been provided to TSB.

.2 LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.

.3 Confirmation if the project will be demonstrating compliance with the Tier 2 requirements through energy modeling or adherence to the ASHRAE 50% DG as required.

.2 CONSTRUCTION DOCUMENTS – 60% COMPLETE

.1 Updated LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.

    - .2 If energy modelling compliance was chosen, provide an energy model report that identifies the HVAC options available and perform a life-cycle cost assessment. This should follow Step 4: Model potential HVAC system types, as per the Optimize Energy Performance Guidance.
    - .3 If the ASHRAE 50% compliance path was chosen, provide documentation identifying the ASHRAE 50% DG requirements for the facility type and the projects.
    - .4 Confirm a third party commissioning agent been has been engaged.
    - .5 LEED related Specification sections are included for review.

- .3 PRE-TENDER DOCUMENTS
    - .1 LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.
    - .2 If energy modelling compliance was chosen, provide a final energy report that includes the 'Required Documentation' from the Optimize Energy Performance credit. This includes the energy model inputs, input-output reports, exceptional calculations (including thermal bridging), the energy consumption and demand for each building end use, and the fuel rates (including the source for those rates).
    - .3 If the ASHRAE 50% AEDG path was chosen, completed AEDG Tables demonstrating compliance. https://www.usgbc.org/resources/aedg-tables
    - .4 Provide the Commissioning Plan for review.
    - .5 LEED related Specification sections are included for review.

1.5 Tier 3 – Limited Scope System Upgrades with Energy and GHG Impact

The following requirements and recommendations apply to the project unless the affected system or strategy is specifically excluded from the scope of the project.

.1 Integrated Design

.1 Review applicable Alberta Infrastructure Sustainability Requirements with design team when the project begins. There are no formal requirements, though project teams are encouraged to pursue integrated design practices to the extent that it is feasible.

.2 LEED Certification/ Sustainability Requirements

.1 For Tier 3 projects, LEED certification is beyond the scope of the project. Project Teams are to review the LEED scorecard and the Reference Guide to determine the pre-requisites and credits that apply to the project scope. Projects are to comply with the requirements identified in the appropriate LEED v4.1 Reference Guide.

.2 MANDATORY CREDITS

.1 The following credits are mandatory based on the project type and corresponding certification (*BD+C* or *ID+C*).

Cat.	***Required Credit***	**BD+C MR**	**ID+C CI**	**Additional Guidance**
Energy & Atmosphere	*Fundamental Commissioning*	P	P	Depending on the project scope, fundamental commissioning is required.
	Optimize Energy Performance Option 2	>1	>1	Meet the prescriptive compliance paths for Option 2 as applicable.
MR	*Construction & Demolition Waste Management*	1	1	Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives.
EQ	*Low-Emitting Materials*	≥1*	≥1*	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.

*** As Applicable to project scope**

.3 RECOMMENDED CREDITS

Cat.	***Potential Credits***	**BD+C MR**	**ID+C CI**	**Rationale**
Sustainable Sites	*Rainwater Management*	1	1	With a focus on resilience to the changing climate, review the feasibility to incorporate green infrastructure and low impact development strategies into the site design.
	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	*Outdoor Potable Water Use Reduction*	1	1	Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, AI recommends this be included as a sub-metered system in the Water Metering credit.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.
EA	*Enhanced Commissioning* Option 1, Path 2	4	5	The project's Commissioning (Cx) Plan should determine the scope of the project and identify the mechanical systems monitoring for the project goals, addressing input from the building's operations team.

.3 Deliverable Requirements

.1 SCHEMATIC DESIGN

.1 LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.

.2 Confirmation if the project will be demonstrating compliance with the Tier 3 requirements with adherence to the ASHRAE 50% DG as required.

.2 CONSTRUCTION DOCUMENTS – 60% COMPLETE
  .1 Updated LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.
  .2 Provide documentation identifying the ASHRAE 50% DG requirements for the facility type and the projects.
  .3 Confirm a commissioning agent been has been engaged. The commissioning agent can be a part of the consultant’s team if they report directly to Alberta Infrastructure.
  .4 LEED related Specification sections are included for review.

.3 PRE-TENDER DOCUMENTS
  .1 LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.
  .2 If the ASHRAE 50% AEDG path was chosen, completed AEDG Tables demonstrating compliance. https://www.usgbc.org/resources/aedg-tables
  .3 Provide the Commissioning Plan for review.
  .4 LEED related Specification sections are included for review.

1.6 Tier 4 – Limited Scope with No or Limited Energy/ GHG Impact

The following requirements and recommendations apply to the project as applicable.

.1 Integrated Design

.1 Review applicable Alberta Infrastructure Sustainability Requirements with design team when the project begins.
.2 With a focus on resilience to the changing climate, review the feasibility to incorporate green infrastructure and low impact development strategies into the site design.

.2 Sustainability Requirements

.1 For Tier 4 projects, LEED certification is beyond the scope of the project. Project teams are to review the LEED scorecard and determine the pre-requisites and credits that apply to the project scope. Projects are to comply with the requirements identified in the appropriate LEED v4.1 Guidelines.

.2 MANDATORY CREDITS
  .1 The following credits (following page) are mandatory based on the project type and corresponding certification (*BD+C* or *ID+C*).

.2 MANDATORY CREDITS

Cat.	Potential Credits	BD+C NC	BD+C MR	Rationale
MR	Construction & Demolition Waste Management	1	1	Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives.
IEQ	Low-Emitting Materials	≥1*	≥1*	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.

*** As Applicable to project scope**

.3 RECOMMENDED CREDITS

Cat.	Potential Credits	BD+C NC	BD+C MR	Rationale
Sustainable Sites	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	Outdoor Potable Water Use Reduction	1	1	Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, Alberta Infrastructure recommends this be included as a sub-metered system in the Water Metering credit.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.

.3 Deliverable Requirements

.1 SCHEMATIC DESIGN

.1 LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.

.2 CONSTRUCTION DOCUMENTS – 60% COMPLETE

.1 Updated LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.

.2 LEED related Specification sections are included for review.

.3 PRE-TENDER DOCUMENTS

.1 LEED v4.1 scorecard and/ or documentation demonstrating Mandatory Credits.

.2 LEED related Specification sections are included for review.

End of Sustainability Section

2.0 Building Envelope

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.1 References

.1 *ASHRAE Handbook of Fundamentals*, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, 2009.

.2 *Part 2, Architectural Details for Insulated Buildings*, Brand, Ronald, Van Nostrand Reinhold, 1990.

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.5 *Building Science for a Cold Climate*, Hutcheon, N, Handegord, G, (1989).

.6 *National Energy Code for Buildings* (NECB). 2017 National Research Council Canada, Ottawa, ON.

.7 *Designing the Exterior Wall: An Architectural Guide to the Vertical Envelope* Brock, L, (2005).

.8 *Alberta Roofing Contractors Association (ARCA) Roofing Application Standards Manual*.

.9 *National Building Code – 2019 Alberta Edition* including amendments.

.2 General

.1 Building envelope assemblies separate spaces requiring differing environmental conditions by controlling the flow of air, water and energy.

.2 The design approach generally recommended by Alberta Infrastructure (AI) may be described as the “Pressure Equalized Rain Screen Insulated Structure Technique”, or “PERSIST”. This approach is characterized by the following:

  .1 Exterior cladding covering an air space that is pressure equalized with the exterior.

  .2 Insulation mainly located to the exterior of structural components, in direct contact with and exterior to the air barrier system.

  .3 An air barrier system that also functions as a vapour retarder installed exterior to and supported by the structure.

.3 While other design approaches are possible, AI recommends the PERSIST approach because, properly implemented, it is relatively forgiving and minimizes the following:

  1 Moisture deteriorating the building envelope due to ingress of exterior bulk moisture and trapping of condensation from relatively humid air introduced into the envelope by air exfiltration.

- .2 Detrimental effects on air barrier from exposure to:
  - .1 UV radiation,
  - .2 Extreme temperature fluctuations, and
  - .3 Moisture.
- .3 Thermally induced movement of structural elements and any connected air barrier.

.4 Detail the building envelope to ensure that water, snow and ice sheds safely from exterior surfaces and is not trapped on or allowed to build up or to enter the assembly to cause deterioration or staining. Any non-vertical surface should be protected with flashing sloped a minimum 1:6 and include a drip edge.

.5 Materials used in the building envelope assembly should be suitable for the environmental conditions to which each will be exposed, including during the construction period. Materials should provide a service life consistent with accessibility for maintenance of building components and planned building life.

.6 Select envelope assemblies and materials to minimize maintenance requirements. Inert materials that are timeless, durable and non-stainable are preferred. Obtain prior AI approval before using exterior cladding materials requiring frequent maintenance.

.7 Avoid combining design approaches, for example, the Airtight Drywall Approach (ADA) in combination with the PERSIST approach. Where different systems come together, renovations for example, complete detailing should be provided to show continuity, compatibility, and constructability.

.8 Design to minimize the area of building envelope and the volume requiring conditioning. Do not detail projecting elements, overhangs, or canopies to create additional area of insulated air barrier.

.3 High Interior Humidity

.1 Indoor relative humidity higher than specified in Section 5.0 – Mechanical (30%RH reducing to 15% at -30°C), can result in excessive condensation on or within the building envelope during the winter.

.2 Where feasible, provide lower humidity “buffer spaces” to separate spaces with high relative humidity from the building envelope. To make such separation effective, design partitions and mechanical system air pressure differentials to minimize humid air transfer to the buffer spaces.

.3 Where high humidity space cannot be "buffered" from the building envelope, avoid condensation with carefully detailing of the building envelope assembly.

.4 Air Barrier

.1 Design building envelope components to meet the characteristics of an air barrier system as discussed in Construction Specifications Canada's *TEK-AID 01795 AIR BARRIERS*.

.2 Locate the plane of the sealing element (usually an SBS sheet membrane) exterior to the major structural elements.

.3 The air barrier typically consists of a number of materials acting together as a system. Minimize the number of materials used to form the air barrier.

.4 Minimize changes of plane in the air barrier system. Avoid changes of plane at air barrier membrane connections to windows and other fenestrations. Where unavoidable, detail a method of supporting the transition such as galvanized sheet metal transition strips (mechanically fastened) to assist in bridging abrupt changes.

.5 Minimize penetrations through the air barrier system. Where unavoidable, detail a continuous air barrier that is easily constructed, such as transition plates around steel elements, and membrane collars or collared sleeves at pipe and conduit. Do not use materials that cannot be sealed, armored electrical cable for example, if alternatives are available. (refer to Appendix D – Standard Envelope Details.)

.6 Do not extend roof deck through the air barrier at canopies and overhangs. Provide separate structure outside the envelope, and minimize penetrating structure.

.7 Air barrier detail continuity and constructability should be given particular attention at:

  .1 Window and door frames,
  .2 Mechanical, electrical and structural penetrations,
  .3 Wall/roof connections,
  .4 Changes in plane,
  .5 Joints between dissimilar materials, and
  .6 Building expansion and movement joint locations.

.8 Identify in drawings all the elements that make up the continuous air barrier. Provide large scale details to show how air barrier continuity will be achieved, how differential movements will be accommodated, and where construction sequence must be considered.

.9 Do not use foamed-in-place insulation as a substitution for a continuous, well detailed air barrier membrane.

.10 Do not consider polypropylene and polyethylene woven/non-woven films, or plastic film as air barrier elements.

.11 Avoid the use of systems or details that rely on caulking and sealants as air barrier elements. Consult Technical Services and Procurement Branch before considering these systems.

A. Specific Requirements for Healthcare Facilities

.1 Where indoor humidity levels will be maintained at levels higher than the design criteria in *Section 5.0 – Mechanical*, provide more robust air barrier systems such as thicker torch applied membranes or thicker self-adhesive membranes with fusible laps.

.5 Insulation

.1 Design insulation to be secured mechanically and in direct contact with the air barrier system.

.2 Specify effective RSI values for envelope components as part of an integrated design to provide the mandatory LEED® credits, and minimum effective RSI value from the *National Energy Code for Buildings (NECB)*. An adjustment of the thickness and RSI value for various locations may be required based on energy modeling results and targeted LEED® credits sought in optimizing energy performance per *Section 1.0 – Sustainability, paragraph 1.2.4*. Consider all elements bridging the envelope in energy modeling.

.3 Minimize thermal bridging at penetrations and connections, considering methods such as structural thermal breaks and thermally improved cladding systems. Design to prevent condensation on interior surfaces due to thermal bridging. For example, along concrete fins projecting from the interior of the insulated structural plane, extend insulation out four times fin thickness, use structural thermal breaks for projecting steel elements, and use insulated double Z-bars or thermal clips to support cladding and metal roofing. (refer to *Appendix D – Standard Envelope Details.*)

.6 Roofs

.1 General

.1 Design the roof and provide details to meet or exceed the requirements of the ARCA Roofing Application Standard Manual.

.2 For projects contemplating roof mounted photovoltaics, consult Alberta Infrastructure's Solar Photovoltaic Guidelines: https://www.alberta.ca/assets/documents/tr/tr-solarpvguide.pdf

.3 Prepare roof plans that identify roof slope elevations from high points to drains. Indicate locations of drains, overflow scuppers, roof slope percentages, roof mounted equipment and roof penetrations. Reference roofing detail drawings to the roof plan.

.4 For additional requirements related to roof drainage, (refer to Section 5.0 – Mechanical).

.5 Insulation should have a minimum depth of 50 mm at the roof drains.

.6 Maximum thickness of sloped insulation should be approximately 150 mm. The limitation of sloped roofing primary insulation maximum thickness may require additional roof drains.

.7 Lead sheets are not to be used in any drain assemblies.

.8 Use scuppers only as overflow devices, typically located 25 mm to 50 mm above membrane at roof perimeters. Do not use scuppers to replace roof drains. Minimum size of scupper to be determined by a rational analysis of expected maximum one day rainfall but should not be less than 150 mm x 300 mm.

.9 Auxiliary leveling surface is required over metal deck substrates.

.10 New/Existing Parapets - (re) construction should be built with a minimum of 38 mm x 140 mm wood framing with cap sloped 1:6 towards the roof.

.11 Install walkways of 250 granular MBM cap sheet in a contrasting colour around mechanical roof top units and in paths with direct lines to stairwell or roof hatches. Leave 25 mm gaps in the MBM cap sheet walkway every meter to not impede drainage to the roof drains.

.12 No pitch pans (gum boxes) are permitted on any new or re roofs. Install curbed roof openings with metal enclosures that have removable tops that will allow adding or deleting of mechanical equipment (refer to Appendix D – Standard Envelope Details, Sketch 12).

.2 Near-Flat Roofs

.1 Generally, the roofing membrane should consist of two-ply modified bituminous membrane (MBM). Before specifying other roofing systems such as single-ply (EPDM, PVC, etc.), consult Technical Services and Procurement regarding building usage, issues of durability, maintainability, access and safety.

.2 Slope roof surfaces to drains, including valleys and transverse slopes across top of parapets.

.3 Form roof drainage slopes (minimum 1:50) with the structure, not with insulation. Insulation thickness that varies from less than average to more than average results in temperature variance across the roof surface and a shorter service life for the roofing membrane. A consistent insulation thickness reduces waste during reroofing and results in lower life cycle costs.

.4 Backslopes, in a conventional application, may be formed using sloped insulation, provided the vapour retarder membrane continue to envelope the backslope insulation. Where tapered insulation is needed utilize the structural slope of the roof deck by applying wide cricket insulation layouts.

.5 Where practical, maintain a constant elevation along the perimeter of contained roof areas. This does not include roof to high wall transitions. Dimensioned details should be provide where varying perimeter elevation cannot be avoided, indicating low and high perimeter conditions.

.6 Each contained roof area must be designed to have a minimum of two drains. The intent is that if one drain is blocked, water can flow into an adjacent drain. Provide overflow scuppers where a structural hazard would result from a blocked drainage. Do not locate scuppers at roof expansion joints and over building access points. Lead sheets are not to be used in any drain assemblies.

.7 Use scuppers only as overflow devices, typically located 25 mm to 50 mm above membrane at roof perimeters. Do not use scuppers to replace roof drains. Minimum size of scupper to be determined by a rational analysis of expected maximum one day rainfall but should not be less than 150 mm x 300 mm.

.8 Auxiliary leveling surface is required over metal deck substrates.

.9 Minimize penetrations through the roof. Provide curbs at all roof penetrations other than drains (refer to Appendix D – Standard Envelope Details). Exceptions will be considered if utilizing an ARCA approved, pre-engineered device (spun aluminum plumbing vent flashing, tie off anchor, etc.). Vapour retarder membrane continuity is still required if using a pre-engineered device.

.10 Detail top of curbs at minimum 200 mm above the adjacent roof membrane.

.11 Parapet construction should be built with a minimum of 38 mm x 140 mm wood framing with cap sloped 1:6 towards the roof.

.12 Provide minimum 1.0 m clearance around and between curbs and parapets to facilitate roofing application and drainage.

.13 Locate all movement joints (expansion joints, etc.) on curbs, minimum 200mm above the adjacent membrane.

.14 Coordinate waterproofing of mechanical equipment and related supply lines, on roof curbs or on raised steel structure, with other members of the design team. For curbed designs, determine whether voids below equipment are to be treated as interior or exterior space.

.15 Where a roof joins a wall extending above the roof, locate window sills, door thresholds, louvers, wall cladding, and other wall penetrations a minimum of 300 mm above the roofing assembly. Consult Technical Services and Procurement Branch for approval of variance requests due to design constraints.

.16 Design transitions from roofs to walls projecting above roofs as protected membrane transitions (refer to Appendix D -– Standard Envelope Details, Series 01, Sketch 3).

.17 For protected membrane systems, use gravel ballast with filter fabric. Provide removable precast paver units around roof perimeters, curb (greater than 3 m any side) and for access paths and plaza decks (plaza decks require the use of paver pedestals to ensure uniform surface). A drainage mat is required between the insulation layer and the membrane.

.18 When the exposed surface of a roof assembly (for example, a plaza-type deck) is required to be cast-in-place concrete, provide the following:

  .1 Drains at both deck and membrane levels, designed to allow for differential movement between those levels.
  .2 Venting of insulation layer and concrete above roof membrane, and

.3 Geotechnical type filter fabric between concrete and insulation below, to prevent concrete penetrating into insulation layer.

.4 A drainage mat between the insulation layer and membrane. This acts as both an uninhibited drainage plane, as well as a separator sheet between the insulation and membrane.

.19 If equipment on the roof requires servicing and/or the building height is 3m or taller, provide main access to rooftop from inside the building by way of a stair assembly. Where practical, connect additional separate roof levels with external wall mounted caged ladders designed to meet or exceed safety regulations.

.3 Steep Roofs

.1 Design steep roofs (slopes 1:6 and greater) with a plane of waterproofing membrane beneath the plane of ventilated roof cladding. Normally, use the PERSIST approach with SBS (2-ply styrene-butadiene-styrene modified bitumen) membrane on sheathing, with insulation, air space and cladding. Avoid ventilated attics.

.2 Provide roofing membrane below all metal roofing and flashings. Consider metal roofing and flashings to perform a water-shedding function and not be a waterproofing cladding.

.3 Configure steep roofs and perimeters so that snow, ice and rainwater will not create safety, maintenance or appearance problems. Design to prevent ice and snow from sliding onto areas intended for use by vehicles or pedestrians.

.4 Size eavestroughs to accommodate water from contributory roof and wall areas and to resist expected snow and ice loads. Off-the-shelf eavestroughs typically do not provide adequate resistance to dynamic loads from ice and snow. Eavestroughs to be a minimum of 125 mm wide.

.5 Locate rainwater leaders along with the use of splashpads and positively sloped grading to direct discharge at grade so that water does not flow onto walks or paved areas where it could freeze, or onto areas where it could cause erosion damage.

.6 Locate eavestroughs and rainwater leaders so they are accessible for maintenance and will not cause leakage into the building.

.7 Comply with the following minimum slopes for applications of shingles and shakes:

.1 1:3 for asphalt laminate shingle applications,

.2 1:2.4 for cedar shingles, and

.3 1:2 for cedar shakes.

.8 Minimize thermal bridging and provide sufficient insulation to prevent ice damming on steep roofs.

.4 Green Roofs

.1 Plants should be low maintenance, native to the region or adapted to the local climate zone. Plants should not require water beyond what is typically available in the climate zone (except for the initial placement and nurturing for the first 90 days).

.2 A preference should be given for ‘intensive systems’ that have a minimum soil depth of 200 mm.

.3 Incorporate the requirements of a sloped structure and the methodology for placement of roof drains for near-flat roofs per paragraphs in 2.6.2.

.4 Incorporate a leak detection system with capability for remote monitoring by facility management staff, particularly if minimum roof slopes are compromised.

.5 Ensure additional live and dead loads are accounted for in the overall design of green roofs Consider additional live and dead loads in the overall design of green roofs. (whether new construction or as part of a major renovation), per *Section 4.0 – Structural*.

.7 Re-Roofing

.1 Re-roofing report from a knowledgeable roofing consultant to be forwarded to Technical Services and Procurement. The report conclusions and recommendations should be reviewed by Technical Services and Procurement staff before proceeding with re-roof specifications and details.

.2 Re-roofing should only be done after actual repairs and troubleshooting has confirmed that further repairs would not be cost effective, or the deteriorated condition of the roofing system makes repairs difficult or impossible to complete.

.3 If a roof requires replacement prior to the normal life expectancy, the roof condition report should summarize the cause of the failure, for example, poor initial installation, material failure, design defect, etc.

.4 Cut tests should be done on all roof zones prior to preparation of re- roofing specifications and drawing details.

.5 On structurally sloped roofs the re-roofing design may consider leaving existing primary insulation and cover panels in place if they are found to be in a dry condition. The existing vapour barrier which should be equivalent to two plies of built up roofing must be tied into adjacent wall air seals or vapour barriers. Generally, provide a minimum slope to drain of 1:50. Where this is not practical, for example, where existing flashing heights or details limit maximum thickness of sloped insulation, consider adding drains to reduce maximum insulation heights. Where adding drains is not practical, consult with the owner or Technical Services and Procurement regarding the likelihood of ponding and reduced service life.

.8 Under normal building humidity and operation PWF lumber should be specified only for ARCA sleepers supporting mechanical roof top equipment.

.9 Roof curbs for hot pipes, as in standby engine exhaust or other hot roof penetrations, should have metal curbs and additional clearances to combustible construction.

.12 Review actual depths of ponding water on roof, generally over 50mm, and locations of roof deck depressions prior to designing a new sloped insulation roofing system.

.13 Provide a minimum of two 100 mm roof drains per roof zone. Exceptions could include small canopy roofs with low parapets.

.14 All re-roofing drawing details and specifications should meet or exceed the ARCA's *Roofing Application Standards Manual*.

.15 Determine if the roof to wall tie-ins have an adequate air seal. If the existing wall air seal membrane is weak or non-existent, provide the roof to wall connection membrane stripping that could be tied into if the wall if re-cladded at a later date.

.16 Generally the re-roofing membrane would consist of two-ply modified bituminous membrane (MBM). Consult Technical Services and Procurement before specifying other systems. Where there is a potential fire hazard with the original building construction or building occupancy creates an unacceptable fire risk, a flameless roofing system (cold applied SBS membranes, single ply membranes, etc.) should be specified.

.17 Review controlled flow roof drainage system with a mechanical engineer to investigate alternate water drainage options. Review size of overflow scuppers to prevent overloading the building structure.

.18 At each drain location provide a new roof drain, conventional roof drain complete with sump receiver, aluminum dome, and under-deck clamping rings. Lead sheets are not to be used in any drain assemblies. Sleeved re-roof drains with u-flow connectors are not to be used. Check if existing roof drain piping or the underside of the existing roof drain is covered with insulation containing asbestos. Test that the insulation is asbestos free, and if so, make arrangements to remove the asbestos materials before the re-roofing is tendered.

.19 If the existing rainwater leaders direct water to grade through an exterior wall, check that there are no freezing problems associated with the existing construction. Correct any inherent flaws found in the existing construction.

.20 Remove and reinstall all mechanical roof top equipment to accommodate re-roofing. Raise curbs, ductwork, mechanical piping and electrical services to accommodate roof slopes.

.21 Reinstall mechanical roof top units and pipe supports using precast pavers set on 25 mm, Type 4, extruded polystyrene insulation on isolation sheet. Leave 50% of the space under the pavers open for drainage. Install a loose laid 250 granular cap sheet under the new mechanical supports. Review of structure by a structural engineer is required prior to utilizing pavers as support. Do not use pavers as support without prior review by a structural engineer.

.24 Provide a minimum of 610 mm clearance between mechanical curbs.

.25 Include mechanical instructions for removal and replacement of roof top units in the design.

.26 Include mechanical plumbing instructions for adding and removing roof drains and associated piping.

.27 Specify removal of all redundant rainwater leader piping and hangers if any roof drains are abandoned during the re-roof.

.8 Walls

.1 Design exterior walls as “PERSIST” assemblies consisting of:

  .1 Exterior cladding,

  .2 Ventilated air space,

  .3 Thermal insulation with a fastening system designed to minimize thermal bridging,

  .4 Air/vapour barrier system.

.2 Wall cavities should be sized to provide minimum 25 mm clearance (air space) between exterior face of insulation and back face of exterior cladding. Provide additional clearance where construction tolerances are greater (for example, in concrete structures and high-rise buildings). Consult Technical Services and Procurement Branch before considering alternative systems with smaller gaps.

.3 Provide appropriately located openings (weep holes) in the cladding to permit drainage and to allow pressure equalization of the air space.

.4 Compartmentalize air spaces in the wall cavity to restrict air flow around corners. Compartments should not measure more than 4m in any direction within the cavity generally. Detail and show the location of control joints and compartmentalization baffles in cladding.

.5 Allow for deflection where walls are associated with structurally framed systems (as opposed to load-bearing systems). Locate and detail the deflection joints.

.9 Windows, Doors and Glass

.1 Specify window performance and fenestration ratios using modeling for NECB and LEED®, and to prevent condensation from forming at design criteria specified in *Section 5.0 – Mechanical,* using thermally improved framing systems.

.2 These Technical Design Requirements are based on the use of pressure equalized rain screen, exterior glazed curtain wall systems for punch and strip windows. These systems integrate well with PERSIST assemblies, with a single plane of air and moisture barrier, and the insulating elements exterior to the structure. Consult Technical Services and Procurement for approval before specifying other systems. For isometric details refer to *Appendix D – Standard Envelope Details*.

.3 Minimize the use of spandrel framing and other opaque glazing approaches. PERSIST wall assemblies provide superior performance, durability, and service life.

.4 The design of the curtain wall should have mechanically keyed gaskets in the box section and pressure plate. Avoid structural silicone glazing. Consult Technical Services and Procurement for approval before specifying these systems.

.5 Adhere membrane directly to the tube face of the frame, and fasten with a thermally improved anti-rotation device.

.6 Anchors for the framing must be located within the vertical tube sections or at the interior so they DO NOT INTERFERE with adhesion of the membrane from the wall directly to the tube face of the frame.

.7 Do not project the main mass of window frames beyond the exterior plane of the air barrier. Bridge the cavity of the wall by means of flashing (not the frame or cover-cap). Do not caulk cover-caps to flashings or perimeter.

.8 Do not extend curtain wall to within 150mm of exterior grade or interior floor. At the exterior, a curb or other durable construction should be provided to minimize damage due to weather, maintenance and abuse. At the interior, the frame should be protected, or should be above the floor for safety, durability and maintainability.

.9 Avoid using curtain wall as building envelope at parapets. Consult Technical Services and Procurement for approval before including these details. (refer to Appendix D – Standard Envelope Details, Series Curtain Wall Details, # 5 & 6).

.10 Design windows, window treatment and interior surrounds to allow uniform, unobstructed movement of heated room air across glass and frame.

.11 Provide vestibules at building entrances where significant travel is expected, where interior humidity may otherwise result in frost buildup on doors and frames, to minimize cold drafts, and to minimize energy use. Vestibules should be a minimum of 3 m in the direction of travel to facilitate walk off mats that reduce pollutant contamination of interior spaces. All other doors require adequate mechanical treatment to minimize ice buildup.

.12 Exterior entrances without vestibules require adequate mechanical treatment to minimize ice buildup. Do not consider interior space within 2 m of an exterior door without vestibule or other protection as suitable for seated occupants.

.13 Coordinate the selection of glazing with lighting, mechanical and other systems to avoid glare and solar overheating. Provide:

    .1 Triple glazed sealed vision units with minimum 6mm interior and exterior glass. Consult Technical Services and Procurement for approval before specifying other systems.

    .2 Low emissivity coating(s) for the insulating glass units selecting surfaces to be coated that provides optimum benefit in the climate zone where project is located as part of the design for energy use and comfort.

    .3 Inert gas fill

    .4 Window spacer and edge seal systems with improved thermal performance.

.10 Skylights and Sloped Glazing

.1 When light is to be introduced through the roof, vertical clerestory glazing is preferred over skylights and sloped glazing. Such designs allow for better control of overheating, condensation control and solar glare.

.2 Skylights and sloped glazing systems frequently become building envelope problems, triggering significant operation and maintenance costs to building owners.

.3 Skylights or sloped glazing may be appropriate for some projects, for example, modernizations where structural capacity makes a clerestory configuration impractical.

.4 Before including skylights or sloped glazing in a new or modernization project, contact Technical Services and Procurement for approval and for advice to help minimize adverse consequences.

.11 Concealed Spaces

.1 Avoid sealed cavities and "dead space" as part of or adjacent to the building envelope. Enclosed spaces inside the envelope require heat and circulation to avoid the formation of condensation. Any unheated cavities created by minor architectural features should be vented to the exterior. Avoid detailing spaces beneath or adjacent roof mounted mechanical components without access for maintenance.

.2 Provide access to any heated concealed spaces from the interior (for example, heated overhangs). Anticipate necessary related requirements such as detection devices, sprinklering and compartmentalization.

.3 Provide access to unheated ventilated concealed spaces from the exterior (for example, unheated soffits with recessed lights).

.12 Crawl Spaces

.1 Design crawl spaces as dry, insulated and conditioned space inside the building envelope, and not vented to the exterior. Unconditioned (naturally ventilated) crawl spaces should only be used in conjunction with temporary and re-locatable structures.

.2 Crawl spaces must be accessible, cleanable and inspectable (floor slab, mud slab, or inspectable ground cover). Sand on polyethylene often becomes contaminated and often before construction is completed.

.3 If durable floor ground covers are provided, ensure there are additional pathway covers to protect the ground covers.

.4 Do not design spaces without basic lighting needed for safety and to make the crawl space inspectable. (refer to *Section 6.0 – Electrical*).

.5 Mechanical ventilation is required (refer to *Section 5.0 – Mecha*nical) to condition the space with heat and air changes to control moisture.

.6 For new health facilities, design of crawl spaces should include a full concrete floor slab to ensure cleanability (to assist with infection control and risk mitigation).

End of Building Envelope Section

3.0 Interior Design

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3.1 Interior Design Definition:

.1 Definition: Interior Design

.1 Interior Design is a distinct discipline with specialized knowledge applied to the planning and design of interior environments that promote health, safety, and welfare, while supporting and enhancing the human experience.

.2 References

Meet or exceed the following guidelines and standards:

- .1 National Building Code – 2019 Alberta Edition
- .2 National Fire Code – 2019 Alberta Edition
- .3 Infrastructure Technical Resources - Guidelines and Standards, https://www.alberta.ca/infrastructure-technical-resources.aspx
- .4 Alberta Infrastructure Technical Specifications (as a basis for developing project specifications), https://www.alberta.ca/basic-master-and-technical-specifications.aspx

.3 Deliverable Requirements: Interior Design

- .1 SCHEMATIC DESIGN
  - .1 Programmatic requirements of interior spaces
  - .2 Functional relationships identified
  - .3 Life safety and universal design requirements
  - .4 Proposed general interior finishes
  - .5 Preliminary floor plans, with room names and North arrow

- .2 DESIGN DEVELOPMENT
  - .1 All floor plans (Demolition, Construction, Reflected Ceiling Plan, Finishes, Furniture)
  - .2 Life safety plans, showing furniture
  - .3 Room names and numbers
  - .4 Partition types identified (including standard construction, architectural wall systems, or operable)
  - .5 Preliminary interior elevations
  - .6 Preliminary millwork

- .3 CONSTRUCTION DOCUMENTS – 60% COMPLETE
  - .1 Preliminary coordination with all engineering disciplines (i.e. structural, mechanical, electrical, etc.), shown on floor plans and elevations
  - .2 Door, frame, hardware, and glazing schedules
  - .3 All partition type details, heights, and acoustic ratings
  - .4 Further developed interior elevations, sections and details
  - .5 Furniture, fixtures, and equipment (FF&E) identified and located

.6 Millwork elevations and preliminary sections
.7 All interior finish locations identified and products specified
.8 Preliminary technical specifications

.4 CONSTRUCTION DOCUMENTS – 90% COMPLETE
  .1 Complete floor plans with legends and notes
  .2 Complete interior partition details
  .3 Complete elevations, sections, and details
  .4 Complete specifications for all interior finishes
  .5 Complete millwork details
  .6 Complete technical specifications
  .7 Coordinated cross-referencing between plans, details, and specifications

.5 CONSTRUCTION DOCUMENTS – 100% COMPLETE
  .1 All previous comments fully addressed

.6 CONSTRUCTION DOCUMENTS – PRE-TENDER
  .1 Final floor plans, elevations, sections and details fully coordinated with all disciplines
  .2 Final specifications

.4 Guiding Principles: Interior Design

.1 Refer to *0.2 Design Principles for Publicly Funded Infrastructure, and 0.3 Functionality Standards, in the 0.0 General Requirements Section*

.2 Support function-based needs and workspace allocation.

.3 Reduce renovation and reconfiguration costs.

.4 Allocate space consistently and equitably.

.5 Provide flexible and adaptable work environments.

.6 Promote the flow of natural light into the space (right-to-light).

.7 Promote and support user control, productivity and effectiveness.

.8 Support common collaborative tools and technology.

.9 Promote the safety, health and wellness of building users.

.10 Incorporate biophilia (elements of nature) in the interior environment.

.11 Support LEED Silver standards and sustainable initiatives.

.12 Promote staff satisfaction, retention and recruitment.

.13 Support the Asset Management Plan.

.14 Improve density.

.15 Standardize furniture and finishes within each building.

.5 Interior Finishes and Materials

.1 Finishes and materials must:
  - .1 be durable, low maintenance, readily available, and aesthetically pleasing.
  - .2 be environmentally friendly and sustainable, whenever possible.
  - .3 allow for future adaptability and flexibility.
  - .4 be specified as a basis of design and not sole sourced.
  - .5 be listed in a finish schedule noting the basis of design manufacturer, product name and number, finish, pattern, and other applicable information.
  - .6 be clearly identified on the finishes plan.

.2 The interior office environment should convey a modern corporate ambience. Select colours in a neutral range that will not become dated quickly. Limit accent colours to pieces that are easy and inexpensive to change (e.g. seat cushions).

.6 Walls

.1 Paint:
  - .1 Paint quality, colours and gloss levels must be durable, maintainable and appropriate for the usage, site conditions, and lighting levels.
  - .2 Colours must be selected from the manufacturer's standard running line. Custom paint colours are not acceptable.
  - .3 Multiple paint colour locations should be kept to a minimum.

.2 Wallcovering:
  - .1 Site applied wallcovering shall be Type II commercial grade, minimum.
  - .2 Vinyl graphic images are acceptable solutions for wallcoverings, when used in limited locations as an accent.

.3 The wall area surrounding electric hand dryers, drinking fountains, mop sinks, etc. must be protected from water stains and potential damage, with a durable material (e.g. ceramic tile, stainless steel, etc.).

.4 The surface of masonry walls must be smooth, and the corners bullnosed.

.5 Corner guards should be used to protect outside gypsum wallboard corners in high traffic areas. Corner guards must be stainless steel, or of a manufacturer's standard colour to match the walls, and adhered (not mechanically fastened) to the wall. Full height is preferred.

.6 Adequate blocking to support wall hung equipment and displays must be provided in partition cavities.

.7 Tackable and writeable surfaces:
  - .1 Locate to suit program requirements.
  - .2 Shall be easily removable to allow for future changes to the room function.
  - .3 Whiteboards shall be:
    - .1 magnetic to allow for dual purposes.
    - .2 of a commercial-grade material that is suitable for non-permanent dry-erase markers. The material must not scratch, stain, or leave “ghost” marks over time. Acceptable materials are polypropylene/vinyl film (for large surfaces) and tempered glass or enameled porcelain steel (for smaller areas). Unacceptable materials are melamine, laminate, or painted metal.
    - .3 white in colour with a gloss level acceptable for projected images.
    - .4 seamless if size permits. If a large area is to be covered, minimize seams by using the largest dimensional size possible and locate the seams higher, lower, or to the side of the primary writing surface.
    - .5 easily distinguished from surfaces that are not intended for writing on.

.8 Specific to Educational Facilities
  - .1 Ensure that the lower (minimum 1800mm) portion of gymnasium walls are smooth with no projections that could cause injury or abrasion.

.9 Interior Wall Construction (Typical)
  - .1 Standard Construction:
    - .1 Traditional gypsum board and stud construction method may be used where future reconfiguration of the interior environment is not anticipated and a cost benefit can be achieved.
    - .2 Refer to Appendix F for *Standard Interior Details.*

  - .2 Architectural Wall Systems:
    - .1 Use where appropriate to allow flexibility and re-configurability of the interior environment.
    - .2 Determine the most appropriate wall system type (demountable, modular, movable, unitized, frame and tile, etc.) based on:
      - .1 Type of space (office, warehouse, etc.)
      - .2 Current and future functional requirements
      - .3 Ease of installation, relocation and reconfiguration
      - .4 Code requirements
      - .5 Cost effectiveness
      - .6 Acoustical requirements
      - .7 Aesthetic requirements and finish options
      - .8 Maintainability, durability, and product quality
      - .9 Integration of glazing, power and data, plumbing, millwork, accessories, and systems furniture, if required
      - .10 Building site parameters
      - .11 Amount of disruption to existing staff or environment
    - .3 Incorporate full height or clerestory glass to allow natural light to flow into the space, where suitable.

.4 Must not require a mechanical connection or attachment to the floor or ceiling.
.5 Must be from a single manufacturer within a building, although various product lines from the same manufacturer may be used if suitable.

.7 Floors

.1 Carpet
  .1 Modular carpet tile shall be used in most office workspaces and meeting spaces.
  .2 Broadloom carpet should only be used in locations where modular carpet is not practical.
  .3 Carpet should not be used in wet areas.
  .4 Heights must be consistent where one carpet butts up to another.

.2 Resilient and Tile Flooring
  .1 Resilient or tile flooring should be used in wet or high maintenance areas.

.3 Flooring Accessories
  .1 Carpet edge guards shall be non-metallic, extruded or a molded heavy-duty rubber "T" shaped cap insert and extruded aluminum anchorage flange, profiled to accept cap.
  .2 Stair nosings must be one piece.
  .3 Carpet base cap strip may be extruded vinyl or metal cap strip to suit carpet base thickness. Base cap may wrap over the top edge of the base.
  .4 Carpet base shall be the same material, colour, pattern and texture as adjoining carpet. Exposed edges to be bound.
  .5 Resilient base may be solid rubber, thermoplastic, minimum 102mm high and a cove profile. Resilient base shall be installed in one continuous piece length. Base edge shall end at inside corners only.
  .6 Porcelain tile floors shall have wall base of the same material; minimum 102mm high, factory edge; edge protection profile, or a metal trim cap.
  .7 Flooring transitions between rooms shall be located at the centerline of the door, to avoid a sliver of different material being visible when the door is closed.

.4 Wet areas, such as shower rooms, must have slip-resistant flooring.

.5 Specific to Educational Facilities
  .1 Science rooms must have durable and chemical resistant flooring.
  .2 Rooms used for food preparation must have slip-resistant flooring.
  .3 Fitness rooms must have flooring that is designed to prevent physical injury and damage to equipment.

.8 Interior Doors

.1 Doors swinging out into a high traffic corridor should be avoided, unless they are recessed or protected by a barrier, such as a stub wall or millwork.

.2 Interior double door openings should be free of mullions, wherever possible. If they are deemed necessary, use removable mullions in openings where there is a requirement for large items to pass through.

.3 Specific to Educational Facilities:
- .1 Doors between a clean space, (i.e. a classroom) and a dirty space (i.e. a construction lab) must be properly sealed to prevent dust transfer.
- .2 Lockers and boot racks etc. should not be located directly behind door swings.

.9 Interior Glazing and Glazing Treatments

.1 Glazing is encouraged to allow natural light to flow between spaces; however, the amount of glazing should be limited when constructing rooms that require a high acoustic separation.

.2 Glazing should not extend to the floor. The bottom horizontal mullion should be no lower than the adjacent wall base.

.3 Specific to Educational Facilities:
- .1 In gymnasiums, interior glazing should be mounted flush to the room side of the frame, to reduce ledges and protrusions.

.4 The use of interior glazing treatments other than film (e.g. horizontal blinds) is restricted to program areas requiring variable visual privacy (e.g. observation rooms).

.5 The operating system of all types of window coverings must comply with current safety regulations.

.6 Film
- .1 Privacy film should be applied to glazing in offices, meeting rooms and support spaces.
- .2 Privacy film should obscure items from being visible at eye level between a seated and standing position. A white 20% opacity film is a guide but may be more or less, dependent on program privacy requirements.
- .3 If security film is needed, based on program requirements, it may be used in combination with a privacy film. Refer to the Physical Security Guidelines for Government of Alberta Facilities.
- .4 A cloaking film that blocks the visibility of digital screens may be considered, based on the program requirements.

.5 Coloured film may be used as part of a pattern, for wayfinding or room identification.
.6 Glazing film should be applied to the side of the glass that is subject to the least amount of traffic.

.7 Perimeter Window Treatments
  .1 Perimeter windowcoverings are typically Landlord or base building standard.
  .2 If perimeter windowcoverings are used in lieu of Landlord or base building standard, they must be similar in colour, or lined to appear compatible from the exterior.

.10 Ceilings

.1 Existing acoustic ceiling tile and T-bar ceiling grid should be reused if in good condition, wherever possible.

.2 Acoustic ceiling treatments, whether new or reused/re-furbished, shall meet the acoustical performance requirements as set out in *Section 7.0 – Acoustical.*

.3 Ceiling products must meet acoustic requirements, security objectives, aesthetics, end use requirements and the base building standard.

.4 Reconfiguration of the space should affect the ceiling as minimally as possible.

.5 Bulkheads, specialty and suspended ceiling elements shall be limited, and serve a functional purpose.

.6 Ceiling plans and treatments must be designed in consideration of mechanical, electrical, or structural elements. Coordination at an early stage of design is essential. Refer to Sections *4.0 Structural, 5.0 Mechanical and 6.0 Electrical.*

.7 Specialty and Accent Light Fixtures
  .1 Specialty and/or accent light fixtures may be used if required for specific program requirements, or to enhance presentations.
  .2 Accent lighting should be on a separate switch and be dimmable.
  .3 The location and heights of specialty and accent light fixtures must be identified in the construction documents.

.8 Moisture resistant gypsum board must be used in washrooms, shower rooms and areas of high humidity.

.9 Specific to Educational Facilities:
  .1 A clear unobstructed ceiling height of 3m above the finished floor is recommended in standard classrooms.

  .2 A clear unobstructed ceiling height of 8m minimum above the finished floor is recommended in most gymnasiums. To prevent the need for specialized equipment to perform maintenance, the ceiling height should be not exceed 11m.

.11 Millwork

.1 Must comply with current Architectural Woodwork Manufacturer's Association of Canada (AWMAC) and North American Architectural Woodwork Standards (NAAWS).

.2 In locations where accessibility is required, barrier-free sections must allow for access both above and below the counter.

.3 Sizes and functional requirements of all equipment and appliances must be confirmed prior to millwork fabrication.

.4 Millwork with a plastic laminate countertop shall have a 2-3mm colour-matched PVC edge, or a more durable material if required to suit program requirements.

.5 In wet areas, countertops shall have a moisture-resistant substrate, and a backsplash.

.6 If electrical outlets for countertop appliances and/or equipment are located below the counter, concealed grommets shall be provided.

.7 If microwaves are incorporated, they should be located on or below the counter, for accessibility and safety.

.8 Specific to Educational Facilities:
- .1 Countertops in science rooms and prep areas should be a solid core chemical and heat resistant material.
- .2 Coat hooks, shelves, and other applicable millwork, should be located at an appropriate height for the age group of the students.
- .3 An accessible millwork section should be provided at one sink location in food labs, science rooms, and staff rooms, as a minimum.

.9 Refer to *Appendix E* for standard interior millwork details.

.12 Signage and Wayfinding

.1 Wayfinding is a design strategy used to influence the navigation of building occupants and visitors in unfamiliar surroundings and may include signage, landmarks, or interior elements to guide them.

.2 Wayfinding strategies should be planned in the early stages of a project and be intuitive, simple, consistent, and coordinated throughout the space.

.3 Signage
- .1 For signage in a leased building, the requirements to match existing base building signage must be confirmed with the Landlord.

    - .2 Location, type, and installation dimensions must be clearly identified on signage plans.
    - .3 Signage must meet code and accessibility requirements.

- .4 Intuitive Wayfinding
    - .1 Destination points and intersections should be well lit.
    - .2 Where applicable, the reception, or main entrance should be clearly visible upon arrival.
    - .3 Alternate materials, colours, textures, or interior architectural features (such as a wall with a contrasting colour or graphic) may be used to differentiate the main path of travel and/or act as landmarks upon which people can orientate themselves in the space.

3.2 Accommodation Guidelines and Requirements for Office Space

.1 Overview

- .1 Refer to *0.2 Design Principles for Publicly Funded Architecture*

.2 Spatial Definitions and Density

- .1 The GoA defines space as per the current version of the Building Owners and Managers Association (BOMA).

- .2 Density
    - .1 Density is the average area allocated by position. It is based on all the useable office space and the GoA occupants in the entire owned or leased space (allocated to the Client Ministry).
    - .2 **The GoA wide density target is a maximum of 18 useable metres squared (um^2) per occupant of useable office space.** The density target is a guide for all upgrading, renovation and new development of GoA office accommodations.

    - .3 A density calculation shall be used for all occupant open and enclosed workspace and support space.
        - .1 **Density (um2 per occupant) = useable area m2/total number of occupants**
    - .4 Circulation space is included in the density calculation
        - .1 The total square metres of **programmed** workspaces and support spaces should be multiplied by a factor of 1.43 to achieve 30 percent circulation (typical).

    - .5 **NOT** included in the useable density calculation:
        - .1 staff visiting from other sites
        - .2 special purpose spaces as defined below
        - .3 public interaction service areas (front-end), such as Alberta Work Support Centres; however, office areas (back-end) are to be included in density calculations.
        - .4 shared amenity spaces that are common to the building.

- .3 Occupants are defined as:
    - .1 full-time employees (FTE's) (obtained from the HR system)
    - .2 vacancies
    - .3 positions for individuals on long-term disability
    - .4 contracted and seasonal staff that occupy the space
    - .5 practicum and summer students
    - .6 interns

- .4 Support space examples are:
    - .1 Hoteling workstations
    - .2 Quiet rooms
    - .3 Waiting and reception areas
    - .4 Open collaborative space
    - .5 Resource and print areas
    - .6 Meeting rooms
    - .7 Training rooms
    - .8 Therapy rooms
    - .9 Interview rooms
    - .10 Java centers
    - .11 File/storage rooms
    - .12 Hearing rooms
    - .13 First-aid rooms
    - .14 Mailrooms
    - .15 Children's play areas

- .5 Special purpose space examples are:
    - .1 Large ventilated server rooms
    - .2 Warehouses
    - .3 Trade shops
    - .4 Laboratories
    - .5 Necropsy rooms
    - .6 Wash bays
    - .7 Weld test centers
    - .8 Courtrooms
    - .9 Detention rooms
- .6 In situations where the density target cannot be met (e.g. very small groups in rural locations), space requirements may be based on the programmed functional needs.

3.3 Workspace Allocations and Planning Criteria

.1 Workspaces

Workspace Allocation Chart:

Occupant	Workspace Allocation	Workspace Type/ Location	Notes
Hoteling Staff Staff or visitors who require a temporary "touch-down" workspace.	2.5 m^2	Open/ Core (if possible)	-Unassigned workspace. -Provision is optional, based on programmatic requirements. -Space allocation does not include a storage tower (panel hung coat hook to be used). Space permitting, an optional storage tower could be provided within (not in addition to) the circulation space outside of the hoteling workstation.
Rover Staff Staff who either work primarily in special purpose areas or occupy their designated workspace less than 50% of the time; summer students; interns; contractors.	5.2 m^2	Open/ Core	-Assigned, unassigned, or oversubscribed depending on staffing requirements.
Resident Staff	6.7 m^2	Open/ Perimeter	-Managers and staff who occupy their primary designated workspace more than 50% of time.
Director (and Equivalent)	10.1 m^2	Open/ Perimeter	
Executive Director (and Equivalent)	14.0 m^2	Open/ Perimeter; or Closed/ Core	
Assistant Deputy Minister (and Equivalent)	20.9 m2	Closed/ Core	-Architectural wall systems are permitted to create restrictive workspaces (enclosed offices) for Assistant Deputy Ministers; however, they must adhere to AI's acoustic requirements.
Deputy Minister (and Equivalent)	27.9 m^2	Closed/Core (if possible)	-Defined as a restrictive workspace (individual enclosed office), typically located within a Deputy Minister's executive suite (DMO). -Where space is limited, the Deputy Minister workspace (individual enclosed office) is permitted on the perimeter of the building (at the windows) within the suite, if no core location is possible. -Architectural wall systems are permitted to create a restrictive workspace (enclosed office) for a Deputy Minister; however, they must adhere to AI's acoustic requirements.

Occupant	Workspace Allocation	Workspace Type/ Location	Notes
Deputy Minister Office (executive suite)	approx. 117m² * (including circulation; excluding meeting room) *varies according to Ministry requirements; does not include meeting room	Demised/Core (if possible)	-The DMO suite is permitted on the perimeter if a core location is not possible due to constraints of the building, and shall be determined on a case-by-case basis. -Refer to 3.3.1.7 for typical suite inclusions.

.1 Refer to *Appendix I* for typical details of each workspace type.

.2 Refer to the *Interior Design Guiding Principles 3.1.4.*

.3 Occupants are entitled to no more than one designated workspace.

.4 Workstations located in high traffic areas are permitted to have the panel height increased by one stack (up to a maximum overall height of 1676mm [66"]) and/or privacy film applied to the glazed panels, on the corridor side.

.5 A restrictive workspace is an enclosed office and is allocated to the positions of Deputy Minister, Assistant Deputy Minister, Executive Director (optional) and their equivalents. Positions that are not entitled to a restrictive workspace must receive approval based on the Restrictive Workspace Questionnaire, as provided by the Client Ministry Accommodation Contact to the Infrastructure Accommodation Planner.

.6 Staff that are permitted an enclosed office as an exception, based on the restrictive workspace questionnaire, may receive an office of the equivalent size to their open workspace allocation, located along the core and consolidated/zoned together for maximum flexibility and functionality of the space.

.7 Principles of the office allocation standards apply to demised suite spaces. Offices in a demised space are to be located along the core to allow natural light to be accessible to open workstations.

.8 Permitted Demised Suites:
  .1 Deputy Minister
  .2 Human Resources
  .3 Case/Investigations

.4 Finance is not eligible for a demised suite. However, it is acceptable for HR and Finance to jointly share a demised suite, if desired. Provide separation between the two units through zoning solutions. Support space such as meeting rooms etc. shall be shared. No individual support space will be allocated to specific units within a demised space, except as noted for the Deputy Minister's Suite.

.9 A Deputy Minister's Office (DMO) is a demised executive suite.

- .1 Work and support spaces within the suite shall conform to space allocations and criteria defined in sections 3.3 and 3.4.
- .2 Program requirements vary according to Ministry and must be determined and confirmed. A suite may typically contain:
  - .1 one Deputy Minister restrictive workspace (27.9m^2 individual enclosed office)
  - .2 one barrier-free ensuite washroom (approximately 5m^2) with lavatory, toilet, and applicable accessories
  - .3 Resident workstations
  - .4 Director (or equivalent) workstations
  - .5 one small java centre
  - .6 one print area
  - .7 one 4-person waiting area
- .3 The DMO is permitted to have direct access to an adjacent, large non-dedicated meeting room (29m^2). Common corridor access into the meeting room should also be provided to allow shared usage of the room when it is not required by the DMO.

.2 Alternative Workplace Arrangements (AWA)

.1 AWA shall:

- .1 be based on the functional program requirements.
- .2 be determined by the client ministry.
- .3 involve new and different ways to work by supporting mobility and collaboration.
- .4 be supported with appropriate technology and furniture.
- .5 allow users to move from workplace to workplace.

.2 AWA Space Planning Criteria:

- .1 AWA participants shall not be assigned a designated workspace.
- .2 On-site AWA may include desk sharing, hoteling, mobile suite work points, etc.
- .3 Examples of off-site AWA to support mobility include:
  - .1 telework/telecommuting: working from remote locations (e.g. home offices).
  - .2 satellite office: small office centers with support staff that act as extensions of the main office, often located more conveniently to employees' homes.
  - .3 mobile office: work in specific non-stationary places (e.g. vehicle),

.4 third place: public space (e.g. coffee shop).
.5 virtual office: work anywhere, anytime.

Note: Hybrid and Activity-based work (ABW) environments (e.g.: Mobile Suites, Co-Working Hubs, etc.) are currently being studied.

3.4 Support Space Allocations and Planning Criteria

.1 Overview

.1 Support space shall:
  - .1 be shared between multiple groups based on the functional program requirements.
  - .2 be distributed throughout the work environment.
  - .3 be located on the core.
  - .4 maximize the amount of glazing used, allowing natural light to flow into the space.
  - .5 have dimensional logic, allowing for maximum utilization and reconfiguration for current and future groups.
  - .6 be clustered together, support growth and change through the adoption and removal of parts and pieces allowing change in size and usage.
  - .7 be designed for accessibility.
  - .8 use architectural wall systems that adhere to AI's acoustic requirements, if required.
  - .9 meet security requirements based on the functional program requirements for secure support spaces.

.2 Examples of support spaces are listed in 3.2.2.4

.2 Waiting Area

Waiting Area Space Allocation:

No. of Seats	Approximate Dimensions	Size (m^2)
2	1829 mm x 1829 mm (6'-0" x 6'-0")	3.3
4	2743 mm x 2743 mm (9'-0" x 9'-0")	7.5
6	3658 mm x 3658 mm (12'-0" x 12'-0")	13.4

Note: If program requirements exceed 6 seats for a waiting area, allow 1.5 – 2m^2 per visitor.

.1 Waiting areas shall:
  - .1 be near large collaboration/meeting spaces and/or reception areas, and where passive supervision is provided.

    .2 have appropriate seating (size, scale, maintenance, durability and function).
    .3 have a minimum of 1-duplex outlet, 1- voice/data.

.3 Open Collaborative Areas

.1 Open collaborative areas:
    .1 act as meeting space for quick informal team meetings.
    .2 are not enclosed.
    .3 have the ability to be converted into an alternate type of support space or workspace.
    .4 are non-bookable.
    .5 have flexible furniture that can be arranged in a variety of configurations.
    .6 should be located in open workspace, in areas that shall not cause disruption to nearby staff.
    .7 may be equipped with technology (e.g. monitors) or whiteboards, based on functional program requirements.
    .8 may not be applicable to all user groups.

.2 For programming purposes, allocate up to 5% (maximum) of the Ministry Program floor area for open collaborative area(s).

.4 Enclosed Meeting Spaces

.1 Includes Meeting Rooms, Quiet Rooms, Interview Rooms and Training Rooms.

.2 Enclosed meeting spaces shall:
    .1 be shareable. If dedicated usage is requested by a primary user group, it must be demonstrated in the functional program requirements, and typical optimization verified by booking statistics.
    .2 be located for convenient access by other groups (limiting outside individuals from access into the open work environment).
    .3 be allocated consistently and equally.
    .4 maximize the amount of glazing used to allow natural light to flow into the workspace.
    .5 comply with AI’s acoustical requirements.
    .6 accommodate a wheelchair and be barrier-free.
    .7 have a minimum of one writeable surface.
    .8 have an architectural wall system, where feasible, to allow for a flexible and adaptable workspace, allowing for reconfiguration and growth.
    .9 shall incorporate electrical, data, and video conferencing technology as recommended by Service Alberta.
    .10 have a minimum of 1-duplex outlet on at least three walls and a minimum of 1-voice/data on a least one wall. Additional electrical, voice/data outlets to be identified in the functional program requirements.
    .11 have modular table components sized for the functional requirement of the room.

Allocation and size of Enclosed Meeting Spaces:

GoA Occupants per Building	1-2 Person Quiet Room (X-SMALL)**	3-6 Person Room (SMALL)	7-10 Person Room (MEDIUM)	11-14 Person Room (LARGE)*	Total # of rooms
	7 m² (75 sf)	13.9 m² (150 sf)	23.2 m² (250 sf)	29 m² (312 sf)	
	Approximate size: 2286 mm (7’-6”) x 3048 mm (10’—0”)	Approximate size: 3048 mm (10’-0”) x 4572 mm (15’-0”)	Approximate size: 6096 mm (20’-0”) x 3810 mm (12’-6”)	Approximate size: 7620 mm (25’-0”) x 3810 mm (12’-6”)	
5-25	1	1			2
26-50	2	2			4
51-75	2	2	1		5
76-100	2	3	1	1	7
101-150	3	4	1	1*	9*
151-200	4	5	1	1*	11*

Notes:

- Seating capacity must be verified for rooms that are set up classroom-style for training purposes.

* If centralized conference centres are available, the number of large meeting rooms may be reduced or eliminated, as the ability to share would increase.

** Quiet (x-small) Rooms:

  - Provide an environment to facilitate private phone conversations, a higher level of concentration and/or impromptu 2-person meetings.
  - The number of quiet rooms may be increased based on the functional requirements for support spaces of the primary user group.
  - Are non-reservable.

.5 Java (Coffee) Centre

Java Centre Space Allocation:

GoA Occupants per Building	Dimensions (counter, upper/lower storage & Aisle access)	Size (m^2)
5-10	1524 mm x 2134 mm (5’-0” x 7’-0”)	3.3
11-25	2438 mm x 2134 mm (8’-0” x 7’-0”)	5.2
26-50	3048 mm x 2134 mm (10’-0” x 7’-0”)	6.5

.1 Java Centres shall:

  .1 be located throughout the building appropriately and equally for easy shared access for all staff.

  - .2 include space for a fridge, microwave, garbage/recycling area and sink. A dishwasher and/or a filtered hot/cold water dispenser may be provided depending on the requirements of the primary user group. Ministries are typically responsible for their own appliances.
  - .3 allow for sufficient space above the sink to accommodate the faucet.
  - .4 have a barrier-free section at the sink in one Java Centre per floor (minimum).
  - .5 have visual separation from the work environment, to minimize disruption to staff.
  - .6 accommodate electrical requirements for equipment, plus have a minimum of two GFI outlets above the counter. Functional program requirements may necessitate additional outlets.
  - .7 be located adjacent to a large collaborative area (space permitting).

- .2 Refer to *Appendix E* for interior standard millwork details.

3.6 Document Management Allocations and Storage Planning Criteria

.1 Print Areas

Print Area Allocation:

Quantity	Dimensions	Size (m^2)
1 per 35 people	2743 mm x 1524 mm (9’-0” x 5’-0”)	4.2

- .1 Print areas shall:
  - .1 be based on the functional program requirements for low quantity printing.
  - .2 be distributed throughout the space to allow for convenient access.
  - .3 consist of a multi-functional unit (MFU) adjacent to a freestanding cabinet for a work area and paper/supply storage; or alternatively, tabletop printers can sit on a low (2 high) closed storage cabinet with a durable top.
  - .4 be provided in combination with, or in addition to, a centrally located resource area.
  - .5 have sufficient operational space in front of equipment.
  - .6 be located in areas where the noise generated will minimally disturb nearby occupants.

.2 Resource Area

Resource Area Allocation:

Quantity	Dimensions	Size (m^2)
1 per floor	3048 mm x 4572 mm (10’-0” x 15’-0”)	13.9

.1 Resource area shall:

- .1 be provided, if necessary, for mass production and document assembly.
- .2 be located on the core, away from open workspaces, to minimize disruption to staff.
- .3 be shareable amongst program groups unless there is a confidentiality requirement stating otherwise.
- .4 include space for general storage, paper storage (boxes and recycling containers) and document handling (plotter, laminators, collating, sorting, binding, etc.).
- .5 contain a minimum of one multi-function unit (MFU).

.3 Storage

.1 Typical storage cabinet widths and depths (provided for information only, to assist in planning the total filing space required):

Description	Typical Size
Lateral file/storage cabinet	Width – 914 mm (36”), 1067 mm (42”), 1219 mm (48”)
Lateral file/storage cabinet	Depth – 305 mm (12”), 457 mm (18”), 810 mm (24”)
High-density (HD) file storage – various types	Varies (generally requires approximately have as much floor space as static storage cabinets)

.2 File storage areas:

- .1 shall accommodate the amount of physical files that are required on site, as verified through site visits. Off-site storage is the ministry’s responsibility.
- .2 may house active files in open office space. Inactive retention files should be housed elsewhere (e.g. a storage room).
- .3 shall be appropriately secured to suit program requirements.
- .4 shall be located on the core and reviewed by a Structural Engineer prior to proceeding with design development.
- .5 shall have cabinets of the appropriate height so as to not impede proper operation of ceiling sprinklers and be in compliance with applicable mechanical codes, including fire suppression.
- .6 shall have sufficient space in front of file cabinets when placed in corridors and open areas, in compliance with the current Alberta Building Code and Fire Code.

    .7 may be combined with the resource room where feasible to maximize space utilization.
    .8 may utilize a high density (HD) filing system if the requirements for height, weight, floor load, safety, accessibility, codes, building restrictions, and cost are verified, prior to proceeding with design development.

.3 Office supplies may be housed in furniture cabinets in the open work environment.

.4 Ministries must appropriately dispose of non-essential files, office supplies, materials, equipment, surplus furniture, etc.; or be responsible for the storage of such items either within the program's allocated space, or off-site.

3.7 Special Purpose Spaces

.1 Special-Purpose Space shall :
    .1 be sharable and available to various users or groups (in consideration of security requirements).
    .2 be otherwise unable to meet the operational, functional or personal needs of other allotted workspace.
    .3 meet a program delivery need that may involve significant and frequent service to the general public.

.2 Examples of Special Purpose spaces are listed in 3.2.2.5.

3.8 Security

.1 Refer to the current version of the *Physical Security Guidelines and Standards for Government of Alberta Facilities* https://www.alberta.ca/assets/documents/tr/tr-securityguidelinesstandards.pdf

.2 Refer to *Section 6.0 – Electrical– Electronic Safety and Security Systems*.

3.9 Acoustics

.1 Refer to *Section 7.0 – Acoustics*

3.10 Furniture

.1 Overview

.1 Furniture is an important part of AI facilities for upgrades, renovations and new development, and as such, the use of existing, new, and/or recycled furniture must be determined at the onset of all projects.

.2 Workspaces have a kit-of-parts, to allow re-configurability of the work environment. Workspaces shall have dimensional logic and consistency in sizes of parts and pieces, and material finishes. Refer to Appendix I – *Workspace Furniture Typicals.*

.3 Workspaces should be logically planned to suit the building grid/infrastructure. Modifications to the workspace components may be considered if the building has physical constraints (such as column locations) that prevent an efficient layout, although this should kept to a minimum and addressed on a case-by-case basis.

.4 AutoCAD blocks and details for typical workspaces and support spaces are available through Infrastructure Technical Services – Interior Design.

.5 Floor load issues and space limitations must be considered prior to proceeding with any acquisitions.

.6 Furniture and workspace equipment must support the principles of office ergonomics for safety, comfort, and efficiency. Refer to Workplace Ergonomics in the Infrastructure Technical Resources website (*https://www.alberta.ca/assets/documents/tr-workplace-ergonomics.pdf*). Further information is available in CSA Workplace Ergonomics Standards.

.2 Asset Management's Approach to Furniture Management

.1 Asset Management (AM) is an integrated, lifecycle approach to effective stewardship of AI assets. This applies to tangible assets, including furniture. The AM approach develops a systematic understanding of needs and demands of Clients, and provides holistic and corporate based solutions. AM recognizes the importance of making the right decision and optimizing value.

.2 In order to maximize the value of furniture, AI has developed a centralized approach to the design of space and the purchase and ownership of furniture to allow flexibility in accommodating Client Ministry needs. A corporate, strategic long-term plan that sets in place furniture guidelines (e.g. consistent procurement and furniture harmonization) ensures reliable service levels and cost-savings (through economies of scale) for AI's assets.

.3 Equipment

.1 Appliances and program specific equipment are considered fixed assets and are purchased by the user group from their operating budgets.

End of Interior Design Section

4.0 Structural

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4.1 Codes and Material Design Standards

.1 New design, additions, upgrades and repairs shall conform to the code, standards and guides listed below. In case of any discrepancy between these documents and the Technical Design Requirements for Alberta Infrastructure Facilities (TDR), the more stringent requirement shall apply.

  .1 National Building Code, 2019 Alberta Edition [hereinafter referred to as NBC(AE)].
  .2 Structural Commentaries (User's Guide – NBC 2015, Part 4 of Division B).
  .3 CSA S413-14 – Parking structures.
  .4 CSA S478-95 (R2007) – Guideline on Durability in Buildings.
  .5 CSA SPE-900-13 – Solar photovoltaic rooftop-installation best practices guideline.
  .6 CAN/CSA S6-14 – Canadian Highway Bridge Design Code.

Commentary:
The following abbreviations are used for the documents referenced in the Commentary to the Structural TDR:
.A NBC(AE): The National Building Code – 2019 Alberta Edition.
.B Structural Commentaries: Structural Commentaries, User's Guide – NBC 2015: Part 4 of Division B, Canadian Commission on Building and Fire Codes, National Research Council of Canada, 4th Edition, 2017.
.C ASCE/SEI 7-22: Minimum Design Loads and Associated Criteria for Buildings and Other Structures, American Society of Civil Engineers, 2022.
.D NIH 2020: Design Requirements Manual, Division of Technical Resources, National Institutes of Health, Rev. 1.5, 03/05/2020

.1 NBC(AE) is adapted from the 10th Edition of the NBC. It applies to the design and construction of new buildings, change in occupancy, addition, alteration, and demolition of existing buildings, renovations of building damaged by fire, earthquake or other causes and correction of unsafe conditions in any building.

.2 The Structural Commentaries provide background to the NBC(AE) provisions. Commentary L is used for structural evaluation and upgrading of existing buildings that are deficient and it does not apply to new additions to an existing building. Structural evaluation becomes necessary when (a) there is a change in the use of a building, and (b) when there are known potential defects which are a safety concern.

.3 CSA S413-14, Parking structures. This standard specifies the minimum design, construction, and maintenance requirements necessary for the structural durability of new parking structures, storage garages, parts of buildings subject to vehicular traffic or used for parking, and pedestrian areas adjoining to or contained within parking structures. Table 1 of the Standard lists acceptable protection systems for floors and roofs, such as, membrane, corrosion inhibitor and C-XL concrete.

.4 CSA S478. Specifies the design service life of buildings per Table 2:

Table 2 in CSA S478

Category	DSL	Examples
Temporary	*Up to 10 years*	* Non-permanent construction buildings (sales offices, bunkhouses) * Temporary exhibition buildings
Medium Life	*25 to 49 years*	* Most industrial buildings * Most parking structures
Long Life	*50 to 99 years*	* Most residential, commercial and office buildings * Health and education buildings * Parking structures below buildings designed for long life category
Permanent	*100 years minimum*	* Monumental buildings * Heritage buildings

.5 CSA SPE-900-13 guideline addresses structural analysis of the building and the roof mounted solar PV racking. The primary loads on the solar PV system are wind and seismic. Solar PV arrays may be (a) attached to the building structure (penetrating system), or (b) rely on self-weight (ballasted system). Dead load of solar PV systems is noted to be in the range of 0.15 to 0.50 kPa. The structural consultant to coordinate with solar PV consultant to confirm the load.

.6 The Canadian Highway Bridge Design Code, CAN/CSA S6-14, provides axle load configuration and distribution, and wheel load and its footprint (loading area) for traffic loads (CL-W loading) and maintenance vehicles in Section 3. The distribution of wheel loads through fill over a buried structure and the effect of vehicle (live) load surcharge on basement walls is discussed in Section 6.

.2 Material design standards to be as per Division B, Section 1.3 of NBC(AE).

Commentary:

.1 Table 1.3.1.2 of Division B provides the list of all documents including CSA Standards with edition that are referenced by the NBC(AE). Some CSA material design standards relevant to the structural discipline are:

a. CSA A23.1-14, Concrete materials and methods of concrete construction
b. CSA A23.3-14, Design of concrete structures
c. CSA A23.4-16, Precast concrete – materials and construction
d. CSA S16-14, Design of steel structures
e. CSA S136-16, North American specification for the design of cold-formed steel structural members
f. CSA S304-14, Design of masonry structures
g. CSA O86-14, Engineering design in wood

4.2 Specified Design Loads and Analysis

.1 General office areas (not including record storage and computer rooms) located in the basement and the first storey: Minimum floor occupancy live load 4.8 kPa or 9 kN concentrated, whichever produces the more critical effect. For floors above the first storey, 3.6 kPa or 9 kN concentrated, whichever produces the more critical effect.

.2 Records storage and library shelving areas: Design live load to be based on type and layout of the proposed storage system, but not less than 7.2 kPa. Note that some compact mobile filing systems and high density mobile storage systems have the potential to impose greater live load depending on the shelving configuration and the media stored. Specify a minimum design live load of 12 kPa for compact mobile filing systems and high density mobile storage systems.

.3 Floors of interstitial spaces: Minimum live load 1.5 kPa or 1.5 kN concentrated, whichever produces the more critical effect, plus equipment loads.

.4 Mechanical loads: Mechanical units shall be considered as live load. Obtain loads from the mechanical consultant. In mechanical rooms, allow for a minimum of 100 mm thick concrete housekeeping pads or 100 mm thick concrete floating slab above the top of surrounding floor elevation at any location on the floor. Refer to requirements in Section 7.0 - Acoustical and structural sections, and coordinate with the mechanical consultant. Design for installation and future replacement of mechanical or other heavy equipment. This may require knock out wall panels, removable roof panels, and / or heavy loading on floor travel paths. Ensure that the structure has adequate capacity for suspended piping loads.

.5 Minimum roof design live load: 1.5 kPa uniform or 1.5 kN concentrated (over an area of 200 mm by 200 mm), or the snow and rain loads, whichever produces the most critical effect in the members concerned. For roofs over mechanical rooms, increase the concentrated load to 4.5 kN for all elements except metal deck. Roof structures shall be designed for the 1/50 One Day Rain including the effect of ponding and assuming that the roof drains are plugged.

.6 For snow accumulation loads for buildings that are built close to property lines on urban sites, assume the neighboring property will be built higher than the building, to the extent permitted by the local zoning by-law.

.7 When there is a known plan to change the usage of an area in the future, design for the more stringent of current and future live loads.

.8 Provide design calculations if requested by the Province.

.9 The design life of new structures to be 75 years (“Long life” per CSA S478), or 40 years (“Medium life” per CSA S478) for parking structures not integral with long life structures.

Commentary:

.1 For office areas, Table 4.1.5.3 of the NBC(AE) specifies a design live load of 4.8 kPa for the basement and first storey and 2.4 kPa for floors above the first storey. Table 4.1.5.9 specifies a concentrated live load of 9.0 kN over an area of 750 mm x 750 mm for floors of offices. In the TDR, 3.6 kPa for floors above the first storey allows future flexibility / adaptability in use of the space.

.2 NBC(AE) specifies a design live load of 7.2 kPa for library stack rooms. The NIH 2020, in Section 5.2 – Structural Loads, Table 5.2.1(A), specifies 7.2 kPa for standard file rooms and 12.0 kPa for dedicated areas for compact file systems. The Spacesaver Corporation (www.spacesaver.com) document titled “Floor Loading Considerations High-Density Mobile Storage”, 2013, recommends 125 to 200 psf (6 kPa to 9.6 kPa) for paper files and books and 275 to 300 psf (13.2 kPa to 14.4 kPa) for museums, depending on number of tiers of shelving and type of floor system. ASCE/SEI 7-22 specifies 250 psf (12 kPa) for storage warehouses (heavy) and manufacturing (heavy).

.3 The NIH 2020 in Section 5.2 – Structural Loads, Table 5.2.1(A), specifies a minimum design live load of 1.9 kPa (40 psf) for catwalks and Interstitial platform (exclusively walking surfaces).

.4 The NIH 2020 in Section 5.2 – Structural Loads, Table 5.2.1(A), specifies a minimum design live load of 7.2 kPa (150 psf) for mechanical areas (or weight of equipment if greater) along with 2.5 kPa at housekeeping pad locations (assumed 100 mm thick).

.5 Tables 4.1.5.3 and 4.1.5.9 of the NBC(AE) specify a minimum design live load of 1.0 kPa and 1.3 kN (on an area of 200 mm x 200 mm) for roofs. ASCE/SEI 7-22 specifies 1.0 kPa (20 psf) and 1.33 kN (300 lbs) [weight of a maintenance worker] over an area of 762 mm x 762 mm. NIH 2020 specifies 1.9 kPa (40 psf) for roofs not designed for future expansion. The TDR values (1.5 kPa and 1.5 kN over an area of 200 mm x 200 mm) allow for higher loads.

.7 The floor plate in some facilities (healthcare) may be designed for a greater live load to allow future flexibility / adaptability in use of the space.

.9 Location and site specific requirements should be considered when determining the design life of the building. Structures located in a flood plain should include appropriate design parameters to ensure the building life for design flood condition.

A. Specific Requirements for Schools

.1 Gymnasium roof structures shall be designed with special consideration for suspended loads. This includes moveable partitions in the extended and stacked position, and basketball backboards in the extended and stowed positions. These loads shall be indicated on the structural drawings.
The concrete floor finish of the gymnasium slab should satisfy the requirements of the intended flooring and as a minimum shall be Class B slab and floor finish classification with Ff=25 and Fl=20 as per Table 21 of CSA A23.1-14.

.2 Design structural steel floors to prevent floor vibration due to walking from exceeding comfort thresholds for all areas. Typically, a peak acceleration less than 0.5% g (within 4-8 Hz) for office and classroom occupancy is acceptable.

.3 Structural support for operable partitions. The weight of the operable partition, in addition to all dead loads, shall be taken into consideration when designing the supporting member. Deflection under maximum anticipated load shall not exceed 3.2 mm per 3.658 m of opening width. If greater deflection is anticipated, either a structural member independent of the roof / floor structure above should be installed to support the operable partition, or an operable partition with bottom seals designed to accommodate the larger deflection should be specified.

Commentary:

.1 Approximate load of:
Moveable partitions: typically 0.5 kPa (extended position); for stacked weight, multiply above intensity by approximate length of the partition.
Basketball backboards: about 15 kN total divided over 4 to 6 connection points to roof joists above.
Verify loads with the equipment supplier.

.3 The deflection limit (about L/1143) for structural support is for proper sound isolation between spaces separated by operable partitions per ASTM E557-12.

B. Specific Requirements for Healthcare Facilities

.1 Patient bedrooms: Minimum floor occupancy live load 2.4 kPa or 9 kN concentrated, whichever produces the more critical effect.

.2 Obtain information on loads due to heavy medical equipment, such as diagnostic imaging equipment, X-ray equipment, surgical lights, and surgical tables. Provide adequate capacity in affected structural elements of walls, floors and ceilings, including those on access routes.

Commentary:

.1 For patient's bedrooms, Table 4.1.5.3 of the NBC(AE) specifies a design live load of 1.9 kPa and Table 4.1.5.9 specifies a concentrated live load of 9.0 kN for floors of hospital wards. ASCE/SEI 7-22 specifies 40 psf (1.9 kPa) for patient rooms. The higher design value (of 2.4 kPa) in the TDR is for future adaptability; in some facilities, this may be increased to 3.6 kPa if patient bedrooms are anticipated to be converted to clinical areas in the future.

.2 The NIH 2020 in Section 5.2 – Structural Loads, Table 5.2.1(A), specifies minimum design live loads of:

a.	Equipment imaging spaces	9.6 kPa	(200 psf)
b.	Frozen storage / Refrigeration	9.6 kPa	(200 psf)
c.	Laboratories	4.8 kPa	(100 psf)
d.	Operating rooms	4.8 kPa	(100 psf)
e.	Offices	4.8 kPa	(100 psf)
f.	Reception lobby areas	6.0 kPa	(125 psf)

For operating rooms and laboratories, NBC(AE) specifies 3.6 kPa and ASCE/SEI 7-22 specifies 60 psf (2.9 kPa).

C. Specific Requirements for Government Facilities

.1 Multi-service facilities (e.g., provincial buildings): Minimum floor occupancy live load shall be as per Item 4.2.1.

Commentary:

.1 The specified design live load for some occupancies that may be present in Government facilities include:
Per ASCE/SEI 7-22:

Access floor systems (computer use)	4.8 kPa	(100 psf)

4.3 Foundations and Basements

.1 Aspects of design and construction that depend on soil or groundwater conditions shall be reviewed and approved by a geotechnical engineer.

.2 Maintain the integrity of existing structures and service lines on adjacent properties.

.3 Do not incorporate "tie-back" earth retaining system as an essential part of the permanent structure.

.4 The weight of soil fill and the associated lateral earth pressure shall be treated as a live load, with a load factor of 1.5. If the weight of the soil is used to counter-act uplift or overturning, it shall be treated as a dead load with a load factor of 0.85.

.5 In the design of basement walls, consider the horizontal and vertical force effects due to live load surcharge from vehicles located within a distance from the exterior face of the basement wall equal to its depth. Basement walls shall be designed for a minimum live load surcharge of 12 kPa.

.6 Below-grade extensions. The roof of basements extending beyond the exterior façade of the building shall be designed to support the live load of firefighting equipment and maintenance vehicles, such as boom lifts that may be required to access the façade or roof of a building for inspection and maintenance. The specified live load on such roofs shall not be less than the uniformly distributed live load of 12 kPa per Table 4.1.5.3 of NBC(AE) or the concentrated loads listed in Item 4.1.5.9, whichever produces the most critical effect. For distribution of vehicle wheel loads through fill, refer to Clause 6.12.6 of CAN/CSA S6-14, “Canadian Highway Bridge Design Code.”

.7 Screw piles shall not be used for the permanent core structure (the use of screw piles may be approved on a case-by-case basis if project constraints preclude the use of other foundation types. In such an instance, a design exception must be obtained from Alberta Infrastructure Technical Services prior to the use of screw piles).

The use of screw piles is allowed for modular structures, such as modular classrooms and courthouses, for supporting the free end of the exterior apron slab at doorways, and for supporting garbage enclosure slabs.

.8 Driven piles shall not be used.

Commentary:

.1 Structural design should follow the recommendations in the project geotechnical report.

.3 Tie-back earth retaining systems use ground anchors that project into the ground behind the retained face. The ground anchors may prevent future development in the adjacent site and hence may not be used in permanent earth retaining systems. A design exception may be considered for a site where economical options for an earth retaining system do not exist and where future development is unlikely to be constrained by the permanent ground anchors.

.6 ASCE/SEI 7-22 specifies a design live load of 250 psf (12 kPa) and a concentrated load of 8,000 lbs (35.6 kN) over an area of 4.5 inch x 4.5 inch (114 mm x 114 mm) for sidewalks, vehicular driveways and yards subject to trucking.

.8 Vibration and noise impact of pile driving may cause disruption to the function, use or occupancy of the adjacent properties and may lead to damage claims.

4.4 Structure

A. Concrete

.1 Do not use unbonded post-tensioned reinforcement as an essential reinforcing element of a structural member.

.2 Frost heave on exterior apron slabs may cause binding of doors or water drainage towards the building. Design measures to mitigate such effects.

.3 Specify minimum 10 mil (0.25 mm) thick (15 mil [0.38 mm] preferred) poly vapour barrier between the underside of interior slab-on-grade and the engineered sub-base. Coordinate with requirements for the Radon gas mitigation system.

.4 When a combination of the dimensions of the member being cast, the boundary conditions, the characteristics of the concrete mix, and the ambient conditions can lead to undesirable thermal stresses, cracking, deleterious chemical reactions, or reduction in the long-term strength as a result of elevated concrete temperature due to heat of hydration, the concrete shall be considered mass concrete. Any placement of normal structural concrete that has a minimum thickness of 1000 mm or greater shall also be considered mass concrete. Provide appropriate mitigation measures in the specifications, such as, a thermal control plan.

.5 Consider providing shrinkage strips (also referred to as closure strips or pour strips) in reinforced concrete buildings with a large floor plan (generally exceeding about 60 to 76 m) to reduce shrinkage stresses and mitigate crack formation due to shrinkage restraint provided by vertical structural elements such as columns, shear walls and shear cores.

.6 Do not specify fly ash in exterior concrete slabs subjected to freezing-thawing and de-icing chemicals. The exterior concrete containing fly ash is less resistant to scaling when subjected to freezing-thawing and de-icing chemicals.

.7 Limit fly ash content to a maximum of 6% of mass of cementitious materials if polished concrete floor finish is to be provided by grinding and polishing of the floor surface. The action of concrete hardeners and densifiers used for polishing may be hindered by high fly ash content. Take precautions to reduce the risk of pop outs while grinding and polishing the concrete surface.

.8 All concrete elements shall be reinforced, including concrete topping.

Commentary:

.1 There are concerns about corrosion-protection and durability of unbonded post-tensioning systems; hence their use is not recommended.

.2 Exterior slabs (apron slabs at entrances / exits, garbage enclosure slabs) should preferably be pile supported (or foundation supported and not just a floating slab or asphalt on subgrade) with crushable void form below the slab to mitigate the effects of frost heave. The slabs are typically dowelled into the grade beam at the face of the exterior doorway to prevent any differential movement at this location. The slab is usually provided a drainage slope of 2% away from the door.

.3 The traditionally used 6 mil (0.15 mm) thick poly vapour barrier is thin and prone to puncture from construction workers walking on it. A thicker poly (10 mil minimum, 15 mil preferred) is recommended also due to the requirements for the Radon barrier membrane (minimum 10 mil thickness) that needs to be air tight.

.4 The project specifications should require the contractor to submit a thermal control plan for any mass concrete pours (that is, concrete placement thicker than 1.0 m). Ensure that the instrumentation required (thermocouples, other) including its installation is the responsibility of the contractor (and not the independent 3rd party materials testing agency appointed by the Province). The Alberta Infrastructure sample technical specification Section 03 30 00 has requirements for mass concrete.

.5 It is recommended to provide shrinkage strips in concrete slabs greater than 76 m in extent (Suprenant, B.A., Shrinkage and Temperature Reinforcement, Concrete International, Vol. 24, No. 9, September 2002, pp. 72-76). Shrinkage strips containing lap splices are typically 900 to 1200 mm wide. They are cast 2 to 12 weeks later than the adjacent slabs. The stiffness and distribution of vertical elements (columns, shear walls and shear cores) restrain the slab and influence its shrinkage behavior.

.6 Concrete with fly ash is less resistant to scaling when subjected to freezing and thawing in the presence of de-icing chemicals. This has been reported in literature.

Mixtures containing fly ash may experience a delay in early-age strength development, especially in cooler weather. This could delay the concrete set time and the ability to saw without excessive raveling. After setting, the time available for sawing before cracking begins may be shorter than normal. This decrease in available sawing time increases the risk of uncontrolled cracking in cooler weather.

.7 Fly ash reacts with calcium hydroxide to form hydration products; this is the same calcium hydroxide needed to react with the liquid surface treatment that eventually hardens at the floor slab surface; therefore, less calcium hydroxide may be available to the floor treatment if higher dosage of fly ash is used in concrete to be polished.

Pop outs of aggregate have been reported in floors being ground and polished. Pop outs are due to presence of deleterious substances in the aggregate, such as coal, shale, ironstone and limestone. Specify concrete made with aggregates having low percentage of deleterious substances (refer limits for low-density granular materials in Table 12 of CSA A23.1-14) and a good performance history for such applications.

B. Steel

.1 Design cantilever or continuous steel roof beams according to “Roof Framing with Cantilever (Gerber) Girders and Open Web Steel Joists”, published by the Canadian Institute of Steel Construction, July 1989. Do not use Gerber design for floor construction.

.2 Any long span roof structures and other longer span structures using joists or trusses shall be proportioned in consideration of the deflection adjacent to rigid end walls. The deflection shall be limited to ensure the integrity of the roof diaphragm and to keep roof deck stresses to an acceptable level. Refer to Clause 16.12.2.5 of CSA S16-14 for maximum deviation requirements for structural steel joists.

.3 Where metal deck is to be exposed, consider avoiding the use of 0.76 mm or thinner metal deck, as this deck may be subject to damage, including possible footprint marks from construction workers.

.4 Where the underside of metal deck is exposed (exposed ceiling), consider using acoustic deck or other treatment to meet acoustic requirements.

.5 Specify ASTM A992 / 992M for wide flange sections in lieu of CSA G40.21 350W. This may result in greater flexibility in sourcing material.

.6 When designing HSS trusses, proportion members and select wall thicknesses in consideration of accepted HSS connection design principles. Refer to the CISC publication “Hollow Structural Section Connections and Trusses – A Design Guide” by J.A. Packer and J.E. Henderson for practical details. In particular, avoid flare bevel welds and specify gap connections with positive eccentricity, when possible.

.7 For all HSS members subject to freezing, specify drain holes at lowest point to allow the release of water and specify neoprene seals around all fastening penetrations exposed to water. Provide cap plates at column ends.

.8 Specify Class C for square and rectangular HSS sections. Class H sections may require a special mill order, are more expensive, and their use is justifiable only if the additional compressive resistance (over Class C sections) is required. Specify ASTM A500 round hollow sections as they are easier to procure than CSA G40.21 350W.

.9 Trusses with W-shaped members for chords and diagonals may be a cost-effective alternate to HSS trusses and should be given consideration.

.10 Tension-only concentrically braced frames shall not be used for the Lateral Load Resisting System (LLRS) for buildings with importance category of high and post-disaster.

.11 When structural steel is to be welded, consider specifying a boron content of less than 0.0008%. Higher levels of boron can affect weld quality.

.12 When structural steel is to be galvanized, consider specifying a silicon content either less than 0.04% or between 0.15% and 0.25%. Other levels of silicon can affect the quality of the galvanizing.

.13 When mill test reports originate from a mill outside of Canada or the United States of America, consider specifying that mill test reports are to be verified by a certified laboratory in Canada by testing the material to the specified material standards, including boron content. Steel procured from outside of Canada or the United States of America may have a high boron content.

.14 Connection design is usually delegated to a specialty connection design engineer. Specify connection design forces for steel members for the specialty connection design engineer to design and detail the connections.

.15 Unless specified otherwise, structural steel outside of the building envelope shall be hot-dip galvanized.

.16 Guardrails and other structural posts subject to application of spray of de-icing salts; ladders, platforms and covers in areas of moisture exposure such as sumps; and their supporting frames, baseplates and anchor rods are to be hot-dip galvanized or of stainless steel. Any repairs to damaged hot-dip galvanizing shall be done in accordance with ASTM A780.

Commentary:

.1 Use of cantilever Gerber girder system is not recommended for floors due to past failures in such systems (1988 Station Square collapse in Burnaby, B.C., involving four bays of a supermarket with a rooftop parking facility; 2011 Texas warehouse partial roof collapse). The failures were due to distortional buckling of the girder web at the column support location arising from inadequate lateral support at the top of the column and lateral torsional support to the girder. The 1989 CISC publication identifies specific structural concerns with this framing system and provides guidance on addressing the instability issues. Gerber systems do not allow sufficient flexibility for future modifications.

.5 For wide flange sections, it is preferable to specify ASTM A992 / 992M in lieu of CSA G40.21 Grade 350W. CSA S16-14 explicitly recognizes this grade. A992 / 992M has enhanced properties for seismic applications (better production control on maximum yield stress limit, maximum yield to tensile strength ratio).

.6 For HSS truss members, square and rectangular sections are preferred over circular sections that require profile cutting at member connections. Use of gap connections with positive eccentricity may reduce member overlap and alleviate complicated weld geometry at diagonal and vertical to chord connections. HSS truss diagonals appropriately smaller in size than the chords allow simple fillet welds to make the diagonal to chord connections (and thereby avoid expensive flare-bevel welded joints that are not prequalified per CSA W59 and require the fabricator to demonstrate the effective weld throat by preparing mock samples and sectioning them).

.9 Trusses with W-shaped members are cost effective when the W-shapes for chords, diagonals and verticals are from the same family (that is, similar depth) to facilitate welding. The webs of the chords and diagonals are turned 90 degrees from the vertical plane (resulting in an H shape) to allow direct welding of the members at the truss nodes without the need for stiffeners and gusset plates.

.10 CSA S16 14, Clause 10.4.2.2 specifies a limit of 300 on the effective slenderness ratio (k L/r) for tension members. This limit assist in the handling of members and may prevent flutter under oscillating loads such as those induced in wind bracing designed for tension loads only. This limit may be waived if other means are provided to control flexibility, sag, vibration, and slack in a manner commensurate with the service conditions of the structure (for example, use of turnbuckles in rod bracing). This all applies to normal importance category buildings

For high and post-disaster buildings, tension-only bracing is not allowed. It is reported in literature that such bracing has performed poorly in past earthquakes. The lack of compressive brace resistance leads to inelastic behaviour with slack braces that have little or no stiffness until the slack is taken up. Slack braces may lead to progressively increasing lateral drift, possible impulse loading on the brace and its connections, and early brace / connection fracture due to low cycle fatigue caused by cyclic buckling.

.11 Boron is added to fully killed steel to improve hardenability. Boron-treated steels are typically produced to a range of 0.0005% to 0.003%. Boron is not typically added to structural grade steels, nor are the maximum levels in Standards typically controlled or specified. Mills would not typically add boron to structural grade steels due to cost. A very small amount of boron has a significant effect on hardenability and weldability. Hardness, tensile strength and yield strength increase with elevated boron concentrations. However, elongation and impact properties (in the form of Charpy V-Notch absorbed energy values) can be compromised with elevated boron contents. Brittle fracture modes over ductile can be favored with higher concentrations of boron. In the case of structural steel welds containing elevated levels of boron, various crack mechanisms can occur, including cold cracking, hot cracking, and stress-corrosion cracking (source – Acuren).

.12 The silicon content limits in steel to be hot-dip galvanized are based on the Sandelin curve (refer to the American Galvanizers Association). Silicon content between 0.04% and 0.15% results in galvanizing having a dark grey appearance, a thicker zinc layer, and reduced adhesion of the zinc layer to the steel substrate. Silicon content greater than 0.25% results in a similar dark grey appearance and a missing substrate layer required for galvanizing adhesion; any defects to such galvanizing cannot be repaired by the methods outlined in ASTM A780.

.13 Steel is being supplied by mills from around the world, whether it is to the North American Standards or other standards. There have been reports of non-conformity, incorrect mill test reports and material that contains elements not normally expected or controlled by the material standard. This problem is applicable to rebar as well as to structural steel. Hence the need for verification of mill test reports for imported structural steels by a certified laboratory in Canada.

.15 Structural steel outside of the building envelope is exposed to weather elements, which may lead to corrosion. Hot-dip galvanizing will protect the exposed steel from corrosion.

C. Concrete Masonry

.1 Concrete masonry units shall be as per CSA A165-14 Series, “CSA standards on concrete masonry units”. The specified compressive strength of masonry blocks shall be 15 MPa or higher.

.2 Type “S” mortar shall be used in all load bearing masonry.

.3 Specify grout as per CSA A179-14, “Mortar and grout for unit masonry”.

.4 Bond beams shall be provided at the top of all walls, including both load bearing and non-load bearing walls.

.5 Provide lateral support at the top for all masonry walls.

.6 Provide lintel beams at all wall openings.

.7 Provide connection details of equipment connection to masonry walls, such as basketball back-stops mounted on masonry walls.

.8 Coordinate with Architectural and provide acoustic masonry blocks where required.

.9 Provide connection details of any structural elements (steel, wood) connected to masonry.

Commentary:

.1 CSA A165-14 Series, “CSA Standards on concrete masonry units” specifies minimum requirements for concrete block masonry units. The standard identifies four physical properties: solid content; specified compressive strength; concrete type; moisture control. 15 MPa masonry units are the most common and provide flexibility in procurement than units with other specified compressive strength.

.2 Type “S” mortar should be used in load bearing walls since it provides higher fm’ (compressive strength of masonry normal to the bed joint at 28 days) for a given specified compressive strength of masonry unit.

.3 CSA A 179-14, “Mortar and grout for unit masonry” provides minimum requirement for grout to be used in masonry walls and beams.

.4 Bond beams provide a solid bearing surface for supported beams / columns and tie the vertical blocks together.

.5 Masonry walls are generally designed with the assumption of pin support at the top. Hence, a lateral support at the top is required to justify the analysis / design assumption.

.6 Portion of wall above any wall opening has to be supported by a beam element (lintel).

.7 Details of equipment connection to masonry walls, such as basketball back-stops mounted on masonry walls, will help the steel fabricator to fabricate appropriate connection elements.

.8 Acoustic masonry blocks are usually required in school gymnasiums, music rooms, and cultural rooms. The Architectural / Acoustic discipline usually takes the lead in specifying the extent of wall requiring acoustic block.

.9 As per APEGA “Responsibilities for Engineering Services for Building Projects”, Appendix B-3, the Structural Engineer of Record (SER) is responsible to provide connection details at the intersection of different structural materials. Details of any structural elements (steel, wood) connected to masonry will help the steel or wood subcontractor to fabricate appropriate connection elements.

D. Wood

.1 Provide wood connection details including the nailing requirements for built-up members, connection of wall studs to wall plates, connection requirements (nailing or other fastener, blocking) for floor and roof diaphragms, and connection requirements (nailing or other fastener, blocking, hold-downs and anchorage) for shear walls.

.2 Provide connection details for all wood to concrete, wood to steel, and wood to masonry connections.

.3 Provide lintels at all wall openings.

.4 Untreated wood members shall not be in direct contact with concrete or masonry without protection.

.5 For all wood members exposed to weather, provide protection requirement on the drawings such as pressure treatment and / or preservative treatment.

.6 Design wood framing to accommodate shrinkage of sawn lumber floor joists, studs and columns.

Commentary:

.1 Connection details including the nailing requirements for built-up members and connection of wall studs to wall plates are required to be shown on structural drawings for the contractor to use the appropriate connectors. As per APEGA “Responsibilities for Engineering Services for Building Projects”, Appendix B-3, the SER is responsible for lateral load design of the building. Lateral capacity and stiffness of wood structure is dependent on its connections.

.3 Portion of wall above any wall opening has to be supported by a beam element (lintel).

.4 Untreated wood members in direct contact with concrete or masonry will deteriorate over time. Pressure treatment and / or preservative treatment will protect the exposed wood element from deterioration.

.5 See Commentary on 4 above.

E. Precast Concrete

.1 Precast concrete is generally a delegated design item to be designed by a specialty engineer. The Structural Engineer of Record (SER) should provide design requirements on structural drawings, which should include (but not limited to) the following:
  - .1 Design gravity loads to be used by the specialty engineer to design the precast elements and connections for gravity loads.
  - .2 Design seismic and wind loads to be used by the specialty engineer to design the precast walls, precast floor and roof diaphragms, and the connections.
  - .3 Any performance requirements such as deflection, camber, and tolerances.
  - .4 Concrete mix specifications based on the concrete exposure class.
  - .5 Building envelope details and requirements which the precast designer should follow in detailing the precast concrete components and connections.

.2 Provide connection details between precast element and the base structure, including the connection of precast walls to grade beams / foundation walls and connection of structural steel to precast elements.

.3 Any steel connectors and embed plates outside of the building envelope shall be hot-dip galvanized.

.4 Precast walls shall be supported by grade beams / foundation walls and shall not be in contact with subgrade.

.5 Coordinate finish requirements with the Architectural / Interior Design discipline.

Commentary:

.1 Even though precast concrete is generally a delegated design item to be designed by a specialty engineer, the SER takes responsibility of overall gravity and overall lateral design. Items listed in (1) to (5) should be provided for the specialty engineer to design the structure consistent with base buildings design assumptions as per APEGA “Responsibilities for Engineering Services for Building Projects”, Appendix B-3.

.3 Steel connectors and embed plates outside of the building envelope are susceptible to corrosion and hot-dip galvanizing is an effective method to protect the exposed steel.

.4 Precast walls, if detailed to be in contact with subgrade, are susceptible to damage due to moisture and chemicals in the soil. To obviate this concern, the precast wall should be above subgrade supported by foundation wall / grade beam.

F. Other

.1 Structural systems for parkades: Design according to CSA S413, Parking structures. Specify protection against corrosion of reinforcing steel, including a positive slope and drainage system with adequate allowances for construction tolerances and deflections.

.2 Specify protection against corrosion for structural elements that may be subject to spills or leaks of corrosive solutions (e.g., mechanical room floors supporting brine tanks and water softeners).

.3 Aluminum in contact with concrete, masonry, wood, or metals other than steel shall be coated with an appropriate coating system, or an inert separator (e.g., neoprene) shall be provided between the aluminum and these materials. Steel in contact with aluminum shall be coated with an appropriate coating system or zinc-coated. Aluminum shall not be placed where runoff from other metals might come in contact with the aluminum.

.4 Provide expansion joints when required based on building configuration and dimensions. Design expansion joints, including those between existing and new structures, so that an abrupt change in floor elevation is prevented. Detail the expansion joints appropriately from a building envelope perspective.

.5 In major renovations of existing facilities, investigate safety with respect to current seismic loading in areas where this is applicable. Upgrade as deemed appropriate for the specific project. At a minimum, ensure adequate lateral support for non-structural components.

Commentary:

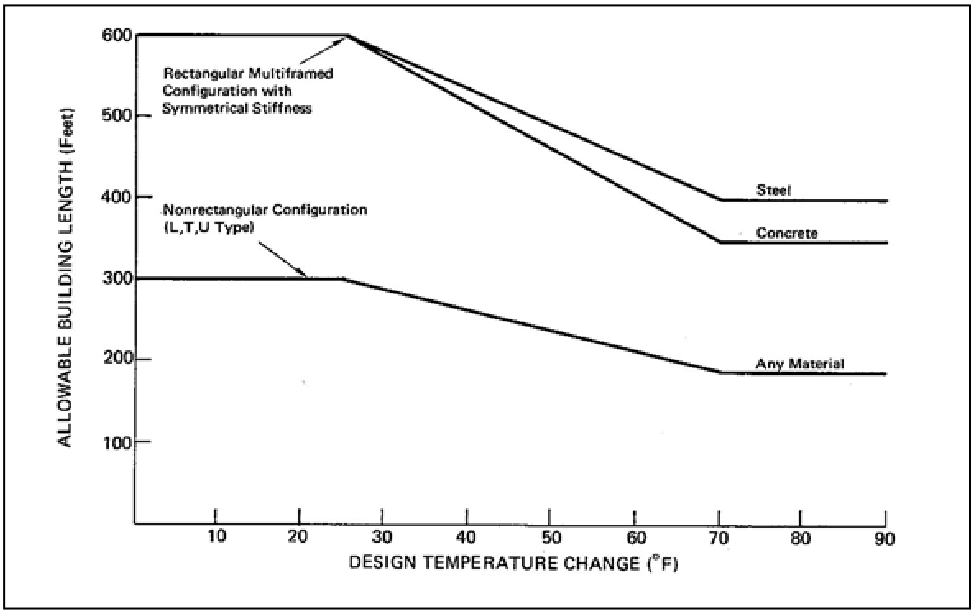
.1 Refer to structural commentary to TDR Item 4.1.1.3.

.2 A chemical resistant coating system may be required to protect the underlying concrete (such as, Sikagard CRV 20 topping over Sikagard WDE primer and Sikafloor 81 Epocem). Specifications for preparation of concrete surface prior to application of coating should be as per the manufacturer’s recommendations. This may involve shot blasting of existing concrete surface or equivalent mechanical means to achieve an appropriate surface profile equivalent to International Concrete Repair Institute (ICRI) CSP 3 to 4 or as specified by the manufacturer.

.3 Aluminum is towards the anodic / less noble / corroded end of the Galvanic scale as compared to galvanized steel, mild steel, stainless steel that are increasingly cathodic / more noble / protected. In the presence of an electrolyte (such as rain water), a galvanic cell is set up and the less noble Aluminum is corroded. Hence an inert separator is required.

.4 Refer to Technical Report No. 65, National Academy of Sciences, 1974 titled "Expansion Joints in Buildings." The empirical approach uses the figure below and assumes a design temperature change between 50 to 70 degrees F for an enclosed heated / air conditioned building to determine the allowable length of building beyond which an expansion joint is required.

Chart from 4.4.F.4



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Expansion joints are expensive and may be difficult to detail correctly from a building envelope perspective. Complexities include:

a. Need to be carried through the roofing membrane.

b. Additional structural framing required at the joint (typically a double line of structural columns is provided along the joint).

c. Independent LLRS in two orthogonal directions is required on each side of the expansion joint.

d. The expansion gap needs to be designed and detailed appropriately for thermal, wind and seismic effects.

e. Wall cladding should be detailed appropriately to accommodate the movement at the expansion joint.

.5 Refer to the structural commentary to TDR Item 4.1.1 regarding renovations to existing facilities.

4.5 Interaction and Coordination with Other Disciplines

.1 The prime structural consultant (Structural Engineer of Record, SER) is responsible for the integrity of the primary structural system of the building including the LLRS. This includes both the horizontal LLRS (HLLRS) and the vertical LLRS (VLLRS). Although the SER may rely on other structural engineers to be responsible for some structural elements, the SER has overall responsibility to verify that the designs achieve a primary structural system that meets applicable standards.

.2 Where possible, avoid thermal bridging. Where this is not possible, incorporate measures to mitigate its effect. Refer to Section 2.0 - Building Envelope.

.3 Structurally design and detail the fastening, support, and back-up systems for exterior walls, brick veneers, cladding, and attachments. Specify galvanizing of steel connections outside the air barrier and shop welding of welded connections.

.4 In the design of exterior wall back-up systems, limit deflections according to the properties of the cladding or veneer material being used.

.5 Specify details that allow for building movements including deflections.

.6 Advise the prime consultant, if applicable, of expected movements of the structure, including those due to deflection, shrinkage, settlement, and volume changes in the soil. Specify adequate allowances in all affected elements, including partitions and mechanical systems.

.7 Where a grade-supported floor slab (i.e., a slab-on-grade) will be constructed over a significant depth (> 1 m) of engineered backfill, determine the probable long-term settlement with the geotechnical engineer. If the expected movements of a slab-on-grade cannot justifiably be accommodated or tolerated, use a structural slab. For use of a slab-on-grade, the post-construction settlement / heave should be limited to about 20 mm. Movements exceeding this limit may result in distress at T-junctions of interior partitions and exterior walls, possible cracks in interior partitions, and cracks in the slab-on-grade that are visible to building occupants that may raise concerns regarding maintenance and structural safety. Where a slab-on-grade is used, it shall be minimum 130 mm thick and shall be reinforced. A crawl space is generally not necessary and should be provided only in cases where there are specific known benefits that justify the extra cost. Structural slabs constructed over a void-form shall not be used where a significant amount of buried piping will be provided below the floor. The piping shall be protected within trenching or other means to isolate the piping from soil. If there is a significant amount of piping, a crawl space should be considered.

.8 Ensure that sub-surface weeping tile drainage system design, drawing and specification responsibilities are delineated between consultants and satisfied. This also applies to drainage of elevator pits and sump pits.

.9 Radon gas mitigation. Construction of new buildings should employ techniques to minimize entry of Radon gas and allow for its removal. Coordinate with Section 2.0 - Building Envelope, Section 5.0 - Mechanical, and Section 11.0 – Environmental Hazards.

.10 A recessed entry mat system may be provided at entrance vestibules. This requires a recess in the floor slab and possibly measures to drain the recess. Coordinate requirements with the Architectural discipline.

.11 Specify concrete floor flatness that is consistent with the flooring material to be applied and the aesthetic requirements. Due to the higher placing and finishing cost involved, specify unconventionally stringent flatness and levelness only for areas where there is a justifiable benefit. CSA A23.1-14 provides guidance on slab and floor finish for various facilities. Do not specify floor levelness for elevated concrete slabs of Class A and B.

.12 Check the structural adequacy of support systems for ceilings, particularly heavy plaster ceilings, and follow up with on-site inspection.

.13 Ensure adequate stiffness of lightweight roof or other structure that supports mechanical equipment with spring isolators. Resonance problems can usually be avoided if the additional structural deflection caused by the equipment load, does not exceed 6 mm or 7 % of the vibration isolator static deflection, whichever is less. Coordinate with the mechanical consultant.

.14 Specify a steel hoist beam at the roof above elevator cores to facilitate erection and maintenance of the elevator equipment.

.15 For roof slopes, refer to Section 2.0 - Building Envelope. Structural design must consider the resulting non-uniform loads caused by accumulation of rain water. The removal of rain water at drains may be restricted by hail associated with a major rainfall or accumulation of debris. The structural design must consider the 1/50 One Day Rain including effect of ponding assuming that roof drains are plugged.

.16 Structurally design and detail required guardrails.

Commentary:

.1 Steel roof diaphragms often act as the HLLRS in buildings. The design of the roof diaphragm for transfer of lateral loads from wind or earthquake to the VLLRS is the responsibility of the SER. This typically involves specifying the appropriate steel deck thickness, its span layout (continuity), and its connections (weld / mechanical fastener size and spacing) to underlying structural steel members to provide the required stiffness for SLS and shear strength for the ULS. Similar considerations apply to composite steel floor diaphragms and reinforced concrete roof and floor diaphragms.

.2 Review details at entrance slabs / ramps, canopies, balconies, entrance projections and rooftop mounted mechanical units (RTUs). Some proprietary thermal bridging / isolation systems are commercially available.

.4 CSSBI B15B-17 (Serviceability Design Criteria for Low Rise Steel Building Systems) provides serviceability considerations for various types of cladding supported by foundation or spandrel beams.

.5 A vertical deflection gap of 25 mm (1 inch) is typically provided between top of non-load bearing partitions and underside of the structure above. An isolation joint or expansion joint is provided between existing building and any new addition. Buildings with complicated floor plan (e.g., L, T and U shape) may warrant appropriate seismic isolation joints for improved seismic response.

.7 Use of a slab-on-grade:

- a. Geotechnical engineers estimate the settlement of engineered fill at about 1% to 2% of fill thickness. Hence, engineered fills in excess of about 1.0 to 1.5 m in thickness may result in settlements exceeding the 20 mm limit.
- b. Ground improvement techniques maybe considered to facilitate use of a slab-on-grade at marginal sites; discuss with a ground improvement specialist. Ensure that vibration monitoring is carried out in urban sites to protect the Province from any damage claims if vibro-improvement techniques are employed. A post-improvement geotechnical assessment report should be requested of the contractor.
- c. Caution on sites with near surface high plastic clay. Such soils are known to undergo shrinkage / swelling in response to decrease / increase in moisture content, resulting in distress to the slab-on-grade.

.8 Weeping tile details are typically shown on architectural, structural and mechanical drawings and requires coordination between disciplines.

.9 Radon gas mitigation details on drawings include location of radon collection pits, piping for the system, sleeves through interior grade beams for radon piping, radon rock and membrane (10 or 15 mil poly) under the slab-on-grade.

.11 Table 21 of CSA A23.1-14 provides slab and floor finish classifications with suggested floor flatness (F_F) and floor levelness (F_L) numbers.

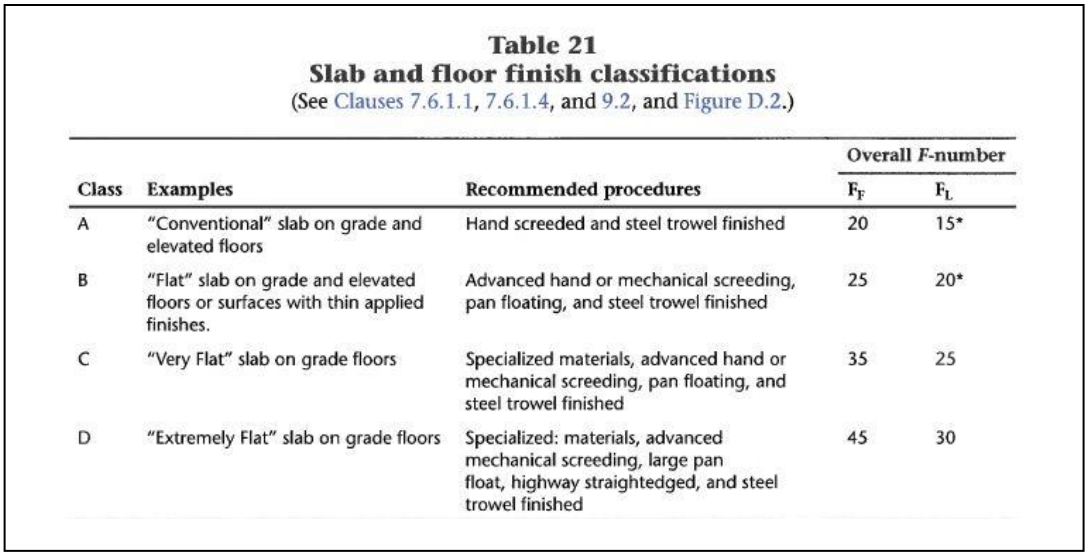

Table 21
Slab and floor finish classifications
(See Clauses 7.6.1.1, 7.6.1.4, and 9.2, and Figure D.2.)

			Overall *F*-number	
Class	**Examples**	**Recommended procedures**	F_F	F_L
A	"Conventional" slab on grade and elevated floors	Hand screeded and steel trowel finished	20	15*
B	"Flat" slab on grade and elevated floors or surfaces with thin applied finishes.	Advanced hand or mechanical screeding, pan floating, and steel trowel finished	25	20*
C	"Very Flat" slab on grade floors	Specialized materials, advanced hand or mechanical screeding, pan floating, and steel trowel finished	35	25
D	"Extremely Flat" slab on grade floors	Specialized: materials, advanced mechanical screeding, large pan float, highway straightedged, and steel trowel finished	45	30

4.6 Vibration Requirements

.1 Specify a minimum of 130 mm thick concrete for mechanical room floors to mitigate structural vibration problems. For composite floor deck, this thickness is from underside of steel deck to top of concrete.

.2 Ensure the rooftop mechanical equipment is located on a stiff portion of a lightweight roof to avoid resonance problems. If the dead load of the equipment causes the roof structure to deflect more than 6 mm, additional roof stiffening is recommended.

.3 Allow for a minimum of 100 mm thick concrete housekeeping pad for all mechanical equipment. This shall be in addition to the thickness of the structural floor slab. This should be indicated as a superimposed dead load (SDL) in addition to any other SDL required for the area. Refer to the mechanical consultant for further requirements.

.4 Design structural steel supporting floors to prevent transient footstep induced vibration from exceeding the annoyance threshold. Refer to Annex E (Floor vibrations) in CSA S16-14 and Structural Commentary D in the National Building Code of Canada, Deflection and Vibration Criteria for Serviceability and Fatigue Limit States.

.5 Locate emergency generators at grade level whenever possible to avoid structural vibration problems. If emergency generators are located on upper floors, specify an inertia base of minimum 1.5 times the weight of the equipment or as recommended by the manufacturer.

.6 Facilities that house vibration-sensitive equipment require an evaluation of the proposed structural framing system. A specialist vibration consultant shall evaluate the compatibility of the proposed structural framing system with the vibration-transmission limitations of the proposed equipment.

.7 Measure to control vibrations transmitted to sensitive areas such as laboratories, include:
  .1 Design the structural system with reduced column spacing.
  .2 Isolate the laboratory spaces from sources of vibration.
  .3 Locate vibration-sensitive equipment on grade-supported slabs.
  .4 Locate vibration-sensitive equipment near column on framed floors.
  .5 Avoid combining corridor and laboratory spans in the same structural bay on framed floors.

Commentary:

.4a CSA S16-14, Annex E (informative) – Floor vibrations. This annex only mentions the items to evaluate in assessing the potential for floor vibrations and does not provide any detail. It refers the users to the NBC Structural Commentaries and AISC Steel Design Guide 11 by Murray et al.

.4b Commentary D of the Structural Commentaries to the NBC summarizes the maximum deflection-to-span ratios in the NBC Part 9 and in the CSA material design standards referenced therein; these ratios have traditionally been used as the serviceability criterion but may not be adequate to assess the potential for disturbing floor vibrations. Commentary D mentions two types of vibration problems in buildings – (a) continuous vibrations arising from cyclic forces of machinery or certain human activities such as dancing that may be further amplified due to resonance with the building frequency, and (b) transient vibrations due to persons walking, jumping, or other impact such as dropping weights in an exercise room and vehicle impact in parking garages. Commentary D refers to the AISC Steel Design Guide 11 for assessing transient vibrations in steel construction and ATC Design Guide 1, 1999 for all materials.

A. Specific Requirements for Healthcare Facilities

.1 Design structural steel floors to prevent floor vibration due to walking from exceeding comfort thresholds for all administrative areas and non-critical areas such as lounges, waiting areas, and cafeterias. Typically, a peak acceleration less than 0.5% g (within 4-8 Hz) for office occupancy is acceptable.

.2 Design normal operation rooms and sensitive patient rooms to limit floor vibration to the tactile perception threshold; typically 0.05 % g (within 4-8 Hz). Less sensitive patient rooms may have slightly higher levels of floor vibration; 0.1% g (within 4-8 Hz).

.3 Operating rooms and other spaces with sensitive equipment (e.g. microsurgery, neurosurgery, MRI) require much lower levels of floor vibration. When possible, design floors to the specific criteria provided by equipment manufacturers, assuming the most stringent requirements.

.4 Consider supporting vibration sensitive equipment from columns or from a structure spanning between columns to avoid making contact with the floor above. When vibration sensitive equipment must be supported directly from the floor structure above, the vibration criteria also apply to the floor above the concerned space.

Commentary:

.1 The following items and Figure 2-1 are from Chapter 2 (Evaluation Criteria for Human Comfort) of the AISC Steel Design Guide 11 by Murray et al., 2nd Edition, 2016:

a. Continuous (steady-state) vibrations can be more objectionable to occupants than vibrations caused by infrequent impact (transient).

b. Continuous vibrations have a duration of more than 30 minutes per 24 hours.

c. Reaction of occupants to vibrations depends on what they are doing; occupants in offices or residences find peak accelerations above about 0.5% g to be distinctly perceptible, whereas occupants taking part in an activity may accept vibrations 10 to 30 times greater (5% g to 15% g or more).

d. The range of resonance frequencies of human internal organs is between 4 and 8 Hertz. Occupants accept higher accelerations outside this frequency range.

e. Figure 2-1 has the recommended tolerance limits for human comfort.

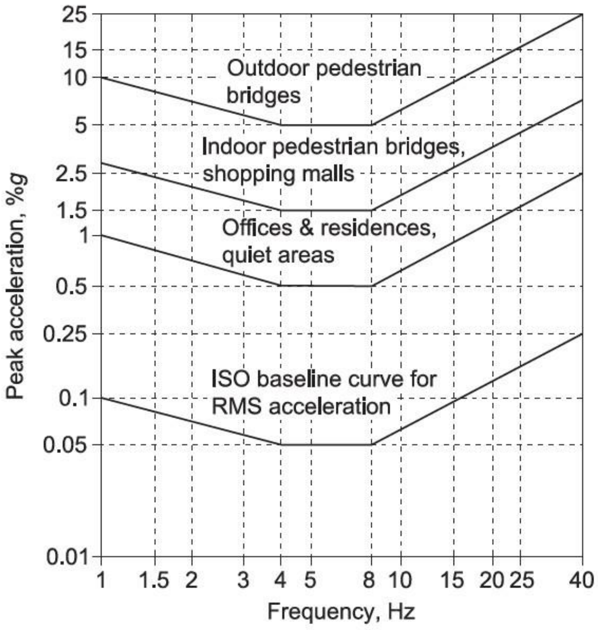

Fig. 2-1. Recommended tolerance limits for human comfort.

.3 Chapter 6 of the AISC Steel Design Guide 11 provides information on vibration criteria for operation of sensitive equipment. Suppliers of sensitive equipment often specify tolerance limits in terms of RMS spectral velocity. These limits are referred to as Vibration Criteria (VC) curves [VC-A to VC-E]. Table 6-2 of this guide has generic vibration criteria tolerance limit for various equipment.
NIH 2020, Table 5.2.2 provides recommended floor vibration velocity limits for various spaces including laboratories and equipment (bench microscopes of various magnification, electron microscopes, surgery suites, laser based optical systems, MRI and NMR).

4.7 Structural Design of Non-Structural Components

.1 The structural design and field review of some of the non-structural elements, restraints, and anchorages shall be provided by a professional engineer registered in the Province of Alberta. The design shall conform to NBC(AE).

.2 Letters of assurance for design and field review shall be provided by the engineer(s) responsible for the design of non-structural elements, and shall be submitted to the SER.

.3 The SER is not responsible for the design of the non-structural elements. However, the SER remains responsible for designing the primary structural system to accommodate these elements and for allowing for their effects on the primary structural system.

.4 Non-structural elements shall include (but are not limited to) the following:

  .1 Cladding, glazing, curtain wall, windows, storefront, interior stud walls exterior wall assemblies.
  .2 Architectural precast concrete.
  .3 Architectural components, such as, guardrails, handrails, flag posts, ceilings, skylights, interior partitions and millwork.
  .4 Mechanical and electrical equipment, components and their attachment.
  .5 Window washing equipment and their attachment.
  .6 Escalators, elevators, and conveying systems.
  .7 Brick, block, or masonry veneers and their attachment.
  .8 Non-load bearing masonry.
  .9 Glass block and its attachment.
  .10 Landscape elements such as benches, light standards, planters, walls, and art installations.
  .11 Non-structural concrete topping.

4.8 Schematic Design Report

The Schematic Design (SD) report shall contain a section for the structural discipline with a narrative outlining the following information:

.1 Building code and design guidelines used in design, including the edition of the NBC(AE) and the Technical Design Requirements for Alberta Infrastructure Facilities.

.2 CSA material design standards including edition used for design of concrete, cold-formed steel, masonry, steel, wood, and other materials.

.3 The importance category for the building per NBC(AE) Table 4.1.2.1 (low, normal, high, or post-disaster).

.4 Design gravity loads – List the specified dead, superimposed dead, and live loads for each level. The specified uniformly distributed live loads shall be listed by occupancy, per NBC(AE) Table 4.1.5.3.

.5 Snow load – List the importance factor (I_S) for the ULS and SLS, the ground snow load (S_s) and the associated rain load (S_r). Also mention the impact of snow drift accumulation around roof obstructions and on lower roofs.

.6 Rain load – List the 1/50 One Day Rain, and mention the effects of ponding assuming the roof drains are plugged.

.7 Wind load – List the importance factor (Iw) for the ULS and SLS, the 1/50 hourly wind pressure, internal pressure coefficient (Cpi), uplift and downward wind pressure on roofs, and the design lateral drift limit for the SLS. Post- disaster buildings shall be designed with an internal pressure coefficient, Cpi of -0.7 to +0.7.

.8 Earthquake load – List the importance factor (I_E) for the ULS, the seismic data ($S_a(t_i)$, PGA, Site Class, F_a, F_v), type of Seismic Force Resisting System (SFRS) used, the force modification factors (R_d, R_o) per NBC(AE) Table 4.1.8.9, and the design interstorey drift limit.

.9 Serviceability criteria for:
  - .1 Deflection limit under specified live load for floor and roof supporting members so that Others designing the building envelope and finishes may account for these movements in their designs.
  - .2 Lateral drift limit for total drift and interstorey drift under wind loads.
  - .3 Vibration control for upper floors.

.10 Construction materials – List the proposed materials and grades for structural steel, reinforced concrete (including air %, cement type), masonry, cold-formed steel and wood.

.11 Geotechnical report – Provide a brief narrative summarizing the impact of the geotechnical conditions on design, including groundwater, seismic site class, foundation options, main floor slab options, fill suitability to support a slab-on-grade, durability requirements (cement type), frost protection measures (void form thickness, minimum depth of burial for foundations), and any special considerations. In addition, provide the reference to the geotechnical report (title, consultant's name, date, and report number).

.12 Structural system – Provide a narrative describing the proposed structural system (foundation, framing, floor system, roof system, and shear cores) and any alternatives that may have been considered. Provide rationale for why the proposed system was chosen over other systems.

.13 Lateral Load Resisting System (LLRS) – Provide a narrative describing the proposed LLRS, including systems for horizontal (HLLRS) and vertical (VLLRS) transfer of lateral loads. Mention if diaphragm action is required of the roof and floor plates.

.14 Delegated design – Indicate items for which Others (specialty professionals) are responsible for the detailed structural design.

.15 Mention any issues that may require special consideration and note short and long-term risks and assumptions.

4.9 Design Development Report

The Design Development (DD) report shall contain a section for the structural discipline. The deliverables shall include a report and drawings. The report shall contain the information listed in the SD report (as per Section 4.8), but it should be updated to include any information that may not have been provided in the SD report and developed in more detail. Drawings shall use the Alberta Infrastructure standard title block / fence surround noted in Section 4.10. The drawings are expected to contain the following information:

.1 General notes [ensure that the information provided below conforms with the text in the DD report]:
    .1 Detailed design criteria for the building.
    .2 Key geotechnical design parameters.
    .3 Material specifications in abridged form.

.2 Three-dimensional renderings – Minimum two views from orthogonal directions along with a north arrow for view orientation.

.3 Typical structural details proposed for use in the building.

.4 Foundation plan:
    .1 Structural grid with labels and dimensions (applies to all plans and sections).
    .2 Foundation layout including location of footings and / or piles, grade beams, basement walls and inclined ramps (with preliminary member sizes).
    .3 Locations of braced bays (VLLRS).
    .4 Legend and schedules where appropriate (applies to all plans).

.5 Floor plans:
    .1 Top of floor elevation.
    .2 Floor system including slab thickness.
    .3 Layout of beams, columns, vertical cores, and braced bays (with preliminary member sizes).
    .4 Major openings in the floor slab.

.6 Roof plans:
    .1 Top of roof elevation. Specify elevation of high points and low points in a sloped roof.
    .2 Roof deck profile and thickness.
    .3 Layout of beams, columns, vertical cores, and braced bays (with preliminary member sizes).
    .4 Major openings in the roof deck.

.7 Building elevations:
  - .1 Show major building exterior elevations and prominent interior elevations (if there are large interior openings requiring structural framing).
  - .2 Building elevations to show location and sizes of headers, locations of braced bays (VLLRS) and size of VLLRS members.

.8 Building sections:
  - .1 Major sections showing relevant conditions.
  - .2 Sections showing peculiar geometry including partial basements and exterior canopies.
  - .3 Elevation of each level and finished grade.

4.10 Contract Drawings

Contract drawings shall be prepared following the guidelines in Appendix B-3 - Structural Drawings, of the Responsibilities for Engineering Services for Building Projects, March 2009, published by APEGA, and Chapter 6.4 - Construction Documents, of the Canadian Handbook of Practice for Architects 2021, published by the RAIC. Include Items 4.9.1 to 4.9.8 from the DD report with additional details as appropriate.

All contract drawings shall use the Alberta Infrastructure standard title block / fence surround available at https://www.alberta.ca/guidelines-and-standards-owned-and-supported.aspx under Section “Title block drawings.”

Include the following design information on the structural drawings, concisely grouped on the first drawing where logical, regardless of whether also included in the specifications:

.1 Building code and design guidelines as per Item 4.8.1.

.2 The CSA material design standards as per Item 4.8.2.

.3 The importance category for the building as per Item 4.8.3.

.4 Design gravity loads as per Item 4.8.4. In addition, provide a key plan indicating design live load for floors that have varying live loads.

.5 Special loadings, such as fire truck, storage areas, landscaped areas, areas with heavy equipment, loading from OH & S fall protection requirements, or other unusual load conditions, shall be identified and located on the drawings.

.6 Snow load as per Item 4.8.5. In addition, show the loads due to snow drift accumulation around roof obstructions and on lower roofs.

.7 Rain load as per Item 4.8.6. In addition, show the rain load on the roof including the effect of ponding assuming roof drains are plugged.

.8 Wind load as per Item 4.8.7. For post-disaster buildings, list the ULS factored lateral wind load on the building in two orthogonal directions used for design of the LLRS.

.9 Earthquake load as per Item 4.8.8. For post-disaster buildings, list the method of analysis used (equivalent static or dynamic), the fundamental period of the building (T_a) used in the calculation of base shear and the factored ULS base shear in two orthogonal directions.

.10 Description of the LLRS (HLLRS and VLLRS) for transfer of lateral loads, including the R_d and R_o used in design.

.11 Serviceability criteria as per Item 4.8.9. Specify minimum moment of inertia required of the floor joists for vibration control of suspended floors.

.12 Geotechnical design parameters – provide the reference to the geotechnical report (title, consultant's name, date, and report number), the factored ULS bearing capacity for spread footings, factored ULS skin friction and end bearing resistance for pile foundations, and the lateral earth pressure coefficient, assumed density of soil, and surcharge live load for design of basements and retaining walls (if applicable).

.13 Material specifications (abridged) for the proposed construction materials, such as schedule for various concrete elements (see Table 2 of CSA A23.1-14), rebar, grade for structural steel, wood, masonry and cold-formed steel.

.14 Identify areas of future additions (if any), indicating design loads and assumptions.

.15 Design criteria for any elements to be designed by the contractor's engineer.

.16 Indicate clearly items for which others are responsible for the detailed structural design (i.e. delegated design items) and provide design criteria for these items.

.17 Elevations of the existing grade, finished grade, foundation, floors and roofs. Geodetic elevation of the top of the main floor slab.

.18 Any special construction procedures or sequence assumed in design, if critical to the construction or long-term performance of the structure.

4.11 Contract Specifications

In addition to the abridged specifications provided on the contract drawings, the contract documents shall include book specification sections for all structural items in the scope of work for the project. The detailed book specifications not only provide technical requirements for materials, workmanship, and special provisions, but they may also provide criteria for acceptance of materials and workmanship and definition of defects. The detailed book specifications are essential for interpretation of the contract and help protect all signatories to the contract.

The specifications should generally describe the following items:

.1 Type and quality of materials and equipment.
.2 Quality of workmanship including fabrication and erection tolerances, and definition of defects.
.3 Methods of fabrication, installation and erection.
.4 Test and code requirements.
.5 Allowances.
.6 Alternates and options.
.7 Shop drawing submittals required and mock-ups.
.8 Requirements and responsibilities for delegated design items.

For multistory buildings, the contractor's engineer shall develop a formwork design, installation and removal sequence plan and submit it to the SER for review before the first-level concrete is poured.

Sample generic specification sections are provided on the Alberta Infrastructure Technical Resources website. Consultants may use these generic specifications and adapt them to meet project specific needs.

The following is a list of Specification Sections that are Structural or related to Structural. The Consultant shall review and provide the appropriate specification sections in the Contract Documents. Section numbers below are suggested for reference only:

00 21 13	Instructions to Bidders (check with Prime Consultant / AI PM)
01 33 50	Delegated Design Submittals
01 43 20	Geotechnical Testing and Inspection (foundation installation, backfill and slab-on-grade subgrade compaction)
01 45 00	Quality Control
01 62 00	Product Options and Substitutions (required if specific Product names are used, such as Hilti, Dywidag, etc.)
02 41 16	Building Demolition / Selective Building Demolition
02 90 00	Radon – Readily Remediated New Construction
03 05 05	Concrete Testing and Inspection – including Mortar / Block / Grout Testing
03 11 00	Concrete Forming and Accessories
03 15 19	Under-Slab Vapour Barriers

03 20 00	Concrete Reinforcing
03 30 00	Cast-in-Place Concrete
03 33 00	Architecturally Exposed Concrete
03 35 00	Concrete Finishing (for Slab-on-Grade and Structural Slab)
03 45 00	Precast Architectural Concrete
03 52 16	Lightweight Insulating Concrete
04 20 00	Concrete Unit Masonry including Grouting
04 23 00	Glass Unit Masonry
04 42 19	Stone Cladding
05 05 05	Steel Inspection and Testing (for Structural Steel Framing, OWSJ and Steel Deck)
05 12 00	Structural Steel Framing
05 21 00	Open Web Steel Joists
05 31 00	Metal Decking
05 41 00	Wind Load Bearing Metal Stud Framing
05 50 00	Metal Fabrications
05 51 00	Metal Stairs, Railings and Ladders
05 70 00	Ornamental Metal Fabrications
05 73 13	Decorative Metal and Glass Railings
06 10 00	Rough Carpentry
06 15 00	Wood Decking
06 17 53	Prefabricated Wood Trusses
06 18 00	Glued Laminated Structural Units
07 21 20	Rigid Board Insulation
31 23 16	Building and Structure Excavating
31 23 35	Building and Structure Backfilling
31 32 13	Soil Cement Base Course (mud slab if required below spread and strip footings)
31 62 13	Cast-in-Place Concrete Piles (drilled concrete piles, CFA piles)
31 62 19	Timber Piles
31 66 15	Screw Piles

Please ensure that specification sections 00 21 13 and 01 62 00 are included in the construction documents to allow for naming products for basis of design

4.12 Construction Inspection and Materials Testing

.1 For Design-Bid-Build projects (for other project delivery mechanisms, discuss with the Alberta Infrastructure project manager), the contract documents are to note that the Province will engage construction inspection and materials testing agencies for quality assurance purpose including:

  .1 Professional geotechnical inspection of foundation installation, soil compaction under slab-on-grade and backfill
  .2 Sampling of plastic concrete.
  .3 Structural steel fabrication and erection.
  .4 Sampling and testing of other materials (wood, masonry).

.2 The structural consultant shall provide the material testing requirements including scope of work to the Province. The Alberta Infrastructure Technical Resources Centre website has sample specification sections that provide generic quality assurance testing requirements for cast-in-place concrete, masonry and structural steel. The Consultant may adapt these to the project specific requirements.

.3 The purpose of the quality assurance program is to inspect, sample, and test an appropriate number of members, details, quantity of materials and procedures, in order to determine conformance of the work with the contract documents.

.4 Quality assurance by the Province is not intended to serve as any part of the contractor’s quality control program. The contractor shall remain responsible for all quality control inspection and testing and shall facilitate the quality assurance testing by the Province’s appointed agencies. The consultant shall ensure that testing requirements for quality control are specified in the contract documents.

Commentary:

.2 The sample specification sections at the Alberta Infrastructure Technical Resources Centre website have testing requirements for the following materials:
  a. 03 05 05 – testing of cast-in-place concrete, reinforcement, mortar and grout for masonry
  b. 04 20 00 – field control tests for masonry
  c. 05 05 05 – testing and inspection of structural steel framing, open web steel joists, steel deck, headed shear connectors, structural fasteners and post-installed fasteners.

Any project specific structural concerns should be brought to the attention of the Alberta Infrastructure Project Manager. Structural consultants are encouraged to provide their input in terms of feedback, concerns, experience in projects, and suggest items for consideration in the TDR or its commentary via email to the Standards and Specifications Specialist at infras.trc@gov.ab.ca

End of Structural Section

5.0 Mechanical

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5.1 General Mechanical Requirements

.1 Intent

.1 The intent of this Section is to outline the requirements for the mechanical systems in new and renovated buildings funded by the Province, that are not otherwise covered by applicable codes and standards, to indicate a preference for certain system design elements over others, or to call attention to particular requirements that require careful consideration.

.2 This Section is not intended to address every conceivable condition or situation, to preclude the use of innovative design, as a substitute for good engineering practice, or to prevent the adoption of installation, operations, and maintenance procedures more stringent than those specified in this document. Where issues arise that are not addressed within this Section, or where it is determined that the requirement is not appropriate for a given project, the Design Consultant and the Project Manager shall apply due diligence in determining appropriate measures.

.3 Mechanical systems shall be designed and built to meet or exceed all applicable codes, standards, organizational requirements, and legislations.

.4 All mechanical systems shall be selected and designed taking into consideration their functionality, reliability, efficiency, flexibility, safety, maintainability, ability to be cleaned, potential for vandalism, and expandability/reserve capacity for future modifications where required.

.5 Do not design mechanical systems to accommodate future building expansion except where directed by the Project Manager.

.6 Use life cycle cost considerations when analyzing and selecting mechanical systems and equipment.

.2 References

.1 The Design Consultant shall use the following Codes and Standards as the basis of design. Discuss the use of Standards not listed here with the Province and document decisions in design reports. Where conflicts or omissions exist between various Codes and Standards, indicate in design report which measures were taken including the reasoning to support that decision.

.2 Follow editions of Codes and Standards referenced in current *National Building Code - Alberta Edition*. Use of more recent edition of Standards not listed in the *National Building Code - Alberta Edition* shall be discussed with the Province and decisions documented in design reports.

.3 Referenced Documents

- .1 Air-Conditioning, Heating, and Refrigeration Institute (AHRI), Standard 885-Procedures for Estimating Occupied Space Sound Levels In The Application of Air Terminals and Air Outlets
- .2 Alberta Infrastructure

    - .1 EMCS Guideline for Logical Point Mnemonics
    - .2 Alberta Infrastructure Technical Specifications
    - .3 Alberta Infrastructure Water Treatment Program Manual

- .3 Alberta Safety Codes Council, *Alberta Safety Codes Act*
- .4 American Conference of Governmental Industrial Hygienists (ACGIH), *Industrial Ventilation – A Manual of Recommended Practice*
- .5 American National Standards Institute (ANSI),

    - .1 ANSI/ISEA Z358.1, Emergency Eyewashes and Shower Equipment
    - .2 ANSI/ASSE Z9.5- American National Standard for Laboratory Ventilation

- .6 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

    - .1 ASHRAE Handbooks
    - .2 ASHRAE Guideline 12, Managing the Risk of Legionellosis Associated with Building Water Systems
    - .3 ASHRAE Guideline 1.5 – The Commissioning Process for Smoke Control Systems
    - .4 ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
    - .5 ANSI/ASHRAE 55, Thermal Environmental Conditions for Human Occupancy
    - .6 ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality
    - .7 ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
    - .8 ASHRAE 110, Method of Testing Performance of Laboratory Fume Hoods
    - .9 ANSI/ASHRAE Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Building
    - .10 ASHRAE, Laboratory Design Guide- Planning and Operation of Laboratory HVAC Systems

- .7 American Society of Plumbing Engineers (ASPE), *Plumbing Engineering Design Handbooks*

.8 Occupational Health and Safety (OHS)

  - .1 Occupational Health and Safety Code
  - .2 Occupational Health and Safety Regulations

.9 Canadian Commission on Building and Fire Code (CCBFC), National Research Council of Canada (NRC)

  - .1 National Building Code - Alberta Edition
  - .2 National Fire Code - Alberta Edition
  - .3 National Plumbing Code of Canada
  - .4 National Energy Code of Canada for Buildings

.10 Canadian Council on Animal Care (CCAC), *Guidelines on Laboratory Animal Facilities*

.11 *U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) green building rating system (LEED v4.1).*

.12 Canadian Standards Association (CSA)

  - .1 ASME A17.1/CSA B44, Handbook on Safety Code for Elevators and Escalators
  - .2 ASME A112.19.3/CSA B45.4, Stainless Steel Plumbing Fixtures
  - .3 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code
  - .4 CSA B52, Mechanical Refrigeration Code
  - .5 CSA B64.10, Selection and Installation of Backflow Preventers
  - .6 CSA B64.10.1, Maintenance and Field Testing of Backflow Preventers
  - .7 CSA B128.1, Design and Installation of Non-Potable Water Systems
  - .8 CSA B139, Installation Code for Oil-Burning Equipment
  - .9 CSA B149.1, Natural Gas and Propane Installation Code
  - .10 CSA B651, Accessible Design for the Built Environment
  - .11 CSA C282, Emergency Electrical Power Supply for Buildings
  - .12 CSA C390, Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors
  - .13 CSA C22.1, Canadian Electrical Code, Part 1
  - .14 CSA Z316.5, Fume Hoods and Associated Exhaust Systems
  - .15 CSA Z320, Building Commissioning Standard & Check Sheets
  - .16 CSA Z662, Oil and Gas Pipeline Systems

.13 National Air Duct Cleaners Association (NADCA)

  .1 Assessment, Cleaning, and Restoration (ACR) of HVAC Systems

.14 National Fire Protection Association (NFPA)

  .1 NFPA 10, Standard for Portable Fire Extinguishers
  .2 NFPA 13, Standard for the Installation of Sprinkler Systems
  .3 NFPA 14, Standard for the Installation of Standpipe and Hose Systems
  .4 NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
  .5 NFPA 51, Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting and Allied Processes
  .6 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems
  .7 NFPA 92, Standard for Smoke Control Systems
  .8 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
  .9 NFPA 214, Standard on Water-Cooling Towers

.15 Sheet Metal & Air Conditioning Contractor's National Association (SMACNA), *HVAC Duct Construction Standards*

.16 Underwriters' Laboratories of Canada (ULC)

.17 Province of Alberta, *Public Health Act: Food Regulation*

.A Specific Requirements for Schools

.1 National Fire Protection Association (NFPA)

  .1 NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

.B Specific Requirements for Healthcare Facilities

.1 Alberta Health Services (AHS)

  .1 Infection Prevention and Control Healthcare Facility Design Requirements
  .2 Infection Control Risk Assessment (ICRA) and Preventive Measures Toolkit for Construction, Renovation and Maintenance
  .3 Best Practice Recommendations: Hand Hygiene Sink Requirements

- .4 Design Guidelines for Continuing Care Facilities in Alberta
- **.5** Standards for the Reprocessing of Reusable Medical Devices and for the Use of Single-use Medical Devices in all Health Care Facilities and Settings
- .6 AHS POLICY PS-47, Safe Bathing Temperatures
- .7 AHS PROCEDURE PS-47-01, Safe Bathing Temperatures and Frequency
- .8 AHS PROCEDURE PS-47-02, Safe Bathing Temperatures and Frequency – Hottest Flowing Water for Therapeutic Tubs

.2 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

- .1 ASHRAE, HVAC Design Manual for Hospitals and Clinics
- .2 ANSI/ASHRAE/ASHE 170, Ventilation of Health Care Facilities

.3 Canadian Standards Association (CSA)

- .1 CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities
- .2 CAN/CSA Z305.6, Medical Oxygen Concentrator Central Supply System: For Use with Nonflammable Medical Gas Piping Systems
- .3 CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities
- .4 CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities
- .5 CAN/CSA Z317.10, Handling of Health Care Waste Materials
- .6 CSA Z317.13, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities
- .7 CAN/CSA Z7396.1, Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems
- .8 CSA Z8000, Canadian Health Care Facilities
- .9 CSA Z8001, Commissioning of Health Care Facilities

.4 Facility Guidelines Institute (FGI)

- .1 Guidelines for Design and Construction of Hospitals
- .2 Guidelines for Design and Construction of Outpatient Facilities
- .3 Guidelines for Design and Construction of Residential Health, Care, and Support Facilities

.5 Canadian Tuberculosis Standards, Chapter 15 Prevention and Control of Tuberculosis Transmission in Health Care and Other Settings

.6 National Fire Protection Association (NFPA)

  - .1 NFPA 99, Health Care Facilities Code
  - .2 NFPA 418, Standard for Heliports

.7 United States Green Building Council (USGBC), *LEED For Healthcare*

.8 United States Pharmacopeia, USP 797*, Pharmaceutical Compounding Sterile Preparations*

.3 Schematic Design Submission

.1 Schematic Design Submission should provide conceptual mechanical design and viable alternatives with recommendations.

.2 As a minimum, Schematic Design Report needs to include the following:

  - .1 Design criteria.
  - .2 Applicable codes, regulations, restrictions, environmental issues and other factors affecting the design.
  - .3 Deviations from Owner’s Project Requirements and potential impacts
  - .4 Site condition assessment, if needed.
  - .5 Utility and/or building system tie-ins.
  - .6 Locations of mechanical rooms and major mechanical equipment.
  - .7 Preliminary mechanical design layout and system schematics.
  - .8 Equipment weights and sizes for coordination with other disciplines.
  - .9 Any specialty services e.g. acoustics, code consulting, seismic supports and restraints, medical gas system testing, commissioning, fire protection engineering, exhaust air re-entrainment investigation, wind tunnel study, etc.

.4 Design Development Submission

.1 Design Development Submission needs to fully convey the design intent of all mechanical systems. All design related issues, technical criteria and performance shall be included in Design Development Report.

.2 As a minimum, the Design Development Report shall include the following:

  - .1 Written Information:

    - .1 Referenced Codes and Standards (with applicable version or edition).
    - .2 Detailed mechanical systems description.
    - .3 Deviations from Owner’s Project Requirements and potential impacts.
    - .4 Building overall heating and cooling loads.

    - .5 Major equipment selections with capacities.
    - .6 System and equipment redundancies and essential electrical system requirements.
    - .7 Vibration and noise control.
    - .8 Seismic supports and restraints for mechanical services and equipment.
    - .9 Smoke control system.
    - .10 Energy Management Control System, communication protocol and any interface to subsystems such as security, fire alarm and lighting
    - .11 Preliminary plumbing fixtures selections (product data sheets)

  - .2 Drawings:

    - .1 Site Plan: all utility service connection locations and sizes, gas meter and fire department connection locations.
    - .2 Roof Plan: mechanical equipment, air intake and exhaust locations, roof drains.
    - .3 Plumbing Plan: fixtures, floor drains, cleanouts, plumbing and drainage mains.
    - .4 Fire Protection Plan: fire mains, fire protection zone boundaries, sprinkler tree location and hazard classifications.
    - .5 Heating Plan: distribution system and layout of terminal units.
    - .6 Cooling Plan: distribution system and layout of terminal units.
    - .7 Ventilation Plan: single line distribution mains and layout of terminal units.
    - .8 Mechanical Room Plan: equipment layout.
    - .9 Mechanical Systems Schematics: domestic water, natural gas, medical gas, heating, cooling, ventilation and smoke control.

.5 Contract Documents

- .1 Prepare contract document drawings to include, but not limited to the following items:

  - .1 Title page

  - .2 Plan drawings:

    - .1 Locations of existing mechanical systems and equipment.
    - .2 Locations of valves (isolation valves, balancing valves, etc.).
    - .3 Locations of dampers (balancing, fire dampers, smoke dampers, control dampers, etc.).
    - .4 Plan locations of differential pressure sensors for variable flow control loops

    - .5 Room temperature thermostats and sensors (CO2, humidity, etc.)
    - .6 Locations of flow measuring devices (airflow stations, etc.).
    - .7 Equipment access/pull/removal areas.
    - .8 Locations of fire protection mains, sprinkler tree, fire pump, and sprinkler zone boundaries.
    - .9 Total connected gas load summary including planned future load.
    - .10 Seismic supports and restraints for mechanical services and equipment.
    - .11 Mechanical equipment legend.

  - .3 Details and sections:

    - .1 Details of air handling unit showing sections and component order (except for packaged unitary rooftop units).
    - .2 Sections through congested areas.
    - .3 Other project specific details

  - .4 Mechanical system schematics:

    - .1 Fire protection
    - .2 Heating and cooling piping
    - .3 Ventilation
    - .4 Smoke control
    - .5 Natural gas and specialty gases (compressed air, medical gas etc.)
    - .6 Potable and non-potable water piping
    - .7 EMCS input/output and related end devices (sensors locations e.g. including temperature, humidity, pressure/pressure differential, etc.) should be indicated on mechanical system schematics.

  - .5 Mechanical equipment schedules for all equipment not defined in the specifications.

- .2 Prepare contract document specifications using the Alberta Infrastructure Technical Specifications as a reference. See Section 5.14 for specific EMCS Specification requirements. Edit relevant sections to suit the project. Specifications should include, but not be limited to the following:

  - .1 Requirements for system demonstration and training for facility operational staff.
  - .2 Requirements for ‘As-built’ or ‘Record’ drawings.
  - .3 Requirements for system start up, testing, balancing and commissioning.
  - .4 Requirements for system cleaning and chemical treatment.
  - .5 Requirements for O&M manuals including system descriptions, design set points, sequences of operations, maintenance requirements, training literature, performance tests, and shop drawings.

.6 Requirements for duct, pipe, valve, and equipment labeling including identification, colour coding and naming nomenclature.
.7 Requirements for seismic supports and restraints for mechanical services and equipment.
.8 Requirements of Alberta Infrastructure Technical Specification Section 23 09 24 EMCS Network Communication and System Configuration for communication interface between mechanical systems and EMCS.

B Specific Requirements for Healthcare Facilities

.1 Contract document drawings to include, but not limited to, the following items:

  .1 Mechanical system schematics:

    .1 Medical gases

.2 Contract document specifications to include, but not limited to, the following:

  .1 Requirements for the Contractor to follow CSA Z317.13*, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities* for precautionary measures before, during, and after construction in a Health Care Facility.

.6 Accessibility

.1 Provide adequate space around equipment for serviceability, balancing, commissioning, safety, equipment removal, and to accommodate component removal such as tube bundles, filter media, and large motors.

.2 Provide a means to remove large equipment from mechanical areas that may require periodic replacement for maintenance or for future equipment installations (consider door opening sizes such as double doors, elevator size and maximum weights, corridor dimensions and obstructions, etc.).

  .1 Provide permanent access platform structure for any major equipment (e.g., AHUs) located above 2000 mm within a mechanical room.

.3 Refer to each section for specific accessibility requirements.

.7 Coordination with Other Disciplines

.1 Coordinate the mechanical systems with other members of the design team as required for consistency and integration with other building components.

.2 The following list of mechanical system coordination items is not intended to be complete, but rather to highlight some of the more common items and issues that typically require coordination.

.1 Base mechanical systems on building code studies to determine occupancy classification, high-rise requirements, and defined areas of refuge.
.2 Base mechanical systems on studies produced by other consultants including geotechnical reports, acoustic requirements, elevator requirements, and helipad requirements.
.3 Coordinate the space requirements for mechanical services with other services sharing the ceiling space for distribution.
.4 Coordinate mechanical equipment weights, locations, and dimensions.
.5 Coordinate the locations, dimensions, and height of roof-mounted mechanical equipment.
.6 Coordinate the location of mechanical equipment mounted within the ceiling system (diffusers, grilles, sprinkler heads, access panels to service equipment, etc.) with other ceiling-mounted components (lights, speakers, signs, etc).
.7 Base heating and cooling load calculations on the actual envelope construction details using actual glazing shading coefficients and thermal resistance values (that account for the thermal bridging through the window frames).
.8 Base seismic and expansion compensators for mechanical systems on the maximum displacement due to the wind or seismic forces where building expansion joints are required.
.9 Base supports and restraints for mechanical systems on the seismic loads as required by the National Building Code - Alberta Edition.
.10 Determine the details of the foundation drainage system and whether or not a sump is required within the building.
.11 Base mechanical system attenuation components on the requirements of the Acoustic Consultant (when involved).
.12 Coordinate noise data emitted from mechanical equipment.
.13 Design duct and pipe distribution on the structural design and the height of the ceiling space.
.14 Coordinate the size, slope, peak flow rate, location, and inverts of the sanitary sewer and storm drainage mains at the building perimeter.
.15 Base distribution piping for irrigation purposes inside the building on the required flow, pressure, and location requirements of the Landscape Architect.
.16 Coordinate the type of fire protection for electrical, server and telecom rooms.
.17 Coordinate design of smoke control system with other disciplines.
.18 Base water and sprinkler pipe designs on the actual available pressure and flow at the design conditions. Conduct fire hydrant flow tests as required.

.19 Coordinate mechanical equipment voltages, motor horsepower, current draw, emergency power requirements, redundancy, and control methodology.

.20 Variable Frequency Drives (VFD) shall comply with the requirements of *Technical Design Requirements*, Section 6.0 Electrical.

.21 Coordinate the current and future natural gas loads with the utility service provider.

.22 Coordinate treatment for all envelope penetrations such as pipes, ducts, louvers, and exhaust with the requirements of *Technical Design Requirements*, Section 2.0 - Building Envelope.

.23 Coordinate waterproofing of mechanical equipment and related supply lines, on roof curbs or raised steel structures, with other members of the design team. For curbed designs, determine whether voids below equipment are to be treated as interior or exterior space.

.A Specific Requirements for Schools

.1 Coordinate mechanical equipment layout (e.g. ductwork, piping, terminal units etc.) in gymnasium storage to avoid potential conflicts with shelf and gym equipment locations.

.B Specific Requirements for Healthcare Facilities

.1 Coordinate the location of mechanical equipment mounted within the ceiling system with patient lifts, vertical headwalls, and booms.

.2 Coordinate to ensure that floors of mechanical rooms other than concrete slabs on grade are waterproof and provided with curbs at all penetrations other than at floor drains.

.3 Coordinate to ensure that interstitial spaces, or service floor areas (other than concrete slabs on grade) that are used as mechanical spaces and that contain significant plumbing or equipment that could pose a risk of leaks or floods are waterproofed and provided with curb penetrations other than at floor drains.

.C Specific Requirements for Continuing Care Facilities

.1 Provide coordination to the same standards as Healthcare Facilities.

.8 Commissioning

.1 The Province will determine the requirement for commissioning on a project.

.2 Comply with CSA Z320, *Building commissioning* for mechanical systems, or as required by LEED.

.3 Commissioning requirements should be based on size and complexity of the project. Work with the Project Manager to outline the "Mechanical Systems to be Commissioned".

.4 Include commissioning requirements in the mechanical specifications for the mechanical contractor's scope of work.

.5 Participate in the commissioning process.

.B Specific Requirements for Healthcare Facilities

.1 Comply with CSA Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities* and CSA Z8001, *Commissioning of Health Care Facilities* for mechanical systems commissioning, or as required by LEED.

.C Specific Requirements for Continuing Care Facilities

.1 Provide commissioning to the same standards as Healthcare Facilities.

.9 Renovations and Additions

.1 Rebalance all new and existing air and water systems that are modified or extended as part of a renovation.

.2 Document capacity and assess overall capability of existing mechanical systems and equipment during schematic design.

.3 Analyze existing mechanical systems serving renovated areas to identify any adverse environmental impacts (e.g. energy use, emissions of greenhouse gases and ozone-depleting substances etc.). Consideration should be given to renewable energy resources and environmentally sustainable practices.

.4 Provide energy efficient equipment and implement energy/water conservation measures when replacing existing equipment and systems at the end of their service life.

.5 Clean all new and existing air ductwork prior to occupancy.

.B Specific Requirements for Healthcare Facilities

.1 Upgrade HVAC systems serving renovated areas in accordance with the requirements of CSA Standards.

.2 Ensure that precautionary and preventative measures take place before and during construction, renovation, and maintenance of Healthcare Facilities in accordance with CSA Z317.13*, Infection Control During Construction or Renovation of Health Care Facilities*.

.C *Specific Requirements for Continuing Care Facilities*

.1 Provide commissioning to the same standards as Healthcare Facilities.

.10 Acoustic and Vibration Control

.1 Design mechanical systems in accordance with the design guidelines for HVAC-related background sound in rooms in accordance with ASHRAE, *Applications Handbook* and AHRI, *Standard 885.*

.2 Refer to Acoustical Sub-section 7.7 - Mechanical for additional requirements.

.11 Emergency Power

.1 Review with the Project Manager and Facility Administrator during design the mechanical equipment connected to the normal power and essential electrical system (vital, delayed vital, and conditional loads).

.2 Connect mechanical equipment to the electrical system in accordance with CSA C22.1, *Canadian Electrical Code, Part I* and CSA C282*, Emergency Electrical Power Supply for Buildings*.

.B *Specific Requirements for Healthcare Facilities*

.1 Connect mechanical equipment to the essential electrical system in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities and CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities designating the vital, delayed vital, and conditional loads.

.C *Specific Requirements for Continuing Care Facilities*

.1 Provide emergency power to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.12 Energy Efficiency and Sustainability

.1 Design mechanical systems in accordance with the National Energy Code of Canada and ANSI/ASHRAE.IESNA, Standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Energy conservation measures shall not reduce system performance below that required by codes and standards.

.3 Integrate energy conservation and heat recovery strategies into the mechanical design that are supported by economic cost analysis. Discuss energy conservation measures with the Project Manager and the Facility Administrator. Energy Conservation options which should be considered include, but are not limited to:

  .1 Plumbing and Drainage Systems:

    .1 Rainwater harvesting (cooling tower makeup)
    .2 Graywater reuse
    .3 Ultra-low flow plumbing fixtures where adequate slope could be accommodated
    .4 Condensing water heaters
    .5 Control domestic hot water recirculation pumps to stop during non-occupied hours.

  .2 Ventilation Systems:

    .1 Air-handling units capable of providing free-cooling when ambient conditions permit.
    .2 Heat recovery devices in exhaust air streams.
    .3 Variable frequency drives on fans, where applicable.
    .4 Variable volume terminal devices
    .5 Air-handling units controlled to shut down during non-unoccupied hours.
    .6 Variable air volume boxes to reduce airflow or shutdown during unoccupied periods
    .7 Ventilation airflow based on CO_2 demand control
    .8 Reduce space temperature set-point during non-occupied hours
    .9 Supply air temperature reset based on outdoor temperature or Zone demand

  .3 Heating Water Systems:

    .1 Heat recovery devices in boiler combustion exhausts
    .2 Variable speed drives on pumps to maintain system pressure
    .3 Pumps controlled to shut down when heating is not required
    .4 Condensing or near-condensing boilers

  .4 Chilled Water / Condenser Water Systems:

    .1 Airside and/or Waterside economizers.
    .2 Variable speed drives on pumps to maintain system pressure.
    .3 Pumps controlled to reduce flow rate or shut down during non-occupied hours.

- .4 Magnetic bearing chillers
- .5 Variable speed chillers
- .6 Variable speed cooling tower fans

.5 Control Systems:

- .1 Load shedding of non-critical equipment
- .2 Refer to 5.14.4 for additional control measures

.4 Leadership in Energy and Environmental Design (LEED):

.1 All Tier 1 projects shall be certified to a minimum LEED v4.1 Silver rating as required in Section 1.0 – Sustainability.

.2 The Province requires a number of LEED credits to be mandatory for its projects. The credits related to mechanical systems are as follows:

- .1 *Water Efficiency Credit: Water Metering.*
- .2 *Energy and Atmosphere Credit: Optimize Energy Performance.*
- .3 *Energy and Atmosphere Credit: Enhanced and Monitoring-Based Commissioning.*
- .4 *Energy and Atmosphere Credit: Advanced Energy Metering*

.5 Discuss with the Project Manager, Facility Manager and Energy Manager to determine which additional systems shall be monitored as part of the Advanced Energy Metering credit (through the building management system). As a minimum the following systems should be monitored.

.1 Natural Gas:

- .1 Heating water
- .2 Humidification
- .3 Domestic potable hot water
- .4 Process heating

.2 Water:

- .1 Reverse osmosis makeup water
- .2 Cooling tower makeup water

.3 Electrical:

- .1 Lighting
- .2 Heating plant (boiler, pumps)

        .3 Chiller plant (chiller, pumps, cooling towers)
        .4 Ventilation (air-handling unit fans, exhaust fans, makeup air units)

    .4 . Heating Water:

        .1 BTU meter installed in heating water loops

.6 Provide high efficiency motors in accordance with CSA 390, Test methods, marking requirements, and energy efficiency levels for three-phase induction motors.

.7 When replacing existing equipment and systems due to end of service life, energy efficient equipment shall be provided and energy/water conservation measures shall be implemented.

.13 Carbon-monoxide (CO) Detection

.1 Provide CO detection and monitoring in all mechanical rooms that have fuel-burning equipment to avoid CO exposure in case of equipment malfunction.

5.2 Mechanical Design Criteria

.1 HVAC Design Criteria

.1 Design HVAC systems to contribute to a healthy indoor environment by suitable control of temperature, relative humidity, ventilation rate, ventilation effectiveness, air movement, mean radiant temperature, noise level, relative space pressurization, and indoor air quality.

.2 Design mechanical systems to provide heating and cooling capacities based on the outdoor ambient temperatures given in the *National Building Code - Alberta Edition*:

- Cooling – July, 2.5% value

- Heating – January, 1% value

.3 Design mechanical systems to provide 30% relative humidity at outdoor temperatures above 0°C; 15% relative humidity below -30°C and reset relative humidity on a linear scale between 0 and -30°C unless otherwise required by the specific space requirements.

.2 HVAC Room Design Parameters

.1 Design mechanical systems to provide an indoor environment (temperature, thermal radiation, humidity, air speed) that meets ASHRAE 55, *Thermal Environmental Conditions for Human Occupancy*.

.2 Design ventilation systems in compliance with ASHRAE 62, *Ventilation for Acceptable Indoor Air Quality*.

.A Specific Requirements for Schools

.1 Design mechanical systems in schools to meet the criteria set out in Table 5.2.2.A and Table 5.2.2.B.

  .1 Use table 5.2.2.A for spaces with overhead air distribution
  .2 Use table 5.2.2.B for spaces with displacement ventilation

Table 5.2.2.A: Mechanical System Design Parameters for Schools - Overhead Air Distribution

Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC (N) (Note 5)	Remarks
Auditorium	22 - 25	see Note 2	4*	Neutral (E)	20-25	* See Note 3c
Cafeteria	22 - 25	see Note 2	6*	Negative (-)	40	* See Note 3c
Classrooms	22 - 25	see Note 2	4*	Neutral (E)	25-30	* See Note 3c
Conference Rooms	22 - 25	see Note 2	6*	Neutral (E)	30	* See Note 3c
Copier work/ Printer Room	22 - 25	see Note 2	6*	Negative (-)	35	* may require higher ACH to meet exhaust
Corridors	22 - *	see Note 2	2	Neutral (E)	40	* See Note 1b
Daycare Room	24 - 26	see Note 2	4*	Neutral (E)	25-30	* See Note 3c

Table 5.2.2.A: Mechanical System Design Parameters for Schools - Overhead Air Distribution

Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC (N) (Note 5)	Remarks
Gymnasium*	22 - **	see Note 2	6***	Neutral (E)	35	• mechanical cooling not required ** see Note 1b *** see Note 6
Home Economics/ Cosmetology	22 - 25	see Note 2	6 *	Negative (-)	30	* may require higher ACH to meet exhaust
Industrial Arts*	22 – **	see Note 2	6 ***	Negative (-)	35	* mechanical cooling not required ** see Note 1b *** may require higher ACH to meet exhaust demand
Kitchen / Cooking*	22 - **	see Note 2		Negative (-)	45	* mechanical cooling not required ** see Note 1b
Laboratories	22 - 25	see Note 2	6*	Negative (-)	30	*See Note 3c
Library	22 – 25	see Note 2	6	Neutral (E)	30	
Locker Rooms	22 - *	see Note 2		Negative (-)	45	*See Note 1b
Music Room	22 - 25	see Note 2	4*	Neutral (E)	30	*See Note 3c
Office	22 - 25	see Note 2	4*	Neutral (E)	35	*See Note 3c
Reception	22 - 25	see Note 2	4*	Neutral (E)	35	*See Note 3c
Server Room*	22 - 25	see Note 2		Neutral (E)	45	*provide stand-alone AC unit

Table 5.2.2.A: Mechanical System Design Parameters for Schools - Overhead Air Distribution						
Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC (N) (Note 5)	Remarks
Staff Room	22 - 25	see Note 2	6*	Negative (-)	40	*See Note 3c
Gymnasium Storage/ Equipment Room	22 - *	see Note 2	4	Negative (-)	45	*see Note 1b
Washrooms	22 - *	see Note 2		Negative (-)	45	*see Note 1b

Table 5.2.2.A Notes:

.1 Temperature Range:

- *a. Where a temperature range is shown (i.e. 22°C-25°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.*
- *b. No requirement for maximum summer design temperature.*

.2 Relative Humidity:

- *a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.*
- *b. Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.*
- *c. Maintain the humidity level for gymnasiums to meet the manufacturer's requirements for the wood flooring.*

.3 Total Air Changes Per Hour (ACH):

- *a. Refers to total mechanical air circulation provided to a space. May be comprised of outdoor air, return air or transferred air. Outdoor air for ventilation must be provided per applicable codes.*

b. Values listed are minimum values and do not preclude the use of higher or more appropriate values based on more stringent standards or cooling requirements.

c. Where no mechanical cooling is provided, a minimum 6 ACH should be provided for higher air circulation in the learning and administration areas; 8 ACH in the music room and staff room; 10 ACH in the conference rooms and laboratories; 12 ACH in the cafeteria.

d. Values refer to occupied spaces; ventilation can be reduced when space is unoccupied except where specifically noted otherwise.

.4 Relative Pressure:

a. "E" denotes equal or neutral relative pressure to surrounding spaces.

b. "+" denotes positive relative pressure to surrounding spaces.

c. "-" denotes negative relative pressure to surrounding spaces.

.5 Noise Level: This number indicates the acceptable range of background noise level in terms of room criteria (RC) assuming a neutral (N) spectrum. Refer also to Section 7.0 – Acoustics.

.6 Gymnasium normal occupancy 30 to 60 students for outdoor air requirements. Peak occupancy rate to be coordinated with the school board. Air changes to be based on 3m height (i.e. occupied zone).

Table 5.2.2.B: Mechanical System Design Parameters for Schools

Displacement Ventilation

Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC (N) (Note 5)	Remarks
Auditorium	22 - 25	see Note 2	3.6 - 4	Neutral (E)	20-25	
Cafeteria	22 - 25	see Note 2	3.6 - 4	Negative (-)	40	
Classrooms	22 – 25	see Note 2	3.6 - 4	Neutral (E)	25-30	
Conference Rooms	22 - 25	see Note 2	3.6 - 4	Neutral (E)	30	
Copier work/ Printer Room						*See Note 6

Table 5.2.2.B: Mechanical System Design Parameters for Schools

Displacement Ventilation

Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC (N) (Note 5)	Remarks
Corridors	22 - *	see Note 2	2	Neutral (E)	40	*see Note 1b
Daycare Room	24 - 26	see Note 2	3.6 - 4	Neutral (E)	25-30	
Gymnasium*						*See Note 6
Home Economics / Cosmetology*						* See Note 6
Industrial Arts*						*See Note 6
Kitchen/ Cooking*						*See Note 6
Laboratories*						*See Note 6
Library	22 - 25	see Note 2	3.6 - 4	Neutral (E)	30	
Locker Rooms*						*See Note 6
Music Room	22 - 25	see Note 2	3.6 - 4	Neutral (E)	30	
Office	22 - 25	see Note 2	3.6 - 4	Neutral (E)	35	
Reception	22 - 25	see Note 2	3.6 - 4	Neutral (E)	35	
Server Room*	22 - 25	see Note 2		Neutral (E)	45	*Provide stand-alone AC unit
Staff Room	22 - 25	see Note 2	3.6 - 4	Negative (-)	40	
Gymnasium Storage/ Equipment						*See Note 6
Washrooms*						*See Note 6

Table 5.2.2.B Notes:

.1 *Temperature Range:*

  a. *Where a temperature range is shown (i.e. 22°C-25°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.*

b. No requirement for maximum summer design temperature.

.2 Relative Humidity:

- *a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.*
- *b. Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.*
- *c. Maintain the humidity level for gymnasiums to meet the manufacturers requirements for the wood flooring*

.3 Total Air Changes Per Hour (ACH):

- *a. Minimum 3.6 ACH applicable for 100 percent outside air systems, for mixed flow systems use minimum 4 ACH.*
- *b. Refers to total mechanical air circulation provided to a space. May be comprised of outdoor air, return air or transferred air. Outdoor air for ventilation must be provided per applicable codes.*
- *c. Values listed are minimum values and do not preclude the use of higher or more appropriate values based on more stringent standards or cooling requirements.*
- *d. Values refer to occupied spaces; ventilation can be reduced when space is unoccupied except where specifically noted otherwise.*

.4 Relative Pressure:

- *a. "E" denotes equal or neutral relative pressure to surrounding spaces*
- *b. "+" denotes positive relative pressure to surrounding spaces*
- *c. "-" denotes negative relative pressure to surrounding spaces*

.5 Noise Level: This number indicates the acceptable range of background noise level in terms of room criteria (RC) assuming a neutral (N) spectrum. Refer also the Section 7.0 – Acoustics.

.6 This space type is not suitable for displacement ventilation. Use design parameters in Table 5.2.2.A for the corresponding space type.

.B Specific Requirements for Healthcare Facilities

.1 Design mechanical systems in healthcare facilities to meet the criteria set out in CAN/CSA-Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities* (i.e. temperature range, relative humidity, minimum total air changes per hour, minimum outdoor air changes per hour, relative pressurization, filtration requirements, noise level, etc.).

.C Specific Requirements for Continuing Care Facilities

.1 Design mechanical systems in continuing care facilities to meet the criteria set out in Table 5.2.2.C.

Table 5.2.2.C: Mechanical System Design Parameters for Continuing Care Facilities								
Space	Temperature Range °C (Note 1) (1)	Relative Humidity Range (%) (Note 2)	Minimum Total ACH (Note 3)	Minimum Outdoor ACH (Note 3)	Relative Pressurization (Note 4)	All Air Exhausted Directly to Outdoors	Noise Level RC (N) (Note 5)	Remarks
Activity Rooms	22-24	30-60	6	2	Neutral (E)	-	35-40	
Administrative/ Offices	22-24	30-60	6	2	Neutral (E)	-	30-35	
Barber/Beauty Parlour	22-24	30-60	12	3	Negative (-)	Yes	35-45	
Assisted Bath	24-27	30-60	9	3	Negative (-)	Yes	40-45	
Clean Linen Storage	22-24	30-60	4	1	Positive (+)	-	40-45	
Clean Utility	22-24	30-60	6	2	Positive (+)	-	35-40	
Conference Rooms	22-24	30-60	10	*	Neutral (E)	-	30-35	See Note 3a
Dining	22-24	30-60	6	2	Negative (-)	-	35-40	
Dishwashing	22-24	30-60	10	2	Negative (-)	Yes	40-45	
Examination & Treatment	22-24	30-60	6	2	Neutral (E)	-	35-40	
Housekeeping Closets	22-*	30-60	10	-	Negative (-)	Yes	-	*See Note 1b
Kitchen	22-24	30-60	10	2	Negative (-)	Yes	40-45	
Laundry	22-24	30-60	12	3	Negative (-)	-	40-45	
Lounges	22-24	30-60	6	2	Neutral (E)	-	30-35	

Table 5.2.2.C: Mechanical System Design Parameters for Continuing Care Facilities								
Space	Temperature Range °C (Note 1) (1)	Relative Humidity Range (%) (Note 2)	Minimum Total ACH (Note 3)	Minimum Outdoor ACH (Note 3)	Relative Pressurization (Note 4)	All Air Exhausted Directly to Outdoors	Noise Level RC (N) (Note 5)	Remarks
Nursing Stations	22-24	30-60	6	2	Neutral (E)	-	30-35	
Physical Therapy	22-24	30-60	9	3	Negative (-)	-	35-40	
Public Washrooms	22-*	30-60	9	-	Negative (-)	Yes	40-45	*See Note 1b
Resident Bedrooms	22-24	30-60	4	2	Neutral (E)	-	30 max	
Corridors	22-24	30-60	3	1	Neutral (E)	-	35-40	
Resident Washrooms	22-24	30-60	9	-	Negative (-)	Yes	35-40	
Soiled Linen Storage	22-24	30-60	10	-	Negative (-)	Yes	-	
Soiled Utility	22-*	30-60	10	-	Negative (-)	Yes	40-45	*See Note 1b
Storage - General	22-24	30-60	2	-	Negative (-)	-	40-45	

Table 5.2.2.C. Notes:

.1 Temperature Range:

- *a. Where a temperature range is shown (i.e. 22°C-24°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.*
- *b. No requirement for maximum summer design temperature.*

.2 Relative Humidity:

- *a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.*

  - b. *Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.*

.3 *Total air change rates do not preclude the use of higher or more appropriate values based on more stringent standards or cooling requirements.*
  - a. *Conference rooms should have 9.5 L/s per person of outdoor air.*

.4 *Relative Pressure:*
  - a. *E - denotes equal or neutral relative pressure to surrounding spaces*
  - b. *+ - denotes positive relative pressure to surrounding spaces*
  - c. - denotes negative relative pressure to surrounding spaces

.5 *This number indicates the acceptable range of background noise level in terms of room criteria (RC) assuming a neutral (N) spectrum. Refer also the Section 7.0 – Acoustics.*

5.3 Drainage Systems

.1 General Requirements

.1 Design plumbing, drainage, and vent systems in accordance with the *National Plumbing Code.*

.2 Avoid installation of drainage pipes above the ceiling of electrical, server and telecommunication rooms.

.2 Sanitary Sewer System

.1 Coordinate the requirement for a sampling manhole with the Authority Having Jurisdiction and the Civil Consultant for facilities containing laboratories.

.2 Provide interceptors and neutralization tanks with adequate service space.

.3 Provide duplex sanitary sump pumps. Size pumps to prevent short cycling. Control to alternate between lead/lag operations and provide with high-level alarm. Design sump with a separate discharge line out of the pit. Do not combine the discharge pipes until out of the sump. Install check Valves and shut-off valves outside the sump for easy access.

.4 Where a sump is required for an elevator shaft, locate the sump remotely (outside) from the elevator shaft

.5 . Provide sanitary vents in accordance with the National Plumbing Code and as required by the Authority Having Jurisdiction.

.6 Provide adequate and accessible service space for cleanouts. Where cleanouts must be located in a ceiling space, ensure that fixed furniture does not restrict access or extend them as necessary to ensure accessibility.

.7 Provide interceptors in the waste piping of areas such as:

  .1 Dental and other laboratories
  .2 Food preparation areas
  .3 Hair salons
  .4 Science and Science preparation rooms
  .5 Art classrooms

.B Specific Requirements for Healthcare Facilities

.1 Design plumbing systems in accordance with CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.2 Avoid designing drainage systems to pass over areas where leakage or condensation could cause a hazard (i.e. food preparation areas, electrical areas, and patient care areas).

.3 Locate equipment that requires accessibility outside of patient care areas (i.e. valves, cleanouts, control dampers, fire dampers, etc.).

.4 . Provide interceptors in the waste piping of areas such as:

  .1 Fracture rooms sinks and other room where casts may be applied or removed.
  .2 Autopsy suites.

.5 Provide vapor vents to atmosphere sterilizer units.

.C Specific Requirements for Continuing Care Facilities

.1 Design sanitary sewer systems to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.3 Laboratory / Hazardous Waste Drainage Systems

.1 Sanitary waste from buildings containing laboratories and infectious areas shall comply with waste water discharge requirements of local bylaws, codes, and environmental and health regulations.

.2 Evaluate the need for point-of-use dilution or neutralizing traps or central neutralization traps based on the size of the facility and locations where neutralization is required.

.3 Provide large laboratory areas with acid waste drainage to a neutralizing sump equipped with pH probe meter.

.4 Use chemical and fire resistant piping in drainage systems serving laboratories where acids are used.

.5 Drains carrying hazardous or radioactive waste shall be identified as such.

.B Specific Requirements for Healthcare Facilities

.1 Hazardous waste shall meet the requirements of CSA Z317.10, Handling of Waste Materials Within Health Care Facilities and be piped to a neutralizer and treated prior to discharge or collected in a holding tank for off-site disposal.

.4 Storm Drainage System

.1 Pipe storm water separately from the sanitary sewer.

.2 Avoid the use of controlled flow roof drainage systems.

.3 Provide internal drainage systems with open flow drains connected to 100 mm (4 in) diameter pipes (minimum).

.4 Provide a minimum of two roof drains per drainage area. Refer to Section 2.0 – Building Envelope.

.5 Provide cast iron or aluminum dome strainers over roof drains.

.6 Provide a min. 25 mm of insulation on the underside of roof drain bodies and the horizontal storm piping from roof drains up to the first vertical drop.

.7 Where storm water is not directly connected to the storm water service main, terminate roof drain exterior discharge outlet with an elbow at least 1.0 m (3 ft) above grade. Provide thermostatically controlled electric heat tracing inside the piping from the discharge back into the building to prevent freeze-up during the winter. Direct the discharge so that it does not flow onto areas designated for pedestrian, play areas or vehicle traffic where it could freeze and become a safety hazard, or onto areas where it could cause erosion damage.

.8 Sumps to consist of two compartments (a settling compartment and a pumping compartment) if the amount of suspended matter is likely to interfere with the operation of the pumps or cause excessive wear. Size the pumping compartment to limit the frequency of pump starts to that recommended by the manufacturer.

.9 Provide duplex/triplex storm sump pumps. Size pumps to prevent short cycling. Control to alternate between lead/lag operations and provide with high-level alarm. Design sump pumps with a separate discharge line out of the pit. Do not combine the discharge pipes until out of the sump. Install check valves and shut-off valves outside the sump for easy access.

.B Specific Requirements for Healthcare Facilities

.1 Provide provisions for fuel spill control in accordance with NFPA 418, *Standard for Heliports*.

5.4 Plumbing Fixtures and Equipment

.1 General Requirements

.1 Provide plumbing fixtures in accordance with the requirements of the *National Plumbing Code.*

.2 Provide white fixtures of any one type by the same manufacturer with chrome-plated fixture trim and accessories.

.3 Provide barrier-free fixtures where required by the National Building Code - Alberta Edition that are installed in accordance with the requirement of CSA-B651, Accessible Design for the Built Environment and the National Building Code - Alberta Edition.

.4 Coordinate to determine the specific mechanical rough-in requirements for Owner Supplied Equipment (i.e. washers and dryers, bedpan washers/disinfectors, kitchen equipment, etc.). Provide back-flow prevention devices as required.

.A Specific Requirements for Schools

.1 Coordinate with respective School Board to determine the desired fixture and trim types (material, wall or floor mount, manual, metered, power or battery operated hands-free activation).

.B Specific Requirements for Healthcare Facilities

.1 All fixtures and fittings shall meet the requirements of CAN/CSA Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*

.2 Coordinate with the Facility Administrator to determine the appropriate fixture and trim types.

.3 Coordinate with the Facility Administrator to determine where bariatric plumbing fixtures are required.

.4 Provide provision for regulating the temperature delivered from faucets in accordance with CAN/CSA Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*.

.C *Specific Requirements for Continuing Care Facilities*

.1 Provide plumbing fixtures and equipment to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.2 Floor Drains

.1 Equipment Drains: Provide combination, funnel-type in mechanical or service areas.
.2 Use electronic trap seal primer to prevent floor drain traps from losing their water seal by evaporation.

.B *Specific Requirements for Healthcare Facilities*

.1 Floor drains shall not be provided for drench showers located in public and patient care areas.

.3 Interceptions

.1 Provide interceptors such as sediment buckets in floor drains where undesirable material can be discharged into the sanitary drainage system such as in kitchens, garbage rooms, and incinerator rooms.

.4 Water Closets

.1 In general, flush-valve activated water closets are preferred over flush tank types.

.2 Flush Valve Water Closets: Provide hands-free, low flow, quiet-action type.

.3 Flush Tank Water Closets: Provide high performance low-flow or dual-flush water closets to minimize plugging.

.A *Specific Requirements for Schools*

.1 Student/Staff Washrooms

    .1 Provide floor-mounted water closet with hands-free, flush-valve activation.

.2 Early Childhood Services (ECS) Washrooms

.1 Provide high performance residential grade toilets to reduce noise and promote acceptance by elementary students, who can be intimidated by noisier more powerful syphon jet or blowout flush.

.B Specific Requirements for Healthcare Facilities

.1 Bariatric Water Closets

.1 Provide floor-mounted heavy duty water closets, extra wide seat rated for 500 kg (1,120 lbs.), and carriers or supports designed to hold the weight of the patient.

.2 Where bariatric water closets are not desired, but there is still a requirement for bariatric design, coordinate with the Facility Administrator to determine the desired fixture type. Consider the use of a floor-mounted, heavy-duty water closet compatible with a bariatric commode rated for 360 kg (800 lbs.) as an alternative. When a bariatric commode is being used, ensure that the flush valve assembly does not interfere with its operation or provide an unattached flush tank.

.C Specific Requirements for Continuing Care Facilities

.1 Resident Washrooms

.1 Provide all water closets suitable for barrier-free accessibility.

.2 Public Washrooms

.1 Provide at least one wheel-chair accessible water closet (in coordination with the Architect).

.5 Urinals

.1 Provide wall-hung urinals with hands-free flush valve activation.

.6 Washroom Lavatories

.1 Provide hands-free, low-flow lavatory faucets.

.A Specific Requirements for Schools

.1 Student/Staff Washrooms

- .1 Provide stainless steel basins and hands-free activation.

.C Specific Requirements for Continuing Care Facilities

.1 Resident Washrooms

- .1 Provide all lavatories suitable for barrier-free accessibility.
- .2 Provide manual hot and cold taps with wrist blade handles at least 100 mm (4 in.) in length. Automatic sensor faucets shall not be used.
- .3 In washrooms designed for bariatric residents, provide wheelchair accessible sinks with extra support rated for 135 kg (300 lbs.).

.2 Public Washrooms

- .1 Provide at least one sink faucet equipped with wrist-blade handles or infra-red activated.

.7 Sinks

.1 Mechanical Rooms

- .1 Provide stainless steel, recessed sink for maintenance purposes within a countertop of sufficient size to allow for water sampling equipment.

.A Specific Requirements for Schools

.1 Classrooms

- .1 Where sinks are required by the Functional Program they shall be stainless.

.2 Workshop/CTS

- .1 Provide sediment and solids interceptors for sinks.

.B Specific Requirements for Healthcare Facilities

.1 Handwash/Hand Hygiene Sinks

- .1 Coordinate with the Project Manager and Facility Administrator to determine the requirements for handwash/hand hygiene sinks.

.2 Refer to Alberta Health Services Infection Prevention and Control Healthcare Facility Design Requirements.

.C *Specific Requirements for Continuing Care Facilities*

.1 Handwash/Hand Hygiene Sinks

  .1 See Section B – Specific Requirements for Healthcare Facilities.

.2 Beauty Shops

  .1 Provide hair wash sinks complete with hair traps.

.8 Emergency Fixtures

.1 Where the eyes or body of any person may be exposed to injurious corrosive materials, provide suitable facilities for quick drenching or flushing of the eyes and body within the work area for immediate use.

.2 Provide a tempered water supply to emergency eyewash and shower fixtures in accordance with ANSI/ISEA Z358.1*, Emergency Eyewash and Shower Equipment,* American National Standards Institute (ANSI). Coordinate with the facility administrator to determine the desired discharge temperature to emergency fixtures (within the permitted temperature range).

.9 Tubs and Showers

.C *Specific Requirements for Continuing Care Facilities*

.1 Assisted Care Bathing Rooms

  .1 Where specialty tubs are required to be provided as part of the mechanical scope of work, coordinate with Architect and Facility Administrator to determine where bariatric fixtures are required.

.2 Resident Washrooms

  .1 Provide all tubs and showers suitable for barrier-free accessibility.

.10 Hose Bibbs

.1 Provide key-operated, non-freeze hose bibbs every 30 m (100 ft) around the building perimeter or as required to suit the irrigation requirements.

.2 Provide non-freeze cold water hose bibbs for roof areas that contain equipment that requires periodic cleaning.

.3 Provide hose bibbs every 30 m (100 ft) in parkades and garages.

.11 Drinking Fountains

.1 Provide refrigerated drinking water sources as required by the Functional Program (bottle filler, water dispensers, drinking fountains, etc.).

.A Specific Requirements for Schools

.1 Core Spaces

  .1 Provide drinking fountains with bottle-filler, refrigerated or non-refrigerated as per the School Boards requirements.

5.5 Domestic Water and Specialty Water Systems

.1 General Requirements

.1 Plumbing and water systems shall comply with the *National Plumbing Code* and the *National Building Code - Alberta Edition*.

.2 Refer to Alberta Infrastructure’s Technical Specifications, *Section 20 20 30 Piping and Equipment Insulation* for insulation thickness schedule.

.3 Avoid installation of water pipes above the ceiling of electrical, server and telecommunication rooms.

.4 Isolation valves shall be accessible and identified by marking that are permanent, distinct, and easily recognized and be provided for each:
  .1 Building incoming water main.
  .2 Branches connected to a water main.
  .3 Base of a riser and each floor branch connection on a riser.
  .4 Connection at each fixture.
  .5 Connection to equipment.

.2 Domestic Cold Water System

.1 Provide backflow prevention in conformance with the *National Plumbing Code* or the requirements of the municipality (whichever is more stringent). Install in accordance with *CAN/CSA-B64* Series.

.2 Do not exceed 2 m/s (6.5 ft/s) velocity for cold water piping to minimize erosion and corrosion.

.3 Where pressure-booster systems are required, the number and arrangement of pumps shall be such that peak demand can be met in the event of failure of one pump. Alarms shall be provided to indicate failure of a pumping unit and low primary water supply pressure. Alarms shall be annunciated to the building automation system as well as sounded in a continuous supervised location.

.4 Insulate cold water pipes and provide with a continuous vapor barrier. Plumbing fixture supplies need not be insulated, except fixture supplies on barrier-free lavatories (e.g. stops, supplies, traps, and drains).

.B Specific Requirements for Healthcare Facilities

.1 A reliable and adequate alternative water supply shall be provided such that the service to the healthcare facility is not significantly interrupted in the event of failure of the primary potable water supply in accordance with CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.2 Install parallel, approved backflow prevention devices (each sized for full-flow capacity) on the main water service to ensure water availability during testing and maintenance.

.3 The complete potable water system shall be flushed and treated immediately prior to occupancy in accordance with one of the methods identified in CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.4 Gray water shall not be used within healthcare facilities.

.5 Provide redundancy for potable water distribution pumps, storage tanks and other main components.

.6 Treat and test complete water system prior to occupancy in accordance with CAN/CSA-Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design domestic cold water systems to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.3 Domestic Hot Water System

.1 Consider multiple water heating sources (i.e. 2 water heaters) where redundancy is required. Discuss water heater redundancy with the Facility Administrator.

.2 Provide a domestic water heating system that is separate from the building heating system unless a combined system is fundamental to the energy conservation strategy. Where combined systems are proposed, demonstrate energy savings and discuss the implications of reduced redundancy with the facility administrator.

.3 Provide domestic hot water recirculating pump and piping.

.4 Provide recirculating piping for branches which exceed 8 m (25 ft) in length.

.5 Provide recirculating piping with a balancing valve for branches which exceed 15 m (49 ft) in length.

.6 Do not exceed 1.22 m/s (4.0 ft./s) for copper hot water supply and recirculating piping systems operating at 60 °C (140 °F) or less to minimize erosion and corrosion.

.7 Do not exceed 0.76 m/s (2.5 ft./s) for copper hot water supply and recirculating piping systems operating at temperatures greater than 60 °C (140 °F) to minimize erosion and corrosion.

.8 Provide check valves and/or backflow preventers as required by applicable codes and regulations.

.9 Provide water to dishwashers at a temperature in accordance with the manufacturers requirements.

.B Specific Requirements for Healthcare Facilities

.1 Design hot water systems in accordance with CSA Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*.

.2 Arrange water distribution systems to provide hot water at every hot water outlet on demand (less than 10s).

.3 Hot water is preferred to be generated through instantaneous water heaters.

.4 Design shall prevent dead legs in the piping distribution. Connect hot water recirculation piping as close to the fixture control or mixing valve as possible, running down the wall as necessary.

.5 Hot Water Temperature

  .1 Hot water temperature shall be in accordance with Table 1, Hot Water Temperatures of CSA-Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*.
  .2 Provide a means to sanitize the hot water tanks and water distribution system in accordance with CSA-Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*.
  .3 Provide mixing valves compliant with the applicable ASSE Standard to prevent thermal shock and scalding where required.

.6 Consider copper/silver ionization technology for the domestic hot water system on the recirculation piping for new healthcare facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design domestic hot water systems to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.2 For safe bathing temperature range and practices on staff assisted bathing in continuing care, refer to the following Alberta Health Services policy and procedure documents:

  .1 AHS POLICY PS-47, Safe Bathing Temperatures,
  .2 AHS PROCEDURE PS-47-01, Safe Bathing Temperatures and Frequency,
  .3 AHS PROCEDURE PS-47-02, Safe Bathing Temperatures and Frequency – Hottest Flowing Water for Therapeutic Tubs.

.4 Soft Water System

.1 Obtain a basic water analysis of the facility water supply from the facility administrator to determine the quality of the water service hardness, alkalinity, dissolved iron/copper, conductivity, and pH.

.2 Water softening requirements:

  .1 Provide soft water makeup for:

    .1 Steam humidification systems (unless specifically prohibited by the humidifier manufacturer).
    .2 Laundry
    .3 Glass/dishwashing

        - .4 Commercial dishwashing
        - .5 Steam boilers
        - .6 Reverse osmosis systems

    - .2 Review with the Facility Administrator the requirement for soft water when the municipal water service has a water hardness greater than 120 mg/L.

- .3 Use the following as a guide for water softening requirements:
    - .1 Feed water or make-up water to steam boilers (including humidification steam boilers, gas-fired steam generators, and electrode humidifiers): soften water to 3 mg/l or less.
    - .2 Hot water to laundry, glass/dishware washing, and commercial dishwashing applications: soften water to 10 mg/l or less.
    - .3 Domestic hot water: soften domestic water to 10 mg/l or less.

- .4 Provide a soft water sample port downstream of the water softener.

- .5 Provide piped soft water to sample coolers and blow-down tanks.

- .6 Refer to Alberta Infrastructure Technical Specifications, *Section 23 25 01 – Cleaning and Chemical Treatment Equipment* for soft water connection requirements:

    - .1 *Detail 23 25 01.03* for typical steam boiler cleaning and chemical treatment equipment installation.
    - .2 *Detail 23 25 01.06* for a typical packaged steam humidification system installation.

.B Specific Requirements for Healthcare Facilities

- .1 Domestic hot water shall be softened regardless of water hardness at a location. The intent is to reduce scaling for glassware, dishwashing, plumbing fixtures, etc.

.5 Distilled, Demineralized, Pure, and Treated Water Systems

- .1 Establish the quantity and quality of water required with the Facility Administrator. Where demand is low and a reliable commercial source is available, high quality water should be purchased rather than providing in house equipment. Consider central systems for high demand requirements only.

- .2 The materials used in the construction of the pure water distribution system shall not degrade the quality of the water.

.B *Specific Requirements for Healthcare Facilities*

.1 Provide distilled, demineralized, and treated water systems in accordance with CAN/CSA-Z317.1*, Special Requirements for Plumbing Installations in Health Care Facilities.*

5.6 Fuel Oil Systems

.1 General Requirements

.1 Provide fuel storage sufficient for operating emergency generators in accordance with CSA-C282*, Emergency Electrical Power Supply for Buildings.*

.2 Provide fuel oil systems in accordance with CSA B139, *Installation Code for Oil Burning Equipment.*

.3 Fuel oil tanks located inside buildings are preferred. Where outdoor tanks are provided, they shall be located above ground where possible and in accordance with the *National Fire Code - Alberta Edition*.

.B *Specific Requirements for Healthcare Facilities*

.1 Provide fuel oil systems and storage in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design fuel-oil systems shall be to the same standard as Section B – Specific Requirements for Healthcare Facilities.

5.7 Specialty Gases and Vacuum Systems

.1 Laboratory Gas Systems

.1 Where laboratory gases are supplied and distributed from a common manifold system, provide automatic duty/standby capability complete with a relief valve located downstream of the two high pressure regulators and vented to the outdoors.

.2 Do not combine flammable and non-flammable relief vent discharge piping to the outdoors and clearly label them as such.

.2 Dental Compressed Air System

.1 Coordinate the system design to accommodate the specific equipment requirements.

.2 Provide duplex and oil-free type air compressors for dental air systems.

.3 The dental compressed air system shall not be combined with medical compressed air systems.

.3 Dental Vacuum System

.1 Coordinate the system design to accommodate the specific equipment requirements.

.2 Provide duplex dental vacuum pumps designed to provide at least 19 kPa (5.5” of Hg) at the point of use.

.3 Size the distribution piping assuming a 100% usage factor.

.4 Slope distribution piping back to the source equipment.

.5 Provide isolation valves at all risers, branch mains, and at the equipment.

.6 Provide cleanouts for the distribution system.

.7 Discharge vacuum exhaust through the roof away from building intakes.

.4 Central Vacuum Cleaning System

.B Specific Requirements for Healthcare Facilities

.1 Consult with the Facility Administrator to determine the requirement for a central vacuum system.

.2 Where central vacuum systems are required

  .1 Locate central vacuum unit such that the specified room noise levels in adjacent rooms are not exceeded.
  .2 Do not exceed 11m (36 ft.) of hose length.
  .3 Use a minimum of 50mm (2 in) diameter piping.
  .4 Provide heavy brass hose connections.
  .5 Use carbon-steel tubing for dry vacuum system. Maintain required transport velocities.
  .6 Design the distribution system to allow for cleaning and disinfecting.

5.8 Medical Gas Systems

.1 General Requirements

.1 This Section applies only to health care facilities or continuing care facilities where medical gas is used.

.2 Provide medical gas systems in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems.*

.3 Consider capital cost, operating cost, anticipated future expansion, and critical nature of the facility (e.g. regional disaster center) in the selection of the type of primary medical gas service for health care facilities.

.4 Provide nitrogen service to operating rooms with an adjustable pressure regulator and pressure gauge located within each room.

.5 Cylinder Storage rooms shall be heated and ventilated in accordance with the CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems.*

.6 Central equipment (bulk, mini-bulk, and high pressure cylinders) are normally under contract directly with the regional health authority, not through a building construction contract.

.7 Connect medical gas systems to both normal and emergency power supply.

.8 Medical Gas Outlets

  .1 Review the number and type of medical gas outlets with the Facility Administrator. Provide the quantity and types of medical gases for a given room in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems* as a minimum unless otherwise directed.

  .2 Use Diameter Index Safety System (D.I.S.S.) outlets for new construction. Consult with the Users where modifications are made to existing quick connect outlets.

.9 Testing

.1 Test and certify new or altered medical gas piping systems in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems* and the *National Building Code - Alberta Edition*.

.10 Renovating Existing Facilities

.1 Additions and modifications of existing medical gas system to meet the current requirements of the *National Building Code - Alberta Edition,* CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems* and the *National Building Code - Alberta Edition,* and the local Authorities having Jurisdiction.

.2 When adding medical gas or vacuum outlets to existing systems, the Design Consultant should work with the facility operators to determine the actual current demand. Consideration should be given to using compressed gas cylinders to determine usage when run-time data is not available.

.2 Medical Air System

.1 Source of Supply:

.1 The type of central medical air system selected will be based on size and facility, extent of respiratory therapy, projected rate of consumption, remoteness of facility and service from medical gas supplier.

.2 Consider a cylinder manifold system for small facilities with no medical ventilators or anesthesia machines.

.3 For existing facilities with a history of low medical air usage, evaluate the feasibility of converting the medical air compressor system to a cylinder system when it becomes necessary to replace existing compressors.

.4 Air intake for the medical air compressor will be from a non-contaminated location outside the building complete with insect screen and elbow turned downward. Refer to CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems*.

.3 Medical Vacuum System

.1 Source of Supply:

- .1 Where medical vacuum outlets are used for the scavenging of waste anesthetic gases, ensure vacuum pumps have oxygen compatible components and sufficient capacity.
- .2 Locate exhaust discharge outlets in compliance with minimum requirements.
- .3 Vacuum piping shall be a 19 mm (3/4 in) minimum.

- .4 Medical vacuum systems shall be used exclusively for patient care and not connected to other vacuum systems.

.4 Medical Oxygen System

.1 Source of Supply:

.1 Base the type of central oxygen system selection on:

- .1 The size of the facility
- .2 The type of facility (i.e. level of care)
- .3 Extent of respiratory therapy (i.e. mechanical ventilators or anesthesia machines)
- .4 Projected rate of consumption
- .5 Remoteness of facility
- .6 Frequency of service from medical gas supplier

.2 Use the following tables (5.8.3.A & 5.8.3.B) as a guide to determine the central oxygen source type:

Table 5.8.3.A: Oxygen Source – Bed Rating

Number of Beds	Type of System
Less than 50	A duplex manifold system using high pressure gas cylinders is usually all that is required for small facilities. Review anticipated consumption with facility User Groups before final source type decision.
50 – 100	A duplex mini-bulk (liquid cylinders) and a reserve supply of high pressure gas cylinders.
101 – 500	A bulk storage tank and a reserve supply of high pressure gas cylinders. Include an emergency oxygen inlet to the pipeline distribution system.

Table 5.8.3.A: Oxygen Source – Bed Rating	
Number of Beds	Type of System
Over 500	A large main bulk storage tank, compete with a smaller (minimum of 24 hour supply) auxiliary bulk storage tank, and high pressure gas cylinders. Include an emergency oxygen inlet to the pipeline distribution system.

Table 5.8.3.B: Oxygen Source – Known Consumption	
Consumption Cubic Meters per Month	**Type of System**
Less than 250	High pressure gas cylinder
250 - 750	Min-bulk
Over 750	Bulk

.5 Carbon Dioxide System

.1 Source of Supply:

.1 Coordinate with the Facility Administrator to determine the quantity of present and future cylinder quantities for sizing the cylinder manifold.

.6 Nitrogen System

.1 Source of Supply:

.1 Coordinate with the Facility Administrator to determine the quantity of present and future cylinder quantities for sizing the cylinder manifold.

.2 Where information on nitrogen usage is not available, consider providing cylinder storage capacity based on one cylinder per bank for each operating room or workroom requiring nitrogen.

.7 Nitrous Oxide System

.1 Source of Supply:

.1 Coordinate with the Facility Administrator to determine the type and quantity of present and future cylinder quantities for sizing the cylinder manifold.

.2 Where information on nitrous oxide usage is not available, consider providing cylinder storage capacity based on one half a cylinder per bank per anesthetizing location, with a minimum of two bottles.

.8 Anesthetic Gas Scavenging System

.1 Source of Supply:

.1 Provide anesthetic gas scavenging in accordance with, CAN/CSA Z7396.1, Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems.

5.9 Fire & Life Safety Systems

.1 General Requirements

.1 Design fire and life safety systems in accordance with the requirements of the *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, and the *National Fire Protection Agency.*

.B Specific Requirements for Healthcare Facilities

.1 Refer to CSA-Z317.1, Special Requirements for Plumbing Systems in Health Care Facilities for fire-protection requirements.

.2 Fire Pumps

.1 Provide fire pumps, where required, in accordance with the *Alberta Building Code*, the *Alberta Fire Code*, and the requirements of NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.

.3 Standpipe System and Hose Valve cabinets

.1 Design standpipe and hose systems in accordance with the *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, and the requirements of NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*.

.4 Sprinkler System

.1 Design sprinkler systems in accordance with the *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, and the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

.2 Electrical Rooms:

  .1 To help avoid water-incurred damage to electrical equipment, wet or pre-action sprinkler systems shall not be installed in electrical rooms containing equipment greater than 750 volts. Coordinate with Architectural and Electrical divisions to ensure that the room design complies with all applicable codes.

  .2 Coordinate with Electrical Division for electrical rooms containing equipment less than 750 volts.

.3 Provide sprinkler guards for sprinklers subject to damage.

.4 In areas with low ceiling (bulkheads) sprinklers to be of the concealed type.

.B Specific Requirements for Healthcare Facilities

.1 Provide pre-action sprinkler system to avoid accidental discharge in rooms where water damage can affect the operation including operating rooms, delivery rooms, recovery rooms, intensive care units, main electrical rooms, main IT rooms, and rooms containing high value equipment including CT rooms, MRI rooms, linear accelerator rooms and PET scanner rooms.

.2 In areas that require cleaning and sanitation of sprinkler heads, concealed sprinkler heads shall be used.

.3 Sprinkler heads in forensic and mental health facilities should be suitable for such facilities, and in all cases appropriate for patient care areas.

.4 Provide sprinkler head guards in areas where there are no ceilings and there is a risk that the sprinkler head might be damaged.

.5 Fire Extinguishers

.1 Provide fire extinguishers in accordance with the *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, and the requirements of NFPA 10*, Standard for Portable Fire Extinguishers.*

.2 Provide recessed, or semi-recessed cabinets for fire extinguishers in public areas. Coordinate the cabinet type with the architect.

.A Specific Requirements for Schools

.1 Fire Extinguishers

  .1 Provide 6 mm tempered safety glass or plexiglass for fire extinguisher cabinets in gymnasiums to prevent physical damage.

.B Specific Requirements for Healthcare Facilities

.1 Fire Extinguishers

  .1 Provide a 2.27 kg (5 lb) CO_2 fire extinguisher (Class BC) mounted just inside the entrance of each operating room. Do not use water-based, water-mist, dry-powder, or clean agent extinguishers in the OR.
  .2 Provide a 9.1 kg (20 lb) dry-powder (Class ABC) type fire extinguisher for the OR suite (not each room) as a minimum.
  .3 Fire hose cabinets, where present, shall have recessed hinges and latches to facilitate cleaning.

.6 Smoke Control System

.1 Provide smoke control systems that meet the requirements:

  .1 The National Building Code - Alberta Edition
  .2 The National Fire Code - Alberta Edition
  .3 NFPA 92, Standard for Smoke Control Systems
  .4 ASHRAE Guideline 1.5, The Commissioning Process for Smoke Control Systems

.2 Coordinate, commission and test smoke control system design in accordance with the applicable standards and the Authority Having Jurisdiction.

.3 Coordinate smoke control zones with the fire alarm and sprinkler zones.

.B Specific Requirements for Healthcare Facilities

.1 Provide smoke control systems in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.2 Coordinate with the architect to identify the Areas of Refuge and provide smoke-free ventilation in accordance with the National Building Code - Alberta Edition.

.C Specific Requirements for Continuing Care Facilities

.1 Design ventilation systems to the same standards as Healthcare Facilities.

5.10 Heating Systems

.1 General Requirements

.1 Heating Criteria

- .1 Select systems on the basis of energy efficiency, controllability, maintainability, and life-cycle costs.
- .2 Select equipment to account for the heating load profile, thermal energy storage, equipment reliability, and availability of spare parts for servicing.
- .3 Design heating systems to work in conjunction with the ventilation system and building envelope to prevent condensation on interior surfaces and components of the building envelope assemblies.
- .4 Design for decoupled heating/ventilation systems to be able to provide better occupant comfort and temperature control and not rely on the ventilation system for heating.
- .5 Avoid combining copper and aluminum heating components in the same system.
- .6 Zone perimeter heating elements to match the variable air volume box zones. Monitor/control the space temperature using the same thermostat/sensor. Match heating and cooling zones to the extent possible.
- .7 Provide heating to crawlspaces.
- .8 Design coils using the largest temperature drop practical in order to minimize pipe sizes and pump flow rates.
- .9 In areas where heat is lost through the roof, provide finned radiation within the ceiling complete with a temperature sensor to maintain a minimum temperature of 18°C (65°F) within the ceiling space. Do not use the room temperature sensor to control heating elements in the ceiling space.

.2 Heading Source

.1 Provide a building heating system that is separate from the domestic hot water heating system unless a combined system is fundamental to the energy conservation strategy. Where combined systems are proposed, demonstrate energy savings and discuss the implications of reduced redundancy with the facility administrator.

.3 System Cleaning and Chemical Treatment

.1 Provide cleaning, degreasing, and chemical treatment on hot water heating systems. Refer to the Alberta Infrastructure Technical Specifications, *Section 23 25 00* series.
.2 Provide a chemical pot feeder on each closed loop of water or glycol systems.

.4 Accessibility and Maintenance

.1 Ensure equipment and valves are easily accessible for cleaning and inspection.
.2 Provide isolation valves at all terminal heating equipment, supply and return mains, zone branches, and risers.

.5 Pipe Distribution
.1 Refer to Alberta Infrastructure's Technical Specifications, *Section 20 20 30 Piping and Equipment Insulation* for insulation thickness schedule.

.2 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.
.3 Two-pipe, reverse return systems are preferred for heating water piping. Two-pipe, direct-return systems may be used only if the design properly guards against flow imbalance to terminal units and is a small part of the reverse-return system.
.4 Provide reverse-return heating water piping for air handling unit coils that have more than one section such that each section receives the same flow.
.5 Provide means for balancing and flow measuring for all major circuits. Provide balancing valves at each terminal heating unit.
.6 On heating systems, grooved-type pipe joints are permitted within mechanical rooms.
.7 On heating systems, butterfly valves are permitted within mechanical rooms only.
.8 Avoid installation of heating pipes above the ceiling of electrical, server and telecommunication rooms.

.2 Heating Water System

.1 Heating Water Boilers

- .1 Provide a minimum of 2 boilers each sized for a minimum of 60% of the design load.
- .2 Size the heating plant to reflect the seasonal nature of the heating load to allow efficient operation under varying loads.
- **.3** Specify boilers to have a minimum thermal efficiency of 85% and include a packaged control system designed to operate the boiler at peak efficiency possible during non-peak loads.
- .4 Provide fully modulating burner controls in all boiler sizes where possible.
- .5 Where condensing boilers are used, control the return water temperature to maximize the number of hours condensing is possible.

.2 Antifreeze

- .1 Provide glycol antifreeze where freezing conditions exist with a 50/50 water/glycol concentration. The system intended to be operational during winter needs to be designed for both freezing and burst protection.

.3 Heating Water Pumps

- .1 Use variable speed drives on pumps and two-way control valves on terminal devices to maintain system design pressure under variable flow conditions. Indicate the sensor location(s) on the plans.
- .2 Provide 100% redundancy for heating water pumps.

.4 Finned Radiation

- .1 Where finned radiation is used behind millwork, ensure there is access for cleaning.

.5 Radiant Panels

- .1 Consider the use of radiant panels where perimeter furniture and cabinets restrict the use of finned radiation.
- .2 Use special care when locating radiant panel thermostats. Control the radiant panel as first stage heating before the air system reheat coil (where present).
- .3 Do not schedule the temperature of the radiant panel water heating system so low as to adversely affect the performance of the panel when combined with other types of terminal heating equipment.
- .4 Consider architectural details, window coverings, and perimeter air supply outlets in the use of radiant panel heating systems. Ensure that the glazing is completely exposed to the radiation effect.

.6 Terminal Box Reheat Coils

- .1 Terminal boxes serving interior zones shall be equipped with reheat coils.
- .2 Where terminal boxes provide makeup air supply for variable exhaust conditions, size the reheat coil (when present) based on the lowest seasonal heating water supply temperature the boiler is controlled to.

.A Specific Requirements for Schools

.1 Design heating system to provide ease of operation and maintenance.

.2 The optimum system is a central boiler plant complete with a heating water distribution system. This does not preclude other options; however, other systems should only be implemented based on sound and clearly identified benefits and in discussion with the Facility Administrator.

.3 Provide individual thermostatic zoning for each instructional space.

.4 Provide gymnasiums with a heating system independent from the gymnasium ventilation system.

.B Specific Requirements for Healthcare Facilities

.1 Heating water systems shall conform to CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.2 Provide separate boilers for the building heating system, process loads (sterilizers, humidification), and the domestic hot water heating system.

.3 Provide an ancillary heating connection on the outside of the building for temporary connection to a portable boiler under emergency conditions and a means to allow for load shedding to match essential loads against available boiler capacity.

.4 Where heating water mains are buried, provide a redundant pipe sized for 100% of the design load complete with valves to allow 50% of the flow through both pipes under normal operation. A loop system with suitable sectional valves may be considered in lieu of two mains.

.C Specific Requirements for Continuing Care Facilities

.1 Provide an ancillary heating connection on the outside of the building for temporary connection to a portable boiler under emergency conditions and a means to allow for load shedding to match essential loads against available boiler capacity.

.3 Steam heating and Condensate System

.1 Steam Boilers

.1 Avoid designing steam boilers that deliver high pressure steam (103 kPa or greater steam pressure). Where high pressure steam systems are proposed, consider system operating costs including mandatory supervision requirements and discuss with the Facility Administrator.

.2 Makeup Water and Chemical Treatment

.1 Feed water to all steam-producing equipment shall be pre-treated and preheated to ensure the water quality meets the minimum requirements of the equipment and to minimize the operations and maintenance requirements for the equipment.

.2 Chemicals used for corrosion control of steam piping shall not be hazardous to health. The level of impurities used for sterilization shall comply with *CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities*.

.3 Meter chemical treatments for steam system. Avoid batch feed systems.

.3 Steam Pipe Distribution

.1 Refer to Alberta Infrastructure's Technical Specifications, *Section 20 20 30 Piping and Equipment Insulation* for insulation thickness schedule.

.2 Use separate pipes for steam and steam condensate return piping.

.3 Where a steam coil could have an entering air temperature less than 4°C (40°F), provide two steam traps that are each sized for full capacity.

.B Specific Requirements for Healthcare Facilities

.1 Where a steam supply main must be buried, provide a redundant pipe sized for 100% of the design load complete with valves to allow 50% of the flow through both pipes under normal operation. A loop system with suitable sectional valves may be considered in lieu of two mains.

5.11 Cooling Systems

.1 General Requirements

.1 Cooling Criteria

.1 Select cooling systems on the basis of energy efficiency, controllability, maintainability, and life-cycle costs.
.2 Design refrigeration systems in conformance with CSA B52*, Mechanical Refrigeration Code.*
.3 Provide cooling to serve data and server rooms year-round. Where appropriate, provide multiple cooling units for continuous cooling in event of equipment failure.
.4 Do not provide mechanical cooling for mechanical equipment rooms unless specifically required to keep equipment within the ambient temperature conditions recommended by the equipment manufacturer (i.e. electrical panels, etc.). Provide a means to free-cool equipment where possible.

.2 Cooling Source

.1 Chilled water is the preferred means of cooling when the total building cooling load is over 280 kW (80 ton).
.2 Limit the use of direct expansion (DX) refrigeration in air handling units for cooling capacities up to 105 kW (30 ton). Multiple DX air handling units are acceptable for a total cooling load not exceeding 280 kW (80 ton). Provide staged compressors for capacity control in DX systems.
.3 Use outdoor air for free cooling where ambient conditions permit.

.3 Accessibility and Maintenance

.1 Ensure equipment and valves are easily accessible for cleaning and inspection.
.2 Provide isolation valves at all terminal cooling equipment, supply and return mains, zone branches, and risers.

.4 Pipe Distribution

.1 Refer to Alberta Infrastructure's Technical Specifications, *Section 20 20 30 Piping and Equipment Insulation* for insulation thickness schedule.

.2 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.

.3 Two-pipe, reverse return systems are preferred for cooling water piping. Two-pipe, direct-return systems may be used only if the design properly guards against flow imbalance to terminal units and is a small part of the reverse-return system.
.4 Provide reverse-return chilled water piping for air handling unit coils that have more than one section such that each section receives the same flow.
.5 Provide means for balancing and flow measuring for all major circuits. Provide balancing valves at each terminal cooling unit.
.6 Avoid installation of cooling pipes above the ceiling of electrical, server and telecommunication rooms.

.5 System Cleaning and Chemical Treatment

.1 Provide cleaning, degreasing, and chemical treatment on chilled water systems. Refer to the Alberta Infrastructure Technical Specifications, *Section 23 25 00* series.
.2 Provide a chemical pot feeder on each closed loop of water or glycol systems.

.A Specific Requirements for Schools

.1 Cooling Criteria

.1 Coordinate with the Project Manager and the School Board to determine where cooling is required to maintain health and comfort conditions (considering local ambient conditions and the School Boards regional requirements).
.2 Provide cooling in high heat gain areas such as data and server rooms etc.

.2 Displacement ventilation systems

.1 Mechanical cooling shall be provided to maintain supply air temperature within the range 17 - 20°C.

.3 Adiabatic humidification system shall not be used as cooling system.

.B Specific Requirements for Healthcare Facilities

.1 Cooling Criteria

.1 Design the cooling plant to maintain comfort conditions in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.2 Accessibility and Maintenance

- .1 In multi-chiller cooling plants, provide motorized chilled water isolation valves c/w manual wheels to override the valve actuator position.

.C Specific Requirements for Continuing Care Facilities

.1 Cooling Criteria

- .1 In continuing care facilities provide a means of limiting interior temperatures in summer such as through the use of operable windows and air conditioning.
- .2 Provide mechanical cooling for dining areas, corridors, program/activity areas, lounges, kitchens, and laundry spaces.
- .3 Provide individual temperature control zone for resident bedrooms.
- .4 Provide kitchens/serveries with cooling and dedicated temperature control.
- .5 Provide living rooms/activity spaces with cooling and dedicated temperature control.

.2 Condenser Water System

.1 Sediment Removal

- .1 Provide a centrifugal sediment separator interceptor for condenser water systems.

.2 Cooling Towers

- .1 Select cooling tower locations accounting for prevailing wind and locations of building air intakes (to minimize the risk of exposure of building occupants to the cooling tower plume).
- .2 Consider fluid coolers only if proximity to air intakes or vapor plume impingement is a problem.
- .3 Consider cooling tower effect on neighborhood ambient noise level.
- .4 Specify cooling towers with basin heaters to allow reliable operation in shoulder seasons and heat trace makeup water lines.
- .5 Winterize cooling towers for chilled water systems which are designed to operate on a year-round basis.
- .6 Free Cooling
  - .1 Consider free cooling heat exchangers interconnected with the cooling tower for systems that have significant cooling requirements in the heating season (such as server rooms) to prevent the need to operate the chiller.

        - .2 Provide free-cooling technology to the cooling system where possible.
        - .3 Evaluate both plate type heat exchangers and high performance shell and tube heat exchangers in free cooling applications.

    - .7 Provide clearances around cooling towers in accordance with the manufacturers' recommendations accounting for the height of adjacent surfaces.
    - .8 Provide VFDs on cooling tower fans 5 HP or larger.
    - .9 Consider specifying stainless steel construction for cooling tower basins.
    - .10 Consider the radiated noise levels from roof-mounted equipment (fans, fluid coolers, etc.), cooling towers, and transmitted noise from building air intakes/exhausts with respect to adjacent buildings or properties.
- .3 Condenser Water Pumps

    - .1 Ensure adequate net positive suction head on the condenser water pump and suitable piping arrangement to prevent impellor cavitation.

- .4 Remote Condenser Water Tank

    - .1 Where interior condenser water tanks are provided, size the tank to accept the full volume of suspended water (as a minimum) when the condenser water pumps are not running.
    - .2 Design open condenser water tanks to avoid splashing.

.3 Chilled Water System

- .1 Chillers

    - .1 Base the number, type, and capacity of chillers for a cooling plant on the calculated load, diversity factor, and load profile.
    - .2 Do not size a chiller plant for future capacity unless approved by the Project Manager.
    - .3 Size chillers by taking into account the magnitude and duration of the part-load capacity to optimize chiller efficiency.
    - .4 Locate chillers in a machine room separate from combustion equipment (i.e. boilers).

- .2 Chilled Water Pumps

    - .1 Use variable speed pumps to maintain design system pressure for variable flow distribution systems. Indicate sensor location(s) on the plans.

.4 Critical Cooling System

.1 Provide a separate cooling system to serve equipment that requires cooling during times that are significantly different from that of the building cooling system or requires a different chilled water temperature or requires chilled water year round (MRI rooms/Server Rooms, etc.).

5.12 Ventilation Systems

.1 General Requirements

.1 Duct Distribution

- .1 Design ductwork in accordance with SMACNA standards with particular emphasis on minimizing the external static pressure of air handling units.
- .2 Provide a minimum of four duct diameters of straight ductwork upstream of VAV terminal boxes inlets (or as recommended by manufacturer’s literature - whichever is greater).
- .3 Where low-level displacement diffusers are provided, coordinate locations to prevent obstructions from furniture or millwork.
- .4 Do not use mechanical rooms and mechanical shafts as return air plenums.
- .5 Public corridors or exit shall not be used as return air plenum.

.2 Ventilation Zones

- .1 Design the ventilation zones in coordination with the perimeter heating system and building envelope to prevent condensation on exterior walls and glazing.
- .2 Design supply air and return air for any given room should be provided by the same air handling unit.
- .3 Provide a separate ventilation zone for corner spaces when cooling requirements are significantly different from adjacent zones.
- .4 Zone air systems in accordance with space functions, occupied hours, and air quality requirements.
- .5 Provide ventilation to crawlspaces. Maintain negative pressurization to the adjacent spaces.
- .6 Where constant volume air systems are used, consider reheat requirements for interior zones.
- .7 To the extent possible, match heating and cooling zones.
- .8 Where areas with different occupancy schedules are served by the same air handling unit, provide a means of area isolation to reduce air flow and energy use.

.3 Diffusers, Grilles, and Louvers

  - .1 Locate ceiling mounted diffusers and grilles to align with lights and other ceiling mounted devices whenever possible.
  - .2 Locate supply and return air diffusers/grilles to prevent short-cycling.
  - .3 Design duct distribution systems using appropriate diffuser/grille type, locations, air velocities, and air-flow patterns to maximize occupant comfort.
  - .4 Install bottom of outdoor air intake louvers at least 2m (6 ft) above grade level. If outdoor air intake is installed above the roof, extend it at least 1 m (3 ft) above roof level or as required due to local snow conditions.

.4 Duct Cleaning

  - .1 All new and existing air ductwork shall be cleaned prior to occupancy for both new and renovation projects.

.5 Accessibility and Maintenance

  - .1 Provide access doors upstream of fire dampers.
  - .2 Provide a minimum of 1 m (3 ft) clearance between the underside of the roof-mounted equipment and the roof surface when the unit is not mounted directly on a curb.
  - .3 Where possible, install air-handling units within the building rather than on rooftops.
  - .4 Where motorized dampers are provided separate from a packaged air-handling unit, locate the actuator where it is visible, accessible, and in a heated space.
  - .5 Provide removable terminal box sensors for periodic cleaning to prevent buildup of lint.
  - .6 The use of a ships ladder shall not be considered an acceptable means of servicing equipment in high locations where filters or other components need to be replaced.
  - .7 Consider means to mitigate snow entrainment and hoarfrost on air handling unit intakes.
  - .8 Provide access doors upstream and downstream of duct-mounted heating coils.

.6 Smoke Management

  - .1 Smoke management systems shall be designed, commissioned and tested in accordance with the applicable requirements.

.7 Smudging Rooms

  - .1 Provide dedicated exhaust and negative pressure relationship to the adjacent spaces to contain, capture and remove smoke.
  - .2 At minimum provide 12 air changes per hour (ACH) of dedicated exhaust.
  - .3 Provide control damper for isolating the return air from the smudging room during the ceremony.
  - .4 Provide a manually operated switch with timer to activate the exhaust fan and close the control damper on the return side during the ceremony.

.A Specific Requirements for Schools

.1 Duct Distribution

  - .1 Do not use school corridors as a return air plenum.

.2 Gymnasium Ventilation

  - .1 Provide a separate air system with free-cooling capability. Mechanical cooling is not required.
  - .2 Design air systems to vary outdoor air volume for normal occupancy (classes) usage and high occupancy (community events) usage utilizing CO_2 sensors.
  - .3 Provide a system override local control.

.3 Core Building Ventilation

  - .1 Design air distribution at the boot racks and cubbies to avoid potential odor and moisture issues.

.B Specific Requirements for Healthcare Facilities

.1 Provide ventilation systems in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.2 Duct Distribution

  - .1 Do not use ceiling spaces as return air plenum.
  - .2 Design air distribution systems to limit air velocities or control drafts in special draft-sensitive areas/rooms (dialysis area, certain laboratories, isolation rooms, etc.).

.3 Ventilation systems should be zoned accounting for room/space function, occupied hours and air quality requirements. Ventilation systems may be permitted to serve areas of different use provided that the requirements of the most critical occupancy are satisfied. Consider the requirements for continuous airflow to Areas of Refuge when zoning air-handling systems.

.4 All clinical/patient-care rooms shall have dedicated supply and return air terminal boxes.

.5 Operating room supply and exhaust/return grilles, and air boots shall be manufactured from stainless steel.

.3 Accessibility and Maintenance

.1 Provide HVAC system for Type I areas (as defined in CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities) that are capable of being shut down for maintenance and emergency repair without jeopardizing the relative pressurization of adjoining spaces.

.4 Smoke Management

.1 Areas of refuge (operating rooms, delivery rooms, intensive care units, and other areas where it is impractical to move a patient in an emergency) shall be provided with a mechanical air supply that will continue to operate during a fire to assist in keeping the areas smoke free for the duration required by the National Building Code - Alberta Edition. Ductwork passing through other zones that is required to keep the areas smoke free shall be protected with a fire rating equivalent to the length of time that the areas is required to be kept smoke free.

.2 Sleeping room fire compartments shall be designed, installed and commissioned to prevent smoke from spreading to other compartments or areas of the Healthcare Facility, to allow for horizontal relocation of patients to a smoke-free area. Provide fire and smoke dampers on any duct penetrations and air transfer openings at fire separations in accordance with the National Building Code - Alberta Edition.

.5 Infection, prevention, and control, and health considerations

.1 Provide outdoor air change and total air change rates to all rooms and areas within a healthcare facility to control contaminant levels, temperature, and humidity while minimizing stratification and drafts.

.2 Design ventilation systems that move air from clean to less clean areas and with air patterns designed to direct fresh air towards the breathing zone of the occupants.

.3 Design outdoor air intakes to maintain the minimum separation distances to potential outdoor air contaminant sources in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities. Consider the effect of the predominant wind direction and increase distances as appropriate.
.4 Do not circulate air from an areas of low level care to an area of high level care, or high humidity area to low humidity area.

.6 Minimum Operation

.1 Air handling systems shall allow reduced operation during unoccupied periods in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design ventilation systems to the same standards as Healthcare Facilities.

.2 Resident bedrooms

.1 Provide each resident bedroom with individual air temperature controls that are controllable within a range.
.2 Provide ventilation air directly into each resident room. Transferred air from the corridor into the resident room is not acceptable.

.3 Assisted bathing rooms

.1 Provide assisted bathing rooms with a dedicated temperature control that is separate from other rooms.

.2 Air Handling Units

.1 General Construction

.1 Provide hinged doors to all compartments within air-handling units (filter banks, coils, etc.) for accessibility. Arrange doors to open against internal air pressure. In negative pressure sections, the doors should open outward; in positive pressure sections, the doors should open inward. Give consideration to door construction and gasketing material to ensure tightness and durability of the seal.
.2 Provide switches to control internal lighting (except for small packaged rooftop units).

.3 Arrange air handling unit compartments to promote good mixing of air streams and uniform air flow through each component. Use factory mounted air blenders to prevent air stratification and provide uniform flow across coils.

.4 Provide a heated and full-sized, enclosed service corridor within rooftop units where practical. Access to the service corridor is preferable from within the building. Coordinate requirements with Project Manager.

.5 Provide non-ferrous materials in locations where condensation or moisture can occur (i.e. drain pans, cooling coil headers, casings and racks, and cooling coil and humidifier sections).

.6 Provide drains in each section of an air-handling unit where water might accumulate. Design air-handling units to continuously drain water present in outdoor air intakes, cooling coil drain pans, and humidifier drain pans to prevent the accumulation of standing water within the unit. Drain pans to be sloped to drain in a minimum of two directions and at a minimum slope of 2%.

.7 Design air handling unit curb/housekeeping pads of a sufficient height to accommodate the drain condensate trap outside of the unit.

.8 Equip air handling units with an economizer and return fan section.

.2 Location

.1 Locate air handling units indoors within designated mechanical rooms unless otherwise permitted by the Project Manager and Facility Administrator.

.2 Locate roof-mounted air handling equipment over corridors or other non-critical areas that are least impacted by noise and vibration transmission.

.3 Design outdoor air intakes to maintain the minimum separation distances to potential outdoor air contaminant sources in accordance with ANSI/ASHRAE 62.1*, Ventilation for Acceptable Indoor Air Quality*. Consider the effect of the predominant wind direction and increase distances as appropriate. Where other codes or standards indicate higher separation distances, use the larger value.

.3 Redundancy and Standby Capacity

.1 Consider parallel air handling units or interconnected air systems for ventilation systems that serve critical areas. Discuss redundancy requirements with Project Manager and the Facility Administrator.

.4 Humidification

.1 Where wetted media type evaporative cooling and humidification is used, it shall be ‘once-through’ type. Arrange the media and water spray headers in sections to achieve a minimum of three stages of capacity control. Provide stainless steel drain pans and adjustable flow control. The air handling unit should be controlled to shut off only when the media is dry.

.2 Steam generated at the central steam plant may be used for humidification provided that the chemical treatment used in the boilers is appropriate.

    .1 Verify that the boiler water does not contain chemicals that are known to be hazardous to health, or which might contribute to an indoor air quality problem. Chemical concentrations shall not exceed the levels acceptable under the Alberta Occupational Health and Safety Regulations.

    .2 Alternatives to using a central boiler to provide direct steam humidification include, a dedicated gas-fired steam boiler, point-of-use gas-fired steam humidifiers, and a steam-to-steam converter system.

.3 Humidifier Feed-Water

    .1 Provide an appropriate water treatment system for humidifier feed-water to control mineral scaling.

.4 Electrode and electrical steam generators for humidification should only be considered when the humidification load is less than 45 kilograms of steam per hour.

.5 Air Filtration

.1 Provide ventilation systems equipped with filtration in accordance with *ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality (*as a minimum).

.2 Provide ventilation air filtration systems in accordance with ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (as a minimum).

.3 Provide air-handling units with both summer and winter filters sections where frost may occur.

.4 Provide filtration as required to meet the projects targeted Indoor Environmental Quality credits for LEED projects.

.5 Air filters shall be:

  .1 Designed, installed, and located so as to avoid wetting from humidifiers, cooling coils, or other sources of moisture.
  .2 Composed of materials that do not pose carcinogenic or other health hazards.
  .3 Designed and installed for ease of access to allow for changing of filters.
  .4 Equipped with manometers or other pressure-drop monitoring devices.
  .5 Provided with gaskets or seals to prevent leakage between filter segments, filter frames adjacent to each other, and the surrounding filter plenum enclosure.
  .6 Protected during construction.

.6 Burner

.1 Where natural gas heating is used within air handling units, provide air handling units with a turn down ratio of at least 15:1. Where a large turn down ratio is not available, provide multiple stages of heating.

.A Specific Requirements for Schools

.1 General Construction

.1 Provide protection from vandalism where exterior air handling units are provided (i.e. intake screen, padlocks on access doors, etc.).
.2 Where cooling is not provided, air handling equipment shall be equipped with space for a future cooling coil.

.2 Location

.1 Avoid placing roof-mounted air handling units over instructional spaces.

.3 Humidification

.1 In general, use steam humidifiers in air handling systems. This does not preclude other options which should take into account specific systems within the school district where maintenance and familiarity are important considerations.

.4 Filtration

.1 Provide MERV 8 pre-filters and MERV 13 final filters in air handling units (as a minimum).

.B Specific Requirements for Healthcare Facilities

.1 General

.1 Design air handling units in accordance with CAN/CSA Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities*.

.2 Humidification

.1 Use steam humidifiers in all air handling systems injected into the supply air through a steam distribution manifold.
.2 Where feasible, provide lower humidity “buffer spaces” to separate spaces with high relative humidity from the building envelope. Design partitions and mechanical system air pressure differentials to minimize humid air transfer to buffer spaces.
.3 Where high humidity spaces cannot be “buffered” from the building envelope, provide other means to prevent condensation within the building envelope.

.C Specific Requirements for Continuing Care Facilities

.1 General

.1 Design air handling units in accordance with CAN/CSA Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities*.

.2 Humidification

.1 Provide humidified supply air to resident rooms.

.3 Makeup Air Units

.1 Provide makeup air units with remote control panels that can be interlocked in a supervisory or control capacity to the EMCS system.

.4 Terminal Air Devices

.1 Where variable air flow (VAV) terminal boxes and perimeter heating elements are located within a given zone, provide temperature control using the same temperature sensor.

.5 Furnaces

- .1 Provide furnaces with an economizer section.

.6 Emergency Generator Rooms

- .1 Provide airflow to emergency generators rooms to satisfy both the cooling and combustion requirements of the emergency generator(s) in accordance with CSA C282, *Emergency Electrical Power Supply for Buildings*.

.7 Rooms Containing Fuel Oil Storage

- .1 Provide ventilation in rooms where combustible fuels are stored within the building in accordance *National Building Code - Alberta Edition* and *National Fire Code - Alberta Edition*.

5.13 Exhaust Systems

.1 General Requirements

- .1 Provide exhaust air systems to remove odors, smoke, fumes, or heat.
- .2 Do not use ceiling spaces or mechanical rooms as exhaust air plenums.
- .3 All exhaust systems shall be ducted to the inlet of the exhaust fan.
- .4 General return shall not be provided to the areas served by an exhaust system.
- .5 The location of exhaust air discharges shall be designed to prevent the re-entrainment of contaminants. Consider the effects of wind when selecting exhaust air discharge locations.
  - .1 Where re-entrainment is a concern, discuss the need for wind modeling with the Project Manager.

.A Specific Requirements for Schools

- .1 Career technology studies (CTS)
  - .1 Provide exhaust for fume and odor producing equipment and activities (i.e. welding, laboratories, plastic processes, silkscreen, etc.) in accordance with the recommended design practice indicated in *Industrial Ventilation – A Manual of Recommended Practice,* American Conference of Governmental Industrial Hygienists (ACGIH).
  - .2 Provide makeup air and exhaust to maintain negative pressurization for CTS, wood working, industrial arts, and home economics areas.

.3 For woodworking areas, provide dust collection equipment that maintains a safe working environment, particularly with respect to noise and exposure to wood dust. Refer to Occupational Health & Safety, Chemical Hazards Regulation publication “Health Effects from Exposure to Wood Dust” for guidance.

.4 Dust Collectors

  .1 Non-recirculating (direct-type) dust collectors are preferred over recirculating-type dust collectors.
  .2 Where recirculating-type dust collectors are used, ensure NFPA requirements for explosion and fire protection are met.
  .3 Where recirculating-type dust collectors are used, return air shall be designed to avoid condensation within the space (e.g. by reheating).
  .4 Locate dust collectors outside the building and provide sound attenuation on the return air.
  .5 Coordinate, commission and test dust collectors fire protection and explosion systems in accordance with the applicable standards and the Authority Having Jurisdiction.

.B Specific Requirements for Healthcare Facilities

.1 Provide exhaust systems to maintain environmental conditions or to achieve pressure relationships in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.2 Provide exhaust fan redundancy/standby capacity in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design ventilation systems to the same standards as Healthcare Facilities.

.2 Provide exhaust in beauty shops to remove odors related to hair styling chemicals.

.3 Provide negative air pressurization with exhaust to the outside in spaces such as washrooms, bathrooms, housekeeping rooms, soiled utility rooms, kitchens, and laundry rooms to control odor and control humidity.

.2 Kitchen Exhaust System

.1 Design kitchen ventilation design to comply with NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 Provide kitchens with makeup air and maintain negative pressurization in the space during cooking periods.

.3 When exhaust hoods are shut down, reduced makeup air flow may be considered.

.3 Smoke Exhaust Systems

.1 Refer to Section 5.9.5 – Smoke Control System.

.4 Fume and Process Exhaust Systems

.1 Design fume exhaust systems in accordance with ASHRAE, Laboratory Design Guide – Planning and Operation of Laboratory HVAC Systems.

.2 Exhaust duct materials:

  .1 Use corrosion resistant materials for exhaust ducts conveying corrosive fumes and vapor.
  .2 Use stainless steel for exhaust ducts conveying moisture-laden vapors.

.3 Fume Hoods:

  .1 Where fume hoods are provided as part of the mechanical scope of work, consider the use of variable speed fume hoods, sash stops, and proximity sensors.
  .2 Where fume hoods are provided as part of the mechanical scope of work, provide fume hoods with factory supplied face velocity monitor and alarm.

.5 Radon Gas Exhaust

.1 Refer to Section 11.0 – Environmental for radon mitigation rough-in system requirements.

.2 The building design team to retain a C-NRPP Radon Mitigation Professional in good standing to design the radon “rough-in” mitigation system to facilitate the building with possible Active Soil Depressurization (ASD) systems capability. Mechanical considerations for rough-in system include, but not limited to:

  .1 Rough-in riser vent pipes.
  .2 Future tie-in and venting configurations. Radon venting discharges shall be located away from any building air intake and public spaces.
  .3 Future exhaust fan locations and coordination for electrical requirements.

5.14 Energy Management Control System (EMCS)

.1 General Requirements

.1 Specify all applicable requirements in Alberta Infrastructure EMCS Technical Specifications.

  .1 Technical Specification sections for Direct Digital Control (DDC) System :

    23 08 95 EMCS Start-Up and Testing

    23 09 23 EMCS General Requirements

    23 09 24 EMCS Network Communications and System Configuration

    23 09 25 EMCS Central/Portable Control Stations and Peripherals

    23 09 26 EMCS Remote Control Units

    23 09 27 EMCS Terminal Control Units

    23 09 28 EMCS Field Work

    23 09 29 EMCS Sensors, Devices and Actuators

    23 09 30 EMCS Point Schedules

    23 09 93 EMCS Control Sequences

  .2 Technical Specification section for pneumatic, electric and electronic controls systems, where the project size and complexity do not warrant use of a DDC system:

    23 09 93 Control Systems

  Above EMCS Technical Specifications can be downloaded at https://www.alberta.ca/facility-services-sub-group.aspx#jumplinks-3

.2 Provide BACnet Testing Laboratories (BTL) certified components to:

  .1 Control heating, ventilation, and air conditioning systems
  .2 Minimize energy consumption
  .3 Monitor and record mechanical systems performance
  .4 Dial out of alarm signals

.3 Provide commercially available, field proven EMCS that is installed, engineered, and commissioned by trained and qualified personnel, employed by companies that can provide an acceptable level of service after completion of the contract.

.4 Field installation needs to meet applicable requirements specified in Alberta Infrastructure Technical Specifications, 23 09 28 – EMCS Field Work.

.5 Startup and testing needs to meet applicable requirement specified in Alberta Infrastructure Technical Specification, Section 23 08 95 EMCS Start-Up and Testing.

.6 Plan early in the project design schedule to determine the requirements for:

  .1 Contract documentation
  .2 Vendor acceptance
  .3 Design and product approval
  .4 System field inspection
  .5 Customized control sequences
  .6 Commissioning the EMCS

.7 Provide adequate operator training to utilize the EMCS system to its full potential including training on how to interpret energy consumption reading, adjust set points, and modify sequences (where possible).

.8 Provided access to all EMCS field devices for calibration/maintenance or replacement.

.9 Control components to have same level of redundancy, backup power and location fire protection rating as equipment being controlled.

.10 Refer to Section 5.1.5 for EMCS contract documents requirements.

.11 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 23 EMCS General Requirements* for further details.

.12 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 10 Control Systems* for requirements on projects, where size and complexity do not warrant use of Direct Digital Control system.

.2 Requirements for EMCS Major Components

.1 Network Communication and System Configuration

  .1 BACnet only system for all new works. LonMarks devices can be accepted for retrofit projects if circumstances dictate.

  .2 Two tiered network separating communication traffic between controls for major mechanical equipment and zone control.

  .3 Direct peer-to-peer data sharing between all Remote Control Unit (RCU) on primary network.

.4 Where communication is specified between a unitary equipment controller and the EMCS, ensure that the extent of communication is clearly specified. In particular:

  .1 Each point (including virtual points) that is to be communicated.
  .2 Between the EMCS and the unitary controller. List each point discreetly on the EMCS points list.
  .3 Each communicated point within the specification section pertaining to the relevant unitary equipment and its controller.
  .4 Clearly define which points may be read-only by the EMCS and which points must be read/write by the EMCS.

.5 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 24 EMCS Network Communication and System Configuration* for further details.

.2 Central/Portable Control Station (CCS/PCS)

.1 User-friendly interface and control language that allows user reprogramming of the control sequences.

.2 Program and graphics editing software including operating manuals.

.3 Dynamic graphics for all mechanical systems and interface to any other systems. Include all EMCS controlled space temperatures zoned with associated air system.

.4 Real-time and trended efficiency calculations for heating boilers, steam process boilers, chillers, and domestic hot water heaters by monitoring gas/electrical input and output.

.5 Trend log of actual system demand boilers and chillers through the utilization of BTU meters and maintain data points for peak demand for each component on a year-by-year basis with reference to outdoor air temperature.

.6 Remote access by telephone or internet connectivity.

.7 Trend log, reports to support applicable LEED credit requirements.

.8 No control logic, global schedule command engine or global value transfer function shall reside on CCS and PCS. The loss of PCS and CCS shall not affect EMCS control function.

.9 Discuss with project manager and facility administrator to determine EMCS server redundancy requirement.

.10 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 25 EMCS Central/Portable Control Stations and Peripherals* for further details.

.3 Remote Control Units (RCU)

.1 Provide each air handling unit with its own remote control unit (RCU). Using one RCU for multiple air handling units is not acceptable.

.2 RCU to have same level of redundancy, backup power and location fire protection rating as equipment being controlled.

.3 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 26 – EMCS Remote Control Units* for further details.

.4 Terminal Control Units (TCU)

.1 TCU should not be used for control of major equipment (i.e. boilers, air-handling units, etc.).

.2 Floating point control shall not be used for terminal box actuators serving critical care areas. Where floating point control is used, terminal boxes shall not all recalibrate at the same time.

.3 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 27 – EMCS Terminal Control Units* for further details.

.5 Field Devices

.1 Provide electrically powered actuators to drive all valves, dampers and other control devices, except that central equipment actuators may be pneumatically powered in extensions or renovations to existing facilities where pneumatic power of adequate capacity is available.

.2 Select control valves with proper flow characteristics to match the application. Size so as to maintain reasonably linear control characteristics.

.3 Consider the use of 1/3 and 2/3 sized control valves for coils with large load variations.

.4 Match the damper type. Face area, power of actuator, and method of rod and damper linkage to give a linear volume control characteristic.

.5 Install flow measuring devices according to the manufacturer’s recommendation.

.6 Where variable volume control is being used with non-filtered supply or return air, a true differential pressure sensor shall be utilized. Flow-through sensors shall not be permitted.

.7 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 29 – EMCS Sensors, Devices and Actuators* for further details.

.3 Control Point Schedule

.1 Identify EMCS control points according to the Alberta Infrastructure EMCS Guideline for Logical Control Point Mnemonics.

.2 Every major mechanical system and piece of equipment (heating plant, cooling plant, major ventilation equipment, medical gas/vacuum pumps, domestic water heaters, etc.) shall be provided with sufficient control points to:

- .1 Control heating, ventilation, and air conditioning systems.
- .2 Execute control strategies to minimize energy consumption.
- .3 Monitor and record mechanical system's performance and trend data for the current and previous years in operation.
- .4 Provide dial out of alarm signals.

.3 Connect utility meters or real time monitoring meters to the EMCS to facilitate automatic tracking of energy usage.

.4 Provide necessary points and field devices to meet applicable LEED credit requirements.

.5 For variable air volume systems, monitor the supply and return air flow from the air handling unit.

.B Specific Requirements for Healthcare Facilities

.1 Control Points

- .1 Track electrical consumption and run time for vacuum pumps and medical air compressors.

.4 Sequence of Operations

.1 Provide custom control sequences and application programs to conserve energy by:

- .1 Optimizing operation of controlling primary energy consuming equipment.
- .2 Specifying optimum start and stop times for equipment and systems that do not operate 24 hours per day.
- .3 Resetting air and heating water supply temperatures using feedback from occupied space demand and outside air temperature.
- .4 Resetting relative humidity based on outside air temperature.
- .5 Using air systems to preheat, pre-cool or purge to achieve the objective space temperature at the start of occupancy.
- .6 Controlling variable air flow by using system pressure to control fan and pump VFD speed.
- .7 Reset supply air temperature on VAV systems based on feedback from VAV damper position in order to reduce simultaneous heating & cooling.

.8 Schedule VAV terminal boxes where areas with different occupancy schedules are served by the same ventilation system.

.9 Reset supply air temperature on constant volume systems based on feedback from reheat coil/radiant panel/radiation valve position in order to reduce simultaneous heating & cooling.

.10 Controlling car plug power to lock out at -10°C (2°F) and above, and to cycle on/off for 20 minutes intervals at temperatures below.

.2 Provide necessary control logics and functions to meet applicable LEED credit requirements.

.3 Provide control logics and functions to prevent thermal shock to boilers.

End of Mechanical Section

6.0 Electrical

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6.1 General Electrical

.1 Intent

.1 The intent of these Sections is to outline requirements for electrical systems not otherwise covered by applicable codes and standards. It is not intended as a substitute for good engineering practice or fundamental design principals. The Electrical Systems are to be designed and built to meet or exceed all applicable codes, standards, requirements and legislation.

.2 All electrical systems are to be functional, reliable, efficient, flexible, safe, maintainable and expandable with reserve capacity for future modifications.

.3 Systems are to be documented via as-built or record drawings and operational and maintenance manuals.

.4 Demonstration and training sessions are to be provided for operation staff.

.5 Designs shall demonstrate energy efficiencies and be cognizant of energy usage for all electrical equipment. Utilize energy standards and guidelines as outlined herein to every aspect of the electrical system design. Encourage the use of energy-star labeled equipment as a best practice.

.6 Do not sole source or use proprietary equipment or systems for any new facility or major renovation where existing equipment is being replaced. In cases of renovation, campus or addition type projects, specific equipment or systems may be required. If this is the case, these must be itemized and reviewed with the Infrastructure Project Manager.

.2 References

.1 The Design shall follow the Alberta Safety Codes Act and all referenced codes and standards. Application of the Codes and Standards are to be justified by the professional(s) leading the design at the time of design development and shall be clearly stated in design reports. Where conflicts exist between various Codes and Standards, the design report shall indicate the resolution taken and the reasons to support it.

.2 In addition to the Alberta Safety Codes Act, the following standards and guidelines shall be followed where applicable.

Referenced Documents (Where applicable, latest revisions/edition and changes).

- .1 Telecommunications Referenced Standards:
  - .1 ANSI/TIA-568-X.0, Generic Telecommunications Cabling for Customer Premises
  - .2 ANSI/TIA-568-X.1, Commercial Building Telecommunications Cabling Standard
  - .3 ANSI/TIA-568-X.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard
  - .4 ANSI/TIA-568-X.3, Optical Fiber Cabling Components Standard
  - .5 ANSI/TIA-569, Telecommunications Pathways and Spaces
  - .6 ANSI/TIA-606, Administration Standard for Telecommunications Infrastructure
  - .7 ANSI/TIA-607, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
  - .8 TIA TSB-162-X, Telecommunications Cabling Guidelines for Wireless Access Points.
- .7 APEGA Guidelines
- .8 Illuminating Engineering Society (IES)
- .9 Institute of Electrical and Electronic Engineers (IEEE)

.3 For codes and standards currently under regulation in Alberta, only editions/versions of those codes and standards can be specified. If different versions wish to be specified in its entirety, the consultant must apply for an “alternative solution”/variance with the Authority Having Jurisdiction (AHJ) as required by the National Building Code – Alberta Edition (NBC -AE)

.3 Key Design and Performance Requirements

.1 Electrical documents must meet the requirements of the APEGA document entitled Responsibilities for Engineering Services for Building Projects, V1.2 March 2009.

.2 Develop a conduit/raceway/cable tray schedule and include in specifications/drawings. Provide Electrical Metallic Tubing (EMT) for all interior locations such as ceiling spaces and concealed in walls, except where otherwise indicated in specifications/drawings or required by Canadian Electrical Code. Provide details and/or specification for specialized wiring (eg. dedicated neutral circuits) and raceway methods. All low voltage (below 120V) wiring to be installed in a conduit/raceway/cable tray. Do not use Electrical Non-metallic Tubing (ENT) in slab.

.3 Equipment essential to the operation of the facility is to be located and protected to minimize exposure to hazards that could impact its continued operation.

.4 Building Control Systems: Location, identification, type and approximate sizes of equipment control panels, control devices and outlets for control systems requiring 120V power connections, such to be shown.

.5 Provide block diagrams for all electrical systems, Communications and Electronic Safety and Security Systems, to be provided. Provide riser diagrams for multi-level buildings for all electrical systems over two floors.

.6 The electrical systems are to support the facility's operation upon initial occupancy and throughout the life of the facility; allowing for reasonable maintenance, equipment replacements, modernizations and expansion.

.7 The systems shall be designed to permit maintenance, repair and replacement of all electrical equipment without requiring work to be done on live equipment (infra-red scanning excluded).

.8 Power distribution and service equipment are to be located in secure, dedicated vaults, rooms and closets with sufficient clearance, access routes and access panels to allow for the installation, removal and replacement of equipment and to provide maximum flexibility for power distribution to floor area served.

.9 For new construction, rooms housing major electrical equipment shall not be located below the established flood plain, and in all cases shall not be located below grade.

.10 Rooms housing electrical service and distribution equipment shall not contain communications equipment, mechanical equipment, ducts, pipes, shafts or water lines unless the equipment is serving the room. Provide separate communication rooms for major data and electronic equipment.

.11 Electrical equipment shall not be located in or below Janitor rooms, water closets or other rooms with liquids, and shall only be located in mechanical equipment rooms if required to service mechanical equipment. All electrical equipment is to be suitably protected from leakages from the sprinkler system. Any major electrical equipment greater than 750 Volts shall not have sprinkler system or water lines located within the room. Avoid sprinkler systems and water lines in electrical rooms containing equipment less than 750 Volts and greater than 2000 Amps. Coordinate with Architectural and Mechanical divisions to ensure all codes are addressed.

.4 Identification

.1 Equipment to be identified in a clear, consistent manner. Nomenclature describing tagging method shall be shown. Refer to Technical Specifications Section 26 05 53 "Identification for Electrical Systems" for additional requirements where user groups standards are not in place. Edit the section to make it specific to the project.

.5 Operation and Maintenance Manuals

.1 Ensure all data required for the operation and maintenance of the equipment is collected and included in the Manuals. Refer to Technical Specifications Section 26 01 10 "Electrical Operation and Maintenance Data" for minimum requirements. Edit the section to make it specific to the project.

.2 Refer to Technical Specification Section 26 01 11 “Electrical Operation and Maintenance Manual” for manual requirements and organization. Edit the section to make it specific to the project.

.6 Spare Parts and Maintenance Materials

.1 Include spare parts and maintenance materials to the building operator. Refer to Technical Specification Section 26 01 90 “Electrical Spare Part and Maintenance Materials” for manual requirements and organization. Edit the section to make it specific to the project.

.7 Starting and Testing

.1 Include electrical starting and testing requirements. Refer to Technical Specification Sections: 26 08 10 “Electrical Starting and Testing - General Requirements”, 26 08 20 “Electrical Starting and Testing by Contractor”, and 26 08 30 “Electrical Starting and Testing by Contractor's Testing Agent”. Edit the sections to make them specific to the project.

.8 Equipment and Systems Demonstration

.1 Ensure that proper demonstration and instruction procedures are performed for the Province’s maintenance personnel. Refer to Technical Specification Section 26 08 40 “Electrical Equipment and Systems Demonstration and Instruction”. Edit the section to make it specific to the project.

.9 Commissioning

.1 It is the intent of the Province to solicit proposals for Commissioning Consultant Services and Independent Commissioning Authority to meet Leadership in Energy and Environmental Design (LEED) Fundamental and Enhanced Commissioning requirements.

.2 Over and above LEED commissioning requirements, the Commissioning Authority is required to undertake commissioning in accordance with CSA Z320 – Building Commissioning for all systems including:

.1 Electrical power and distribution.
.2 Emergency power and distribution.
.3 Transfer Switch operation.
.4 Lighting levels.
.5 Lighting control including daylight sensor calibration, occupancy sensor calibration and astronomical time clock settings and adjustments.

    - .6 Clock System.
    - .7 Functional testing of Security and Card Access Systems.
    - .8 Testing of Surveillance System.
    - .9 Sound Systems.

.10 Submission Requirements

- .1 Schematic Design Report Submission

    - .1 The Schematic Design Report (SDR) shall contain a section for the Electrical discipline.
    - .2 The SDR shall include all referenced codes and standards, including the most recent “Technical Design Requirements for Alberta Infrastructure Facilities (TDR)”.
    - .3 Convey the design intent of all electrical systems proposed. There must be enough information in the descriptions to ensure that the TDR is being followed so that future submissions and design will be compliant with the TDR.

- .2 Design Development Report Submission

    - .1 The Design Development Report (DDR) must fully convey the design intent. All design related issues, technical criteria and performance shall be included. All comments from the SDR are to be responded to prior to the DDR and addressed in the DDR.
    - .2 The following design related items/issues related to the electrical design to be included, but not limited to:

        - .1 Anticipated electrical load and allowances for future expansion.
        - .2 Single Line Diagram (SLD) indicating basic intent.
        - .3 Estimated service size.
        - .4 Arc flash mitigation strategies.
        - .5 Requirements of incoming electrical and telecom/data services and location and space requirements for the main service equipment.
        - .6 Locations of electrical, emergency/standby generator and data rooms/closets and preliminary size of rooms.
        - .7 Determination of lightning protection and risk assessment as per CSA B72.
        - .8 Description of lighting for interior and outdoor lit spaces, including but not limited to styles and metrics. Include light loss factors that will be used in calculating light levels.
        - .9 Indicate areas where specialized lighting is expected and description of how lighting will be addressed.
        - .10 Description of lighting control system being proposed.

        .11 For Healthcare Facilities, include preliminary risk classification of patient care areas for review by client group.

.3 Contract Documents (75% Submission)

    .1 Include a specification that is 90% complete.
    .2 All electrical and data room layouts.
    .3 Exit lights and emergency lighting.
    .4 Fire Alarm drawings showing zones, zone numbers and names. Show location of all panels and annunciators and as many devices as possible at this stage of design.
    .5 Include schematic drawings, details and panel schedules (included, but not necessarily completed).

A. Specific Requirements for Schools

.1 Provide a comprehensive colour coding and identification system for all electrical systems in accordance with the local school board standards.

B. Specific Requirements for Healthcare Facilities

.1 References

    .1 CSA Z8000, Canadian Health Care Facilities
    .2 CSA Z8001, Commissioning of Health Care Facilities.
    .3 ANSI/TIA 1179, Healthcare Facility Telecommunications Infrastructure Standard.
    .4 UL 1069 Standard for Safety – Hospital Signaling and Nurse Call Equipment
    .5 Design Guidelines for Continuing Care Facilities in Alberta, August 2018

.2 Provide a comprehensive colour coding and identification system for all electrical systems in accordance with the facility standards.

.3 Adopt Infection Prevention and Control (IP&C) requirements as stipulated by Alberta Health Services (AHS), the Health Care Facility and CSA Z317 - Infection Control During Construction, Renovation and Maintenance of Healthcare Facilities.

.4 Include Patient Area Classification drawing(s) indicating Basic, Intermediate and Critical Care areas as defined in CSA Z32 and Canadian Electrical Code.

6.2 Power Distribution and Service

.1 General

.1 This section describes general requirements for power distribution and service. Identify any specialized requirements at the design development stage.

.2 Provide a preliminary short circuit study showing all fault levels prior to completion of design documents. Include this information on the Power Single Line.

.3 Prior to final acceptance of the project, ensure a full coordination study, fault and arc flash incident energy analysis study has been completed and implemented. The maximum arc rating of electrical equipment on the load side of the main breaker is not to exceed 8 cal/cm^2. If this cannot be achieved, proposed solution with recommendation shall be submitted to the Province. Labels to meet the requirements of CSA Z462. Refer to Appendix C for minimum report requirements.

.4 Harmonic distortion and noise:

  .1 Identify non-linear loads, including Uninterruptible Power Supplies (UPS's), computers, rectifiers, variable frequency drives, elevator systems (variable speed drives and/or regenerative systems) and electronic ballasts or Light-emitting diode (LED) drivers, and consider their effects on power distribution system. Meet IEEE 519-2014, "Recommended Practice and Requirements for Harmonic Control in Electric Power Systems" at the utility Point of Common Coupling. Provide corrective measures as required.

.5 Obtain acceptance of the Province for the use of fused equipment. Consideration will only be given where fault duties of equipment require the limitation of available fault current.

.2 Single Line Drawings

.1 Provide electrical single line diagrams, as part of the Contract Documents, indicating the following:

  .1 Configuration, type, voltage and amperage ratings of switchgear, transformers, panelboards and motor control centres (MCCs).
  .2 Type, size and amperage ratings of services and feeders.
  .3 Type, frame size and trip rating of overcurrent protective devices.
  .4 Estimated available fault current at switchgear, distribution panelboards, branch circuit panelboards, transformer secondaries and overcurrent devices.

    - .5 Service and distribution grounding.

- .2 Provide copies of single line diagrams from Record Drawings, recording actual construction as follows:

    - .1 Incorporate into Operating and Maintenance (O & M) Manuals.
    - .2 Frame and hang in each major electrical equipment room, with equipment in the room highlighted.
    - .3 For existing buildings, any changes to the power distribution system is to be reflected on the original or latest building SLD and a new Record Drawing provided with updated revision number and date.

.3 Protection and Control

.1 Ensure priority tripping and coordination of overcurrent and ground fault devices on feeders. Provide final consolidated trip curves for services sized 600 kVA and over and multi-building sites.

.2 Ensure adequate fault duty ratings of all switchgear, panels, MCCs and overcurrent devices. Provide calculation results when requested by Alberta Infrastructure.

.3 Provide all services and feeders with ground fault protection as required by the Canadian Electrical Code. Where ground fault protection is provided on services and feeders, ensure protection is also provided for downstream feeders and loads that are susceptible to nuisance ground faults.

.4 Do not provide undervoltage protection on main breakers. For 3 phase motor starters provide single phase motor protection using differential overloads or phase loss shutdown by the Energy Management Control System (EMCS).

.5 For services over 750V, provide relaying using relay accuracy class CTs with test block and solid state relays with trip indication for each function. Provide a DC battery source for control and tripping power.

.4 Power Service

.1 Sizing

As an aid to determining the electrical service size for a facility, the information provided below can be used as a guide to establish minimum requirements which is to be reflected in the Design Development Report.

- .1 For multi-building sites, or sites with service voltages over 750V, coordinate electrical services with the Province.

- .2 Single building services with service voltage under 750V shall be sized as follows:
    - .1 Size main services and service transformers according to connected load with the appropriate load factor applied. Disclose service sizing criteria in design documentation.
    - .2 Calculate connected load using load factors as dictated by the type of load, plus a minimum 20% allowance for future load growth. Discuss future load allowances with the Province.

- .3 Calculate estimated loads based on basic power loads, plus additional loads anticipated for heavy power usage areas.

- .4 For initial design basic power load due to lighting, general power, convenience loads and basic mechanical equipment, calculated as follows:

    - .1 Buildings Over 1,000 m2 With Air Conditioning: 60 VA/m2 x total building area.
    - .2 Buildings Under 1,000 m2 with Air Conditioning: 70 VA/ m2 x total building area.
    - .3 Buildings Without Air Conditioning: 40 VA/ m2 x total building area.

- .5 Heavy power usage areas include kitchens, workshops, laboratories and areas with large numbers of electrical equipment connections or receptacles. For these areas, calculate additional loads as follows:

    - .1 Each Heavy Usage Area (base initial): 100 VA/ m2, or,
    - .2 Connected load at 100% demand, plus
    - .3 Other loads such as, snow melting, block heater outlets, welders and electric heating. Calculate additional connected load at 100% demand with a seasonal and work flow diversity factor applied.

.2 Transformers and Entry

- .1 Location:

    - .1 Main Building Utility Transformers: Coordinate as typically supplied by the local Utility, and locate outside on concrete pads and with protective bollards and screens where required. Include details of concrete pad, grounding and guard rails on drawings. Review access with utility.
    - .2 Owned Provincial Primary Service: Dry Type or Liquid Filled transformers located indoors in the main electrical room.

.2 Secondary voltage (listed in order of preference):

  - .1 347/600V, three phase, four wire.
  - .2 120/208V, three phase, four wire.
  - .3 120/240V, single phase, three wire.
  - .4 Obtain acceptance of the Province for other voltages and connections.

.3 Service entrance feeders entering the facility, primary and/or secondary service, shall be installed below grade, in conduit/raceway. Provide additional protection where necessary.

.4 Liquid-filled transformers may be used for voltages over 750 V applications and vault installation. Review with the Province.

  - .1 Use 55°C - 65°C insulation and equip with cooling fan.
  - .2 Equipment with sudden pressure relays.

.5 Switchgear, Switchboards, Distribution Panelboards, Motor Control Centres and Panelboards

.1 Switching and Overcurrent Devices:

.1 Main Service (750 V or Less) including future allowances:

  - .1 Over 1200 A: Main breaker to be industrial duty, draw-out Low Voltage Power Circuit Breaker (LVPCB), complete with LSI and G if applicable (Long Time, Short Time, Instantaneous or Ground Fault) adjustable trip units and trip indication for each. Fixed mounted with side or front access enclosure products may be considered.
  - .2 Over 2400 A: Consider all feeder breakers fed from main breaker to match main breaker type and have the same front to back dimension as the main breaker.
  - .3 1200 A and Less: Main breaker to be a Molded Case Circuit Breaker (MCCB) with LSI and G (if applicable) adjustable trip units.

.2 Distribution:

  - .1 Provide molded case thermal magnetic circuit type breaker for feeders under 400 A.
  - .2 For feeders 400 A and over, use molded case breakers complete with LSI and G (if applicable) adjustable trip units and trip indication for each.

- .3 Main Service Over 750V:
  - .1 Use metalclad switchgear with draw-out air magnetic, vacuum or SF 6 circuit breakers for all medium voltage equipment. The use of metal enclosed switchgear with interrupter switches to be reviewed with the Province.
  - .2 Provide maintenance grounding feature for on-going maintenance, such as grounding truck, or integral grounding switch.
  - .3 Provide remote switching of breakers complete with locked cabinet. Coordinate location with the Province.

.2 Bussing: Use solid copper.

.3 Metering: Provide panel mounted digital owner's metering as follows:

- .1 All incoming services over 100 A and distribution equipment over 1000 A. Review metering locations with the Province.
- .2 Meter to display true root means square (RMS) values for phase voltage (line to line and line to neutral), phase currents, kVA, kVAR, kW, PF, Hz, MWhr, kWd and kVAd.
- .3 Coordinate communicating protocols with EMCS equipment.

.4 Accessories: Provide lifting equipment for all industrial type draw-out breakers, medium voltage switches and stacked medium voltage starters.

.5 Working Clearances: As per Safety Codes Act.

.6 Housekeeping Pads: Provide all floor mounted equipment with a housekeeping pad.

.7 Location: Do not locate main service and distribution equipment in mechanical, storage, janitor rooms, corridors or public spaces.

.8 Branch Circuit Panelboards:

- .1 Copper Bussing.
- .2 Breakers to be “bolt-on”.
- .3 Maximum number of breaker positions in a single tub to be 72. Provide a double wide tub for breaker positions greater than 72 to a maximum of 84 positions. Provide minimum 225A bussing for panelboards with 42 or more positions. Feeder to be sized allowing for the required spares and spaces plus an allowance for future load growth for remaining space unused in the panel.
- .4 Do not use feed through lugs.

.5 Do not locate branch circuit panelboards in corridors or public spaces. Use "Closet" in corridor. Do not locate in storage rooms or in any areas where damage will be incurred via regular equipment movement, or clearances cannot be maintained. Do not locate in Janitor Closets.
.6 Include completed Panelboard Schedules with anticipated demand for each circuit. Refer to Sample Detail Sheet in Electrical Appendix B for minimum requirements for the Schedules.
.7 Recessed panelboards: Provide Two 21 mm empty conduits/raceways stubbed to ceiling space.
.8 All doors to be lockable.

.9 Distribution Panelboards:

.1 Provide door-in-door construction.

.10 Spares and Spaces:

.1 Switchgear, switchboards, distribution panelboards: Provide minimum 10% space for future breakers.
.2 Motor Control Centres (MCC's): Provide minimum 10% space for future use. In addition ensure each MCC can be extended a minimum of one vertical section for future use.
.3 Panelboards: Provide minimum 10% spare breakers and minimum 10% space for future breakers.

.6 Dry Type Distribution Transformers

.1 Location:

.1 Locate distribution transformers, on housekeeping pads, in designated electrical rooms only.
.2 Transformers Over 45 kVA: Floor mounted on vibration isolators. Allow for removal by wheel mounted equipment.
.3 Do not locate distribution transformers in ceiling spaces.
.4 Coordinate transformer heat removal with Mechanical.

.2 Size and Type:

.1 Three-phase delta-wye connected sized such that average demand loading is at least 60% of rating. Windings to be copper.
.2 Temperature rating of 150°C rise.
.3 Maximum 500 kVA. Larger sizes only by exception by the Province.
.4 Equipped with four 2.5% taps; two above and two below nominal for voltage adjustment.

.5 Provide harmonic mitigating transformers and strategies for installations which include harmonic content in the load.

.3 Secondary voltage (listed in order of preference):

.1 347/600V, three phase, four wire.
.2 120/208V, three phase, four wire.
.3 120/240V, single phase, three wire.
.4 Obtain acceptance of the Province for other voltages and connections.

.4 Acoustical Considerations:

.1 Ensure adequate acoustic ratings, treatment, location and mounting of transformers. Refer to Section 7.0 – Acoustical for specific requirements and include in project specifications.
.2 Use flexible conduit/raceway connection to transformer for primary and secondary feeders. (Liquid tight flex conduit/raceway in wet areas).

.7 Feeders

.1 Use copper conductors.

.2 All feeders to have a bonding conductor.

.3 Size of neutral conductor to be at least the same size as the phase conductors.

.4 Avoid installing 53 mm (2”) conduit/raceway or larger in-slab. If required coordinate with structural.

.8 Power Factor

.1 Correct power factor to at least 0.95 lagging where normal loading yields a power factor of less than 0.90.

.2 In cases where variable frequency drives (VFD) are not used, provide fixed power factor correction capacitors on load side of starter for motors 22.4 kW and larger.

.9 Motor Protection and Control

.1 Group motor starters in common areas within mechanical or electrical rooms.

.2 Starters to be National Electrical Manufacturers Association (NEMA) rated, Size 1 minimum, complete with hand-off-auto selector switch, minimum of 2 N.O. and 2 N.C. auxiliary contacts and pilot lights.

.3 Do not use fuses for individual motor overcurrent protection.

.4 Provide single phase protection for all three phase motors either by relaying, differential overloads or EMCS shutdown.

.5 Ensure EMCS provides time delay between start-up of each motor over 5 kW on emergency power after transfer to emergency generator, starting largest motor first.

.6 Provide time delay on speed change for two-speed starters.

.7 Provide space on backpan of starter or provide separate enclosure for mounting of EMCS current sensors.

.8 Variable Frequency Drives:

  .1 Whether supplied by the electrical or mechanical sub-trade, drives to be of six (6)-pulse, pulse-width modulation (PWM) type. Drives 22.4 kW (30 HP) and larger to be rated for 690V +/- 15%. Provide minimum 5% iron core reactor (line side) or equivalent DC Link Reactor built into all drives. Consider passive filter for 29.8kW (40HP) and larger at 100% load. Consider active filter for 74.5kW (100HP) and larger drives.

  .2 Provide drive rated (symmetrical) cable between drive and motor terminals. To obtain maximum benefit ensure this cable is correctly installed as per manufacturer’s instructions.

.10 Surge Protective Devices

.1 Provide surge protective devices (SPD’s) either integral buss mounted or separate mounted on the distribution equipment. Coordinate suppression with anticipated energy levels and sensitive loads.

.2 Provide surge suppression in the following manners:

Level 1 Install surge suppression complete with indicator lights on utility incoming mains.

Level 2 For areas containing a large group of electrically sensitive loads, provide surge protection complete with indicator lights on panelboards serving the area.

.3 Coordinate surge protective devices within the same power distribution system.

.4 Provide, as a minimum, Level 1, SPD’s in all buildings.

.11 Emergency Power

.1 Provide a minimum of one receptacle in electrical and mechanical rooms connected to emergency power where a generator is installed.

.2 Criteria for generator installation:

  .1 Dedicated indoor, climate-controlled, fire-rated room. Locate within main building or in a sound attenuated, environmentally controlled, walk-in enclosure. Locate generator room away from noise-sensitive areas and at grade level (to facilitate access).
  .2 Provide engine with circulating type coolant fluid heater to maintain optimum starting temperature.
  .3 Exclude unrelated electrical and mechanical equipment from generator room.
  .4 Provide vibration isolation for generator control panel or remote mount from generator set skid.
  .5 Make provisions for connection to load bank to facilitate annual full load testing. Provide a dedicated breaker for the load bank and single pole cam-type connectors in exterior mounted enclosure. Locate enclosure at ground level at an accessible location.

.3 Generator Sizing:

  .1 Size generator for peak demand loads, plus 20% spare for identified expansion, if applicable.

.4 Acoustic Considerations:

  .1 Refer to Section 7.0 – Acoustical.
  .2 Provide hospital grade exhaust silencers.
  .3 Mount generator set on combination steel spring and neoprene vibration isolation.

.5 Transfer Equipment:

  .1 Provide automatic transfer switch complete with two-sided by-pass.
  .2 Select either three-pole or four-pole application based on ground fault protection strategy and neutral current control.
  .3 Select open or closed transition based on project load characteristics and application. Closed transition is preferred.
  .4 Provide time delay or in-phase monitoring in transfer scheme to prevent motor damage upon transfer to utility power.
  .5 Provide time delay of major motor loads emergency power for transfer to emergency generator, starting largest motor first.

.12 Branch Wiring/Devices

.1 General

- .1 Use copper conductors, minimum size #12 AWG, RW 90 insulation.
- .2 Do not use non-metallic sheathed cable (NMD).
- .3 Minimum size conduit/raceway to be 21 mm.
- .4 Use AC-90(BX) cable only in short lengths for final connections to luminaires and similar equipment.
- .5 Consideration will be given for buildings of combustible construction, where AC-90 will be accepted, in wall spaces. Home runs shall be conduit/raceway and wire.
- .6 Provide a single receptacle on separate circuits for coffee makers, refrigerators and microwave ovens.
- .7 Install a ground conductor in all branch wiring conduits/raceways.
- .8 Maximum Circuits: Nine (9) in home run. Ensure grouping of circuits in home runs are as efficient as possible.
- .9 Provide 20% spare capacity in home run conduit/raceways.
- .10 Switches and receptacles to be minimum specification/commercial grade.
- .11 Minimize the use of floor boxes. Where floor boxes are used, they are to be rated for the environment they are located and ensure top of covers are mounted flush with finished floor.

.2 Block Heater Outlets

- .1 For more than 10 and up to 30 parking stalls:
  - .1 Provide thermostatic controlled contactors designed to shut off all power to outlets when outside temperature is above -10°C.
  - .2 Provide timer to cycle energized outlets on and off at a maximum 20 minute period.

- .2 More than 30 parking stalls:
  - .1 Provide thermostatic controlled contactors designed to shut off all power to outlets when outside temperature is above -10°C.
  - .2 Split the load into two groups. Alternately cycle each group on and off with a maximum 20 minute period.

- .3 Use the building’s EMCS system to control parking lot loads where possible. Coordinate with Mechanical Section.

- .4 Consider the use of flexible type pedestals.

.13 Provisions for Mechanical

.1 Provide trace heating for piping or connect immersion heater in accordance with Section 5.0 - Mechanical.

.2 Coordinate with the control system designer for interface with electrical systems such as lighting and fire alarm.

.3 Coordinate UPS requirements for head end of EMCS in consultation with Mechanical Consultant.

.4 Where there is a three phase service, generally motors larger than 0.37 kW (1/2 HP) to be three phase, and motors 0.37 kW (1/2 HP) and smaller to be single phase, 120V.

.5 Review connection requirements for electric motor starters, drives and controllers provided packaged with mechanical equipment.

.14 Offices and Workstations

.1 For projects containing electronic office space or electronic equipment such as computers, microprocessors and electronic communications equipment, review the requirements for supplemental electrical protection of electronic equipment with the Province.

.2 Determine the extent and severity of electrical service disturbances including voltage sags, surges, short term and long term transients and outages. Consult with the Utility in order to determine the likely incidence of these disturbances.

.3 Identify electronic equipment and systems likely to be affected by disturbances and the extent of protection necessary for normal operation.

.4 Individual computer work station areas to be supplied with a minimum of two shared circuits.

.15 Lightning Protection

.1 Provide lightning arrestors on all primary medium voltage services.

.2 Review requirements for need of a lightning protection system by completing a risk assessment as described in CSA-B72:20, “Installation Code for Lightning Protection Systems”. If the annual threat occurrence is greater than the tolerable lightning frequency (Nd > Nc), provide lightning protection. If annual threat occurrence is less than the tolerable lightning frequency (Nd < Nc) depending on the type of facility, review requirement for lightning protection with the Province.

.3 If lightning protection is required, provide details including plan drawings showing all rods, conductors, down drops and connection points.

.4 Ensure lightning protection is installed by an installation firm with a minimum of five years of experience in lightning protection installation. Upon completion, installers shall provide certification that the system is complete and complies with all applicable standards.

.16 Uninterruptible Power Supplies (UPS)

.1 Size UPS batteries for minimum of 20 minutes.

.2 Connect UPS to emergency/standby power system where applicable.

.3 Use lithium-ion type batteries.

.4 All UPS's to have hot swappable components.

.17 Envelope Penetrations

.1 Ensure adequate treatment for all envelope penetrations such as generator exhaust piping, lightning down conductors and service masts. Refer to Section 2.0 - Building Envelope for specific requirements.

A. Specific Requirements for Schools

.1 Generally, emergency generators are not provided in school facilities, however, where freeze protection or other essential motor loads are present or where the facility is also used as a disaster recovery centre, an emergency generator may be required.

.2 Where schools are located in rural areas, provide Levels 1 and 2 of SPD per Section 6.2.10 of this document.

.3 Receptacles – do not use any circuits in more than one classroom.

.4 Wall mounted switch, receptacle, and low voltage (under 120V) systems cover plates shall be stainless steel type 302/304, #4 finish, and stainless steel screws.

.5 Gymnasium electrical components shall be protected by recessing in custom housing in wall or wire guard. All clocks, emergency luminaires, exit lights, and any other surface mounted equipment shall be protected by wire guard. All receptacles, switches, fire alarm manual stations, microphone outlets, T.V. outlets and other flush devices shall be recessed into wall. Wall mounted speakers shall have integral speaker protection. Ensure a minimum of three circuits for gymnasium receptacles.

.6 Where emergency shutoff switches are located in rooms to de-energize a panelboard via contactor, the switches are to be complete with a keyed reset.

.7 For modular classroom power feeder allow single phase 3-wire 120/208V or 120/240V with 2P-100A breaker.

.8 Provide staff parking block heater receptacles.

B. Specific Requirements for Healthcare Facilities

.1 Consult with the local Utility to provide the highest level of service reliability and discuss results with AHS and the Province of Alberta Project Manager.

.2 Develop an “Electrical Safety and Essential Electrical Systems” plan based on the CSA-Z32 standard of the same name. Incorporate this plan into the Design Development Report for the facility, and submit to the Province for review at the Design Development stage of the project. The plan shall demonstrate all aspects of the CSA-Z32 standard as follows:

  .1 Z32 Risk Classification of all patient care areas.
  .2 Details of branch circuitry and grounding.
  .3 Design of the Essential Electrical Systems including calculations for generator sizes, fuel storage requirements and justification for redundancy.

.3 Make provisions for fan cooling on main service transformers in excess of 750 kVA. Size transformers for calculated capacity without the use of fan-cooling. Make use of fan-cooled rating of transformer in the design of system redundancy. Liquid-filled transformers may be used for high voltage applications and vault installation with the following provisions:

  .1 Use 55°C - 65°C insulation and equip with cooling fan.
  .2 Equip with sudden pressure relays.

.4 Do not use Isolated Power Supply in new construction.

.5 Review use of any in-slab conduit/raceway with Province.

.6 The electrical distribution system serving all essential loads as defined in CSA-Z32 shall be designed with redundancy so that there will be no areas without power while performing maintenance.

.6 Harmonic Distortion and Variable Frequency Drives:

  .1 Identify non-linear loads as identified in item 6.2.1.4.1 and additional equipment in health care facilities such as MRI's, CT Scanners and X-ray equipment.

  .2 Ensure that a harmonic digital simulation is completed to demonstrate that the limits set out in IEEE Standard 519-2014 "Recommended Practice and Requirements for Harmonic Control on Electric Power Systems" are met. Simulation to be from Main Switchboard to Distribution Panels feeding the major/large non-linear loads.

.7 Uninterruptible Power System:

  .1 Minimize battery requirements for UPS by feeding unit from emergency power system. Size UPS batteries for maximum 20 minute outage, except in special cases.
  .2 Provide local UPS to serve individual loads, or a centralized UPS system for groups of loads. As a minimum provide centralized UPS for IT equipment, Nurse Call and Security (ie. Equipment located in Telecommunication Rooms)
  .3 Where larger centralized UPS is used, provide redundancy and a sectionalized load-side distribution system. The UPS shall have hot swappable components.

.8 Batteries for Standby Applications:

  .1 Make standby battery provisions for:

    .1 Fire alarm system.
    .2 Communication systems.
    .3 Switchgear station power supply, if applicable.
    .4 Engine-generator start-up.
    .5 Systems or equipment which require uninterrupted service.
    .6 Emergency lights and exit signs (where generator is not provided).
    .7 Operating room surgical lights (Review with the Province).
    .8 Gas shut off solenoid valves.

  .2 Maintain battery operating ambient temperature as per manufacturers recommendations.

.3 Select battery chargers to match battery type.

.9 Wiring Devices:

  .1 Use hospital grade receptacles for patient care receptacles and specification grade convenience receptacles.
  .2 Identify all receptacles as to panel and circuit number on plastic engraved lamicoid tag, permanently affixed to wall directly above device cover plate; tag to be same width as cover plate.
  .3 Wall mounted switch and receptacle cover plates shall be stainless steel type 302/304, #4 finish, and stainless steel screws.

6.3 Lighting

.1 General

.1 This section describes general requirements for lighting. Identify any specialized lighting requirements at the design development stage. The design to consider maintainability of the lighting and control system, and be cautious with features available in industry. For reliability, consider mean time between failure and mean time to repair over many years. Consider whether additional or replacement devices will be available for the system during this time. Lighting should be reliable, cost-effective, and simple to maintain. Where possible avoid the use of excess technology that could impact reliability and maintenance. With technology and products changing quickly, availability of replacement components is a concern.

.2 Design to be based on current applicable IES recommendations and standards including addenda.

.3 Use the task-ambient approach where work surface and task orientations are predetermined and as agreed to by the Province.

.4 Designs to be generally based on average maintained illuminance targets and luminance values/ratios/gradients as described in the applicable IES recommendations and standards. Designs shall be supported by reference to the appropriate IES recommendations and standards.

.5 Design a luminous environment minimizing glare (luminance values/ratios/gradients) and shadowing for visual comfort. Carefully review glare implications and select luminaires cognizant of intensities at user viewing angles. Reduce shadowing in typical work space areas by avoiding the use of point source type lighting such as pot lights.

.6 For maintenance purposes, provide a table in the operations and maintenance manual listing designed average maintained illuminance values for each type of lit space.

.7 Design files shall include the following information which may be requested by the Province for review:

- .1 Photometric plot showing illumination values on an appropriate grid scale to demonstrate compliance with IES recommended best practices.
- .2 Tabular format of information summarizing the values provided and a description of design assumptions and recommendations.

.2 Lighting Design Parameters

.1 Use the following criteria to select minimum average maintained values within spaces:

- .1 Visual Task: Medium contrast or small size
- .2 Occupants Ages: Under 65 years
- .3 Task Duration: Prolonged periods
- .4 Reflectances: Coordinate with actual finishes

.2 Maintained Values: Use the following criteria for calculation of maintained values:

- .1 Light loss factor: Refer to IES RP-36 Lighting Maintenance, see Light Loss Factors section.
- .2 Determine the Interior and Outdoor Lighting Power Densities and show compliance with current allowances as indicated in the National Energy Code.

.3 Uniformity

.1 All areas in a space need not be to minimum average maintained values if functions permit. Lighting levels may be non-uniform. For example, circulation areas in an office may be of a lower level than recommended for the work surface.

.4 Interior Landscape Lighting

.1 Where interior lighting is required to sustain plant growth, coordinate with the landscape consultant to provide the appropriate illumination levels, light spectra, and control.

.5 Lighting Sources

.1 Only use sources which are readily available from local distributor's stock.

.2 Fluorescent type lighting is acceptable provided items in Fluorescent Lamps and Ballasts section below are met.

.3 Light-Emitting Diode (LED) type lighting is acceptable provided items in LED’s and Drivers section below are met.

.4 For acoustical and electromagnetic interference considerations, refer to Section 7.0 - Acoustical.

.5 Do not use incandescent sources.

.6 Diffusers

.1 Use framed diffusers in recessed luminaires wider than 305 mm.

.2 Use impact resistant diffusers for outdoor luminaires.

.3 High efficiency, low brightness diffusers are preferred in areas containing electronic work stations.

.7 Fluorescent Lamps and Ballasts

.1 Colour Rendering Index (CRI) to be minimum 85. Generally Correlated Colour Temperature (CCT) to be 3500K. Minimum lamp life of 36,000 hours. (Rated Average Life – 12 hour start). Do not use U shaped lamps.

.2 Use programmed start electronic ballasts with ballast factor less than 1.0, less than 10%Total Harmonic Distortion and Power factor not less than 0.95.

.8 LED’s and Drivers

.1 LED lighting shall be selected from production-proven models available at the time of construction and not prototypical or unproven technology.

.2 LED luminaires shall have photometric data in accordance with IES LM-79- Optical and Electrical Measurements of Solid-State Lighting Products.

.3 LED’s shall have test reports in accordance with IES LM-80- Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules, and supported by IES TM-21 – Projecting Long-Term Luminous, Photon, and Radiant Flux Maintenance of LED Light Sources.

.4 Dimming should only be provided where necessary.

.5 Flicker/Temporal Lighting Artifacts (TLA) to be minimized. Review flicker/TLA implications throughout lighting levels for each driver type especially at lower levels. To help reduce flicker/TLA, consider Constant Current Reduction (CCR) instead of Pulse Width Modulation (PWM).

.6 Drivers to be rated minimum 50,000 operating hours for integrated LED luminaires.

.7 Interior LED lighting:

   .1 Luminous flux maintenance for integrated LED luminaires, reported projection as per IES TM-21 to be minimum of 30,000 hours at L90, with calculated or theoretical minimum 60,000 hours at L80, or 90,000 hours at L70. Luminous flux maintenance for non-integrated linear LED luminaires reported projection as per IES TM-21 to be minimum 20,000 hours at L90, with calculated or theoretical minimum 40,000 hours at L80, or 60,000 hours at L70.
   .2 Color Rendering Index (CRI) to be minimum 80 range, targeting 85 or higher site-measured. Generally Correlated Color Temperature (CCT) to be 3500K.
   .3 Luminous efficacy of the source to be a minimum of 85 lumens per watt (delivered fixture lumens).
   .4 To reduce direct glare for direct type lighting, generally select luminaires with larger full area lenses/diffusors/cells to reduce peak direct luminance and help reduce luminance variance across the area of the fixture.
   .5 Avoid the use of small aperture luminaires unless luminance ratios or peak direct luminance can meet IES recommendations and standards.
   .6 Obtain acceptance of the Province for the use of tuneable-white systems, which shall be for specific situations only.

.9 Interior Lighting Control

.1 Lighting control to be a dedicated wired system. Do not use breaker switching.

.2 Provide the simplest system to meet the needs of the facility and requirements by code. For example: Automatic Daylight responsive controls to be provided only if required by code. Show primary and secondary zones on drawings where NECB required Automatic Daylight responsive controls. Use low voltage switching for all multiple circuits that require master control. Do not locate relays in ceiling space. Relays to be located in an enclosed panel in an electrical room/closet next to branch circuit panel.

.3 Provide a minimum of manual on/off switching for conference rooms, board rooms, groups of common offices and large areas common to a single user.

.4 Provide time clock or programmed switching for large general use areas.

.5 Provide motion sensor control for night lighting, exterior man doors and low use areas where economics are favourable.

.6 Minimize night lighting (unswitched lights) to main entrance, service entrances and key areas where interior lighting control switches are located.

.7 Line voltage control components are acceptable for locations with simple switching requirements. If a low voltage control system is to be provided, conventional type centralized low voltage control systems with analog field devices appear to be proven for maintainability for a building to last for many years.

.10 Emergency and Exit Lighting

.1 Where emergency power is not available, provide battery powered emergency lighting unit equipment.

.2 Provide battery powered unit equipment type lighting with a minimum one hour capacity in all electrical, generator and mechanical rooms.

.3 Integral battery power back-up ballasts/drivers in Luminaires are not acceptable.

.4 Exit signs to be LED type

.11 Exterior/Outdoor Lighting

.1 Provide lighting at all building entrances/exits, walkways, parking lots, and other areas requiring lighting determined by user group and site evaluation.

.2 Use fully shielded (zero uplight component) luminaires with a CCT of 3000K or less for building exterior, parking, roadway, walkway and area lighting. For LED type lighting, where possible select lower drive current to increase LED life and reduce glare. Ensure direct luminance levels are controlled to help reduce direct glare for those viewing towards luminaires. The use of warmer color temperatures (eg. 2700K or 2200K) is encouraged. Where color rendering is of less importance consider amber or narrowband amber LEDs.

.3 Control of outdoor luminaires shall be designed, as a minimum, with photosensor “on/off” control. Consider supplementing this control with the use of motion sensors or programmed time control.

.4 Where integrated, include programming of the EMCS for remote control of the outdoor lighting.

.5 Luminaires shall be suitable for operation to –40°C.

.6 Review use of obstruction and aircraft warning lights where applicable.

A. Specific Requirements for Schools

.1 Design to the latest IES standards, specifically refer to ANSI/IES RP-3 –Lighting Educational Facilities.

.2 Design lighting control to have the flexibility required to adjust lighting to suit functions and activities.

.3 Lighting control to be conveniently and appropriately located for each area and allow for control of lighting in their environment.

.4 Provide individual manual on/off switches for lighting in classrooms and like rooms to control room lighting, independent of other lighting control systems in the school. Ensure these on/off manual switches have the capability to turn lights off and remain off, and manual on after manual off. Each classroom provide two or more independently switchable zones. Each gymnasium provide three or more independently switchable lighting zones.

.5 Ensure all lighting in communal, corridors and administration areas are capable of being operated from a central location.

.6 Use battery pack type unit equipment type system for emergency lighting.

.7 Ensure gymnasium lighting glare (peak direct luminances and luminance ratios) is controlled at all viewing angles including nadir. Activities where users are looking straight up shall not be affected by glare.

B. Specific Requirements for Healthcare Facilities

.1 References

  - .1 ANSI/IES RP-28 – Lighting and the Visual Environment for Older Adults and the Visually Impaired
  - .2 ANSI/IES RP-29 – Lighting Hospital and Healthcare Facilities
  - .3 CSA-Z317.5 – Illumination Design in Healthcare Facilities

.2 Lighting Controls:

  - .1 Provide patients or residents with control of the lighting environment in their rooms.
  - .2 Provide patient corridors with distinct levels to accommodate day, evening, and late night activities.
  - .3 Provide adjustable lighting control at Nurses' Station to suit time of day and activities. Design low ambient lighting level with task lighting for night shift.

6.4 Communication

.1 Service Entry

.1 Where applicable, shall be installed below grade in conduit/raceway. Provide additional protection as required.

.2 Structured Cabling – Voice and Data

.1 Review with the Province and Client Groups, requirements of voice (Voice over Internet Protocol (VoIP) or analog) and data communication.

.2 Provide telephone system cables and outlets as part of the building construction contract to meet the needs of the facility.

.3 Design system to meet the referenced TIA standards. Refer to Section 6.1.2 of this document and ensure the installation meets these standards and as follows:

  - .1 Provide a complete structured cabling system that is based on a physical star wiring topology.
  - .2 System is to include details for the supply, installation and termination of all riser (vertical) cabling, horizontal cable from workstation to telecommunications room, racks, power bars, workstation outlets, jacks, Velcro tie-wraps, labelling and testing of all cables and associated items.

.3 Provide a complete wireless network (WiFi) throughout, with no dead spots, which supports any standard network applications.

.4 Utilize standard cross-connect wire, 483 mm, 2 or 4 post communication rack(s) or wall mount cabinet(s), power bars, vertical and horizontal cable managers, patch panels and wall mounted connector with Insulation Displacement Connection (IDC) punchdown clips.

.5 Office workstations shall consist of two data cable outlets housed in one wall mounted or systems furniture mounted single gang interface.

.6 All horizontal cable shall be Unshielded Twisted Pair (UTP), Category 6, 4 pair. Modular jack pin pair assignment shall be to T568A requirements.

.7 Backbone cabling for data shall be a combination of UTP Category 6, 4 pair, 6-strand 50 ųm core diameter/125 ųm cladding diameter multimode fiber and 6-strand single mode fiber. Coordinate with user for specific requirements.

.8 Backbone cabling for voice shall be multi-pair Category 3 with a grey jacket terminated on IDC distribution connectors.

.9 Labelling and identification of the cables shall conform to facility requirements.

.10 A ground bus shall be provided in each communication room wall mounted with stand-off supports.

.11 For analog voice system, provide applicable identification at ports.

.12 The structured cabling installation shall be performed by a Telecommunications Contractor whose normal business is the installation of voice, data and image cabling systems, and to perform associated testing.

.13 Provide conduit, raceway, cable tray or cable tray with barrier to separate systems.

.14 Provide permanent link type testing as per TIA standards.

.3 Paging and Public Address Systems

.1 Review with the Province and Client Group the requirements of a Paging and Public Address System and the extent of the system area coverage.

.2 Where a Paging and Public Address System is determined to be required it shall consist of microphones, mixer preamplifier, dynamic range limiters, solid state audio power amplifiers, telephone paging interface, loudspeakers, system rack, wiring, remote jacks and controls. In addition, the system will generally conform to the following:

.1 Provisions for multi-point microphone input facilities and provisions for background music.

.2 Provisions to integrate with the facility communications system.

.3 Install all system wiring in conduit/raceway and cable tray.

.4 The paging system shall be supplied and installed by a firm that has provided and installed paging system components for a minimum of five years.

    .5 Ensure speech intelligibility reproduced by the installed system, including room reverberance and expected background noise, is part of the design process. Reference IEC 60268, Part 16, Objective Rating of Speech Intelligibility by Speech Transmission Index.

.4 Sound Masking System

.1 Review with the Province and Client Group the requirements of a Sound Masking System and the extent of the system area coverage. Refer to Section 7 – Acoustics, for details of the system.

.2 Coordinate power, raceway and low voltage interface requirement.

.5 Assistive Listening Devices

.1 Provide assistive listening system when required by the Alberta Building Code.
.2 Coordinate with the Province and Client Group the extent of the system.

.6 Clock System

.1 Review with the Province and Client Group the requirements of a Clock System and the extent of the system area coverage. Where a Clock System is required, it shall generally conform to the following:

    .1 Synchronized clock system consisting of all necessary equipment, accessories, software, training and support necessary for a complete and reliable operating system.
    .2 The clock system shall be either wired, wireless, or a combination wired and wireless system.

.7 Cable Television (CATV) / Radio Frequency Television (RFTV)

.1 Review with the Province and Client Group the requirements of a CATV/RFTV System.

.2 Provide design for RFTV distribution system via coaxial cables for signal strength 6 dBmV to 14 dBmV at each outlet.

.3 Connect CATV service to RFTV distribution system. If CATV is not available at present, ensure that it can be connected when service is available.

A. Specific Requirements for Schools

.1 Public Address

    .1 Provide public address to meet the needs of the facility.

    .2 Coordinate exterior audible notification devices with the needs of the facility (Class start, recess end, etc.).

.2 Telephone System

    .1 The telephone system may be purchased through the construction contract or separately by the School Board.
    .2 A small digital PABX system may be used to provide both telephone and intercom services.

.3 Intercom

    .1 Provide building intercom requirements through telephone system with the exception of:

        .1 Point-to-point staff entry door intercom
        .2 Separately identified functions

    .2 Provide speakers and handsets in all applicable locations.
    .3 Provide zoning to suit facility function, i.e., separate zones in wings of school.

.4 Gym Sound Reinforcement

    .1 Provide a fixed sound system that is suitable for highly intelligible speech reinforcement and music.
    .2 Select loudspeaker directivity and mounting locations to provide uniform sound coverage of the floor area and minimize any spill over to wall surfaces.
    .3 For systems that will be used for frequent drama and musical productions, provide 25 mm conduit/raceway from the audio equipment location on stage to a location near the center of the back wall of the gymnasium. Provide recessed junction boxes at both ends. This is to provide a future tie-in for a portable mixer.

.5 Sound Field Systems

    .1 Review with the Province and Client Group the requirements of Sound Field Systems. Provide rough-in for system where locations are agreed upon.

B. Specific Requirements for Healthcare and Continuing Care Facilities

.1 Structured Cabling – Voice and Data

- .1 Referenced standards – refer to Section 6.1.2 of this document and ANSI/TIA 1179, Healthcare Facility Telecommunications Infrastructure Standard.
- .2 Reference AHS Standard – Structured Cabling Requirements Version 2.3 (2016) – This standard is for the design team and is not to be attached into the contract documents.
- .3 Design and installation to meet referenced standards. Exceptions may be required based on client group requirements.
- .4 Prior to design, a business case will have been developed by AHS. Coordinate design details from the functional program, client group meetings and room data sheets.
- .5 Definitions:

    - .1 End to End Structured Cabling Solution - Same manufacturer/vendor from wall jack and cover plate, cable, cable jack at patch panel, and patch panel.
    - .2 VoIP - Voice over Internet Protocol.

- .6 Cable System Consistency - Only one manufacturer/vendor may provide an end-to-end structured cabling solution (UTP and fibre) for each project. However, for existing sites, once precedence for a manufacturer/vendor has been set for an existing to remain patch panel with cables remaining, that manufacturer/vendor shall be used for the end-to-end structured cabling solution for that patch panel.
- .7 Horizontal Copper Cable

    - .1 Type - As recommended by ANSI/TIA-1179
    - .2 New Installations (New Patch Panels) - Category 6A unshielded twisted pair (UTP) as defined in ANSI/TIA-586-X.2, 500MHz minimum channel bandwidth
    - .3 Existing installations - Minimum Category 6 unshielded twisted pair (UTP) as defined in ANSI/TIA-586-X.2, 300MHz minimum channel bandwidth

.2 Nurse Call System:

- .1 Design system to functional requirements of facility.
- .2 Develop a communications program for the facility to facilitate the operation of, and the response to, the nurse call system.

.3 Provide the simplest system that can satisfy the requirements.
.4 System Features:

  .1 Provide wiring in conduit/raceway or in accessible barriered tray section to facilitate system upgrades or modifications.
  .2 Provide wandering patient monitoring system in facilities with mentally impaired patients.
  .3 Identify all wiring clearly and provide wiring diagram in each cabinet.
  .4 Provide power supply to nurse call system from emergency source with battery backup for programmed memory retention.

.3 Multimedia Systems:

.1 Review requirements with client.

.4 Intercom Systems:

.1 Provide building intercom through telephone system with the exception of:

  .1 Point-to-point staff entry door intercom
  .2 Hands free intercom in operating rooms
  .3 Separately identified functions

6.5 Electronic Safety and Security Systems

.1 General

.1 Provide electronic security systems only as required to enhance physical and dynamic security. Primary security is by physical security provisions in the building design and the dynamic security brought about through staff procedures and circulation.

.2 Review security risks with administration and determine needs for each individual project which could include duress alarm, video surveillance, intrusion detection, access control, and various other electronic systems.

.3 Size and level of integration between systems shall be appropriately designed for the facility.

.4 Provide back-up power for all life safety and security systems.

.5 Provide battery back-up for all systems with volatile electronic memory.

.6 Review the use of UPS systems with the Province.

.7 For Government of Alberta Facilities refer to latest version of “Physical Security Guidelines & Standards for Government of Alberta Facilities”. This document is for the design team and not to be attached into the contract documents. *(*https://www.alberta.ca/assets/documents/tr/tr-securityguidelinesstandards.pdf*)*

.8 Do not use electro-magnetic locks unless no other hardware method is available.

.2 Fire Detection and Alarm

.1 Design the most effective fire alarm system to meet the facility’s requirements. Fire alarm system to be a dedicated physically isolated system that operates independently.

.2 System to be designed, installed and verified as per the regulations under the current Safety Codes Act.

.3 Where addressable technology is used for initiating devices use Data Communication Link (DCL) style C as per CAN/ULC-S524. Where fault isolation modules are used, they shall be clearly shown where they are located on the floor plans and clearly described where they are located within a DCL in the verification report.

.4 Avoid the use of optical beam smoke detection where air aspiration type can be used.

.5 Provide static graphic mounted in frame securely fastened to the wall adjacent to annunciator at firefighters entrance. Graphic to clearly show all fire zones, sprinkler valve locations, “You Are Here” indication, and a north arrow.

.6 Refer to CAN/ULC S524 “Plans and Specifications” requirements for design.

.7 Show the wiring routing path between each device on record drawings.

.8 All devices shall be labelled on the external fixed portion of the device with applicable loop/address number or circuit number. Refer to Appendix A for identification requirements.

.9 Program by-pass switches at central panel as coordinated with requirements of user (eg; Smudging).

.10 Indicate in the contract documents which edition of CAN/ULC S524 and CAN/ULC S537 is referenced for Alberta. Refer to Building Code for edition reference (ie. for a project utilizing National Building Code 2019 Alberta Edition, see section 1.3.1.2). Confusion can be remedied for the parties involved if they have the correct standard with them during construction and provide fair preparation for what the expectations will be during verification.

.11 Identify wiring at all panels and junction boxes identifying zone/loop numbers/etc.

A. Specific Requirements for Schools

.1 Provide as a minimum, an empty conduit/raceway/cable tray system for the following electrical systems:

  .1 Electronic Access Control System
  .2 Video Surveillance System.
  .3 Lock down system

.2 Review with the Province Project Management the local school board's additional requirements. Coordinate systems with school board.

.3 Determine security needs in accordance with the School Threat and Risk Assessment and in consultation with the School Board.

.4 Provide perimeter intrusion detection system to detect unauthorized entry. Perimeter door monitor system with internal motion sensors is adequate in most applications. Coordinate with School Board.

.5 Coordinate the location of electronic access control doors and door alarms in consultation with the School Board.

B Specific Requirements for Healthcare Facilities

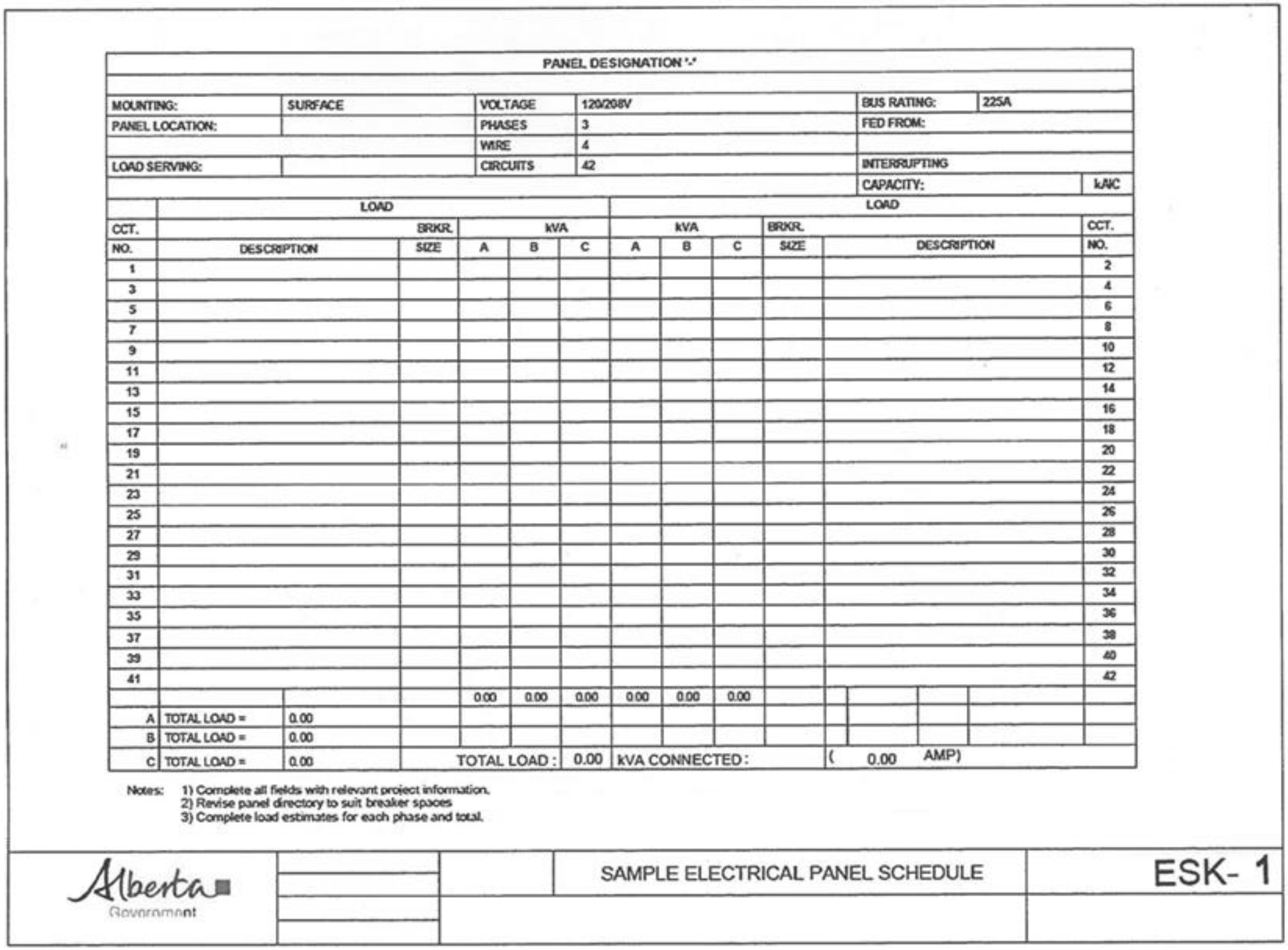
.1 Provide complete Intrusion, Electronic Access Control and Video Surveillance Systems in accordance with AHS Provincial Protection Service Security Design Guidelines and Technical Specifications. The referenced document is for the design team and is not to be attached into the contract documents.

.2 For 24 hour facilities without a 24 hour staffed command station: Provide annunciation at each nursing station with summary information for entire facility as well as the required patient room information.

End of Electrical Section

Electrical – Appendix A

.1 Sample Electrical Panel Schedule



PANEL DESIGNATION '-'

MOUNTING:	SURFACE	VOLTAGE	120/208V	BUS RATING:	225A
PANEL LOCATION:		PHASES	3	FED FROM:	
		WIRE	4		
LOAD SERVING:		CIRCUITS	42	INTERRUPTING CAPACITY:	kAIC

	LOAD								LOAD		
CCT. NO.	DESCRIPTION	BRKR. SIZE	kVA A	kVA B	kVA C	kVA A	kVA B	kVA C	BRKR. SIZE	DESCRIPTION	CCT. NO.
1											2
3											4
5											6
7											8
9											10
11											12
13											14
15											16
17											18
19											20
21											22
23											24
25											26
27											28
29											30
31											32
33											34
35											36
37											38
39											40
41											42
			0.00	0.00	0.00	0.00	0.00	0.00			

A TOTAL LOAD = 0.00

B TOTAL LOAD = 0.00

C TOTAL LOAD = 0.00

TOTAL LOAD : 0.00 kVA CONNECTED : (0.00 AMP)

Notes:
1) Complete all fields with relevant project information.
2) Revise panel directory to suit breaker spaces
3) Complete load estimates for each phase and total.

Alberta Government

SAMPLE ELECTRICAL PANEL SCHEDULE

ESK- 1

Electrical – Appendix B

.1 Coordination, Fault and Arc Flash Incident Energy Analysis Report Requirements:

.1 Include an APEGA licensed professional authenticated report including items as identified in IEEE 1584.1 “IEEE Guide for the Specification of Scope and Deliverable Requirements for an Arc Flash Hazard Calculation Study in Accordance with IEEE Std 1584.

.2 As a minimum report to include:

- APEGA licensed professional authenticated cover page.
- Executive Summary
- Scope of Study and Results Summary
- Background Information used such as available utility fault current used, cable sizes, types and lengths etc., including software used, configuration settings and assumptions used. Include copy of building SLD in an Appendix and ensure labelling between software and SLD are compatible. Include all digital back-up, custom files and any custom library files are submitted with the report in a flash drive.
- Short circuit analysis listing all equipment and verifying that equipment is properly rated for the available short circuit rating.
- Coordination study including results and any recommendations. Include all time-current characteristics curves used. Include potential changes to lower incident energy levels for review by Engineer.
- Arc Flash Incident Energy analysis. Include a spreadsheet listing all equipment. Include recommendations for incident energy reduction.
- Conclusion**/** Recommendations

7.0 Acoustical

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7.1 References

.1 Meet or exceed the guidelines and standards of the following, as applicable:

  - .1 ASHRAE: Applications Handbook (SI) Chapter on Noise and Vibration Control
  - .2 National Building Code – 2019 Alberta Edition: Division B – Sections 5.8, 9.11, Sound Transmission, and Tables 9.10.3.1.-A, 9.10.3.1.-B.
  - .3 National Building Code – 2019 Alberta Edition: Division B, Part 11, Exterior Acoustic Insulation
  - .4 CISC: Handbook of Steel Construction - Appendix G, Guide for Floor Vibrations
  - .5 AISC/CISC 1997 Steel Design Guide Series 11, Floor Vibrations Due to Human Activity
  - .6 ASTM E557-12, Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions
  - .7 ASTM E336-16 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
  - .8 FGI Guidelines for Design and Construction of Residential Health, Care, and Support Facilities – 2014 edition
  - .9 FGI Guidelines for Design and Construction of Hospitals – 2018 edition

  - .10 CSA Z8000, Canadian Health Care Facilities – 2018 edition

7.2 General

.1 The intent of these requirements is to ensure that the acoustic environment of the building is compatible with the general needs and comfort of the building occupants, and the surrounding residential areas.

7.3 Definitions

.1 The following are definitions of common parameters used to describe the acoustic characteristics of building environments, materials and assemblies:

- .1 Apparent Sound Transmission Class (ASTC)—Describes the apparent sound insulation of a partition separating two spaces. All sound transmission, including any flanking transmission, is ascribed to the partition. These are measured in situ and typically are within 5dB of the STC measured in a laboratory.
- .2 Sound Transmission Class (STC): a single number rating of the sound transmission loss properties of a wall, floor, window or door. A good reference for wall and floor STC ratings is the Alberta Building Code.
- .3 Ceiling Attenuation Class (CAC): this is a single number rating of the sound transmission properties of a suspended ceiling system between two rooms having a common plenum.
- .4 Noise Reduction Coefficient (NRC): a single number rating of the sound absorptive properties of a material ranging from 0.01 (negligible absorption) to approximately 1.00 (very high absorption). Manufacturers of ceiling boards, wall panels and various sound absorptive finishes will usually list the NRC rating in their product information.
- .5 Articulation Class (AC): a ceiling performance rating specifically used for open-plan offices. Articulation Class is a single number rating describing a ceiling boards’ ability to attenuate speech sounds between workstations.
- .6 Noise Criteria (NC): a somewhat dated method of rating HVAC system noise. NC is still often used as a design criterion because many manufacturers of mechanical equipment continue to use it.
- .7 Room Criterion (RC): a more recent rating for HVAC system noise. RC is the preferred rating for setting design goals and for qualifying field installations.
- .8 Reverberation Time (RT) – an indication of the persistence of sound in a room, measured in seconds. RT is dependent on the volume of the space and the sound absorptive properties of the room surface.

7.4 Acoustically Critical Spaces

.1 Consult with the Province on rooms where speech privacy, sound isolation, background noise or reverberation control is critical. In most cases, more than one of these acoustic conditions will need to be considered for interview and therapy rooms, teleconference rooms, courtrooms, auditoria and lecture halls.

.2 Secure interview rooms in court facilities require specific soundproofing requirements, as outlined in the Province document, Acoustical and Security Requirements for Secure Interview Rooms in Court Facilities. This document can be found on the Alberta Infrastructure Technical Resource Center – Guidelines and Standards Page.

.3 Consult with the Province on unusual situations, where adjacent occupancies may not be acoustically compatible and special construction is required.

.4 Consult with the Province on large open-plan office projects. There are numerous acoustical requirements associated with this type of space layout.

7.5 Review Requirements

.1 Schematic Design

.1 Identify the rooms that will require acoustic isolation and the ASTC required.

.2 Identify the ceiling and floor finish anticipated in occupied spaces and possible acoustical wall treatment.

.3 The Schematic Design Report (SDR) shall contain a section for the Acoustical discipline. Convey the design strategy for all acoustical considerations.

.4 The SDR shall include all referenced codes and standards.

.2 Design Development

.1 Provide a floor plan or schedule of the rooms and their proposed ASTC performance.

.2 Propose the construction of interior partitions and exterior walls including the STC performance (Alberta building code is a good guide of assemblies and has credible STC and fire ratings).

.3 Identify (in outline specification) product specification for ceiling and wall finishes and their acoustical performance (NRC), and identify relevant sections required for the project (e.g. sound masking, specialty assemblies such as operable walls, specialty systems such as fume hoods, etc.).

.3 75% Contract Documents

.1 All partitions on floor plan clearly identified as to assembly and height (i.e. floor to underside of structure, to dropped ceiling height, etc.).

.2 Any plenum barriers are clearly identified on plans .

.3 Assembly details provided and large scale details of junctions of interior partitions to exterior, floor, structure or dissimilar assemblies showing how the acoustical integrity will be ensured.

.4 Reflected ceiling plan clearly indicating the materials used.

.5 Floor finish plan clearly indicating the materials used.

.6 Room finish schedule indicating finishes and any special acoustical treatment such as wall panels, baffles, acoustic block, acoustic metal deck, etc.

.7 Structural drawings indicating the extent of acoustical deck – preferably with shading (to ensure that it is included by the contractor).

.8 Mechanical plumbing drawings showing the locations of waste water stacks.

.9 Mechanical HVAC duct layout with locations of terminal boxes, fans and silencers.

.10 Mechanical schedule of main equipment (fans, chillers, cooling towers, etc.) .

.11 Mechanical layout of the mechanical rooms.

.12 Mechanical standard details for vibration control and decoupling of pipes.

.13 Electrical floor plan showing the extent of sound masking (if required) with shading.

.14 Electrical schematics of larger audio-visual systems (e.g. courtroom system).

.15 Specifications: Outline of all the required sections for the project at least in draft form with representative products.

.4 100% Contract Documents

.1 All the of the 75% requirements.

.2 Clear coordination between specialties (e.g. diffusers are at the same place on the architectural and mechanical drawings, sutural extent of acoustic deck agrees with reflected celling plan).

.3 Door schedules with acoustic door seals (if necessary) identifies as well as largescale details of the installation of these.

.4 Largescale assembly details completed.

.5 Elevations clearly showing the extent of any required acoustic treatment.

.6 Mechanical HVAC drawings showing all the diffusers and their airflow as well as required internal acoustic lining to duct work.

.7 Completed mechanical layout of mechanical room
.8 Completed mechanical schedules with acoustic specifications for silencers, terminal boxes, diffusers, cooling towers, fans, generators, etc.

.9 Mechanical details for unusual or specialty acoustical treatment (e.g. pipes in floating floors, acoustical plenums, etc.).

.10 Electrical plans showing layout of required audio-visual equipment and the required power. In larger audio-visual installations, rack layouts and detailed schematics are also required.

.11 Specifications – completed. Any acoustical absorptive material (e.g. wall panel, baffle) must specify a minimum NRC, specialty barrier material (e.g. operable doors, moveable walls) specify a minimum STC, Ceiling tile must specify at least a minimum NRC and minimum CAC. Mechanical systems must specify maximum noise levels for major equipment and minimum performance of silencers, vibration isolators and such noise control elements.

7.6 Architectural

.1 General

.1 Develop the floor plan so that noise sensitive spaces are not next to high noise areas (e.g. conference rooms adjacent to mechanical rooms). Consider both the horizontal and vertical layouts.

.2 Floor Construction

.1 Evaluate the need for a floating concrete floor to isolate very loud equipment (e.g. chillers; large open-ended fan units) in mechanical areas. A floating floor is rarely necessary except when rooms with low noise criteria (e.g. auditoria and studios) are located directly below such mechanical areas. It is recommended that an acoustic consultant make a preliminary estimate of the mechanical noise and, if required, develop the details for this type of floor.

.2 Evaluate the construction of floors for impact noise. Footstep noise and other impact sounds can be a source of annoyance, particularly through lightweight and uncarpeted floors. Design for impact sound isolation is especially important where areas of high impact (e.g. corridors, exercise rooms, child play areas) are located above or directly adjacent to occupied rooms. Consult with the Province on floor details for reducing impact sound.

.3 Interior Partitions

.1 Design interior partitions for sound isolation as follows:

7.6.3 Space Description	ASTC Rating[1] (minimum)
Moderate Privacy Requirements • General Office Space, Small Meeting Rooms	35
Confidential Privacy Requirements • Interview rooms, quiet rooms, telephone rooms • Executive Offices • Large Conference Rooms, Training Rooms	40

7.6.3 Space Description	ASTC Rating[1] (minimum)
Acoustically Critical Spaces	
• Video conference rooms	45
• Demising wall between departments or GOA and non-GOA space	45
• Washrooms	50
• Mechanical room	50+
Other Acoustically Critical Spaces (see Section 7.4) • Therapy Rooms, Courtrooms • Studios, Auditoria, Lecture Halls	45+ (varies)

[1] Typically the ASTC is within 5 points of the laboratory STC rating. Selecting a partition rated at an STC 5 points higher than the minimum ASTC required will typically be enough with proper detailing.

.2 Partitions with ASTC 40 rating should generally be full height or incorporate a gypsum board plenum barrier. Where this is not possible, extend partitions slightly above suspended ceiling and maximize the separation between return air openings. Use ceiling boards with a minimum CAC rating of 40 and a minimum NRC of 0.55.

.3 Use full-height wall construction or drywall ceilings in rooms that require ASTC 45 or greater.

.4 To ensure the ASTC is met, prepare large scale details that show continuous, airtight seals at building component junctions such as:

  .1 Partition to perimeter heater cabinet,
  .2 Partition to suspended ceiling,
  .3 Partition to window mullion at exterior walls.
  .4 Partition to underside of structure for full height walls.

.5 Provide a complete, airtight sound seal around piping, duct and conduit/raceway that penetrate partitions and floors. Sealants must comply with fire separation and waterproofing requirements, as applicable.

.6 Provide a solid airtight barrier behind perimeter heater cabinets to prevent sound transfer at common partitions.

.7 Provide a double plumbing wall between washrooms and occupied spaces. Ensure structural separation is maintained between each wall and specify that piping is attached to studs on washroom side only.

.8 Prepare details that show the acoustic treatment at building component junctions, (e.g., partition on metal deck). The objective is to provide a continuous, airtight seal at all junctions.

.9 Non-Progressive Moveable Walls pose significant acoustical challenges. They only extend to the T-bar ceiling and are not necessarily aligned to the grid. The ceiling tile used in these areas shall have a minimum CAC of 35. Consider providing a plenum barrier above the T-bar to the underside of the structure. Consider using a different system for ASTC greater than 35.

.10 Do not use operable partitions between areas that require a high degree of speech privacy. Consider using a different system for ASTC greater than 40. Where operable partitions are deemed *necessary* for general noise isolation, specify a partition that has a minimum STC 50 rating. In addition to sound transmission through the partition itself, the sound leakage around the partition, through all of the connecting building components, must be minimized. Detail such partitions according to ASTM E557-12, *Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions*:

  .1 floor flatness: ±3.2 mm in 3.7 m non-accumulative.
  .2 wall plumb and true: ±3.2 mm for every 3.0 m.
  .3 head track deflection under load < 3.2mm per 3.7m.
  .4 walls must be smooth, flat, free of surface finishes and resist bowing where they intersect the partition.
  .5 fixed wall jambs and ceiling/deck support beams must be installed with airtight seals.
  .6 the floor’s load deflection (under the operable partition’s weight) must be limited to prevent bottom seal leaks.
  .7 routine maintenance must be conducted to check alignment and sound seal wearing.
  .8 Sound transmission paths that commonly occur around regular (non-operable) wall construction still need to be considered, such as, sound leaks through ceiling plenum, floor, ceiling slab, walls, etc.

.11 Use massive wall construction (e.g. concrete block, poured concrete, multi-layer drywall) to separate occupied spaces from duct shafts and mechanical rooms.
.12 Use massive wall construction (e.g. concrete block, poured concrete, brick) around areas that produce high levels of low frequency noise. Typically, this includes walls around large duct shafts, or rooms that contain large mechanical equipment, transformers or emergency generators.

.13 Be aware of potential flanking paths at locations where high STC interior partitions intersect with the exterior building envelope. Depending on the construction of the exterior building envelope, there can sometimes be large air cavities which provide a sound flanking path around the high STC partition (through the exterior building envelop). The design of this intersection must be reviewed and appropriate details provided to ensure that there is a proper intersection with no significant flanking path. Often, this requires the high STC interior partition wall to extend into the space within the exterior building envelope and for fibrous sound absorbing batts to be installed within a few stud cavity spaces of the exterior building envelope on each side of the high STC interior partition.

.4 Interior Finishes

.1 Specify ceiling boards that have a minimum CAC rating of 35 for closed office areas or other rooms that require speech privacy. Generally, these boards will be mineral-fibre type.

.2 Provide a sound absorptive ceiling finish in all general office space, corridors, cafeterias, lobbies and large public areas. Ceiling boards or other ceiling finishes should have a minimum NRC of 0.60.

.3 Provide carpet to all occupied floor areas above offices and other noise sensitive areas to minimize impact noise of footsteps.

.4 Consider additional sound absorbing wall/ceiling finishes for spaces where a high degree of noise is expected. Excess reverberation reduces speech intelligibility within the room. This is true for person-to-person communication, as well as the speech intelligibility through any sound system that may be used for announcements. Optimize speech intelligibility, create a healthy work environment and reduce noise fatigue.

.5 High ceilinged spaces (e.g. lobbies, rooms with clerestory fenestration, etc.) require more acoustic treatment. The maximum reverberation time is 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.6 In Correctional Facilities, “Open Concept Pods” and such common use spaces, the reverberation in unoccupied “Pods” must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. If the “Pod” has a volume large than 800 m^3 the reverberation in unoccupied “Pods” must not exceed RT 1.5 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz

.5 Open Plan Offices

.1 The following for open-plan conditions are required (e.g. Call Centers).

   .1 Specify ceiling boards that have a minimum AC rating of 170 where most systems furniture is less than 1.8 metres high.

.2 Specify ceiling boards that have a minimum AC rating of 200 where most systems furniture is approximately 1.8 metres. This is required where maximum privacy between workstations is desirable.
.3 Specify foil backing for all glass-fibre ceiling boards: minimum CAC 26.
.4 For a mix of open-plan areas and enclosed offices, different ceiling boards may be required for each type of space. Manufacturers offer boards with identical finishes for both applications.
.5 Consider maintenance requirements in the selection of ceiling boards and other sound absorptive finishes. Avoid cloth-faced glass fibre ceiling boards, soft spray-applied materials and other finishes that are difficult to clean.
.6 Avoid flat light lenses. Parabolic or deep “egg-crate” diffusers are preferable.
.7 Specify electronic sound masking. (See 7.8.3 **Sound Masking System)**

A. Specific Requirements for Schools

.1 Interior Finishes

.1 Classrooms:

- .1 Reverberation in unoccupied classrooms shall not exceed RT 0.6 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.
- .2 Acceptable reverberation time can typically be achieved by specifying a ceiling with a minimum NRC 0.55. Wall surfaces should generally remain hard to promote the distribution of speech throughout the room.
- .3 Consider carpet to reduce distracting noises caused by movement of chairs and desks.
- .4 Avoid classrooms with high or vaulted ceilings. Classrooms with ceilings higher than 3m, require additional acoustic treatment on the walls to achieve the RT criterion.
- .5 Avoid highly elongated classrooms.
- .6 During RT commissioning testing of unoccupied and unfurnished Modular Classrooms, add test procedure steps as outlined in: “Guide for Sufficient Diffusion for Reverberation Time Testing of Unoccupied and Unfurnished Gymnasium or Modular Classroom”. This document can be found on the Alberta Infrastructure Technical Resource Center – Guidelines and Standards Page.

.2 Gymnasium:

- .1 Provide acoustic treatment on both the ceiling and walls to control noise and reverberation.
- .2 Reverberation in a typical unoccupied gymnasium shall not exceed RT 2.0 seconds, averaged over the frequency range of 500 Hz - 2,000 Hz.
- .3 Acoustic treatment on the ceiling is most beneficial for general noise control. Select ceiling treatments with a minimum NRC 0.70.

.4 Consider the use of acoustic roof deck, impact resistant acoustic ceiling panels or suspended baffles.
.5 Acoustic spray-on material can also be used as a ceiling finish if the abuse resistant properties (adhesion, cohesion) of the product are suitable for this environment.
.6 Do not use glue-on ceiling tiles.
.7 Wall treatment should be distributed over at least two adjacent walls. Select wall treatment with a minimum NRC 0.70.
.8 Acoustic wall treatment is especially beneficial when placed on the rear wall (opposite stage) if the gymnasium is used for drama or musical events.
.9 Extend acoustic wall treatment as low as practical.
.10 Consider the use of impact resistant wall panels or acoustic concrete block.
.11 Ensure acoustic concrete block is specified to meet the minimum required NRC 0.70, to avoid problems with selective frequency absorption. (Caution – some acoustic concrete block products have been found to reduce STC performance. Be sure that a product is selected that provides minimum STC 50, similar to regular concrete block)
.12 During RT commissioning testing of unoccupied and unfurnished Gymnasium, add test procedure steps as outlined in: “Guide for Sufficient Diffusion for Reverberation Time Testing of Unoccupied and Unfurnished Gymnasium or Modular Classroom”. This document can be found on the Alberta Infrastructure Technical Resource Center – Guidelines and Standards Page.

.3 Music Rooms:

.1 Avoid locating music rooms next to gymnasia, classrooms or other noise sensitive rooms.
.2 Locate non-critical spaces such as corridors and instrument storage rooms around music rooms to provide a buffer.
.3 Consider designing music rooms with two or three exterior walls to minimize sound transmission to other instructional areas.
.4 Reverberation Time in a typical Music Room shall be between RT 0.70 - 0.80 seconds, averaged over the frequency range of 500Hz - 2,000Hz.
.5 Consider a ceiling height of 4m - 5m. Unlike classrooms, music rooms benefit from additional volume.
.6 Avoid concave ceiling profiles or domes.
.7 Consider making portions of the ceiling reflective to promote sound diffusion and ensemble between musicians.
.8 Consider pyramidal or convex ceiling diffuser panels set into the T-bar grid covering approximately 10% - 20% of the ceiling.
.9 Consider non-parallel sidewalls or provide sound diffusing elements on sidewalls such as open instrument storage.

.10 Where the instructor’s teaching position is fixed because of risers, the wall behind the instructor should have acoustic wall treatment.
.11 Acoustic wall treatment should have a minimum NRC 0.80.

.4 Practice Rooms:

.1 Consider using manufactured, modular practice rooms as an alternative to built-in place construction. Practice rooms require many specialized acoustical, mechanical and architectural construction details to function effectively.
.2 Locate practice rooms, where possible, so they do not open directly into a music room. Consider using corridors or vestibules as a buffer.
.3 Reverberation in unoccupied practice rooms shall not exceed RT 0.5 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.
.4 Provide acoustic ceiling with minimum NRC 0.80.
.5 Provide acoustic wall treatment with minimum NRC 0.80, distributed over approximately 50% of the total wall area.
.6 Provide insulated metal or solid core door with acoustic door seals.

.5 Common Areas:

.1 Reverberation in unoccupied common areas shall not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. . If the Common Area has volume larger than 800 m^3, the reverberation in unoccupied Common Areas must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz
.2 Typically, corridors and lunchrooms require a ceiling with a minimum NRC 0.55. Note that high ceilinged spaces require higher sound absorption.
.3 Typically, student gathering areas require acoustic ceiling treatment with a minimum NRC 0.70 to control the high noise levels that can occur in these spaces. Consider suspended ceilings, baffles, acoustic deck or spray-on materials.
.4 Student gathering areas with extensive skylights or high ceilings due to clerestory fenestration require additional acoustic wall treatment to compensate for the lack of ceiling absorption. Provide a corresponding area of acoustic wall panels with a minimum NRC 0.70.

.6 Computer Labs, Flex Spaces, Learning Commons, Maker Spaces:

.1 Reverberation in unoccupied computer labs and informal learning spaces shall not exceed RT 0.7 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. .If the space has a volume large than 800 m^3, the reverberation must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz
.2 Provide ceiling with minimum NRC 0.70.

.7 Drama Theatre:

.1 Large theatres used for drama presentations have numerous acoustical requirements and should be reviewed by an acoustical consultant.
.2 Reverberation time in unoccupied drama theatre shall not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.8 CTS shops – Wood working, Fabrication, Automotive, etc:

.1 Reverberation these unoccupied spaces shall not exceed RT 0.7 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.. If the space has a volume large than 800 m^3, the reverberation must not exceed RT 1 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.2 Interior Walls – Sound Isolation

.1 Use the following table for determining minimum wall requirements. Refer to the Division B – Appendix A - 9.10.3.1 to assist in selecting wall assemblies with the STC lab values which are typically 5 points higher than those within the following table:

7.6.A.2 Space Description	ASTC Rating[2] (minimum)
Offices	40
Classrooms, Computer Labs, Libraries	45
Gathering Spaces, Drama Rooms, Washrooms, Maker space, Daycare space	50
Music Rooms (Elem.), Practice Rooms, Gymnasium/Fitness Rooms, Mechanical room	55
Music Rooms (Jr./Sr.), Woodshop, Automotive, Metal workshop	60

[1] Typically the ASTC is within 5 points of the laboratory STC rating. Selecting a partition rated at an STC 5 points higher than the minimum ASTC required will typically be enough with proper detailing.

.1 Avoid continuous drywall bulkhead construction between classrooms. Provide a complete structural discontinuity of the bulkhead at all common walls between classrooms.
.2 Provide a complete air-tight seal around piping, duct and conduit/raceway penetration through walls.

.3 Use massive wall construction (e.g. concrete block) around areas that produce high levels of low frequency sound such as mechanical rooms and gymnasia.

.4 Do not locate duct shafts in classrooms.

.5 Avoid locating doors in the common wall between classrooms. Where this is necessary, consider double doors with full perimeter acoustic seals.

.6 Consider reducing the number of operable walls between classrooms and gathering spaces. The flexibility they provide in opening up the space is outweighed by the poor acoustic performance users must cope with when they are using the classrooms as individual teaching spaces. When installed, moveable partitions typically provide an ASTC 8-12 points less than the laboratory tested STC rating provided by the manufacturer. See Section 7.5.3.7

.7 Glazed partitions typically have poor acoustic performance. To achieve ASTC 45 requires expensive multi-pane glazing.

.8 Avoid sharing common walls with Gymnasia and Learning Spaces due to ball impact noise generated in the Gymnasia.

.3 Impact Isolation

Design Floor/ceiling constructions and floor coverings to minimize impact noise transmission into core learning spaces. Consider meeting Impact Isolation Class (IIC) requirements set out in ANSI 12.06, Section 5.4.3. Footstep noise and noise from moving furniture is a demonstrated source of annoyance, particularly with uncarpeted, lightweight floors separating vertically adjacent classrooms. The following strategies should be considered to reduce impact sound transmission:

`

.1 Provide resilient flooring that includes an acoustic foam backing layer or carpet.

.2 Provide a resiliently suspended gypsum board ceiling directly below the structural floor slab or deck. The cavity above this ceiling should be filled with acoustic batt insulation. An acoustic T-bar ceiling should be suspended below.

.4 Site Planning

.9 Assess the noise impact of nearby major arterial roads, highways, rail roads and airports.

.10 Orientate the school and locate instructional space to minimize the impact of traffic noise on classrooms.

.11 Design building envelopes, to reduce transportation noise in classrooms to a maximum hourly Leq of 35 dB(A) maximum L_{AS} of 50dBA, should review noise assessment and abatement techniques.

.12 Do not locate classrooms so that exterior windows are exposed to busy loading docks.

B. Specific Requirements for Healthcare Facilities

As a minimum CSA Z 8000 requirements are to be met. Consider meeting FGI recommendations.

.1 Sound Isolation:

- .1 Comply with Z-8000 12.2.7.2 “Architectural sound insulation”
- .2 For long-term care resident suites or rooms the acoustic separation of ASTC 47 is required (this aligns with NBC:AE 9.11.1)

.2 Reverberation and Noise Control

- .1 Comply with Z-8000 12.2.7.3 “Reverberation and noise control”
- .2 Provide a sound absorptive ceiling finish in nurse stations, offices, corridors, cafeterias, large public areas and especially in areas that require voice paging. Reverberation shall be less than RT 0.5 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. Typically, ceiling boards or other ceiling finishes should have a minimum NRC of 0.55.
- .3 Provide a highly sound absorptive ceiling for open offices – see requirements outlined in 7.5.5 Open Plan Offices.
- .4 Consider additional sound absorbing wall finishes for nurse stations, special care nurseries, recreation rooms and other patient activity areas, especially within continuing care facilities.
- .5 Consider the noise interference from common sources such as televisions, washers dryers, ice machines, vending machines. Provide isolated areas for activities associated with this equipment.

.3 Community Noise (Architectural)

- .1 Orientate the hospital on the site so that the noise impact of emergency/supply vehicles, helicopter activity and new traffic routes in the neighbourhood will be minimized.

- .2 Prepare a survey of existing ambient noise conditions if the Health Care Facility is to be built near an established residential community. A minimum twenty-four hour noise measurement around the site is required to determine meaningful design criteria to minimize impact on the community.
- .3 Consider the impact of nearby major arterial roads, rail lines or other transportation noise sources. Design the building envelope to attenuate exterior noise to provide a comfortable interior environment. Acceptable noise levels for various occupancies are defined by the mechanical background noise criteria (Section B of 7.7 Mechanical).

C. Specific Requirements for Court Facilities

.1 Sound Isolation

.1 Courtrooms must provide a minimum ASTC 60 to adjacent spaces
Judicial offices require a minimum ASTC 50 to adjacent spaces

.2 Reverberation and Noise Control

.1 Reverberation in unoccupied courtrooms shall be less than RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

D. Specific Requirements for Continuing Care Facilities

FGI guidelines are to be met.

7.7 Mechanical

.1 Background Noise

.1 Design mechanical systems to provide background noise levels, as follows:

7.7.1.1 Space Description	Room Criterion (RC)
Radio/Recording Studio, Auditorium	20 Maximum
Audio/Visual Room, Courtroom, Teleconference Room	25 Maximum
Large Conference Room, Observation/Therapy Room, Classroom, Lecture Hall, Secure Interview rooms	25-30
Enclosed Office, Meeting Room, Open-Plan Areas	30-35
Cafeteria, Reception/Waiting Areas	35-40
Computer Room, Kitchen	45 Maximum
Light Maintenance Shop	50 Maximum

.2 In most office settings, a neutral, unobtrusive background noise helps to increase speech privacy. Therefore, over-silencing is undesirable.

.3 Consult with the Province on spaces that require a noise level of RC 25 or less.

.2 Ducts, Terminal Devices, Heat Components and Silencers

.1 Whenever possible, design the system layout so that any medium and high velocity ducts and terminal boxes are above service space such as corridors.

.2 Do not locate exhaust fans directly above meeting rooms and conference rooms serving such spaces. Locate these fans in the ceiling plenum above a less critical area (e.g. Waiting/Reception or Corridor) and provide acoustically-lined duct on the fan intake.

.3 Avoid placing rooftop equipment over noise-sensitive areas. Provide details describing acoustic treatment, duct configuration and roof penetration seals for any rooftop installations.

.4 Design main air distribution systems to minimize the use of acoustic duct lining, whenever possible.

.5 Select acoustic silencers with the lowest static pressure loss, when a selection of two or more silencers exist.

.6 Use flexible connections between fans, plenums and all related ductwork.

.7 Provide smooth air flow conditions near fan units to minimize air turbulence. Large, rectangular ductwork with medium and high air velocities can create low frequency duct rumble. Spiral-wound, round duct is preferred for air velocities over 9 m/s or where excessive turbulence is anticipated.

.8 Use non-continuous perimeter heat cabinets that allow acoustic barriers to be installed behind the cabinet at all window mullion locations. Provide easy access at these locations.

.9 Select terminal boxes on basis of both induct and radiated noise level. Manufacturer's VAV box noise data often assumes the equipment is located above a mineral fibre suspended ceiling and that there is use of acoustically-lined duct. Ensure that the design includes the effect of these elements.

.10 Select diffusers/air outlets so that the combined noise from all diffusers in a room meet the design criterion. Noise from a single diffuser will typically need to be specified 6 - 10 dB lower than the RC(N) goal or max. NC 20 when several diffusers are in the same room.

.11 Locate balancing dampers at least 2 m away from diffusers and preferably at the tee where the supply air branch connects to the main to reduce transmitted noise through the diffuser. Avoid specifying diffusers/grilles with integral balancing dampers unless required.

.12 Provide straight ductwork for at least 3 duct diameters upstream of the diffuser inlet. Abrupt bends at the inlet can increase noise levels substantially beyond the manufacturers rating.

.13 Do not use Z shape return air transfer ducts (sound traps) for offices with enclosed plenum spaces. A simple rectangular opening in the plenum barrier, located above the office door, will generally be adequate. Where it is necessary to return air directly between critical areas (i.e. two offices) use a 1.5 m long straight rectangular duct with acoustic duct liner.

.14 Catalogue sound ratings for Terminal boxes often assume the use of additional noise attenuating elements, such as lined flex duct or acoustically lined duct, in the downstream duct work,. Eliminating these elements can have a large impact on the resultant noise levels. Ensure that these elements are provided in the design or accommodate the necessary in-duct attenuation through other means.

.15 Design ductwork to promote uniform air flow through fans and filter banks to the extent possible.

.16 Provide at least 1m (3 ft) of flexible acoustic duct at diffuser inlet for acoustically critical spaces. Flexible duct is not to be used for significant changes of duct direction. Exception - do not use flexible acoustic duct in Healthcare Facilities.

.17 Avoid ducting that starts from within one space, spans entirely across an acoustically sensitive space, and then terminates within a third space (i.e. start in a hallway, run through an acoustically sensitive space, and then terminate in an adjacent space). This will minimize the noise that transmits through the ductwork into the acoustically sensitive space

.3 Plumbing Noise

.1 Use a resilient sleeve around supply pipes with oversize clamps fastened to structure, in areas where water flow noise may be a disturbance. Sleeves comprised of 12 mm thick closed-cell elastomeric pipe insulation or proprietary resilient pipe fasteners are acceptable. Do not use hard plastic sleeves.

.2 Ensure that pipes penetrating through drywall partitions are not rigidly connected. Provide a sleeve at the wall opening, leaving an air space around the pipe, and seal with a resilient (non-hardening or low modulus) caulking.

.3 Where double plumbing walls are used (e.g. washrooms), attach supply piping only to the fixture side of the wall structure.

.4 Consider the use of pressure reducing valves (PRV's) in the system to minimize plumbing noise for noise sensitive areas. Size PRV's to limit the pressure at fixtures to 375 kPa.

.5 Install water hammer arrester adjacent to any quick-acting solenoid valves.

.4 Vibration Isolation

.1 Use the current ASHRAE Applications Handbook, as a guide for selecting vibration isolation of mechanical equipment.

.2 Provide vibration isolators for all vibrating pipes and ducts in mechanical chases and walls common to noise sensitive areas.

.3 Use flexible connectors on pumps that require vibration isolation from piping. Twin sphere neoprene rubber flex connectors are preferred.

.4 Use flexible connections between fans, plenums and all related ductwork.

.5 For rooftop equipment, vibration problems can usually be avoided if the static deflection of each spring isolator is at least 15 times the structural deflection of the roof due to the equipment loading. Typically, this requires springs with a static deflection of 50 to 100 mm.

.6 For additional structural vibration requirements, refer to section 4.0 – Structural.

.5 Community Noise

.1 Determine the community noise impact of large outdoor mechanical equipment, e.g. cooling towers, chillers, and large fan units with louvres to outside. Occupants of residences within 1000 metres of such equipment can be annoyed by mechanical noise, particularly at night. Ideally conduct a noise survey of existing conditions in the area.

.2 Silence or strategically locate outdoor mechanical equipment and intake/exhaust openings to ensure the existing noise level is not increased or at least meet local municipal noise by-law requirements. In the absence of a noise by-law, design systems to a maximum level of 50 dB(A) for neutral sounding equipment and 45 dB(A) if the equipment has a tonal noise (e.g. axial fans). These levels are determined at the residential property line nearest to the equipment.

.3 Silence the outside air intake and discharge openings, and the engine exhaust for emergency generators to meet local municipal noise by-law requirements. In the absence of a noise by-law, the resultant noise shall be no more than 10 dB(A) above the maximum hourly averaged daytime noise level measured at the nearest residential property or otherwise sensitive receptor, but should not exceed 70 dB(A).

A. Specific Requirements for Schools

.1 Background Noise

.1 See Mechanical Section Table 5.2.2.A and 5.2.2.B for Noise Level RC (N) criteria.

.1 Locate furnaces outside of classrooms or in a suitable closet designed to achieve the specified background noise criteria for a given room type. Provide silencing of supply and return air from furnaces. Utilize acoustically lined plenum ducting or transfer ducts as applicable.

.2 Locate mechanical room or main air handling equipment away from instructional spaces or other noise sensitive areas.

B. Specific Requirements for Healthcare Facilities

As a minimum FGI guidelines are to be met

.2 Background Noise

.1 Design mechanical systems to provide background noise levels, as follows:

7.7.B.1.1 Space Description	Room Criterion (RC)
Patient Room	30
Medication Room	40
Multiple occupant patient care areas	35
NICU sleep areas	25
NICU staff and family areas	30
Operating rooms	35
Corridors and public spaces	40
Private offices, exam rooms	35**
Conference rooms	30
Teleconference rooms	25
Auditoria, large lecture rooms	30

Note: **if sound masking is specified, use optimum sound masking spectrum as the target background noise

.2 HVAC systems may generate sound levels higher than this, therefore, extraordinary system design and construction might be needed to meet this requirement.

.3 The noise level requirements are considered optimum for areas where speech privacy is important such as examinations rooms and offices. Do not over silence because the presence of background noise helps to mask conversation and distracting noises from adjacent rooms.

.2 Ducts, Terminal Devices and Silencers

.1 Whenever possible, design the system layout so that medium and high velocity ducts and terminal boxes are located in non-critical areas such as corridors. Only connecting branches that serve a particular patient area should be allowed to enter the room.

.2 Avoid acoustic duct linings exposed to air movement in ducts serving operating rooms, delivery rooms, LDR rooms, nurseries, and critical care units. This requirement shall not apply to mixing boxes and acoustical silencers that have special coverings over acoustic lining.

.3 Specify terminal boxes with the manufacturer's sound attenuation package. In critical areas listed in Tables 3.2-1 to 3.2-6, Mechanical System Design Parameters, terminal boxes and attenuators must use foil-faced acoustic lining.

.4 Use reactive (packless), Mylar lined, or foam lined silencers for all clean room applications.

.3 Plumbing Noise

.1 Divide water supply lines at the riser with each room fed separately. Tee takeoffs serving back-to-back fixtures in separate washrooms are undesirable.

.2 Specify cast iron waste pipe if it is located near noise sensitive areas, such as patient rooms, offices and auditoriums. Waste connections from fixtures may be copper to the waste stack.

.4 Vibration Isolation

.1 Consider the effects of vibration on medical equipment. Refer to Structural Section 4.5 A.

.5 Noise (Mechanical)

.1 Ensure that mechanical noise level in outdoor patient lounge areas and public sidewalks does not exceed 55 dB(A).

C. Specific Requirements for Continuing Care Facilities

As a minimum FGI guidelines are to be met

.1 Background Noise

.1 See Mechanical Section Table 5.2.2.c for Noise Level RC (N) criteria.

7.8 Electrical/Communication

.1 Ballasts

.1 Electronic ballasts can cause severe interference with infrared sound systems. Consult with the Province when electronic ballasts are being considered for spaces with infrared assistive listening systems.

.2 Transformers

.1 Avoid locating transformers within ceiling spaces above noise sensitive spaces.

.2 Provide vibration isolators for transformers located near occupied spaces. Use the following table as a guide for selecting vibration isolators:

7.8.2.2	Near Non-Critical Areas		Near Critical Areas	
Size (kVA)	Isolator Type	Min. Static Deflection	Isolator Type	Min. Static Deflection
Under 50	Neoprene pad	3 mm	Neoprene isolator	10 mm
50 - 250	Neoprene isolator	10 mm	Spring isolator or hanger	19 mm
Over 250	Spring isolator or hanger	19 mm	Spring isolator or hanger	25 mm

.3 Provide flexible conduit/raceway to make the connection to the transformer.

.3 Sound Masking System

.1 Review with the Infrastructure Project Manager the requirements for a Sound Masking System and the extent of the system area coverage.

.2 Where a Sound Masking System is required, determine the type of system to be utilized; preferably an addressable decentralized system or for smaller spaces self-contained. It shall generally conform to one of the following:

  .1 Description of a Self-Contained System:

    .1 An electronic sound masking system installed above suspended acoustic tile ceiling in areas indicated, typically used in smaller office environments.
    .2 System shall be comprised of strategically located self-contained units in a master and/or master-slave arrangement which generate a unique, diffuse, and unobtrusive sound with a spectrum shape designed to mask speech and unwanted noise.

  .2 Description of an Addressable Decentralized System:

    .1 An addressable decentralized sound masking network is appropriate for projects where maximum flexibility is required in masking layout, loudspeaker location and orientation, sound level and sound contour adjustments. Each loudspeaker node (primary network device) is individually addressable via a central control to provide full adjustment of sound level and spectral output of the attached loudspeaker(s). Addressable Decentralized Sound Masking Network Standard Specification is available here: https://www.alberta.ca/assets/documents/tr/tr-27-51-21b.doc

      .1 Strategically located speaker assemblies above the suspended ceiling system in areas indicated.
      .2 Provides diffuse and unobtrusive sound with spatial and temporal uniformity, and having a spectrum shape designed to mask speech and low level, unwanted noise.

7.9 Structural

Refer to *Section 4.0 - Structural*

7.10 Exterior Acoustic Insulation

.1 Design adequate exterior acoustic insulation for all occupied buildings built within an Airport Vicinity Protection Area established by an APV regulation. Use Part 11 of the most recent Alberta Building Code to develop exterior construction details.

.2 For classrooms ensure the interior noise from any transportation noise does not exceed Leq1hr of 35 dBA at any time during operational hours.

End of Acoustical Section

8.0 Accessible Design

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8.1 Introduction

.1 Creating fair opportunities for all in the built environment is vital to the Province of Alberta. All designs of new and renovation projects are to ensure the maintenance of safety and universal usability of public buildings.

.2 To determine the level of accessibility required for buildings, refer to the current NBC: AE for the minimums and then refer to the particular requirements of the project for the appropriate improvements. For example, seniors' housing projects will require a greater accessibility integration than the minimums stated in the NBC: AE.

.3 This Section identifies items to be considered when addressing the issue of accessibility for existing buildings for persons with a range of physical, cognitive, and sensory disabilities. These items are broken down to be readily accessible for small projects or combined as required to suit large projects.

.4 Requirements are described in conformance with the "critical path method," which provides the order in which requirements should follow in sequence. If the sequence is not followed, portions of the building may be upgraded to barrier-free status but may not be accessible. For example, a washroom may have been upgraded, including door opening size and all washroom items. If there is not the required space adjacent to the door to accommodate the operation of the door by persons with disabilities, the washroom is not barrier-free accessible.

8.2 References

.1 **National Building Code - 2019 Alberta Edition [NBC (AE) 2019]**

.2 **Barrier-free Design Guide 2017**, prepared by the Barrier-free Design Advisory Committee of the Safety Codes Council and with the assistance of Alberta Municipal Affairs.

.3 ***CAN/CSA-B651-18****, Accessible design for the built environment,* Canadian Standards Association.

.4 ***Guidelines for Inclusive Design*** *– Universal Washroom Facilities for Alberta Infrastructure Facilities February 2019 – Version 1.1*

8.3 Level of Accessibility

.1 The first step in upgrading the project is to set the level of accessibility based on general objectives and the funding available. Select a level for each of the three variables below:

<u>Number of Floors</u>

- Main Floor only
- Main Floor plus other floor(s)
- All Floors

<u>Extent of Upgrade</u>

- Public Areas Only
- Throughout

<u>Standard of Upgrade:</u>

A: To meet the latest version of NBC: AE

B: To meet the latest version of NBC: AE and the latest version of CSA Standard B651

.2 Thus the minimum level of accessibility upgrade, based on this classification system, is Main Floor/Public Areas Only, as indicated in the NBC: AE and the maximum level of upgrade is All Floors/Throughout/NBC: AE and CSA-B651.

.3 Notwithstanding the preceding, the level of accessibility or portions thereof shall be determined by the Province in consultation with the project stakeholders on an individual project basis.

8.4 Design Requirements

.1 Use of Reference Documents

.1 Refer to Section 3.8 of the NBC: AE, which provides the minimum requirements for Accessible design. As all projects are unique, some may require minimal renovations to achieve accessibility requirements, while extensive renovations may be necessary in other cases. These circumstances should be identified early in the pre-design/programming phase to be appropriately defined in the scope of work.

.2 Refer to the "Barrier-Free Design Guide 2017" for graphic and written examples to illustrate code requirements and elements of accessible design.

.3 Refer to the CSA Standard B-651 for design assistance. Some of the requirements of this standard are more stringent than the requirements of NBC: AE. Wherever possible, incorporate the provisions of this standard into the project's scope of work. Where the NBC: AE and CSA Standard B-651 address the same issues, when practical, the more stringent recommendations should govern.

.2 Level of Accessibility

.1 Consult with Alberta Infrastructure to determine the level of accessibility required for the project in consultation with the project stakeholders and /or pre-design parameters.

.3 Code Analysis

.1 Perform a comprehensive building code analysis of the particular building, including building occupancy, occupant load, fire-resistance rating requirements, corridor and stair widths, exit requirements, and required number of water closets and lavatories based on occupant load. With this analysis, provide the particulars of the code pertaining to Accessible design and section 3.8 of the current NBC: AE, as these relate to the building to be renovated.
Note: the occupant load is based upon the area available for people, not the number of persons using the building.

.4 Design Development

.1 Ensure all the following issues are addressed in order unless directed otherwise by the Province or as dictated by the project circumstances.

  .1 Site Accessibility

    .1 Consider exterior paths of travel, accessible parking, curb cuts/ramps, tactile walking surface indicators (TWSIs), stairs, exterior lighting, and signage.

  .2 Building Access

    .1 Building Entrance Accessibility: consider a method of accessing the building entrance from the street, parking areas and walkways.
    .2 Building Entrance: consider thresholds, powered door operators, location of controls, guard rails and required number of barrier-free entrances.
    .3 Consider the appropriateness of location, dignity and prominence of barrier-free devices.

.3 Accessibility of Path of Travel within Main Level

- .1 Access to Facilities: consider width of corridors and exits, differing elevations of floor levels, flooring requirements, door width and door location requirements, door hardware requirements.
- .2 The project program can impact the accessibility requirements beyond code minimums. For example, seniors housing should have wider than minimum required corridors to accommodate the higher use of mobility devices by seniors.

.4 Personal Facilities

- .1 Hygienic Facilities: determine if existing washrooms can be modified or if it is more feasible to introduce new separate washrooms to meet barrier-free requirements. Then consider required sizes of facilities, building plumbing fixture requirements, washroom accessories and mounting heights.
- .2 Personal Use Facilities: consider requirements for drinking fountains and service counters.
- .3 Consider the value-added function of a universal washroom that can serve as a baby change room and a gender-inclusive washroom.

.5 Accessibility to Other Levels

- .1 Stairwells: consider stair width, landing sizes, stair surfaces and nosings, handrails and guardrails, and lighting.
- .2 Areas of refuge: consider where and to what extent the areas of refuge are required. Identify an area of refuge by directional and identification signage. Often these are provided within stairwells, but not always. Coordinate an emergency evacuation plan with the local fire chief or Authority Having Jurisdiction.
- .3 Chair Lifts: determine if chair lifts can be used to provide access to other levels while ensuring the required exit width is not minimized when the chair lift is in operation.
- .4 Platform Lifts: consider the travel distance limits and location. Generally, platform lifts are only acceptable for use within a one-floor level.
- .5 Enclosed Platform Lifts: consider use restrictions, travel distance limits, requirements for shaft and machine room, and location.
- .6 Elevators: consider size (to allow for a stretcher), travel distances and speed, suitability of various types, location, accessibility and design of controls.

.6 Accessibility of Path of Travel Within Other Levels

- .1 Consider the requirements of Section 8.4.4.4 for each accessible floor to provide at least the same level of accessibility provided on the first level.

.7 Emergency Services: Emergency Lighting, Exit Signs, Fire Alarm, Area of Refuge

.8 Signage within accessible Path of Travel

  .1 Minimum NBC: AE requirements. Consider providing accessibility signage, including tactile, Braille, contrasting, and audible signs.

.9 Millwork

  .1 Cabinetry should function for all users. Consider the knee space at sink locations, the grasp of pulls, and the height of shelving, counters, appliances, outlets, and coat hooks

.10 Building Security

  .1 User Actuated Systems: consider mounting heights of actuation devices and requirements for audible and visual signals to indicate when a door lock is released.
  .2 Remote Actuated Systems: consider mounting heights of call devices and requirements for audible and visual signals to indicate when a door lock is released.

End of Accessible Design Section

9.0 Municipal and Environmental Engineering

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9.1 References

.1 *Geometric Design Guide for Canadian Roads; Manual of Uniform Traffic Control Devices for Canada*; by the Transportation Association of Canada.

.2 Alberta Environment and Parks:

   .1 Standards and Guidelines for Municipal Waterworks; Wastewater and Storm Drainage Systems.
   .2 Stormwater Management Guidelines for the Province of Alberta
   .3 Alberta Environmental Site Assessment Standards
   .4 Alberta Soil and Groundwater Remediation Guidelines
   .5 Alberta Exposure Control Guide
   .6 Alberta Risk Management Plan Guide
   .7 Contaminated Sites Policy Framework

.3 *Alberta Fire Code*, by the Alberta Fire Prevention Council.

.4 Local municipal standards, guidelines and bylaws

.5 Flood Risk management Guidelines, by Alberta Infrastructure (June 2017)

.6 Barrier-Free Design Guide, by Alberta Safety Council.

.7 Alberta Energy Regulator (AER) Guidelines

.8 Alberta Utilities Commission

.9 *Guideline for Wildfire Protection of Institutional Buildings in Forested Regions, by Alberta Infrastructure* (Appendix C)

9.2 Site Selection

.1 Site investigations on proposed sites are including the following:

   .1 Land Status / Zoning requirements
   .2 Services to the Site and Capacities
   .3 Traffic Impact Assessment
   .4 Geotechnical Studies
   .5 Phase I Environmental Site Assessment
   .6 Topographic Survey
   .7 Floodplain Studies
   .8 Archeological Sensitivity Assessment

    - .9 Digital Photographs
    - .10 Additional Information: Identify and significant features on and off site within 2 km that could affect the proposed development.

- .2 Design elevation is above the design flood elevation for the proposed development as per the attached Table A in Appendix B (Exert from “Flood Risk Management Guidelines for Location of New Facilities Funded by Alberta Infrastructure”).

- .3 Sites and development are located at an acceptable distance from high voltage power lines, sour gas wells or pipelines, and “High Pressure and Large Diameter/High Pressure Hydrocarbon Pipelines”.

- .4 Sites and development are located at a minimum of 450 meters away from an operating landfill and a hazardous waste management facility, and a minimum of 300 meters away from a non-operating landfill.

9.3 Site Plan

.1 Survey Plan

- .1 From the information on the site survey plan, items to be shown on the site plan in the contract documents, but not limited to:

    - .1 Legal description and address of the property, property lines and their legal dimensions, and legal pins,
    - .2 Adjacent trees, sidewalks, roadways, utilities, easements and how the new development will tie to them,
    - .3 Work of the contract and any work by other forces and contracts,
    - .4 Main floor elevations, and geodetic datum and the equated , and
    - .5 All utilities including power and telephone

.2 Access

- .1 Locations of site access in consideration to driveways and intersections adjacent to and opposite the site.

.3 Signage

- .1 Locations of all signs with due consideration to vehicular and pedestrian sightlines.

.4 Roads, Walks and Parking

- .1 Driveways and off-site walks meet local municipal standards.

.2 Barrier free access walkways, entrances and parking spaces, along with appropriate surfaces do not restrict the mobility of physically challenged people.

.3 Parking lots and parking appurtenances are to facilitate snow removal and to prevent damage by snow moving equipment.

.4 A concrete pad is need for garbage bin and recycling bin, and locate bins for ease of access and safety.

.5 In order to address potential safety concern, efforts should be made to separate main vehicular traffic from main pedestrian traffic.

.6 Alberta Infrastructure (AI) might accept that asphalt mix design contains a maximum of 10% Reclaimed Asphalt Pavement (RAP) by weight. AI does not accept any asphalt mix design containing Recycled Asphalt Shingles (RAS).

.5 Grading

.1 Maintain minimum grade of 1% and maximum grade of 4% for concrete and asphalt surfaces in parking lots, and grade of 2% for graveled surfaces.

.2 Provide roadways with a 2% crown or crossfall and sidewalks with 2% crossfall.

.3 A positive sloped surface is to effectively drain water away from the foundation walls. Minimum grade requirements are:

  .1 10% for 2 meters (Foundation with basement) – Minimum 20 cm drop for final grade on soft landscaping;
  .2 5% for the first 2 meters (Slab-on-grade) – Minimum 10 cm drop for final grade on soft landscaping;
  .3 1% for concrete, asphalt or other impervious surface treatment

.4 Drainage Swales: minimum swale slope requirements:

  .1 1.5% for a grass drainage swale

  .2 1% for a concrete drainage swale

.5 Address potential ponding and icing problems associated with downspouts. Provide splash pads under downspouts. The recommended minimum standard size for concrete splash pad is 30 cm X 107 cm.

.6 Design considerations for surface ponding:

  .1 The maximum depth should not exceed 0.5 m. For school sites, the maximum depth should not exceed 0.3 m.
  .2 Trap low should be a minimum of 0.3 m lower than foundation elevations.

.3 Ponding areas should be located a minimum of 4 m away from building foundations.

9.4 Site Servicing

.1 General Requirements for Utilities

.1 Dimensions of utilities to property lines or use a grid co-ordinate system.

.2 Where utilities are to be connected to municipal systems, confirm with municipalities and utility companies the adequacies of their systems to service the site.

.3 Where utilities are to be connected to existing on-site systems, advise the user department and confirm that the existing on-site systems can accommodate the additional loads.

.4 Early in design confirm with municipalities about any restrictions on stormwater discharge to their stormwater drainage system.

.5 Contact the local municipality or conduct water pressure test to confirm the municipal water pressure and fire flow capacity. Determine whether on-site boosting is required or not for a fire sprinkler system.

.6 On large sites, locate utilities in utility corridors keeping in mind any potential for future development.

.2 Stormwater Management System

.1 Stormwater Management System is designed in accordance with *Standards and Guidelines for Municipal Waterworks, Wastewater* and *Storm Drainage Systems and Local Municipal Standards,* whichever set higher standards.

.2 Consult with Technical Service regarding the design standards if local municipal standards are not available.

.3 Running the storm mains under buildings is not permitted.

.4 To prevent any potential freezing issues, roof drain should be connected to a manhole not a catch basin manhole.

.3 Sanitary Sewer Services

.1 Sanitary Sewer system is designed in accordance with *Standards and Guidelines for Municipal Waterworks, Wastewater* and *Storm Drainage Systems and Local Municipal Standards,* whichever set higher standards.

.2 Consult with Technical Service regarding the design standards if local municipal standards are not available.

.4 Water Services

.1 Water systems comply with *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* and *Local Municipal Standards,* whichever set higher standards.

.2 Consult with Technical Service regarding the design standards if local municipal standards are not available.

.3 Fire department connection and fire hydrants are in accordance with the *Alberta Building Code* and the *Alberta Fire Code*.

.5 Cross Connections

.1 Comply with *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* and *Local Municipal Standards,* whichever set higher standards.

9.5 Design Document Requirements:

.1 Schematic Design Report

.1 The Schematic Design Report shall provide a section for the civil discipline with a narrative outlining the following information:

a. Referenced codes and standards
b. Site investigation report
c. Site services: water, sanitary sewer, and storm sewer
d. Stormwater management and drainage design
e. Site grading
f. Site accesses

.2 Design Development Report

.1 The Design Development Report shall contain a section for civil discipline. The deliverables include a report and drawings. The report shall contain the information listed above and provide details on the site services (existing locations and capacities, the sizes of new utilities, and connections).

.2 The drawings are expected to have:

a. Existing site grades
b. Site Servicing Plan
c. Stormwater management plan
d. Site grading plan

.3 Contract Drawings

.1 Civil drawings shall include the following:

a. Existing site grades
b. Site Servicing Plan
c. Stormwater management plan
d. Site grading plan
e. Pavement Plan
f. Fire emergence movement plan
g. Detail drawings
h. Erosion and sediment control plan

.4 Contract Specifications

.1 Prepare contract document specifications using the Alberta Infrastructure Technical Specifications as a basis to include, but not to be limited to the following:

a. Local municipality’s design standards
b. Standards and Guidelines for Municipal waterworks, wastewater and storm drainage systems (Alberta Environmental Guidelines)
c. Barrier-Free Design Guidelines
d. All applicable requirements in Alberta Infrastructure Technical Specifications:
    a. Earthwork Testing
    b. Fill material
    c. Site Clearing
    d. Earthwork General Requirements
    e. Site Excavating, Filling and Grading
    f. Trench Excavating and Backfilling
    g. Granular Base
    h. Asphalt Concrete Pavement
    i. Concrete Paving, Curbs and Gutters
    j. Pavement Markings
    k. Chain Link Fencing
    l. Piped Utility Systems General Requirements
    m. Water System
    n. Sewer System

9.6 Environmental Site Assessment

.1 Investigation, Remediation, and Risk Management

.1 Conduct all Environmental Site Assessments (ESAs) according to the *Contaminated Sites Policy Framework*.

.2 Phase I and II ESAs are to be conducted according to the *Alberta Environmental Site Assessment Standard*.

.3 If the Phase I ESA identifies any potential environmental concerns and it recommends further investigation, proceed with a Phase II ESA.

.4 Remediation is to be conducted according to the applicable Tier of the *Alberta Soil and Groundwater Remediation Guidelines*.

.5 In circumstances where remediation is not viable under present circumstances, and the site can be managed through administrative controls or exposure barriers, the exposure control approach can be used to manage the contaminated site.

.6 Risk Management Plan are to be developed in accordance with the *Alberta Exposure Control Guide*, and the *Alberta Risk Management Plan Guide*.

.2 Tanks for Petroleum Products

.1 Comply with the requirements of the *Alberta Fire Code*, Alberta Fire Prevention Council.

.2 Consider using day tanks for emergency generators.

End of Municipal and Environmental Engineering Section

10.0 Landscape Development

Section Contents

10.1 References..1
10.2 Landscape Development Guidelines..1
10.3 Physical Security Guidelines & Standards for Government of Alberta Facilities...3
10.4 Irrigation Systems..4
10.5 Environmental and Conservation Considerations..4

10.1 References

.1 Alberta Yards and Gardens: What to Grow; Backyard Pest Management; by Alberta Agriculture and Rural Development

.2 Pruning in Alberta; by Alberta Agriculture and Rural Development.

.3 Canadian Standards For Nursery Stock: latest edition by CNLA.

.4 Manual for Maintenance of Grounds, by Alberta Infrastructure.

.5 Local municipality landscape requirements

10.2 Landscape Development Guidelines

.1 Provide a landscape design that is aesthetically pleasing, enjoyable, practical, functional and which utilizes sustainable design practices.

.2 Landscape design shall emphasize ease of maintenance. Design with consideration as to whether the on-site owner has the means and resources to provide adequate and proper plant care.

.3 Landscape development shall include municipal boulevards and easement areas.

.4 Provide a minimum 2% gradient away from buildings and other hard surfaces.

.5 Identify and preserve healthy suitable trees and other plants on site, where feasible. If required, properly prune existing trees that remain using the services of a certified arborist unless directed otherwise by the Province, Adequately protect existing trees that remain including exposed roots to prevent damage during construction. Maintain existing grades to the drip lines of existing trees. Existing trees and other plants that are deemed dead, unhealthy, or unsuitable and which are considered hazardous to property and public safety shall be removed from site complete with stump removal.

.6 Use a variety of hardy trees, shrubs and other plants in a cohesive landscape design layout that are tolerant of drought and other local growing conditions. Locate and space selected plant species to avoid overcrowding and to ensure plants reach their natural form at maturity. Avoid monoculture plantings when designing the plant layout. Emphasize species diversity in the landscape design.

.7 Provide a landscape design that respects and accommodates site security, visibility, safety and accessibility through good design practices selection and layout of plant material. Consider future plant maturity size of selected plants to avoid interfering with security camera sightlines or building lighting. Select plant species that do not hinder the natural surveillance from windows.

.8 Plant species that are susceptible to pest infestations considered difficult to control or eliminate must not be installed. Avoid planting trees and shrubs that possess significant nuisance problems on site. Avoid specifying plants that are prone to branch and other structural failures.

.9 Ensure good planting design features are incorporated into tree and shrub planting requirements to maintain a sustainable landscape. Provide tree planting pits with ample growing space and sufficient suitable growing media. For trees located in hard surfaces with metal grated coverings ensure that appropriate structured soil mixes, extended planting depths and proper drainage are provided to ensure healthy growing conditions. Construct continuous shrub beds with minimum 450 mm depth of acceptable soil mix.

.10 Select appropriate plant species along parking structures, retaining walls and other wall structures that reduce opportunities for graffiti vandalism.

.11 Plant Selection: all plants shall be healthy and of specimen quality and of the following minimum size:

- Deciduous trees: minimum 60 mm caliper,
- Coniferous trees: minimum 200 cm in height,
- Deciduous shrubs: supplied in minimum #2 container,
- Coniferous shrubs: supplied in minimum #5 container,
- Perennials / Ornamental grass: supplied in minimum #1 container.

.12 Keep all plantings clear of utilities, services, walkways and buildings.

.13 Provide minimum 1.5 m setback from edge of parking curb to edge of planting beds and tree locations to allow for vehicle overhang and snow accumulation.

.14 Provide adequate setback to ensure plants are not located where light standards, site signage, hydrants, utilities and other site features will be obscured from view.

.15 Spread shredded coniferous bark mulch on all plant beds and tree pits to a minimum depth of 100 mm. Under building overhangs and along building foundations install appropriate and more durable mulch covering.

.16 Spread nursery grown sod in vicinity of buildings, parking areas, and other areas of high pedestrian traffic where turf seed establishment would be difficult and the seed bed would be subject to continuous damage. Where turf seed is required, use an appropriate custom seed mixture to suit local soil conditions, water availability and maintenance requirements for site.

.17 Maintenance Requirements: all landscape works shall be maintained and warranted for a minimum period of two (2) years from date of acceptance of work. However, landscape projects that involve minor landscape upgrades and repairs shall be maintained and warranted for a period of one year from date of acceptance of the work. Consult with the Province to determine an appropriate maintenance/warranty period.

10.3 Physical Security Guidelines & Standards for Government of Alberta Facilities

.1 Review Section 12.0 *Crime Prevention through Environmental Design* (CPTED).

.2 Coordinate future mature size of trees and shrubs to not interfere with security camera sightlines and building lighting.

.3 Shrub and tree varieties should be chosen so that, at maturity, they do not hinder natural surveillance from windows.

.4 Landscaping at walls (parking structures, retaining walls, etc.) can be used to reduce graffiti.

.5 Do not install trees along building structure or which will obscure view of building entrances and exits.

.6 Shrub plantings shall be designed to form thickets and barriers to discourage access and hiding spots.

10.4 Irrigation Systems

.1 Where geotechnical information indicates the presence of highly plastic clay, avoid locating irrigation outlets close to buildings. Changes in moisture content in this type of clay results in volume changes and movement that can damage floors and foundations.

.2 Choose efficient irrigation systems. Minimize losses due to evaporation, wind and overspray onto non-landscaped areas. Incorporate rain sensors or soil moisture sensors.

.3 Contain the irrigation system and equipment, as reasonably feasible, within the property lines of the project.

.4 Provide pipe sleeves for irrigation systems under roadways and sidewalks. Design irrigation systems to allow for emptying water from distribution pipes.

.5 In municipalities where sewage treatment charges are based on water consumption, provide separate meter if cost efficient.

.6 Consult with user department before incorporating irrigation systems into the design for landscape areas.

10.5 Environmental and Conservation Considerations

.1 Design to minimize maintenance requirements. Consider cost efficiencies for irrigation, mowing, trimming, pruning, fertilizing, pesticide application and general clean up requirements.

.2 Use mulches to reduce maintenance and watering requirements for trees and shrubs.

.3 Choose native or adapted plants that are hardy, have low water demand, are reasonably free of pest infestations, and are compatible with the soil on site. Use low maintenance ground cover, including low maintenance grass mixes.

.4 Group plants that have similar moisture requirements.

.5 Promote infiltration of surface water, through the use of bioswales, rain gardens, and minimal slopes on land that is not adjacent to buildings.

.6 Design teams are encouraged to utilize alternative sources of water to potable water, such as harvested rainwater and treated wastewater.

.7 Use plant material to reduce heating and cooling requirements for buildings.

.8 Use plant material to control snow drifting.

End of Landscape Development Section

11. Environmental Hazards

Section Contents

11.1 Site Considerations – Hazardous Materials..........2
11.2 Building Considerations- Hazardous Materials 2
11.3 Other Building Considerations..........3
11.4 Radon Mitigation Rough-in Requirements 4
11.5 Review Submission Requirements 6

11.1 Site Considerations – Hazardous Materials

.1 Prior to acquiring a property, complete a Phase I Environmental Site Assessment (ESA), to determine if there have been any site historic activities that led to soil and/or groundwater contamination. Contact Site Services Section, Technical Services and Procurement, Government of Alberta, Ministry of Infrastructure. If the Phase I ESA indicates that there is a potential for contamination on site, Phase II and Phase III may be necessary.

.2 If the property contains buildings, refer to paragraph *11.2 - Building Considerations – Hazardous Materials* below:

11.2 Building Considerations- Hazardous Materials

.1 For existing owned and supported facilities, a comprehensive hazardous building materials assessment is to occur whenever a building will be maintained, renovated, sold or demolished, and when suspect hazardous building materials are present in poor condition (i.e. severely damaged, deteriorated or delaminated). The area of the assessment shall reflect the project scope. The assessment is to be conducted by a qualified and competent Environmental Consultant experienced in the hazardous materials identified in this section including a competent understanding of the sampling methodologies and procedures involved in inspecting and testing hazardous materials.

.2 A hazardous building materials assessment includes identification, quantification, recommendations, and order of magnitude removal budget cost estimate for the following:

    .1 Asbestos-containing building materials (refer to *Bulletin No. 20B*, Alberta Infrastructure, Technical Resource Centre, Technical Bulletins https://www.alberta.ca/guidelines-and-standards-owned-and-supported.aspx that describes typical building materials that contain asbestos). The assessment is to include the verification and location of any vermiculite insulation in wall cavities or attic spaces and built-up roofing materials;
    .2 Lead based paints/glazes, sheeting and miscellaneous lead-containing materials;
    .3 Mercury-containing equipment and fixtures (fluorescent/mercury light bulbs);
    .4 Ozone-depleting substances in equipment (CFC’s);
    .5 Polychlorinated Biphenyl (PCB) containing equipment;
    .6 Urea formaldehyde foam insulation (UFFI);
    .7 Radioactive building components;
    .8 Visible mould on building materials;

.9 Biohazards; and
.10 Building use chemicals.

.3 All identified hazardous building materials that will be, or has the potential to be, disturbed during maintenance or in a renovation/demolition must be completely removed. Hazardous materials removal/disposal is usually the first component of work in a renovation/demolition.

.4 When there is a concern whether an existing building material is asbestos, lead or mould-containing, it is to be considered potentially harmful, unless laboratory testing confirms the material to be non-asbestos, non-lead or non-mould.

.5 For all hazardous materials information refer to *Division 02 – Existing Conditions*, Technical Specifications, Infrastructure Technical Resources website, https://www.alberta.ca/facility-construction-sub-group.aspx. Removal of all identified hazardous building materials are to be conducted in accordance with Infrastructure's Technical Specification documents. The specification documents submissions shall be project specific and shall reflect the actual removal of materials identified in the Consultants hazardous building materials assessment report.

11.3 Other Building Considerations

.1 When selecting materials for a new building or an existing building renovation, no asbestos-containing materials are to be chosen or installed. Also, consider mould resistant products as they are becoming readily available.

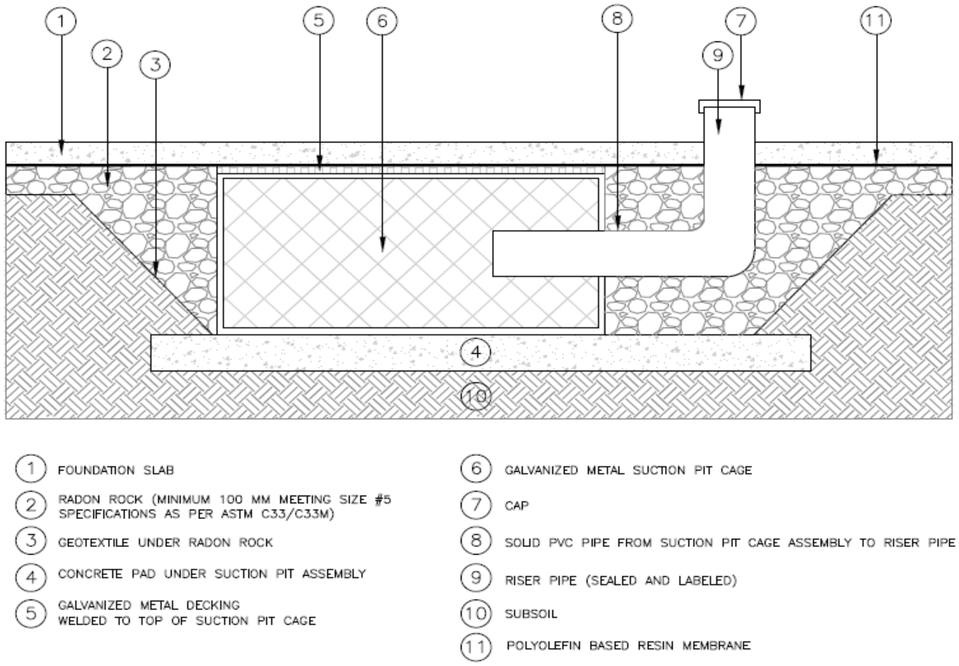
.2 When selecting materials for a new building or an existing building renovation, avoid the potential for harmful chemical off-gassing wherever possible. Examples include materials or products such as carpeting, glues, paints, particleboard furniture, etc., that may contain formaldehyde or volatile organic compounds. These materials or products should be off-gassed off site, prior to installing them in the building. As well it is recommended that the Air Handling Units flush the area with 100% outdoor air post installation to reduce possible emissions from newly installed products.

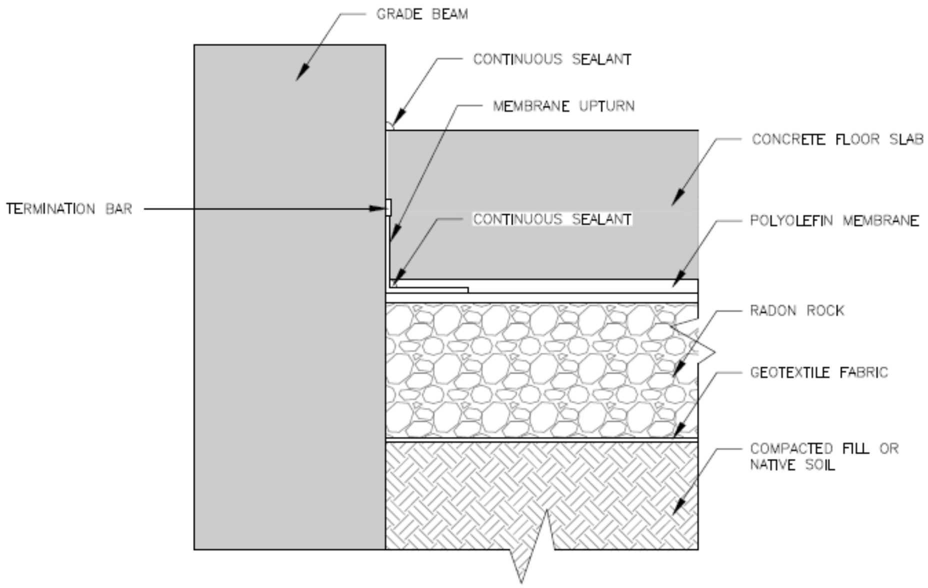
.3 Construction dust control and clean-up procedures to be implemented to assure building occupants are not overexposed to dust. Controls includes dust barriers, directional airflow fans, negative air pressure within the construction area, and sealing/isolation of mechanical ventilation ductwork. Clean-up procedures include HEPA vacuuming, wet wiping techniques and ductwork cleaning. It is also recommended to conduct a review of the Air Handling Units and associated ductwork.

11.4 Radon Mitigation Rough-in Requirements

.1 Infrastructure uses and defines radon mitigation “rough-in” system as a depressurization system which extends the radon pipe (riser) from the sub slab radon venting system to above the foundation slab and capped. Refer to the diagram below. Consult with the Alberta Infrastructure Building Environment Unit Section, Technical Services and Procurement Branch if in doubt.

TYPICAL RADON SUCTION PIT AND MEMBRANE ASSEMBLY DIAGRAMS





.2 A radon mitigation “rough-in” system is required to be installed in all new Government of Alberta Owned or Supported permanent buildings occupied by persons for more than 4 hours per day and it is a requirement of the Province as of February 2016. A radon mitigation “rough-in” system may not apply to buildings or portion of buildings that are intended to be occupied for less than four hours per day. The 2019 National Building Code - Alberta Edition references this installation.

.3 The decision of the Consultant’s building design team not to install a radon rough-in mitigation system during construction would have significant costs incurred by the Consultant, once the building is occupied and operating under normal conditions, should radon air testing confirm the need for installation of radon mitigation. Note that cost of materials and equipment are not consideration factors when choosing to use alterative products from those materials outlined in Infrastructure’s Technical Specification for radon mitigation rough-in systems.

.4 The Consultant’s building design team to retain a Certified Radon Mitigation Professional in good standing from the Canadian National Radon Proficiency Program (C-NRPP) to implement Infrastructure’s Technical Specification for radon mitigation rough-in system 31 21 13B or 31 21 13.03B for a possible future Active Sub-Slab Depressurization (ASD). The specifications are found here: https://www.alberta.ca/site-and-infrastructure-sub-group.aspx. The specifications and associated drawings are to be signed off by the C-NRPP Certified Mitigation Professional.

.5 Infrastructure’s Technical Specifications for radon mitigation rough-in system are considered standard and are not to be altered. The C-NRPP Mitigation Professional is to design the number of extraction points and locations and to inspect, photograph, test and sign off on the completed radon mitigation rough-in system to ensure compliance with Infrastructure’s Technical Specification.

.6 After the radon “rough-in” system and building completion and normal operating conditions, the Building Owner is to retain a C-NRPP Certified Radon Measurement Professional in good standing to conduct air testing to determine the radon levels in the building.

.7 Radon air testing is to follow the Health Canada document, *Guide for Radon Measurements in Public Buildings*, https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/guide-radon-measurements-public-buildings-schools-hospitals-care-facilities-detention-centres.html.

.8 If radon air testing after building construction and occupation determines that average radon concentration exceeds the Health Canada guideline limit, radon mitigation is required. The “rough-in” system piping is to be extended from above the slab to mechanically vent the radon gas to the outside of the building so that radon levels are controlled within the building using Active Sub-Slab Depressurization (ASD). Typically a suction fan is installed along the pipe for mechanical venting. The outside exhaust outlets are to be located to not allow the radon gas to re-enter the building.

.9 Active Sub-Slab Depressurization (ASD) is the most common and usually the most effective radon reduction method according to Health Canada and the United States Environmental Protection Agency. The radon mitigation “rough-in” allows for this method to be used.

.10 Refer to *Section 5.0 – Mechanical, paragraph 5.13.5* for additional information on radon gas exhaust.

11.5 Review Submission Requirements

.1 The schematic design submission includes information related to hazardous building materials including survey report as well as preliminary detailed drawings of proposed radon mitigation “rough-in” system.

.2 The design development submission includes project specific specification for Hazmat removal as well as detailed specification for proposed radon mitigation “rough-in” system. Name and credentials of the C-NRPP Professional to be submitted for review.

.3 The 60% contract documents includes consultant’s responses addressing all of the Hazmat and Radon related feedback at SD and DD stages.

.4 The pre-tender submission includes all comments previously identified must be reflected and included at this stage with no further comments.

.5 The radon mitigation rough-in system specification and the drawings are to be submitted in the stand alone Environmental Hazards section, not in the Mechanical, Architectural, Structural or other like sections.

.6 Letter of assurance for the rough-in system technical specification and schematic documents shall be provided by the Certified Radon Mitigation Professional who is registered in good standing with the Canadian – National Radon Proficiency Program (C-NRPP).

End of Environmental Hazards Section

12.0 Crime Prevention Through Environmental Design (CPTED)

Crime Prevention through Environmental Design (CPTED) is a proactive design approach based on the belief that the proper design and effective use of the built environment can reduce the fear and incidence of crime. The core set of principles is natural access control (entry and exit points), natural surveillance (increased visibility), and territorial reinforcement (clear boundaries, a sense of ownership). When applied early, those concepts can be integrated into any facility providing layers of protection for clients, visitors, and staff.

Government of Alberta facilities are to be designed with these principles in mind. For more information on how to apply these principles, refer to the following document:

“Physical Security Design Requirements for Government of Alberta Facilities”:

https://www.alberta.ca/assets/documents/tr/tr-securityguidelinesstandards.pdf

13.0 Digital Project Delivery

.1 General Digital Project Delivery Requirements

The intent of the Digital Project Delivery Requirements are to ensure that the Province receives contracted deliverables from Architects, Engineers and Contractors in a clear, concise and structured manner.

All projects where required by the contract shall comply with the Province's Digital Project Delivery requirements.

Alberta Infrastructure's Digital Project Delivery requirements are modular requirements and shall be included based on project size, complexity and type. Refer to the project contract for applicable Digital Project Delivery requirements.

.1 Specific Requirements for Government Facilities

All projects shall comply with Alberta Infrastructure's Asset Information Requirements.

Refer to Project contract for applicable Building Information Modelling Requirements.

.2 Specific Requirements for Health Care Facilities

Coordinate with Alberta Health Services and the Project Manager to determine the desired Digital Project Delivery requirements.

.3 Specific Requirements for Education Facilities

Coordinate with the School Board and Project Manager to determine the desired Digital Project Delivery requirements.

Descriptions of the various documents and there intended usage are listed below. The documents themselves are attached to the Technical Design Requirements as appendices.

.2 Document Descriptions

Digital Project Delivery – Asset Information Management – Consultant Requirements

- These documents are for use by all design consultants contracted to the Province, on all forms of project delivery, excluding Design-Build, on all capital projects.

Digital Project Delivery-Asset Information Management-Contractor Requirements

- These documents are for use by all contractors contracted to the Province, on all forms of project delivery, excluding Design-Build, on all capital projects.

Digital Project Delivery-Asset Information Management-Design Builder Requirements

- These documents are for use by consultants and contractors contracted to the Province, on projects using the Design-Build form of project delivery, on all capital projects.

Digital Project Delivery-Building Information Modelling-Consultant Requirements

- These documents are for use by all design consultants contracted to the Province, on all forms of project delivery, excluding Design-Build, on all capital projects.

Digital Project Delivery-Building Information Modelling-Design-Builder Requirements

- These documents are for use by consultants and contractors contracted to the Province, on projects using the Design-Build form of project delivery, on all capital projects.

Digital Project Delivery-COBie Requirements

- These documents are for use by consultants and contractors contracted to the Province, on projects using all forms of project delivery, on all capital projects.

.3 References

NBIMS-US V3 COBie Standard

End of Digital Project Delivery Section

Appendix A – Acronyms

AC/h (also ACH)	air changes per hour
ADA	Americans with Disabilities Act
APEGA	Association of Professional Engineers, Geologists and Geophysicists of Alberta
ARCA	Alberta Roofing Contractors Association
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ASTM	American Society for Testing and Materials
CAC	ceiling attenuation class
CCU	central control unit
CFC	chlorinated fluorocarbon
CISC	Canadian Institute of Steel Construction
CMHC	Canada Mortgage and Housing Corporation
CSA	Canadian Standards Association
CSC	Construction Specifications Canada
CSTC	ceiling sound transmission class
DDC	distributed digital control
EMCS	energy management control system
HID	high intensity discharge
HVAC	heating, ventilating & air conditioning
IEEE	Illumination, Electrical and Electronic Engineers
IES	see IESNA
IESNA	Illuminating Engineering Society of North America
ITR	Infrastructure Technical Resources website
LAN	local area network
LED	light emitting diode
MBM	modified bituminous membrane
MCC	motor control centre
NC	noise criteria
NRC	noise reduction coefficient (also National Research Council)

PERSIST	Pressure Equalized Rain Screen Insulated Structure Technique
RC	room criterion (acoustics)
RCU	remote control unit
RSI	thermal resistance in SI units
SI	Système Internationale (metric system)
SMACNA	Sheet Metal & Air Conditioning Contractors National Association
STC	sound transmission class
TCU	terminal control unit
TDR	Technical Design Requirements for Alberta Infrastructure Facilities
ULC	Underwriters Laboratories of Canada
UPS	uninterruptible power supply
UV	ultraviolet
VAV	variable air volume

End of Appendix A

Appendix B – Flood Risk Management Guidelines

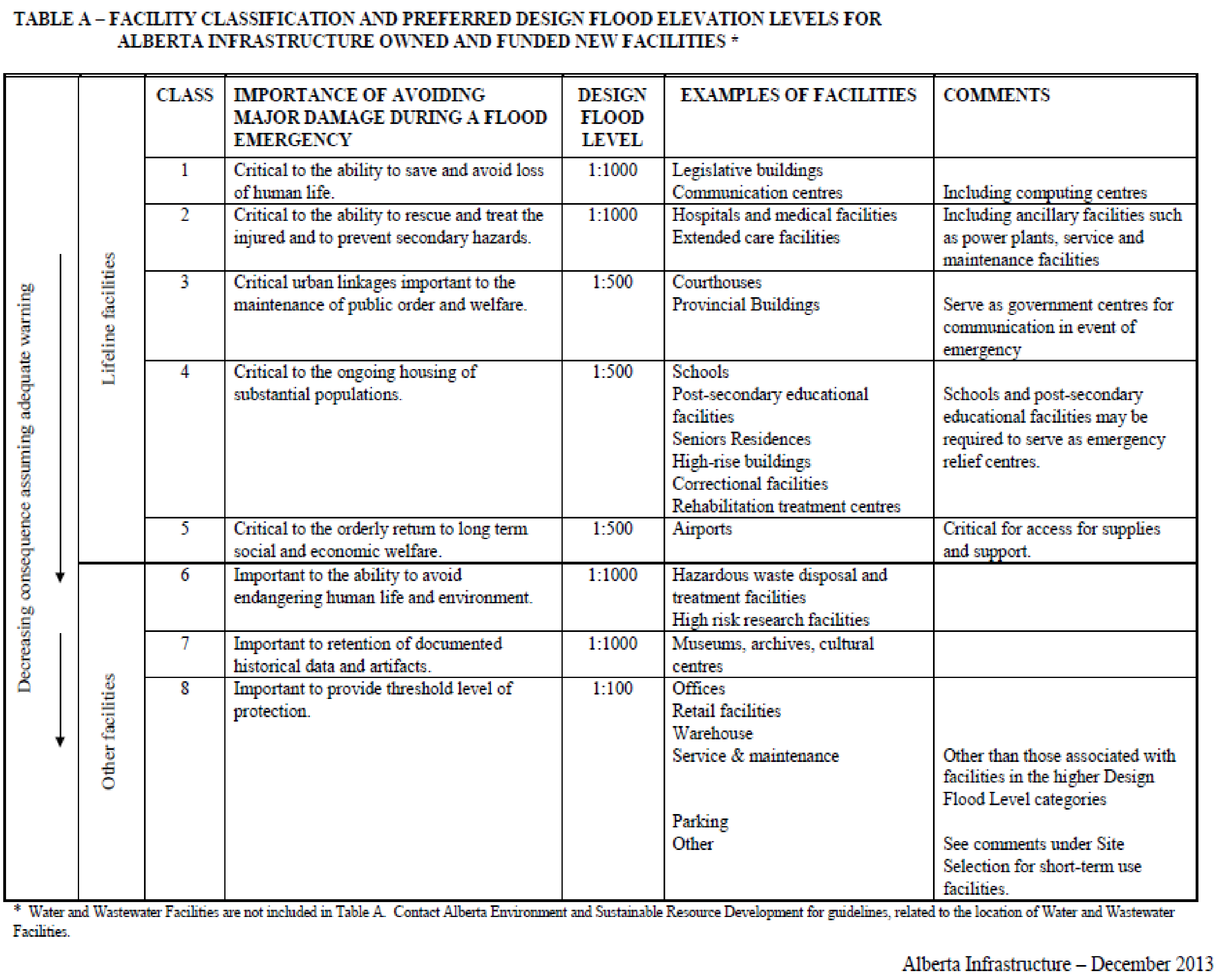


TABLE A – FACILITY CLASSIFICATION AND PREFERRED DESIGN FLOOD ELEVATION LEVELS FOR ALBERTA INFRASTRUCTURE OWNED AND FUNDED NEW FACILITIES *

		CLASS	IMPORTANCE OF AVOIDING MAJOR DAMAGE DURING A FLOOD EMERGENCY	DESIGN FLOOD LEVEL	EXAMPLES OF FACILITIES	COMMENTS
Decreasing consequence assuming adequate warning	Lifeline facilities	1	Critical to the ability to save and avoid loss of human life.	1:1000	Legislative buildings Communication centres	Including computing centres
		2	Critical to the ability to rescue and treat the injured and to prevent secondary hazards.	1:1000	Hospitals and medical facilities Extended care facilities	Including ancillary facilities such as power plants, service and maintenance facilities
		3	Critical urban linkages important to the maintenance of public order and welfare.	1:500	Courthouses Provincial Buildings	Serve as government centres for communication in event of emergency
		4	Critical to the ongoing housing of substantial populations.	1:500	Schools Post-secondary educational facilities Seniors Residences High-rise buildings Correctional facilities Rehabilitation treatment centres	Schools and post-secondary educational facilities may be required to serve as emergency relief centres.
		5	Critical to the orderly return to long term social and economic welfare.	1:500	Airports	Critical for access for supplies and support.
	Other facilities	6	Important to the ability to avoid endangering human life and environment.	1:1000	Hazardous waste disposal and treatment facilities High risk research facilities	
		7	Important to retention of documented historical data and artifacts.	1:1000	Museums, archives, cultural centres	
		8	Important to provide threshold level of protection.	1:100	Offices Retail facilities Warehouse Service & maintenance Parking Other	Other than those associated with facilities in the higher Design Flood Level categories See comments under Site Selection for short-term use facilities.

* Water and Wastewater Facilities are not included in Table A. Contact Alberta Environment and Sustainable Resource Development for guidelines, related to the location of Water and Wastewater Facilities.

Alberta Infrastructure – December 2013

Appendix C – Guideline for Wildfire Protection of Institutional Buildings in Forested Regions of Alberta

March 2013

*“**Introduction***

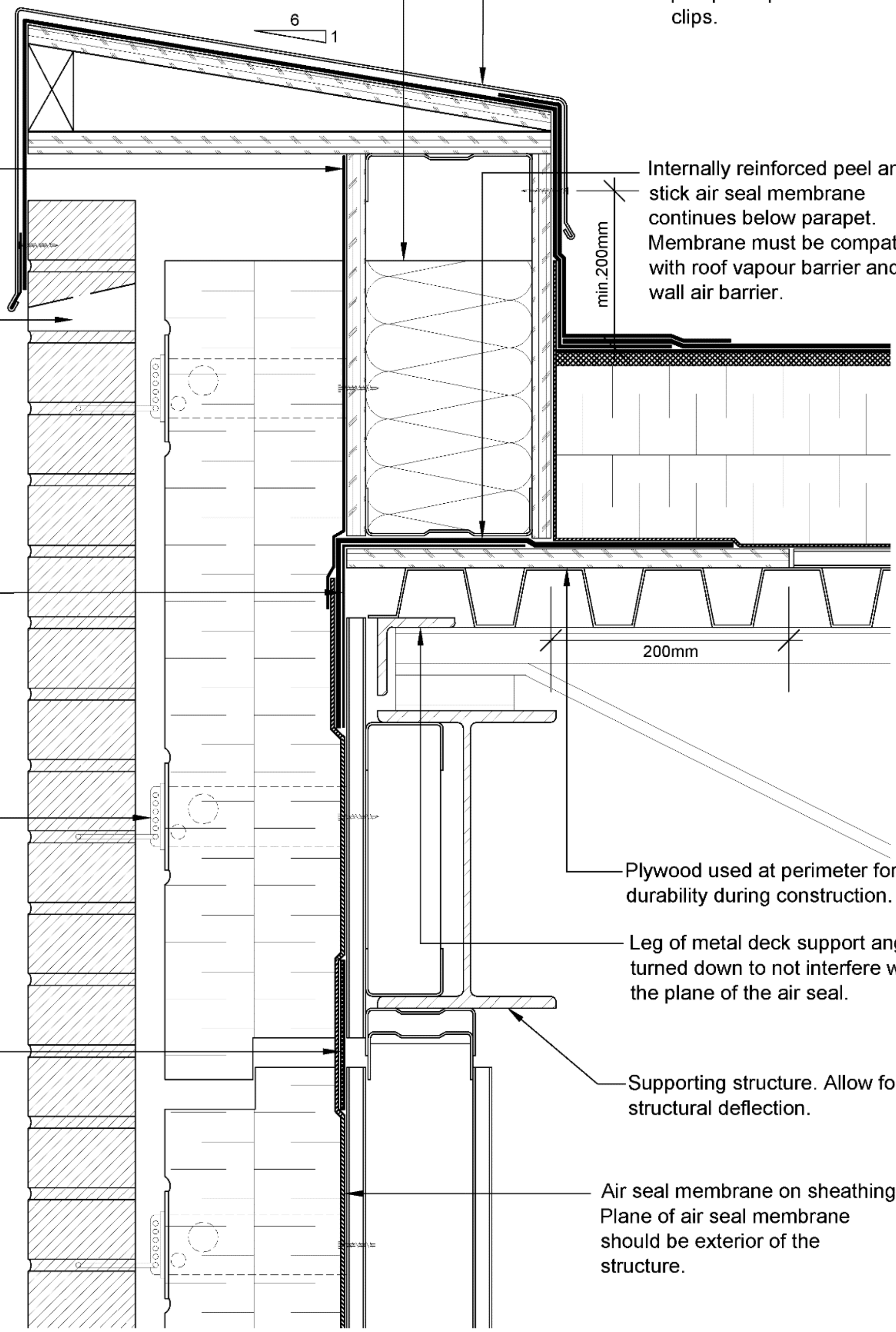
Wildfires are named as such for a reason; they are often uncontrollable. What is controllable is the preparation and planning taken to protect buildings from damage and loss when a wildfire occurs.”

This document is housed on the Infrastructure Technical Resources website:
https://www.alberta.ca/infrastructure-technical-resources.aspx

The document direct link:

https://www.alberta.ca/assets/documents/tr/tr-wildfireprotection.pdf

Appendix D – Standard Envelope Details



Insulation installed on exterior side of the membrane, extending higher than roof (min. 200mm).

Maximum 1500mm length parapet cap with exterior clips.

Building paper installed to shed water while allowing the parapet construction to breathe.

Internally reinforced peel and stick air seal membrane continues below parapet. Membrane must be compatible with roof vapour barrier and wall air barrier.

Weep holes for ventilation.

Continuous 150mm x 150mm galvanized sheet metal backing for membrane at wall/roof junction.

Masonry tie with insulation support.

Plywood used at perimeter for durability during construction.

Leg of metal deck support angle turned down to not interfere with the plane of the air seal.

Strip of reinforcing membrane installed over expansion joints. Use of elastic slip sheet or bent sheet metal backing are alternative options.

Supporting structure. Allow for structural deflection.

Air seal membrane on sheathing. Plane of air seal membrane should be exterior of the structure.

Alberta Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
PARAPET OPTION 1

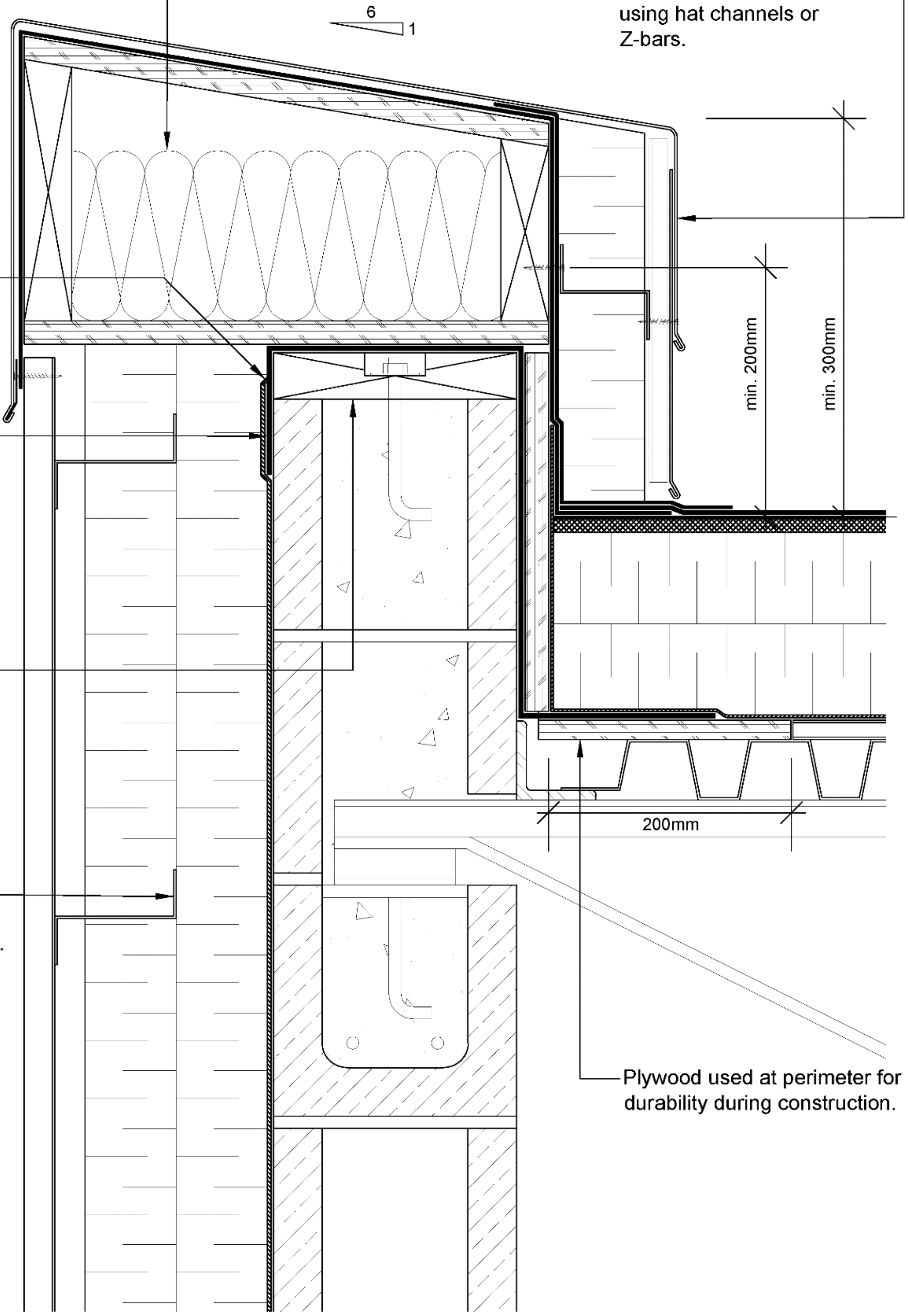
TECHNICAL SERVICES BRANCH

DETAIL NUMBER
1

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5

Insulation must be installed exterior of the roof membrane.

Removable flashing and insulation for future re-roofing. Attached using hat channels or Z-bars.



Mastic.

Internally reinforced peel and stick air seal membrane forms connection between wall air barrier membrane and roof base sheet stripping.

Wood used as a leveling surface for proper adhesion of the membrane.

Double Z-bar system for fastening wall cladding. Or, alternatively, use thermal clips.

Plywood used at perimeter for durability during construction.

Alberta
Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
PARAPET OPTION 2

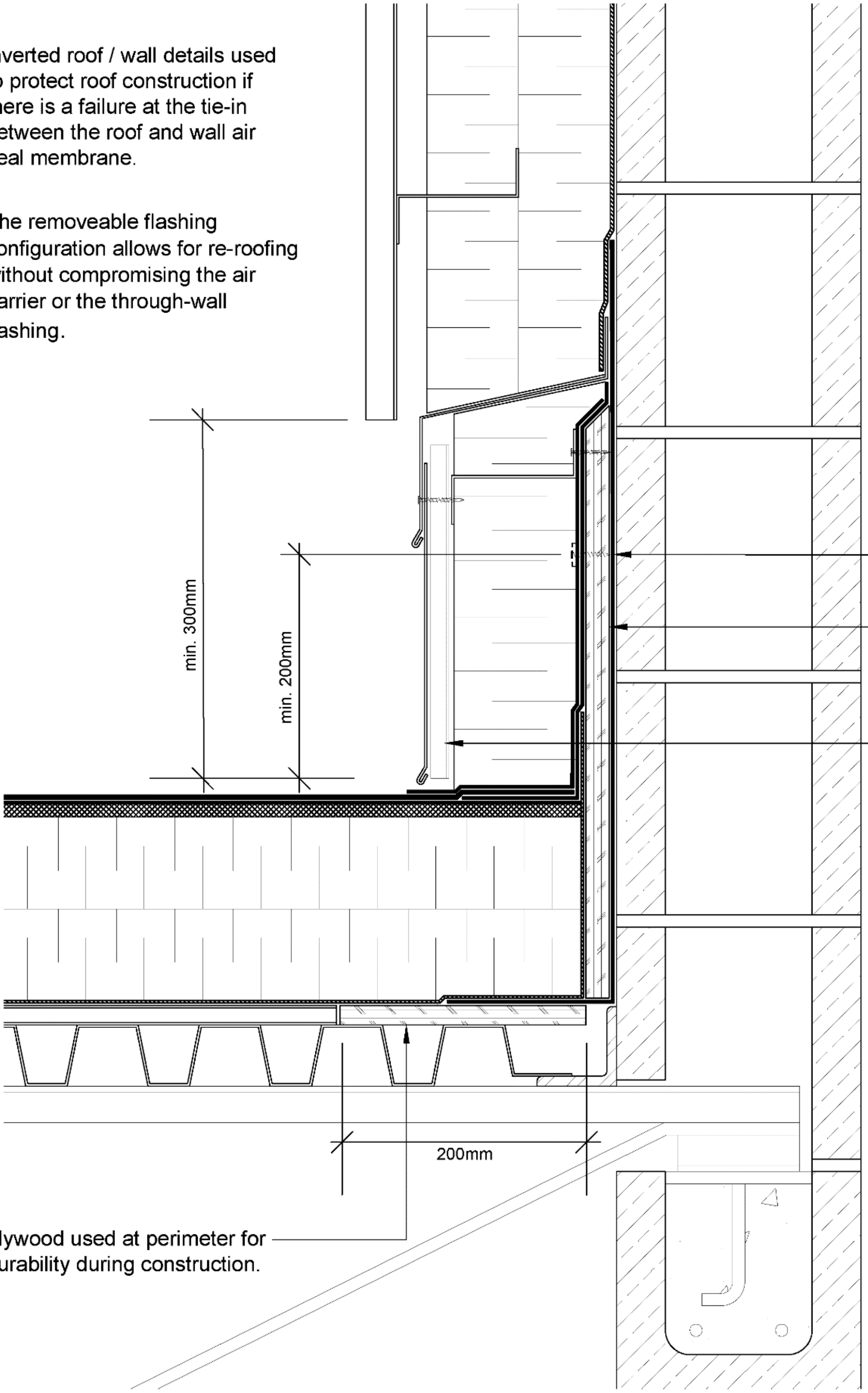
TECHNICAL SERVICES BRANCH

DETAIL NUMBER
2

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5

Inverted roof / wall details used to protect roof construction if there is a failure at the tie-in between the roof and wall air seal membrane.

The removeable flashing configuration allows for re-roofing without compromising the air barrier or the through-wall flashing.



Termination bar outside with mastic

Plywood installed to provide a good adhesion substrate for the roofing membrane.

Insulation attached using a hat channel or z-bar fastened a minimum of 200mm above the roof membrane.

Plywood used at perimeter for durability during construction.

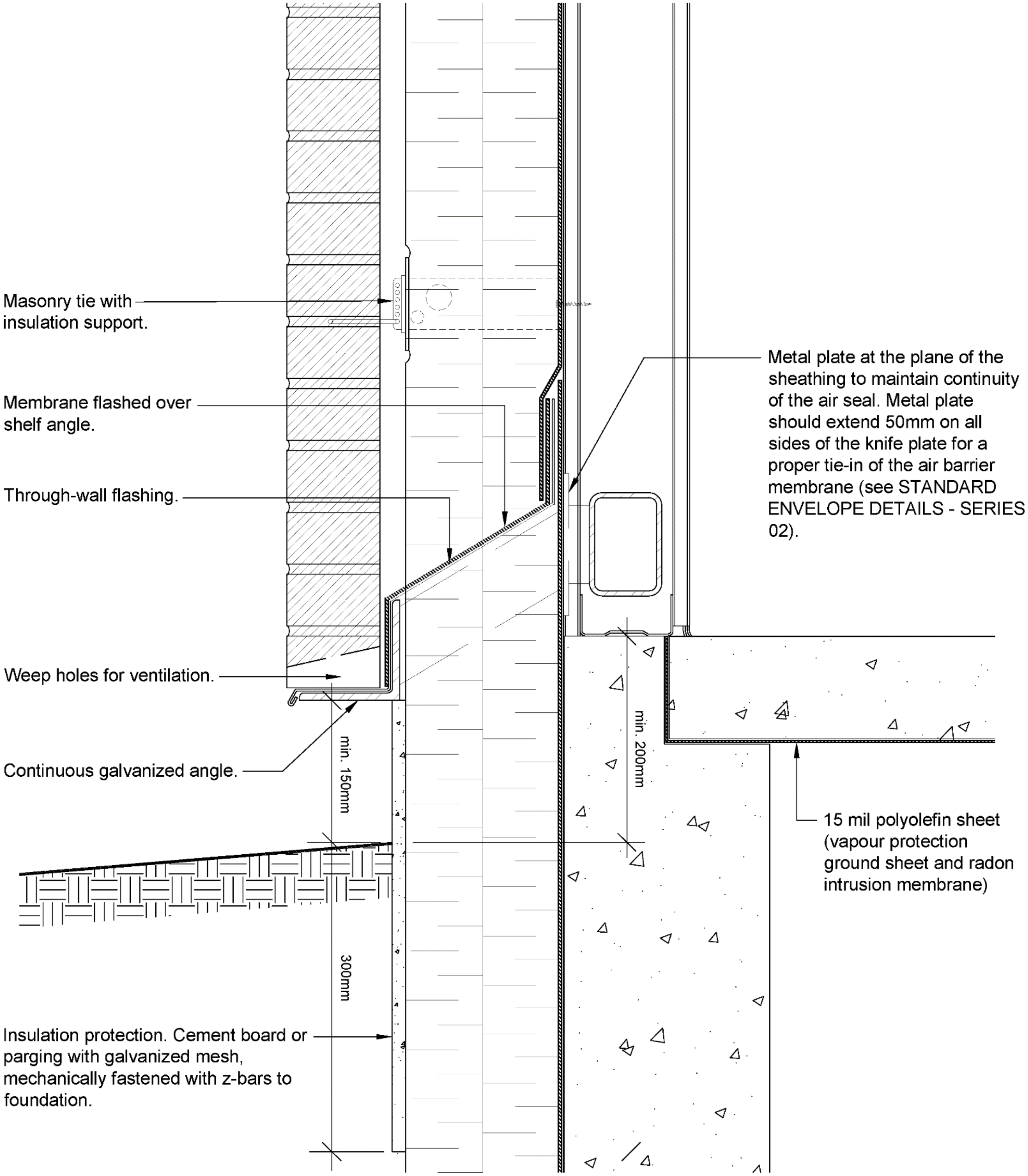
Alberta
Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
INVERTED ROOF TO WALL

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
3

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5



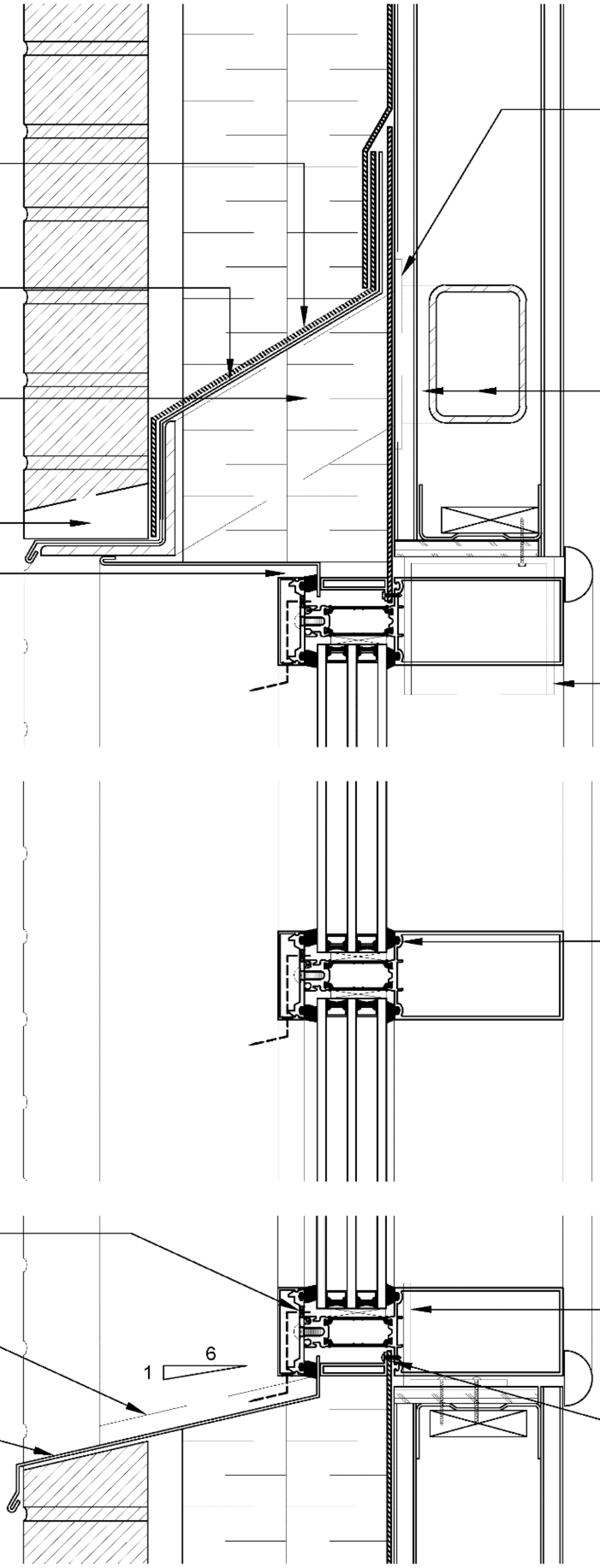
Alberta Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
FOUNDATION

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
4

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5



Membrane flashed over shelf angle.

Through-wall flashing.

Knife plate installed to support steel angle while allowing air barrier membrane tie-in to the window frame.

Weep holes for ventilation.

Do not caulk flashing to cap.

Metal plate at the plane of the sheathing to maintain continuity of the air seal. Metal plate should extend 50 mm on all sides of the knife plate for a proper tie-in of the air barrier membrane (see STANDARD ENVELOPE DETAILS - SERIES 02).

Supporting structural member and knife plate.

Slip anchor at the head to allow for deflection.

Mechanically keyed-in gaskets installed both interior and exterior.

Drainage slots.

Line of sill flashing up-turn at ends (25mm) (behind jamb flashing)

Sloped sill flashing.

Fixed anchor at sill inside the vertical window member.

Membrane sealed directly to the tube face and mechanically fastened with an anti-rotation channel.

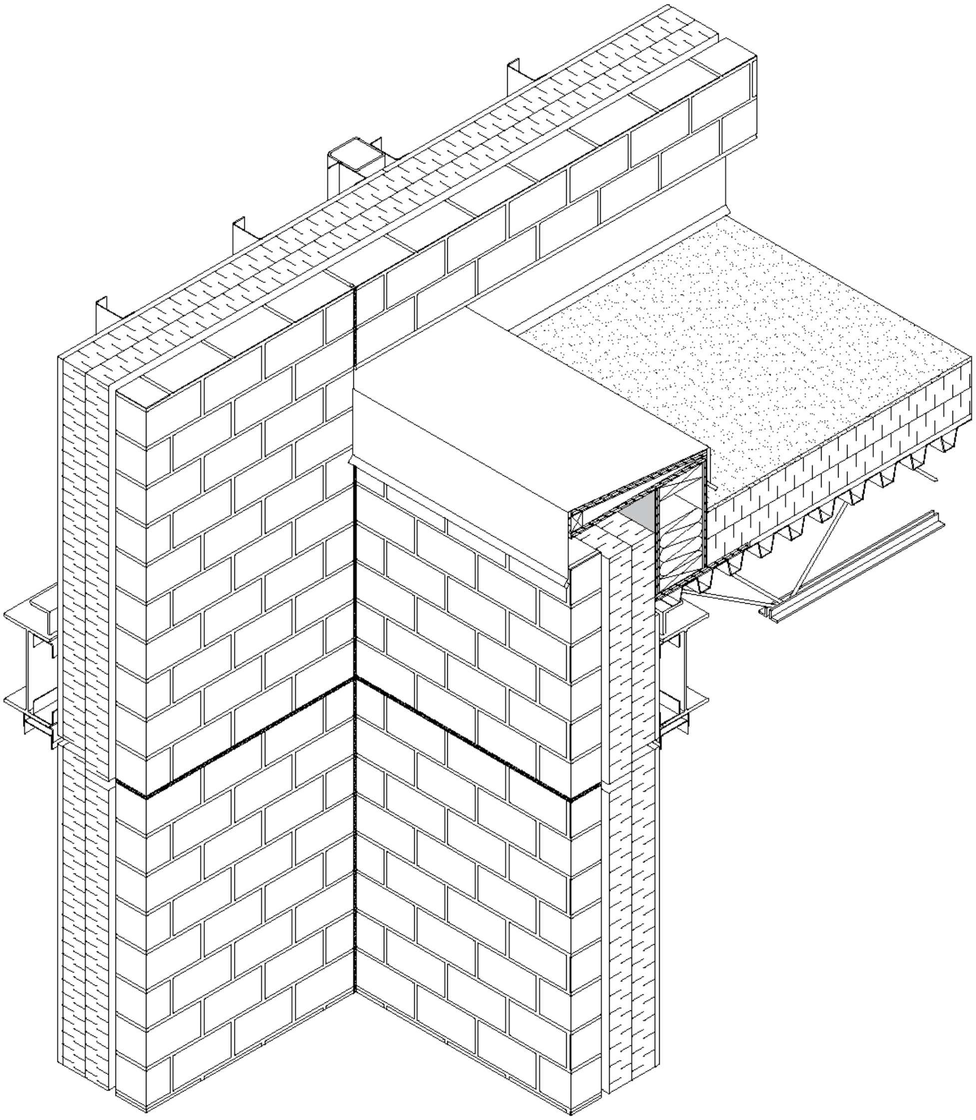
Alberta
Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
PUNCHED WINDOW

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
5

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5



Alberta Infrastructure

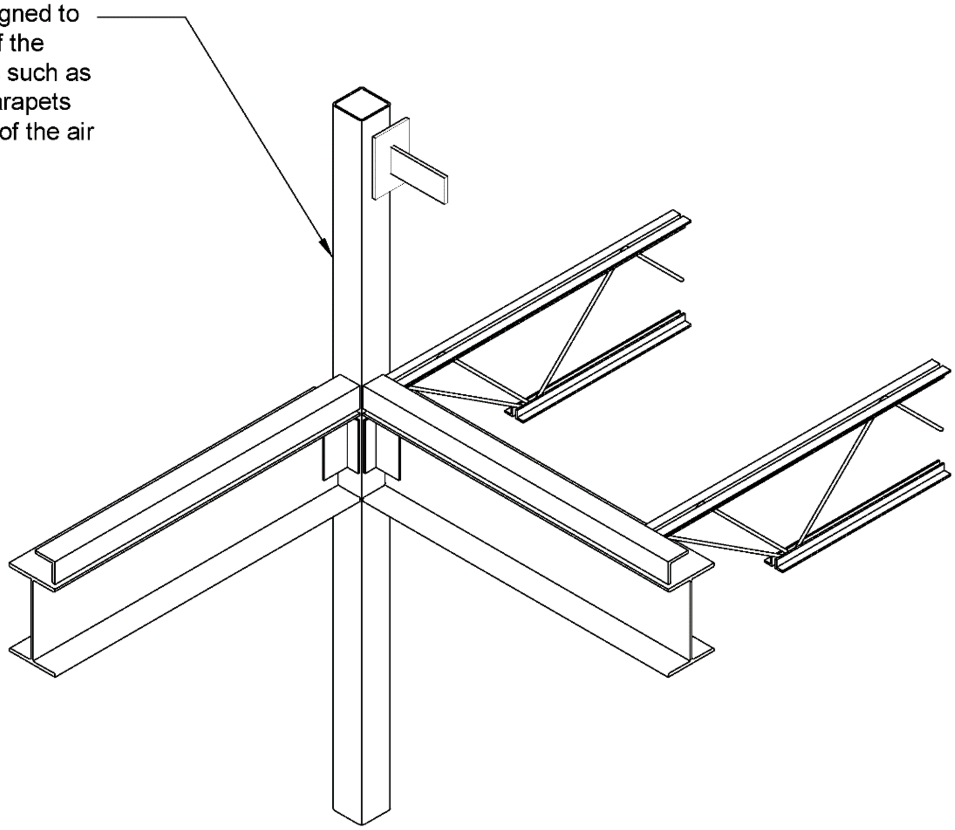
SERIES 02
STANDARD ENVELOPE ASSEMBLY
ISOMETRIC DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-05	V. SOLBAK	NTS

DETAIL NUMBER
0

The structure should be designed to minimize changes in plane of the exterior sheathing. Features such as overhangs, canopies, and parapets should be added on exterior of the air barrier.



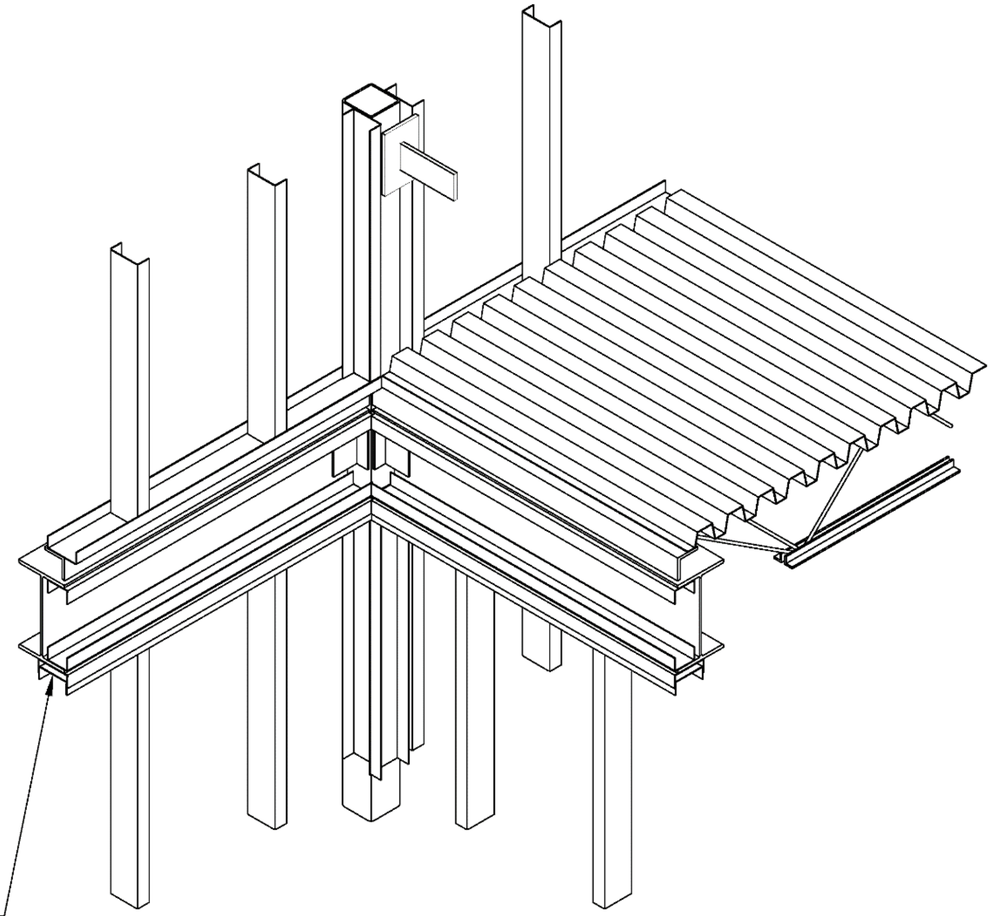
Alberta Infrastructure

SERIES 02
STANDARD ENVELOPE ASSEMBLY
ISOMETRIC DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-05	V. SOLBAK	NTS

DETAIL NUMBER
1



Allow for structural deflection.

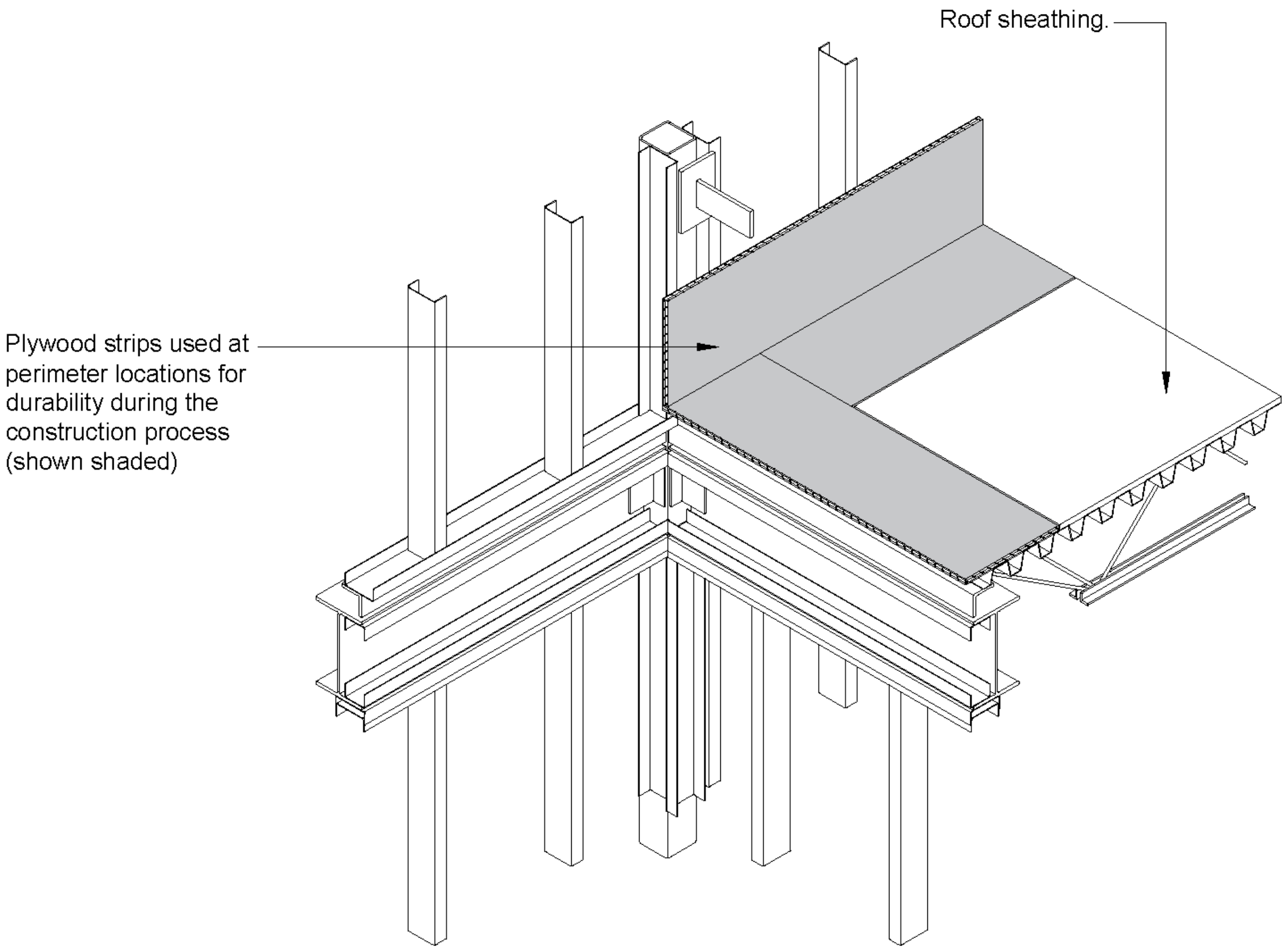
Alberta Infrastructure

SERIES 02
STANDARD ENVELOPE ASSEMBLY
ISOMETRIC DETAILS

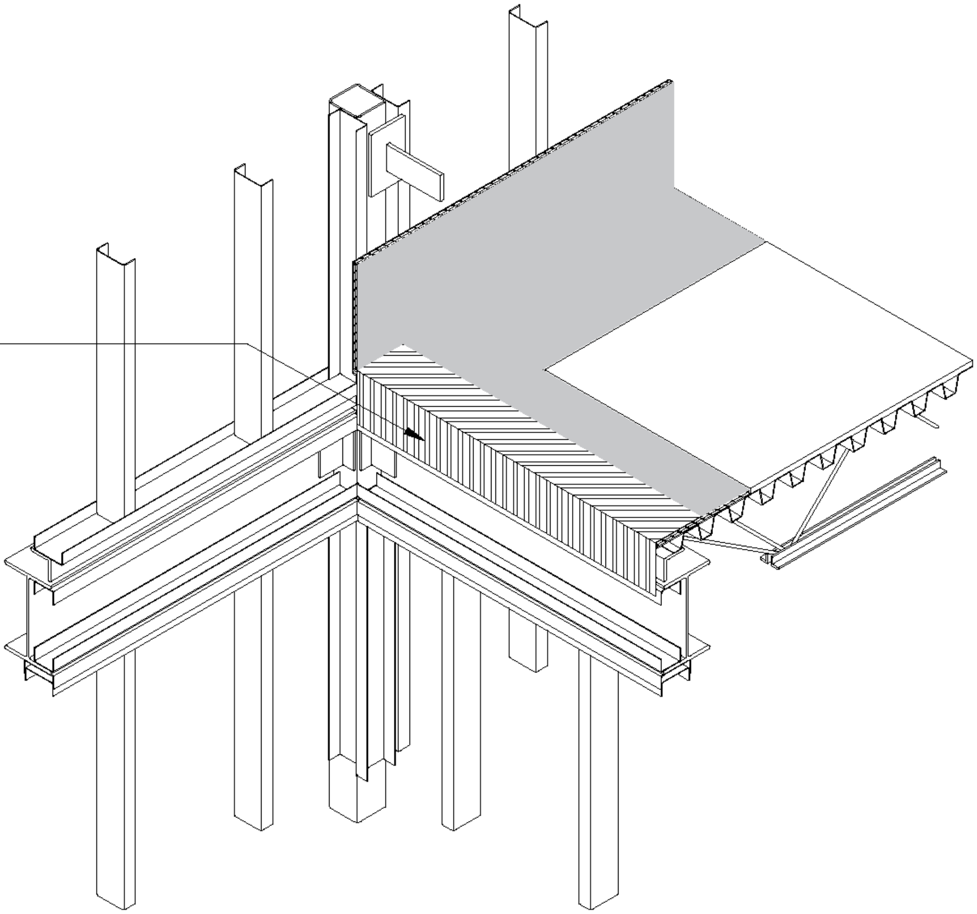
TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-05	V. SOLBAK	NTS

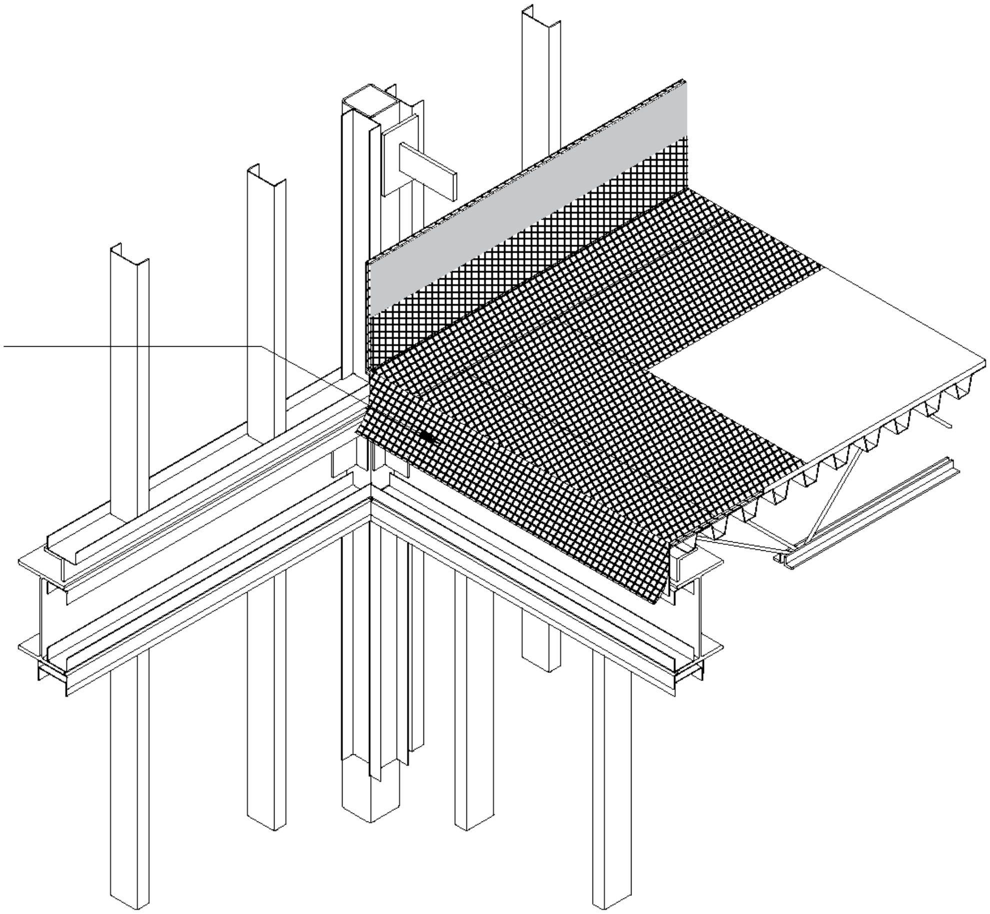
DETAIL NUMBER
2



Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 3
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS

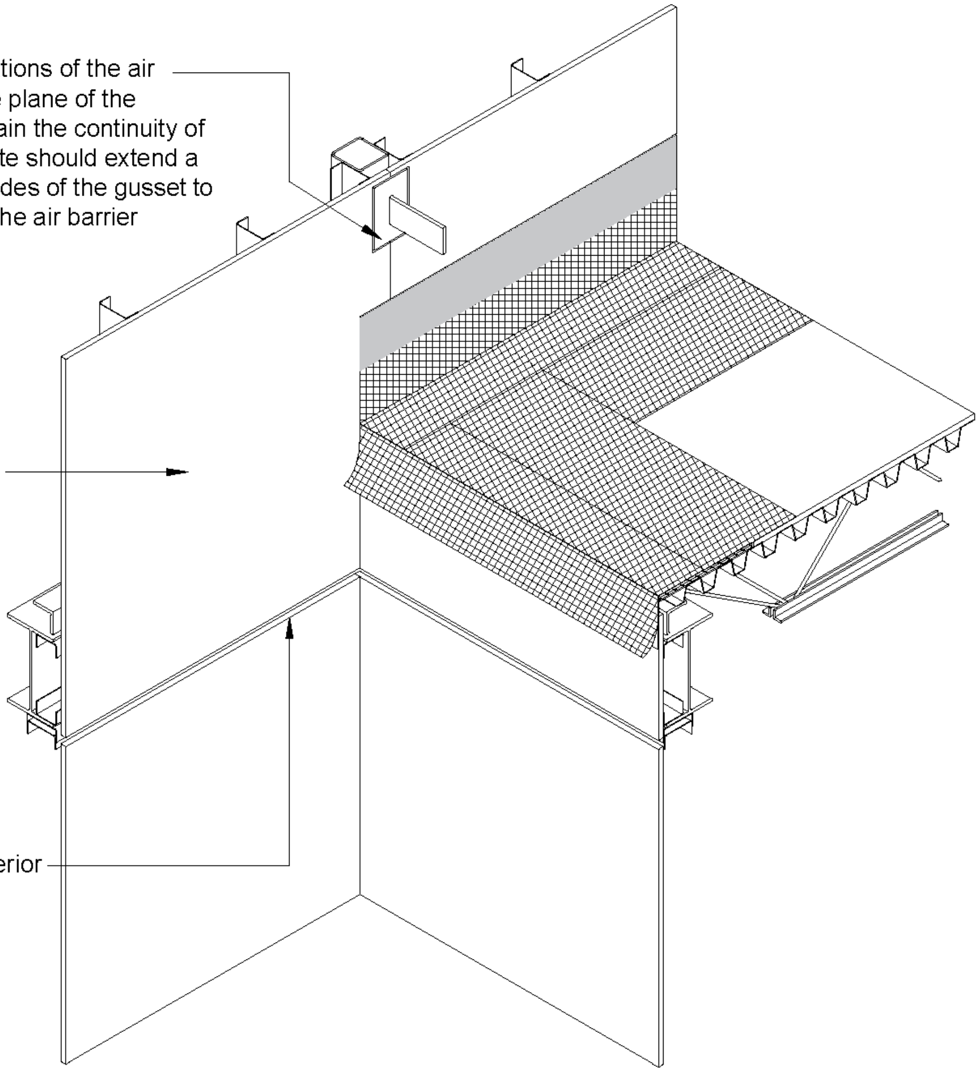


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 4
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



Lapped downward (these laps are covered later).

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 5
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



For structural steel penetrations of the air barrier, a metal plate at the plane of the sheathing is used to maintain the continuity of the air seal. The metal plate should extend a minimum of 50mm on all sides of the gusset to allow for a proper tie-in of the air barrier membrane.

Exterior gypsum sheathing layer added.

Movement joints in the exterior sheathing.

Alberta
Infrastructure

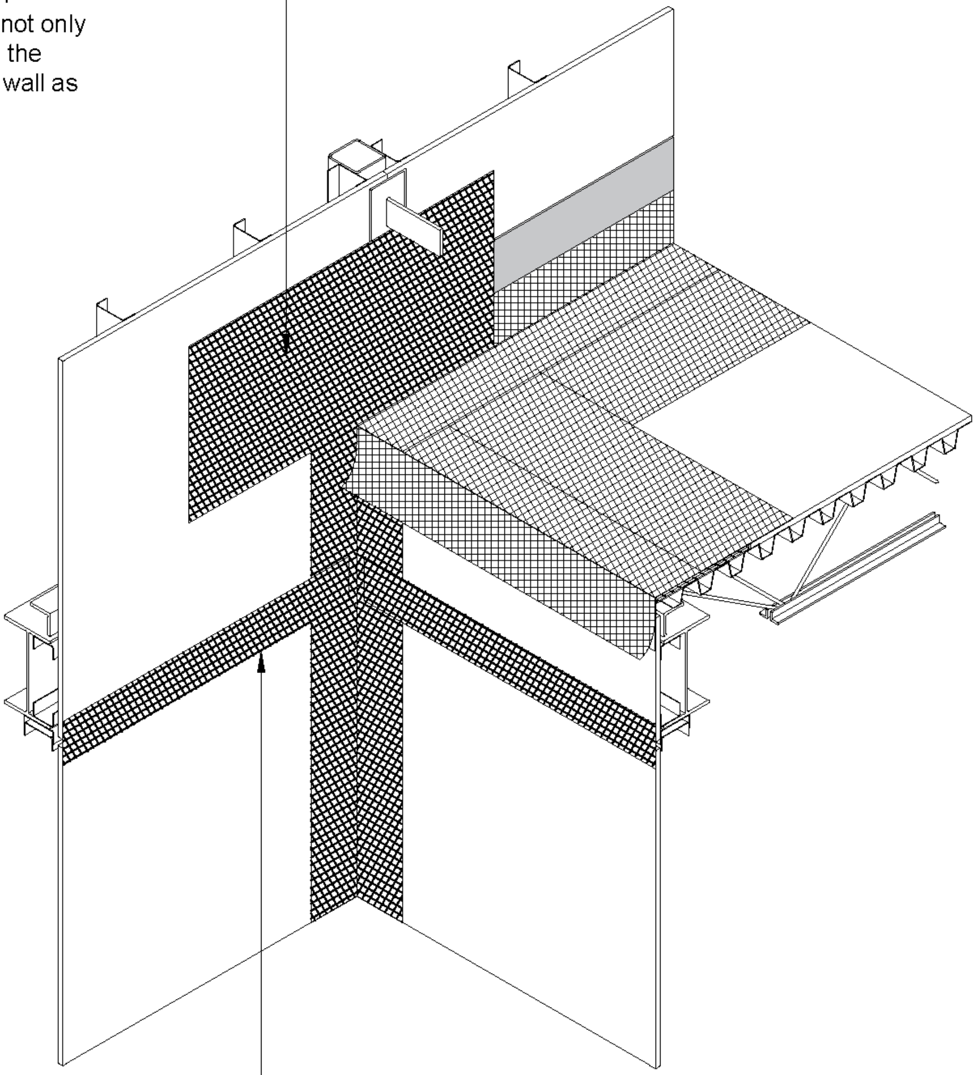
SERIES 02
STANDARD ENVELOPE ASSEMBLY
ISOMETRIC DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-05	V. SOLBAK	NTS

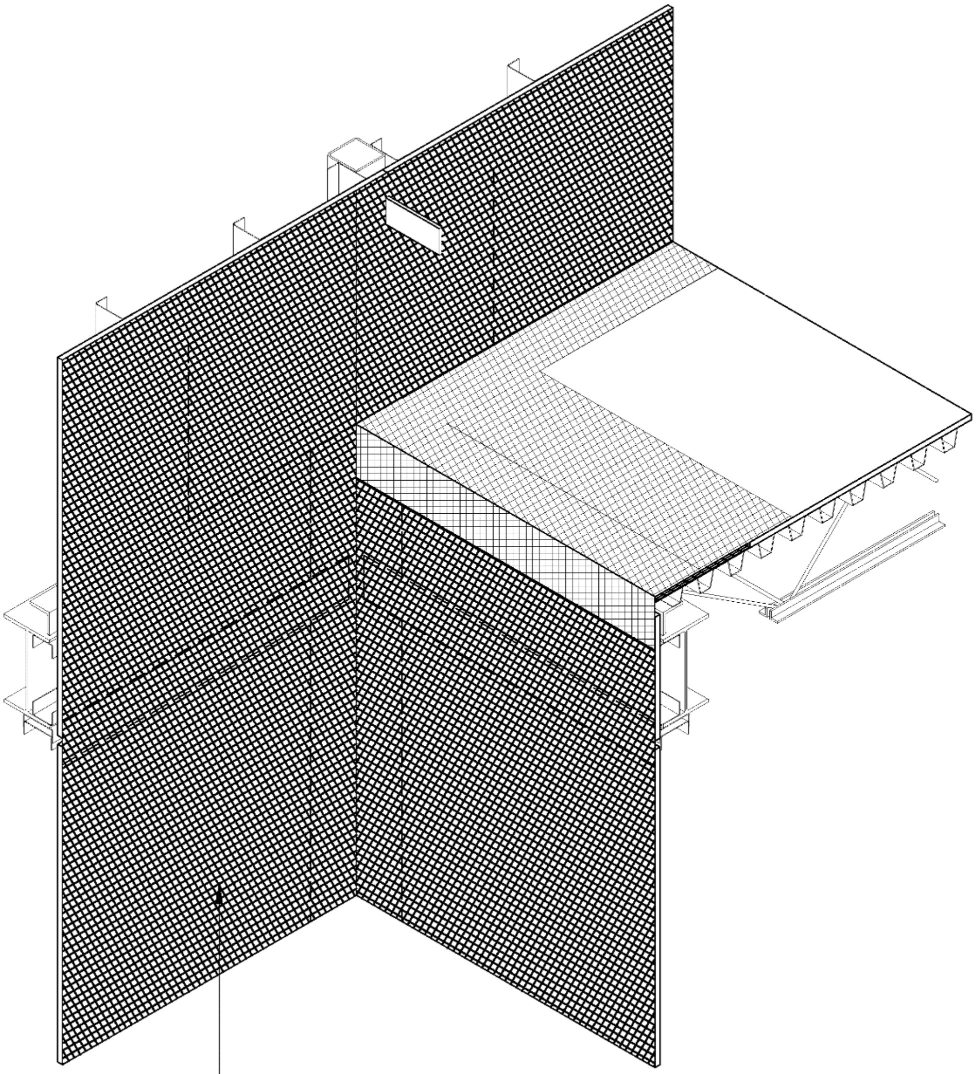
DETAIL NUMBER
6

An internally reinforced peel and stick air seal membrane used as a transition membrane from the roof air/vapour barrier to the wall air barrier. The membrane must be compatible with both the roof air/vapour barrier and the wall air barrier. The transition membrane must be installed not only at the roof level, but between the parapet construction and the wall as well.



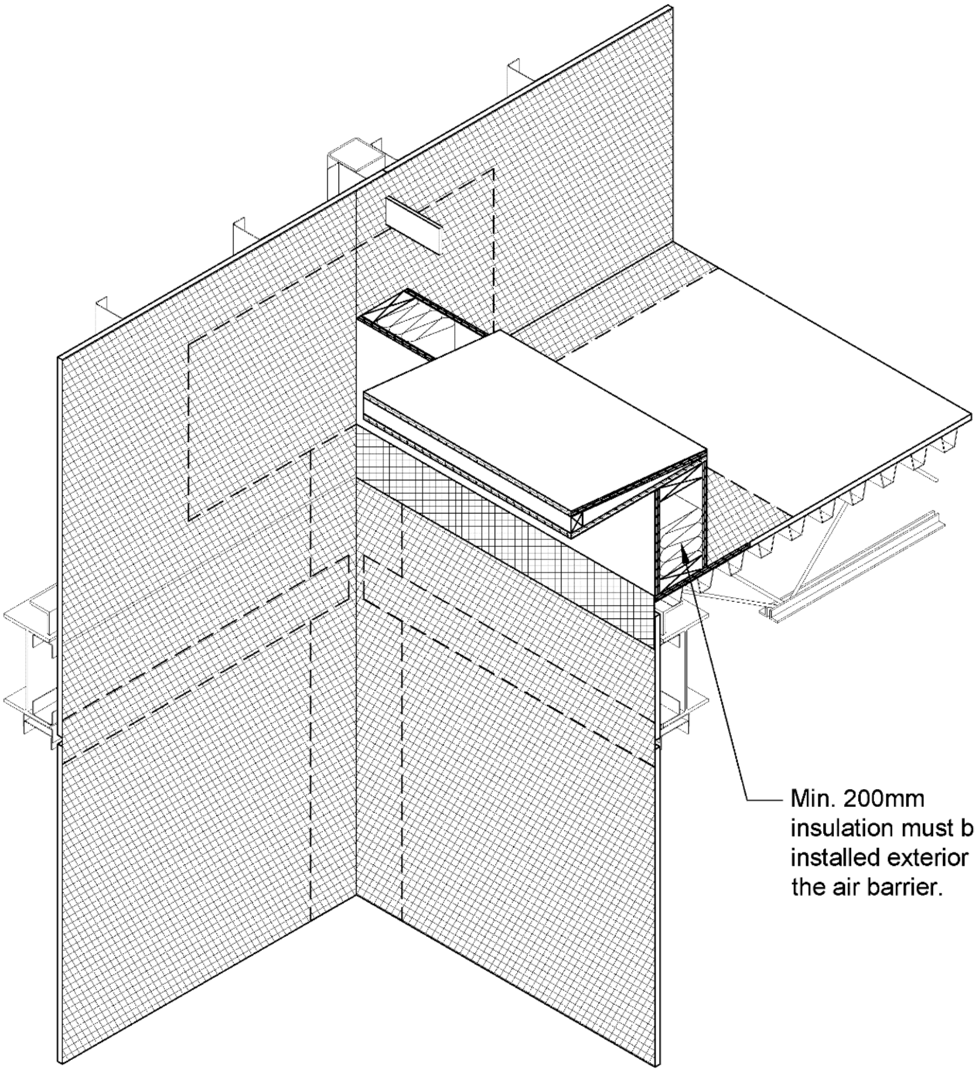
Strip of reinforcing membrane installed over movement joints. Depending on the amount of expected deflection, a slip sheet or sheet metal backing are alternative options, or consider a higher performing material such as silicone transition strips that have better expansion characteristics.

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 7
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



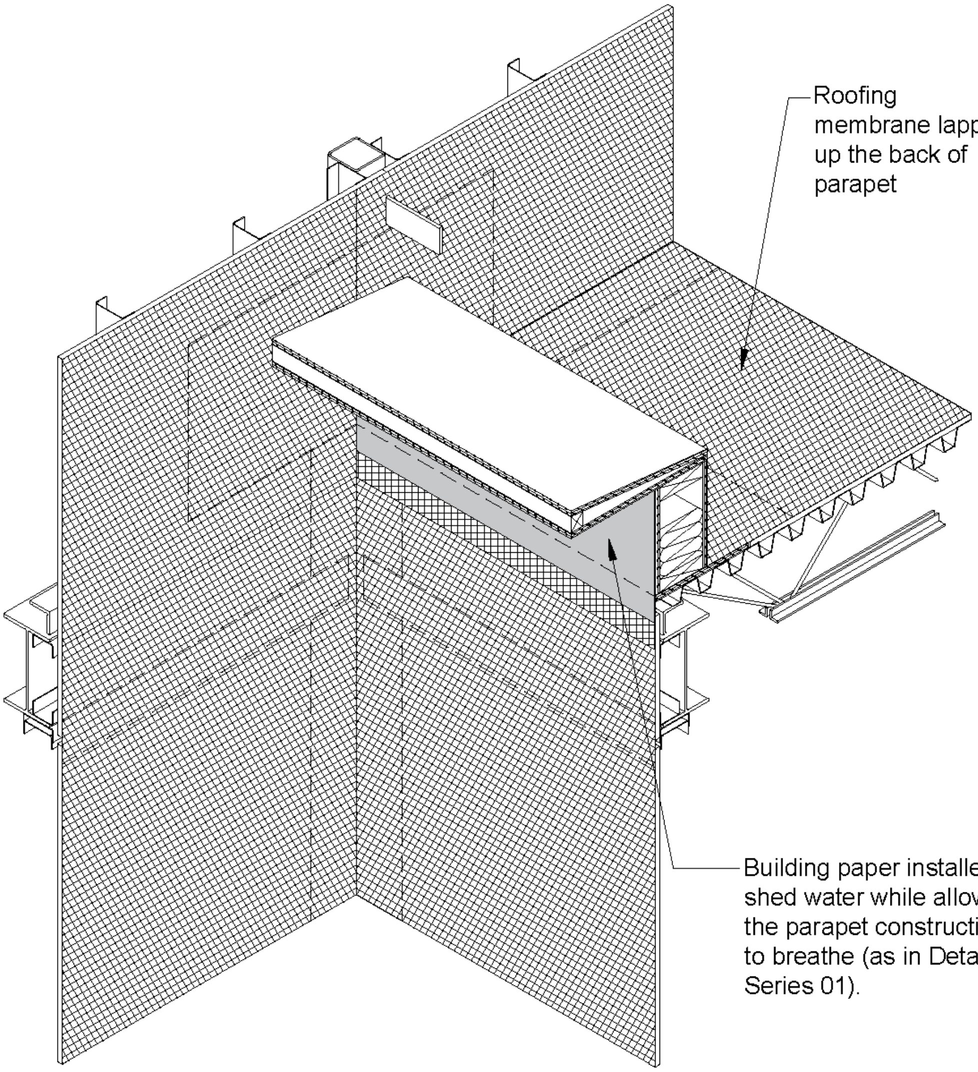
Wall air barrier membrane.

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 8
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

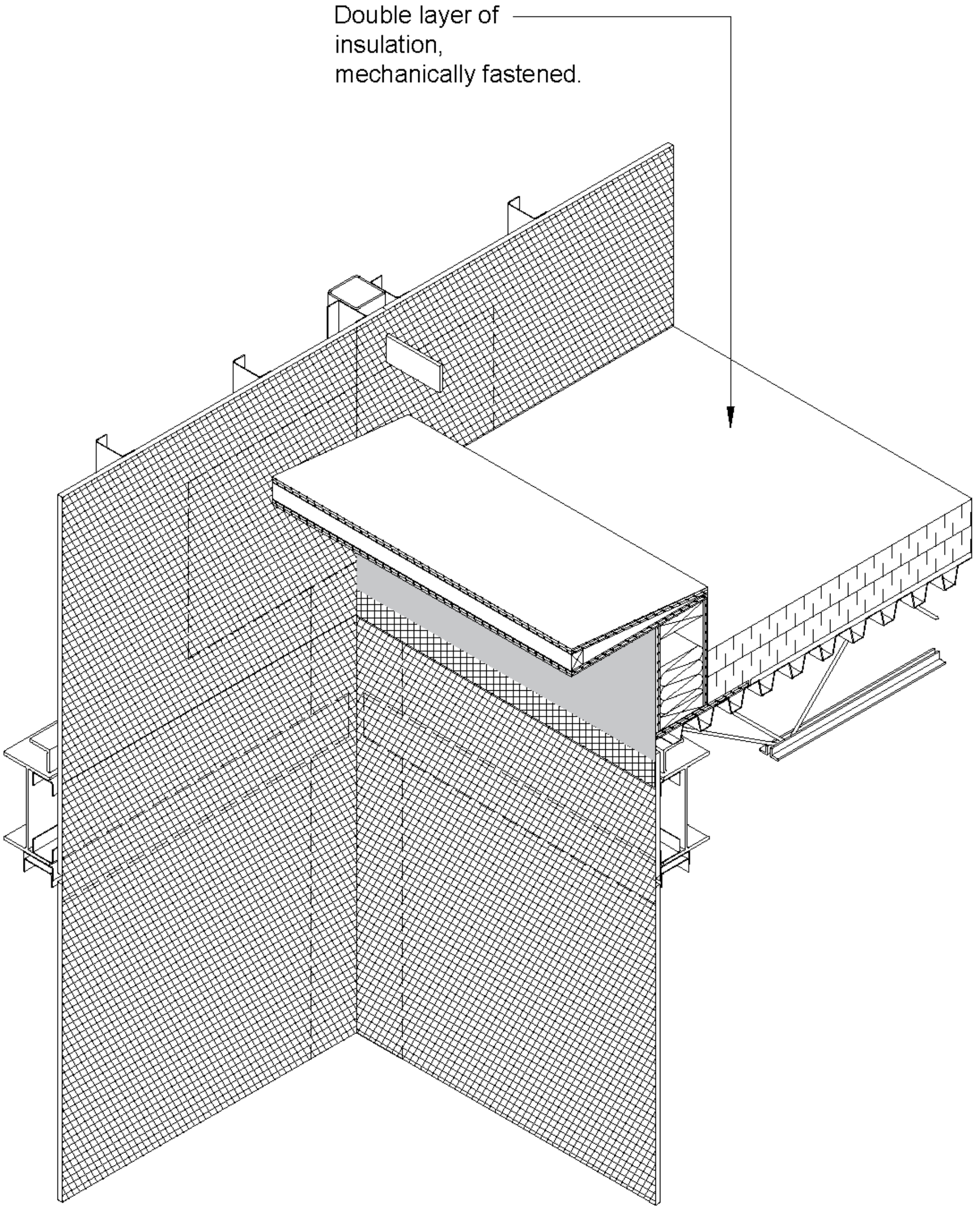


Min. 200mm insulation must be installed exterior of the air barrier.

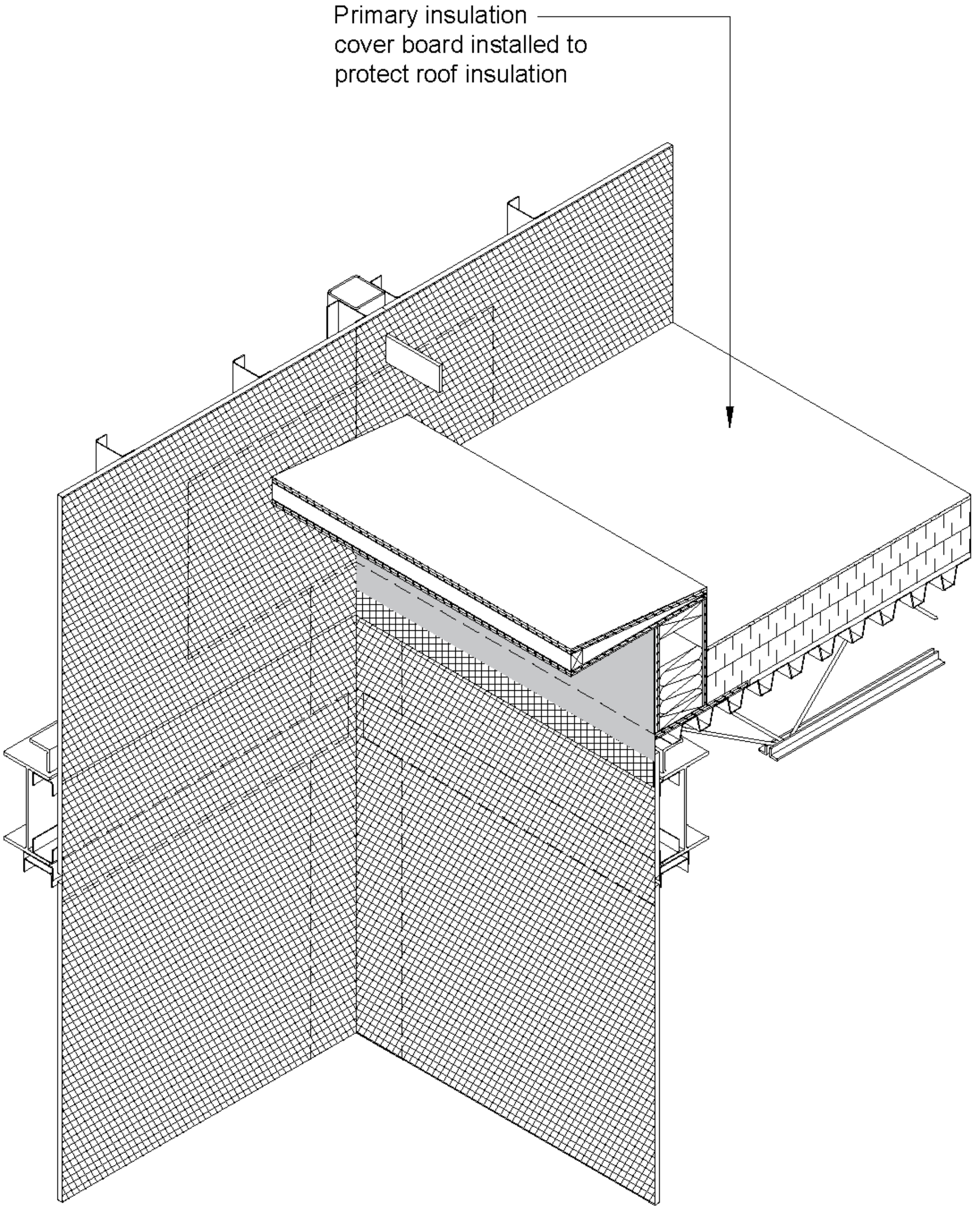
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 9
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 10
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 11
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS

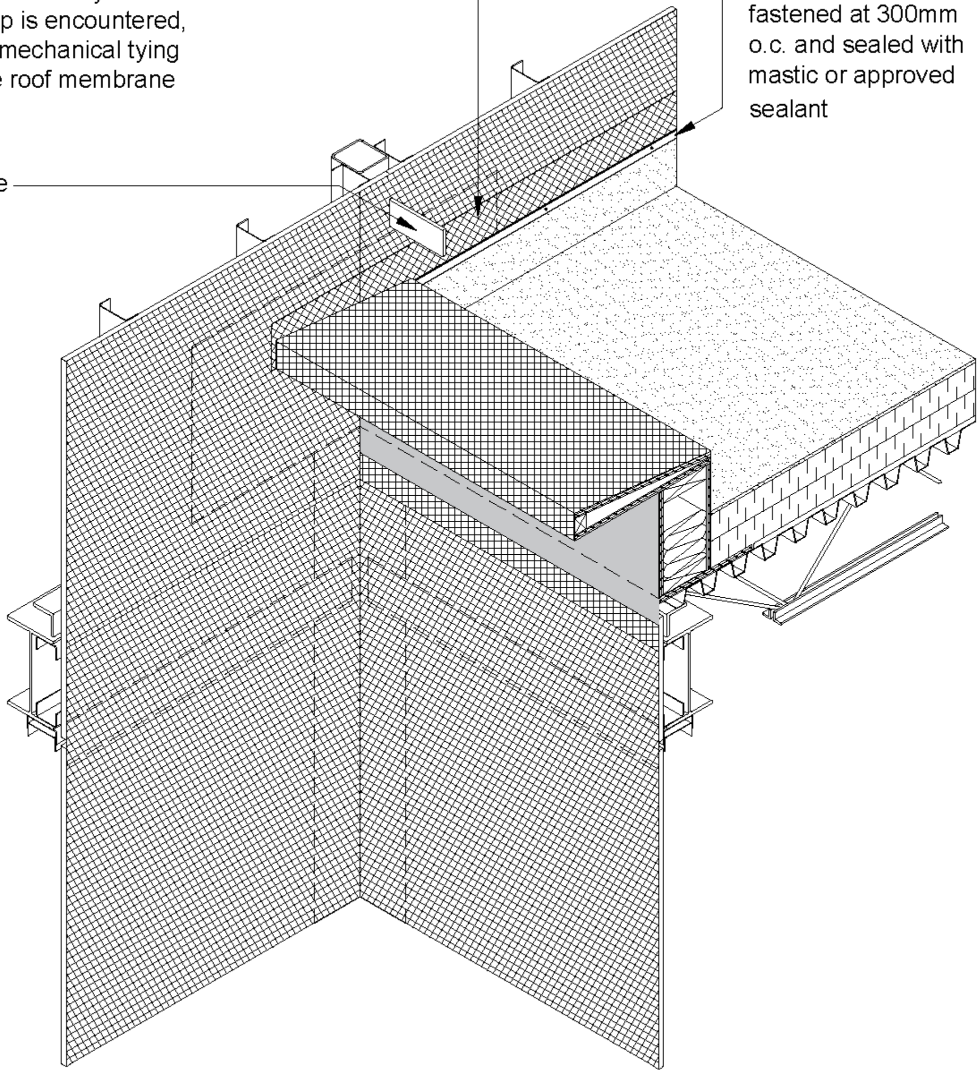


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 12
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS

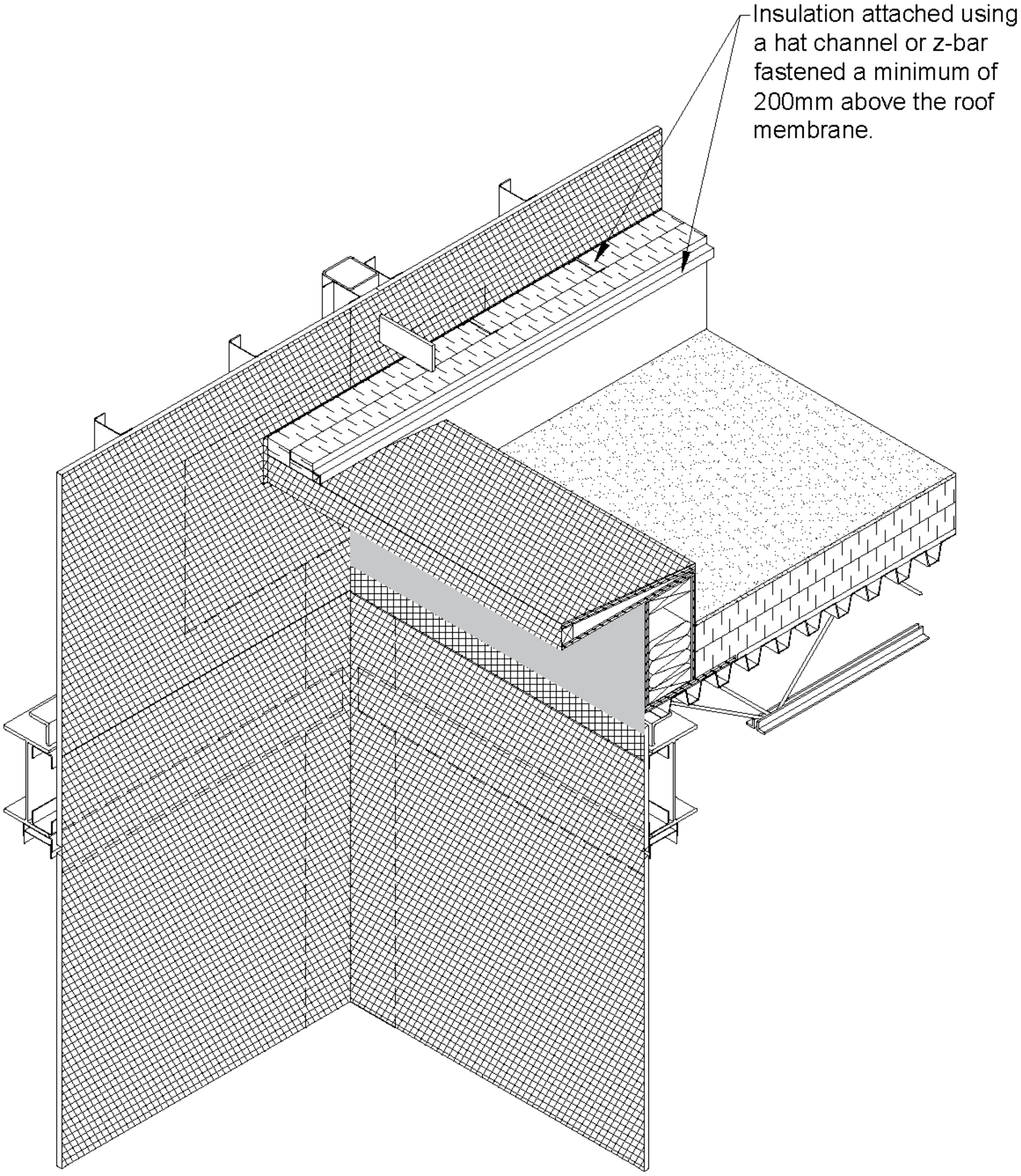
It is preferred that the tie-in between the roof and the wall membrane be shingle lapped. Depending on construction schedule this may not occur. If a reverse lap is encountered, proper buttering and mechanical tying of the top edge of the roof membrane is recommended.

Termination bar fastened at 300mm o.c. and sealed with mastic or approved sealant

Supporting knife plate

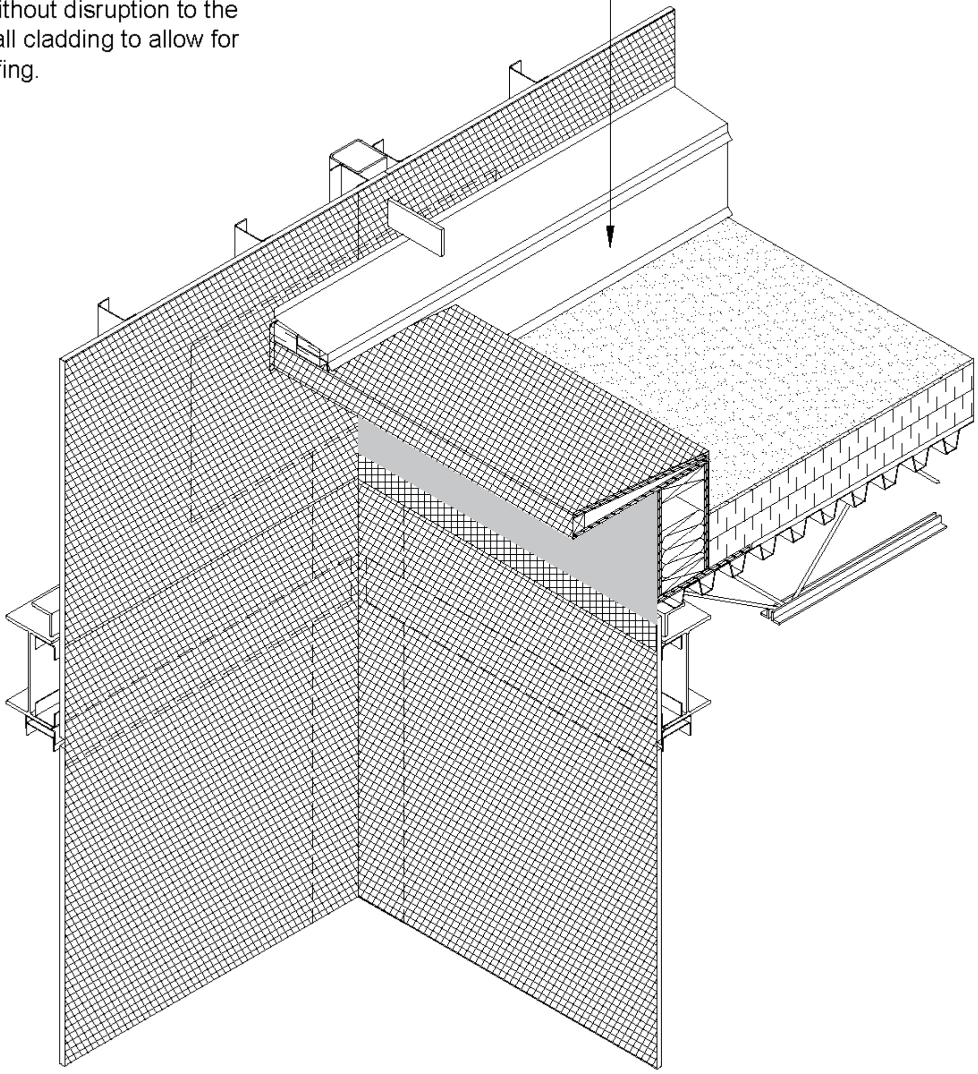


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 13
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS

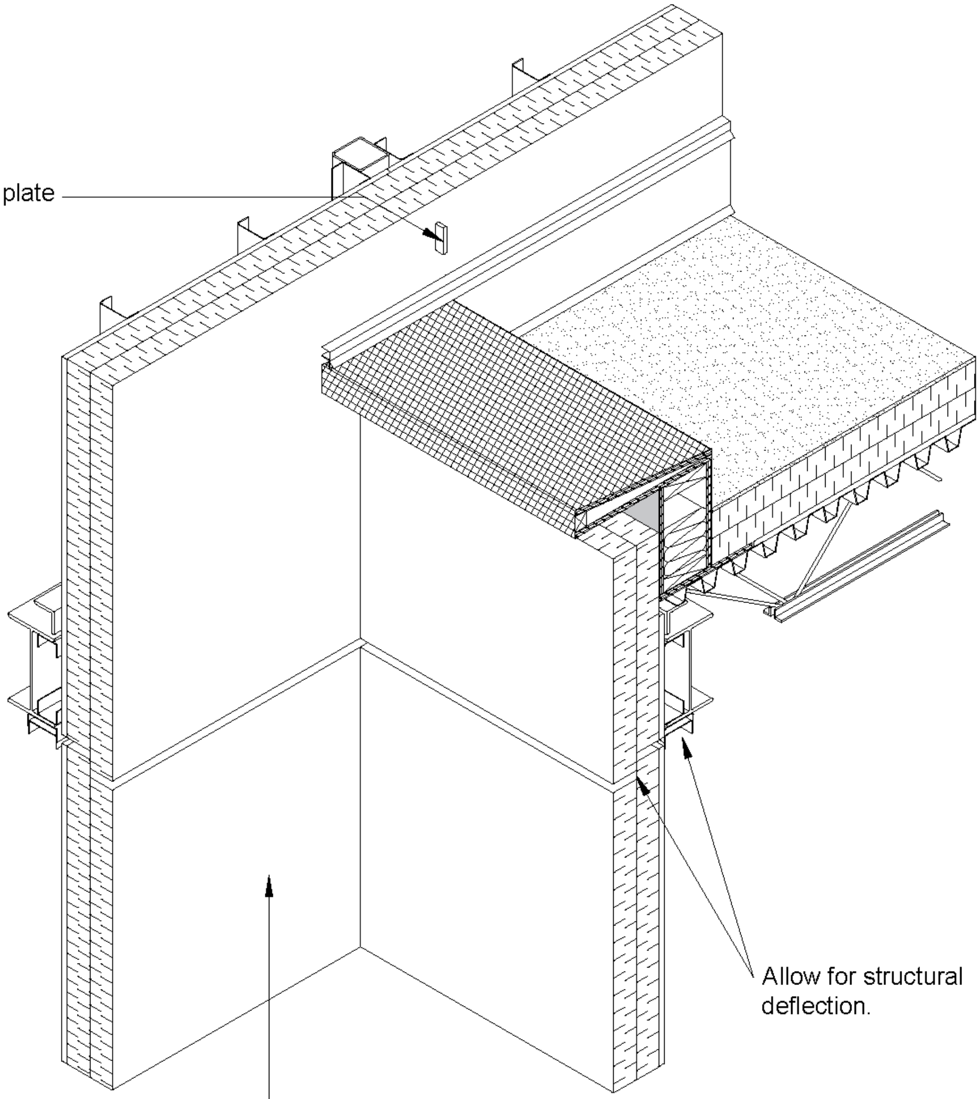

Insulation attached using a hat channel or z-bar fastened a minimum of 200mm above the roof membrane.

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 14
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

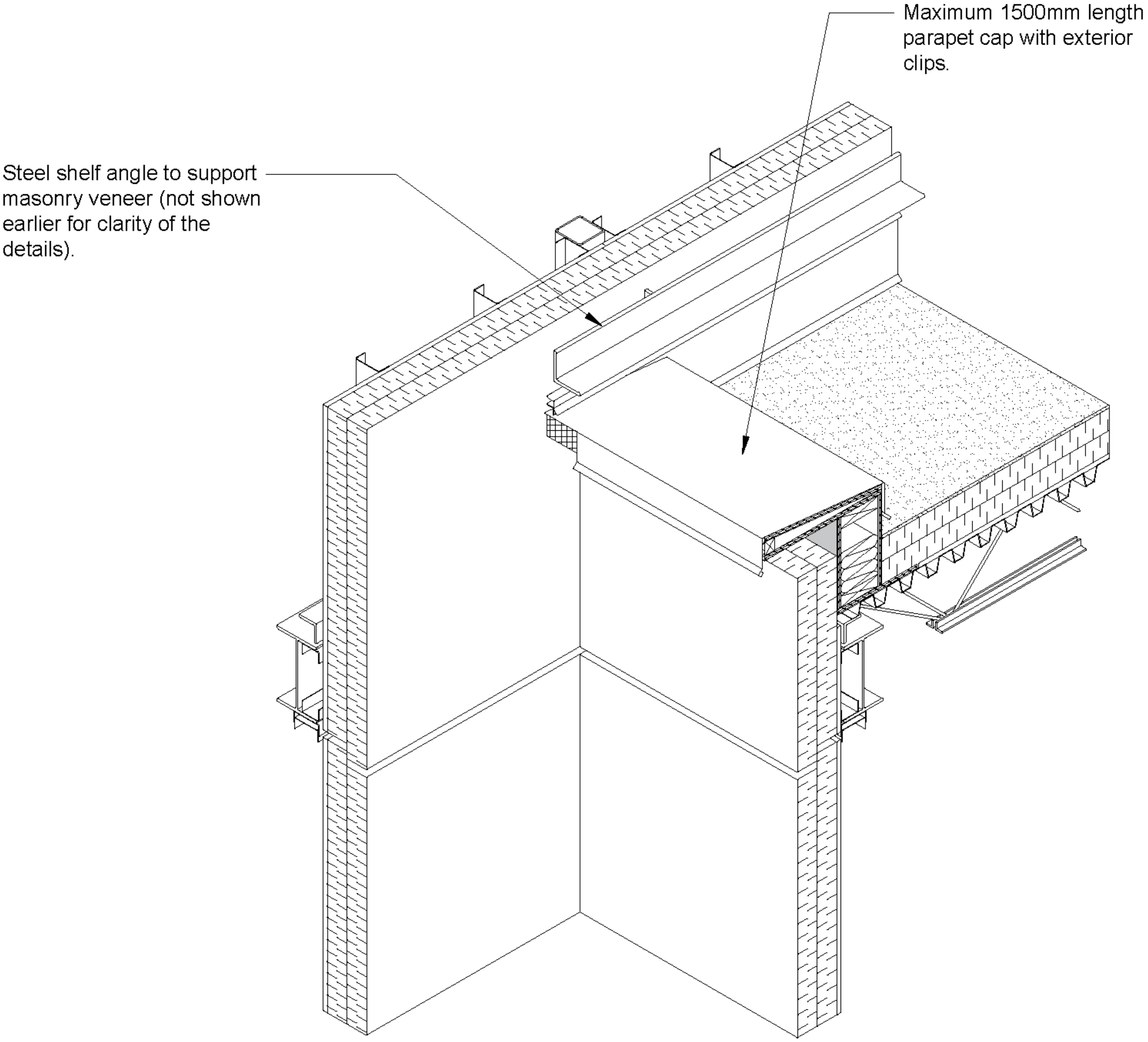
Flashing installed to protect insulation. Bottom 300 mm designed to be removable without disruption to the rest of the wall cladding to allow for future re-roofing.



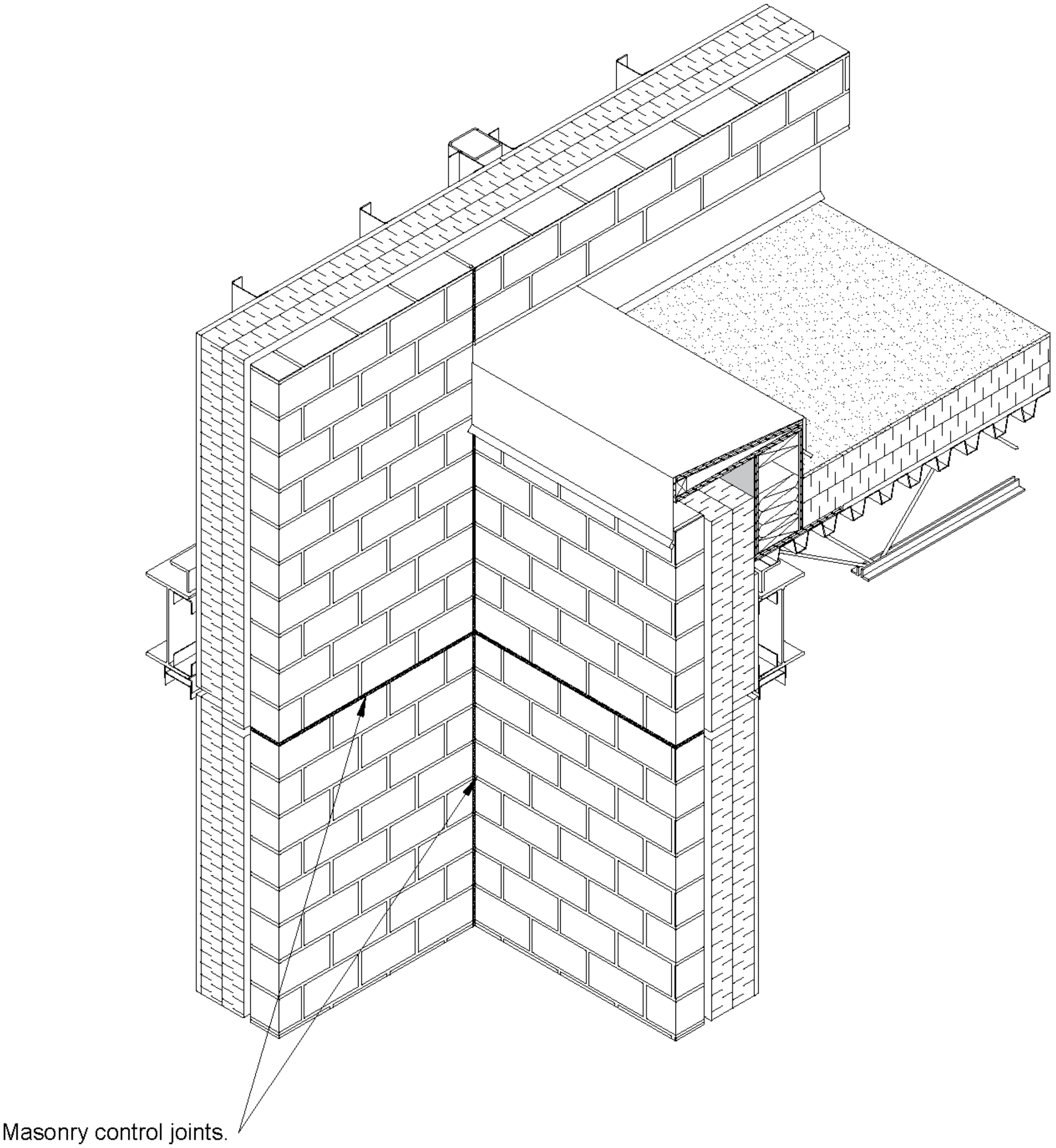
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS			TECHNICAL SERVICES BRANCH	DETAIL NUMBER 15
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



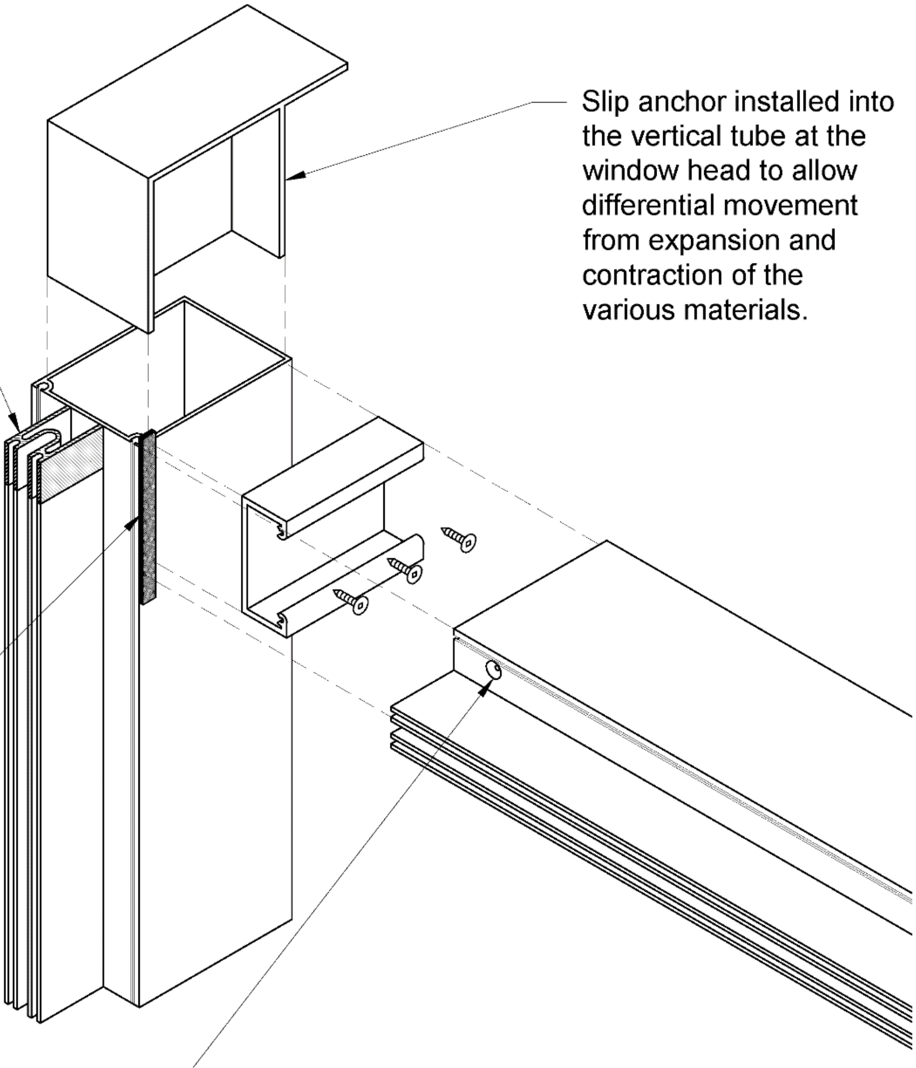
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 16
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 17
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 18
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



Slip anchor installed into the vertical tube at the window head to allow differential movement from expansion and contraction of the various materials.

Portion of the screw spline removed to allow for membrane tie-in to the tube face of the section.

Butt joint between the horizontal and the vertical mullions should be sealed with butyl tape*.

Predrilled holes for screw attachment should be slightly offset from the shear block to ensure a tight joint between the two box sections.

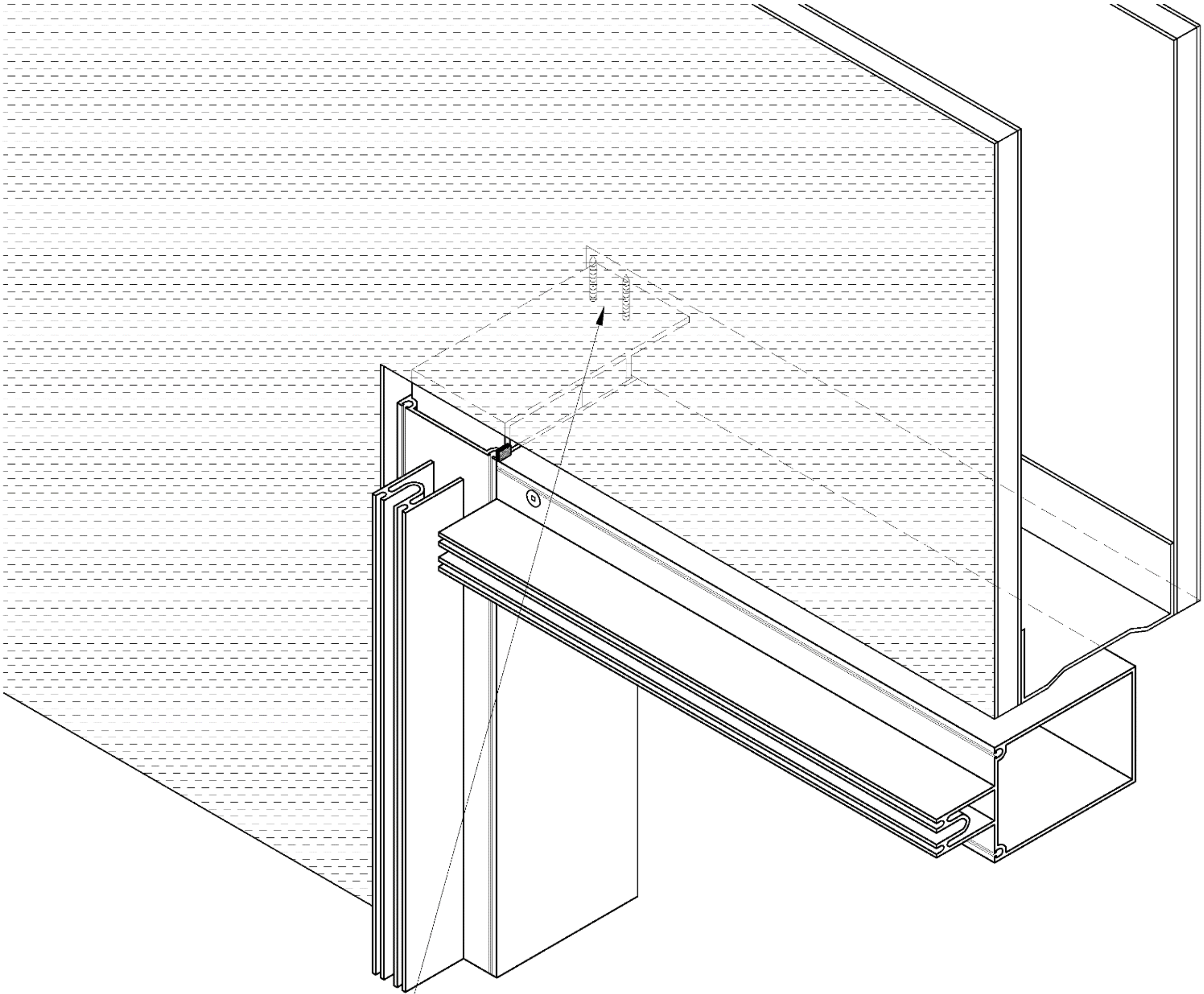
(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

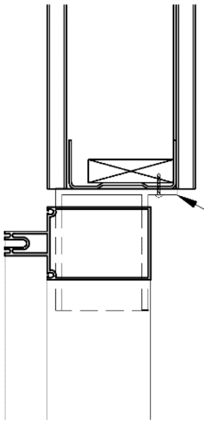
TECHNICAL SERVICES BRANCH

DETAIL NUMBER
1

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Window frame tilted up into the rough opening and the slip anchor at the head is fastened into the structure. The frame is positioned so the tube face of the box curtain-wall section is in plane with the face of the exterior sheathing.



Flange on the slip anchor needs to extend far enough beyond the frame to allow for fastening into the head of the rough opening after the frame is set in place.

Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

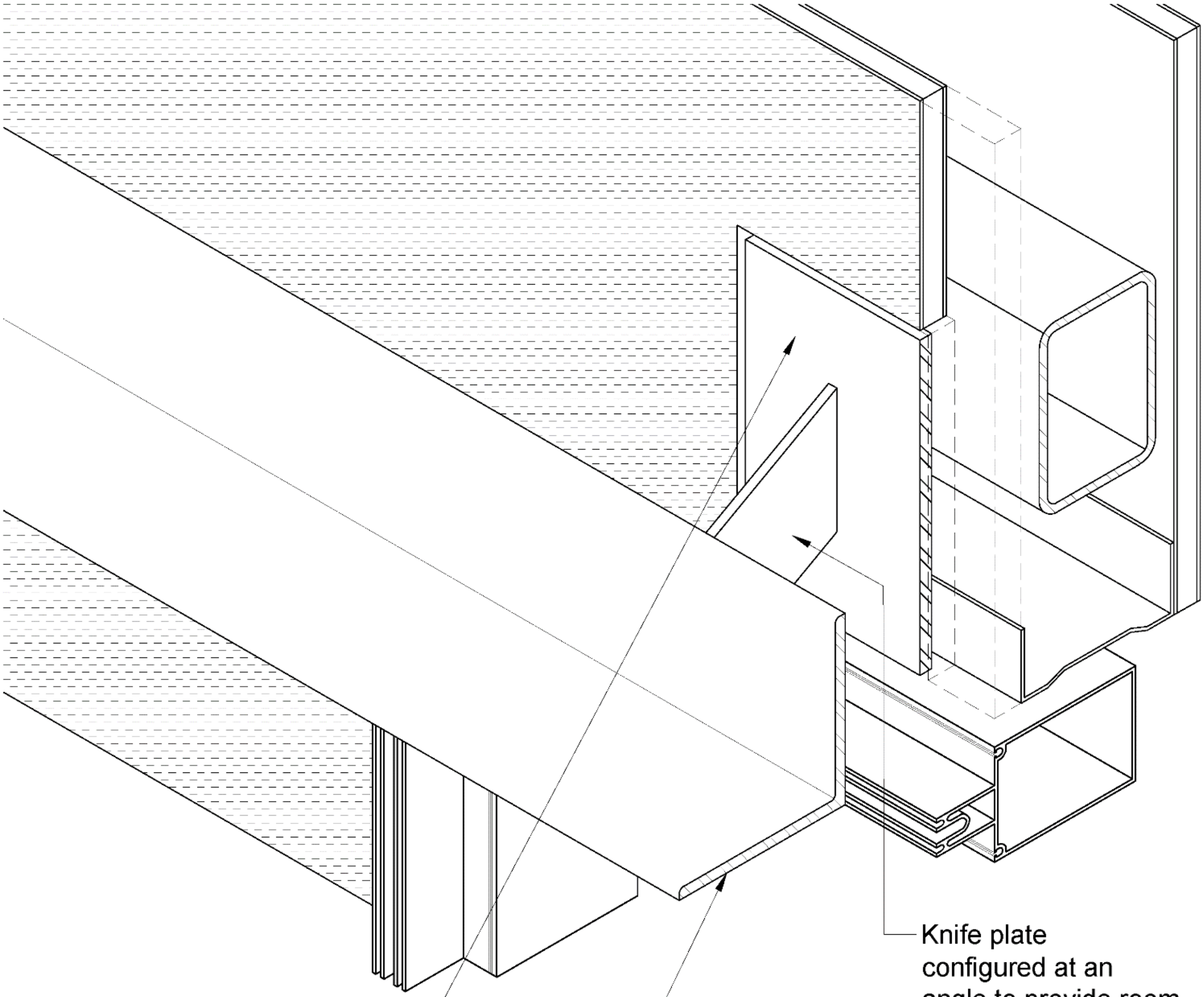
DETAIL NUMBER
2

DRAWN BY
PETER BAKER

DATE
01-01-2005

UPDATED BY
V. SOLBAK

DATE
2016-10-14



Metal plate at the plane of the sheathing used to maintain the continuity of the air seal. Metal plate should extend 50 mm on all side of the knife plate to allow for a proper tie-in of the air barrier membrane (see structural penetration details).

Shelf angle to support the masonry veneer.

Knife plate configured at an angle to provide room for the air barrier membrane tie-in to the window frame.

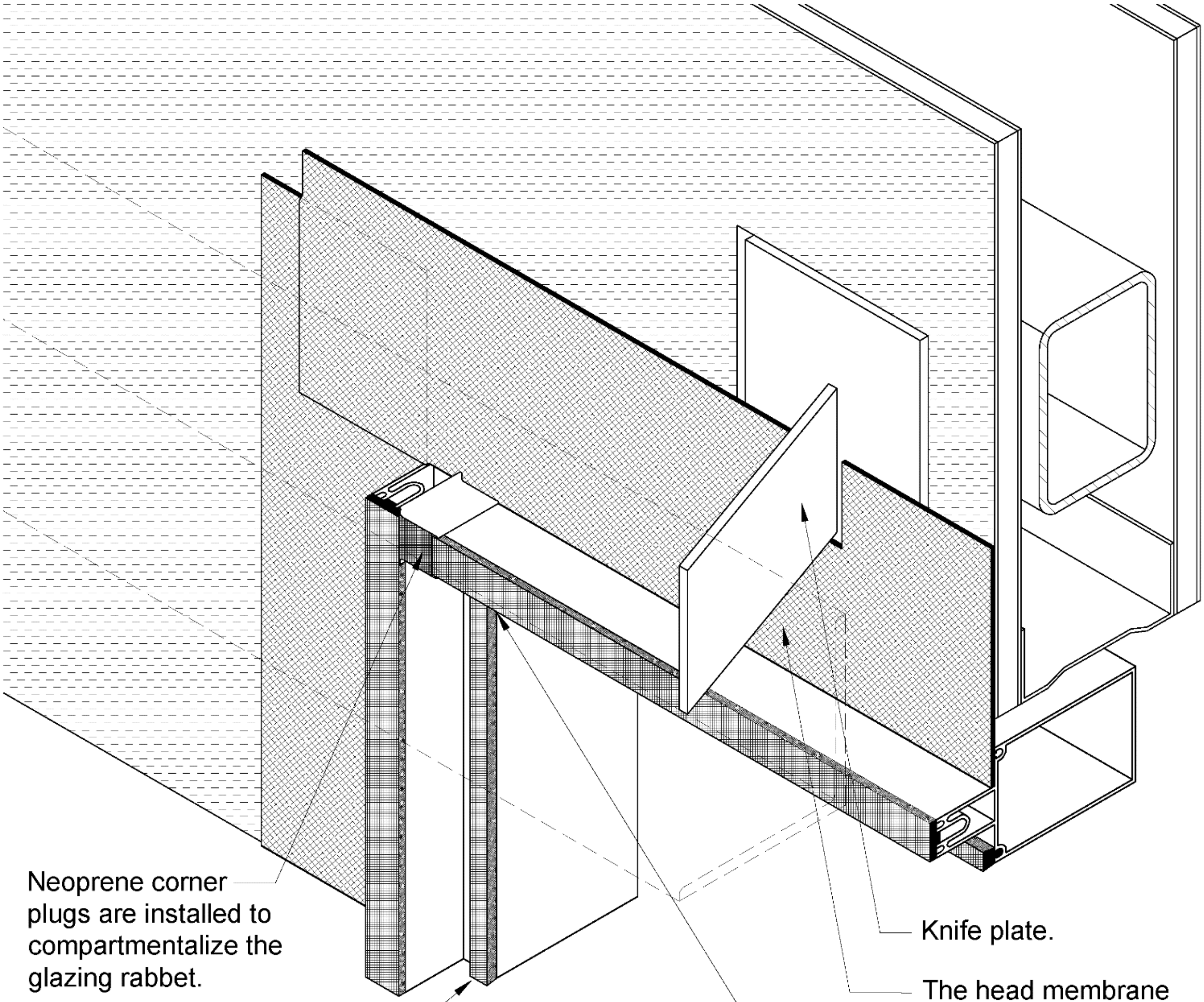
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
3

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Neoprene corner plugs are installed to compartmentalize the glazing rabbet.

The installed length of the gaskets must be greater than the opening to accomodate shrinkage.

Knife plate.

The head membrane tie-in is installed and lapped over top of the jamb membrane tie-in.

Corner junctions of the gaskets should be sealed with sealant or heat welded.

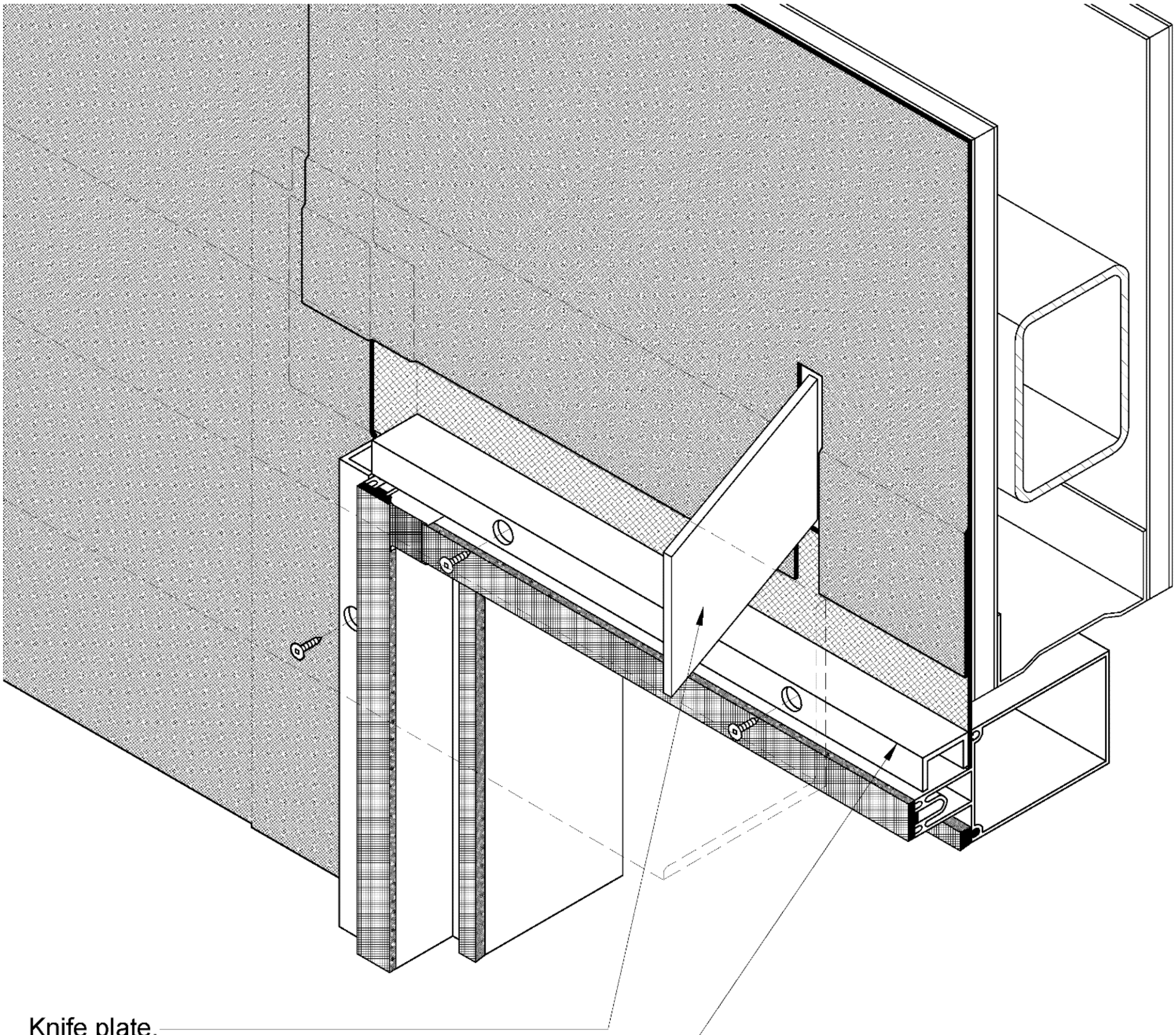
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

DETAIL NUMBER
4



Knife plate.

Aluminum anti-rotation channels installed to mechnically fasten the membrane tie-in to the tube face of the box section.

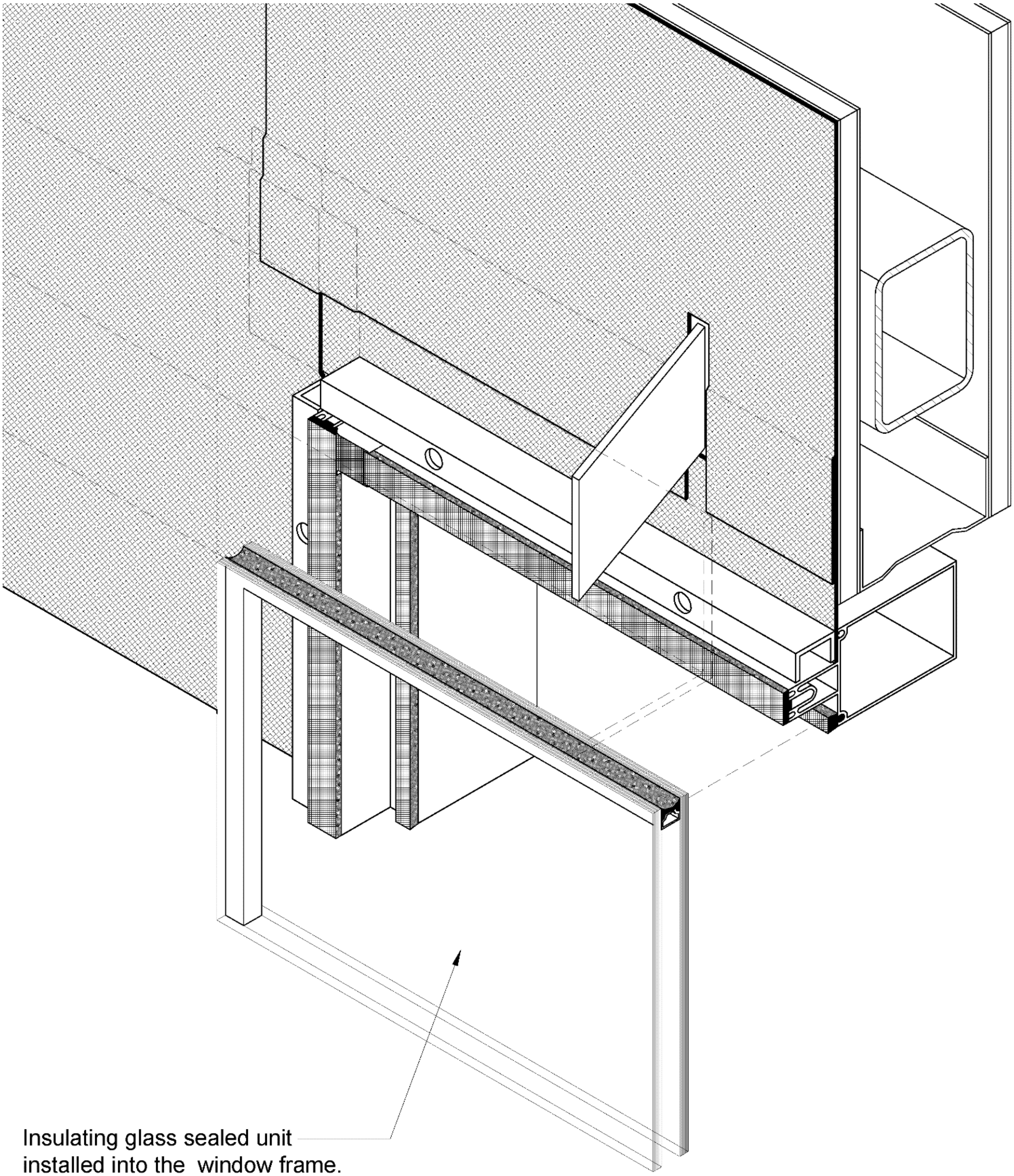
Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
5

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Insulating glass sealed unit installed into the window frame.

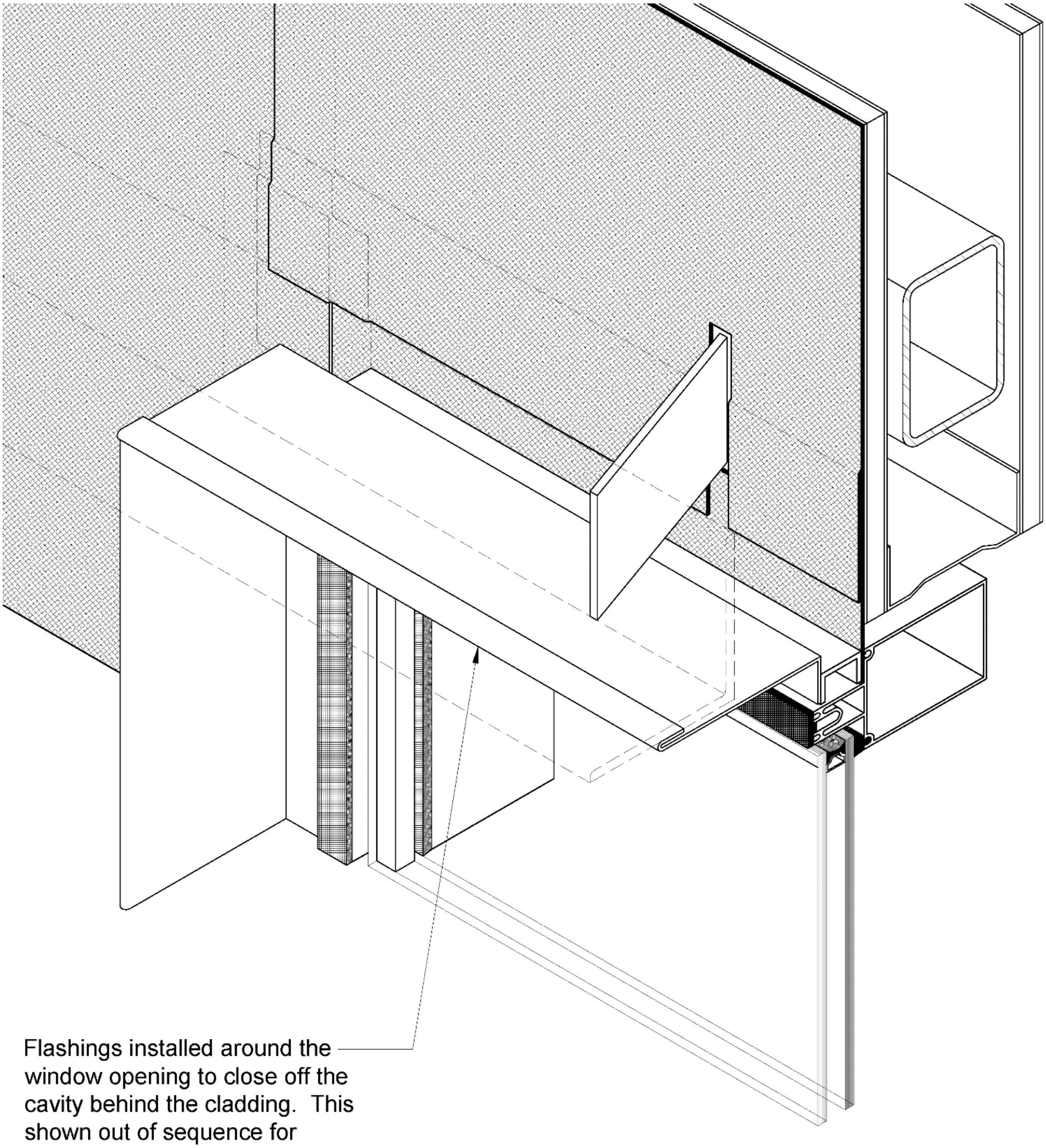
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

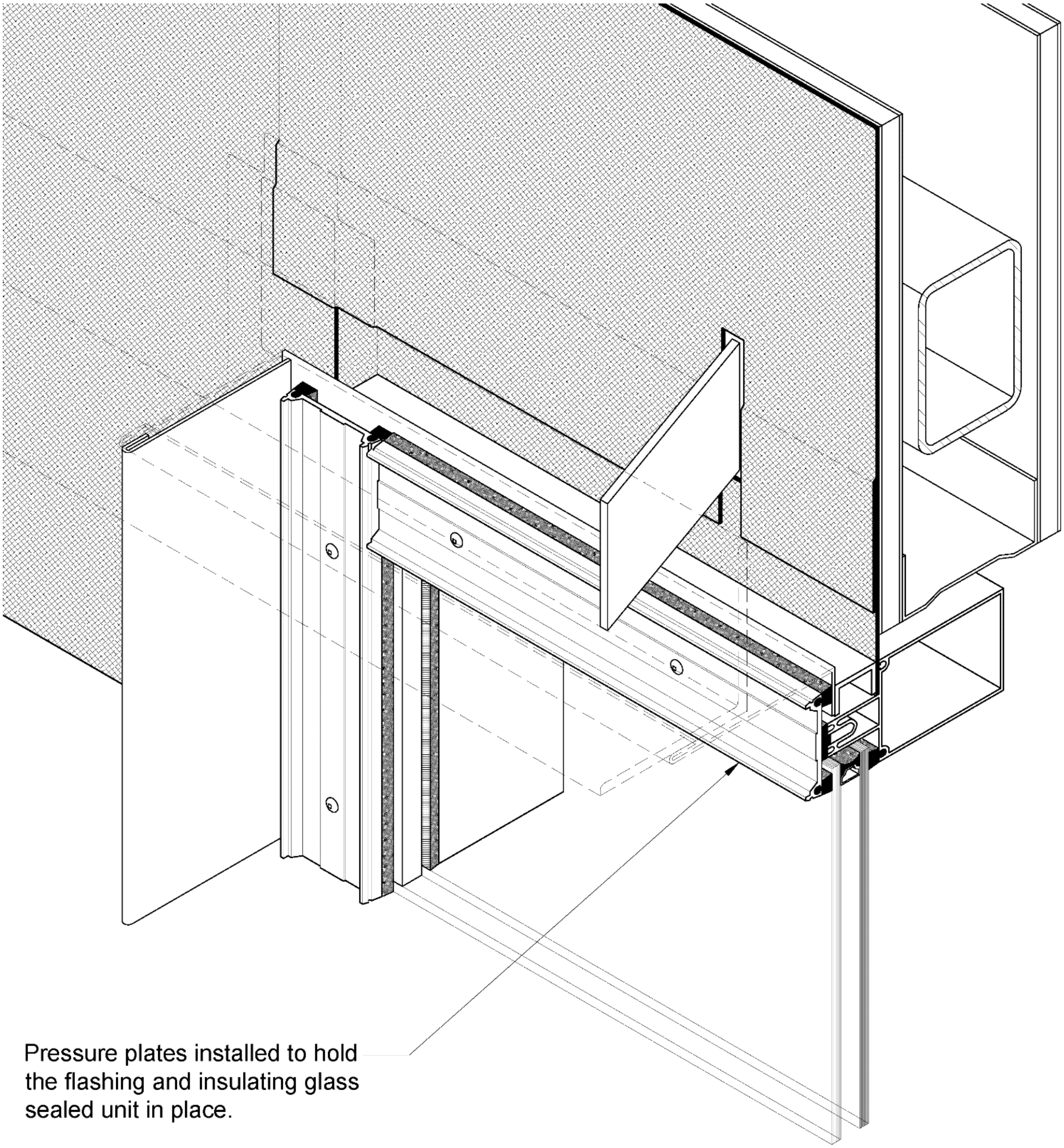
DETAIL NUMBER
6

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



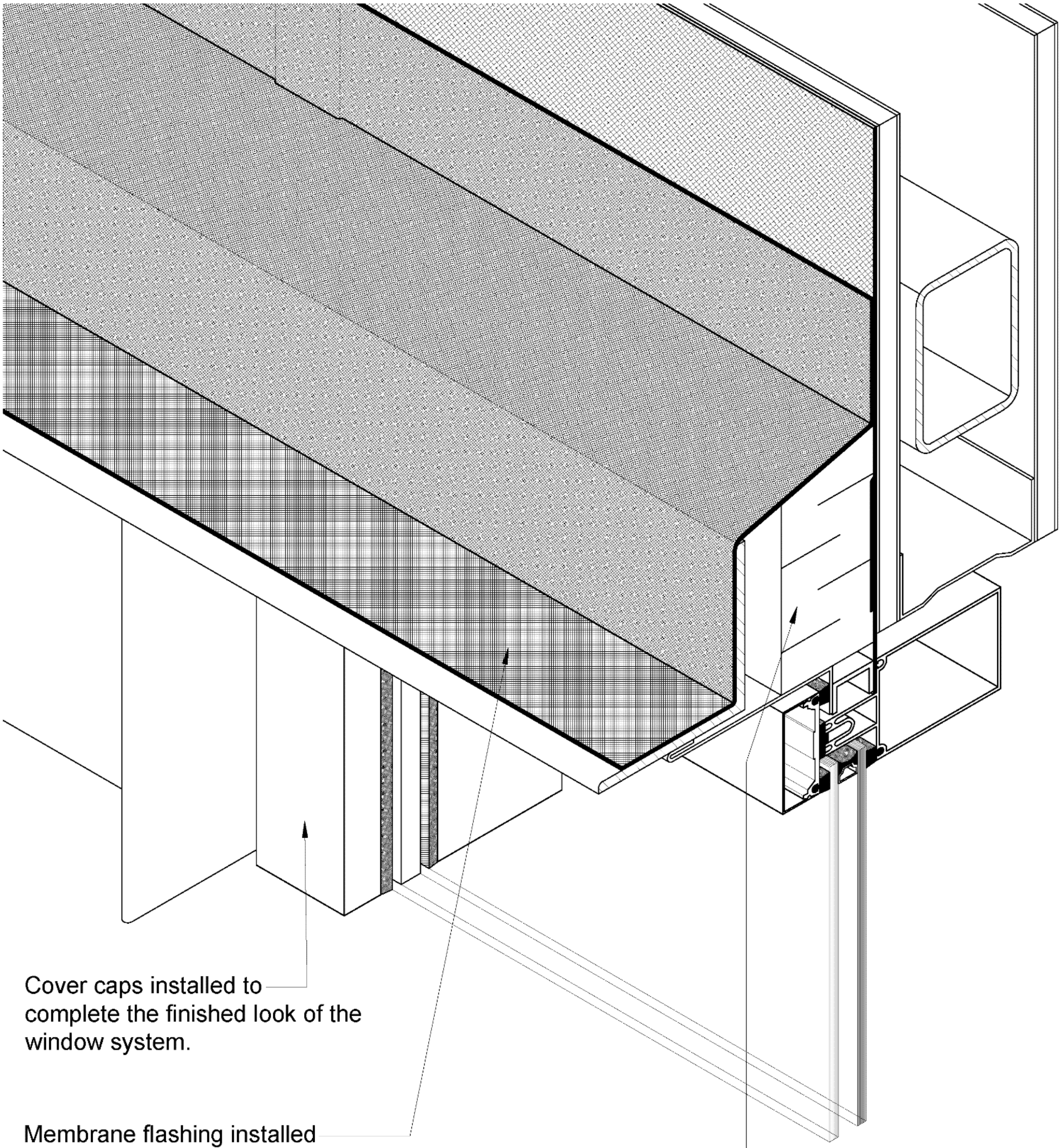
Flashings installed around the window opening to close off the cavity behind the cladding. This shown out of sequence for purposes of clarity. The flashing is usually installed after the cladding is in place.

Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 7
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



Pressure plates installed to hold the flashing and insulating glass sealed unit in place.

Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 8
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



Cover caps installed to complete the finished look of the window system.

Membrane flashing installed over the shelf angle to drain any water from the cavity out at the window head.

Insulation installed tight to the air barrier.

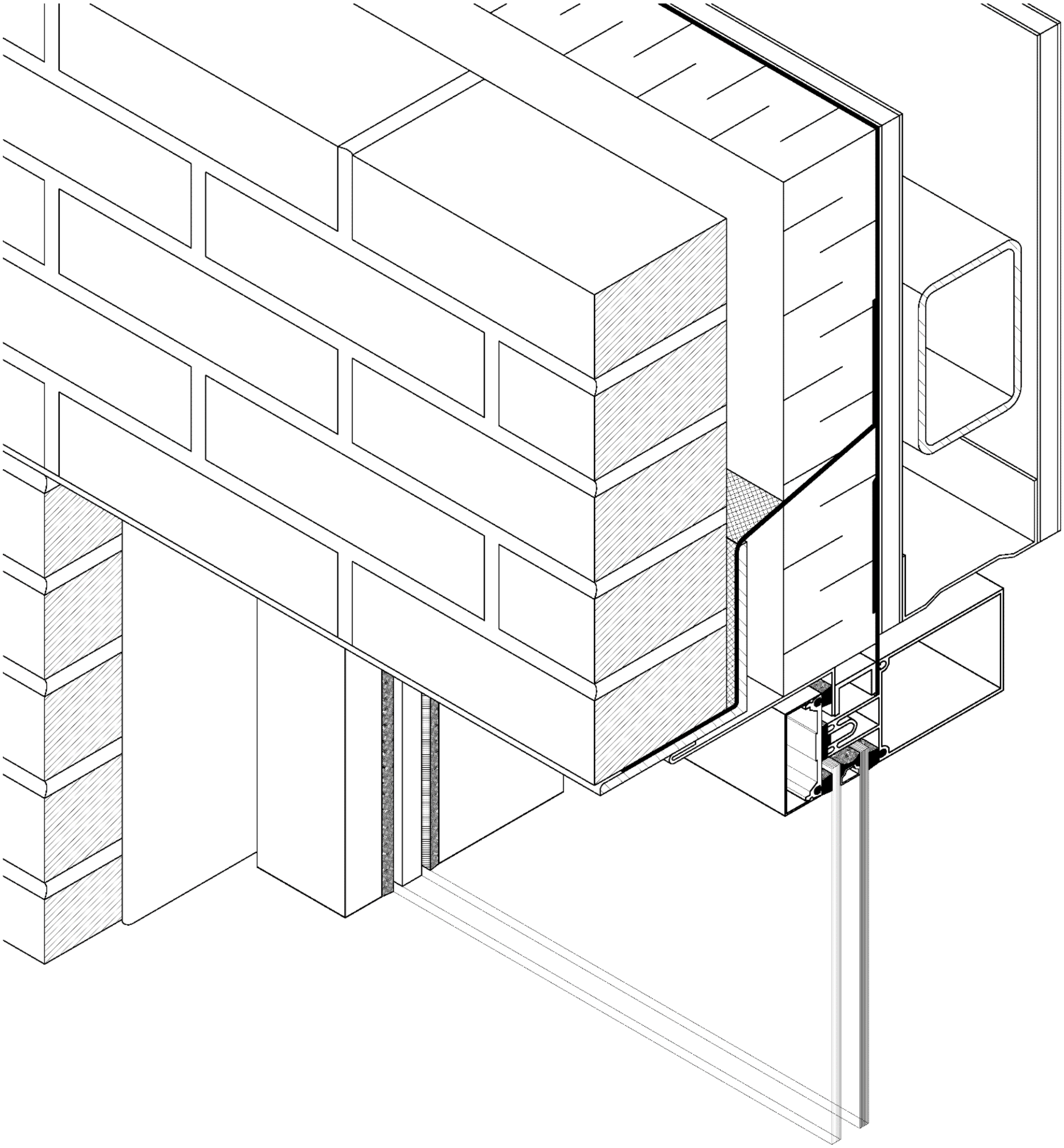
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
9

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Completed installation.

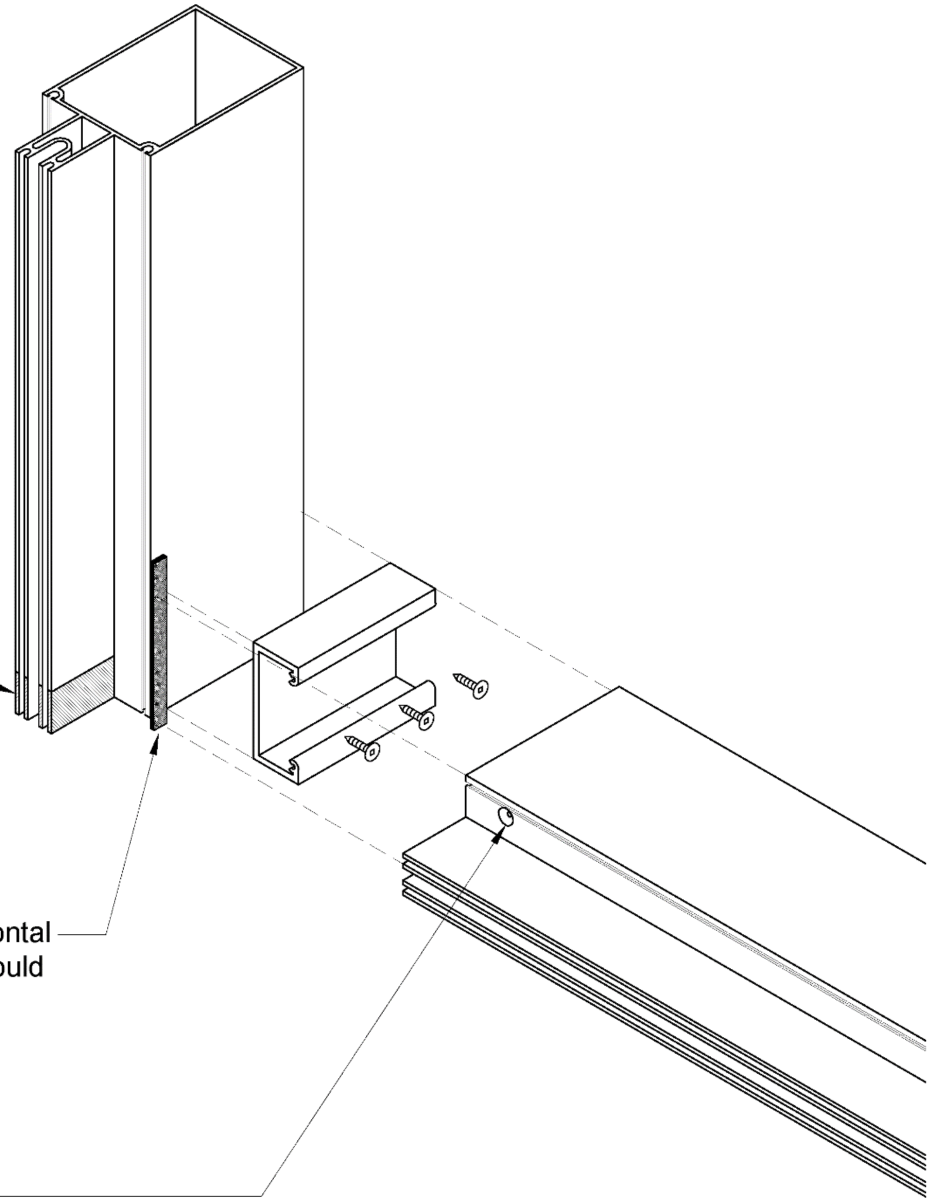
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

DETAIL NUMBER
10



Portion of the screw spline removed to allow for membrane tie-in to the tube face of the section.

Butt joint between the horizontal and the vertical mullions should be sealed with butyl tape*.

Predrilled holes for screw attachment should be slightly offset from the shear block to ensure a tight joint between the two box sections. Cap bead with butyl sealant.

(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)

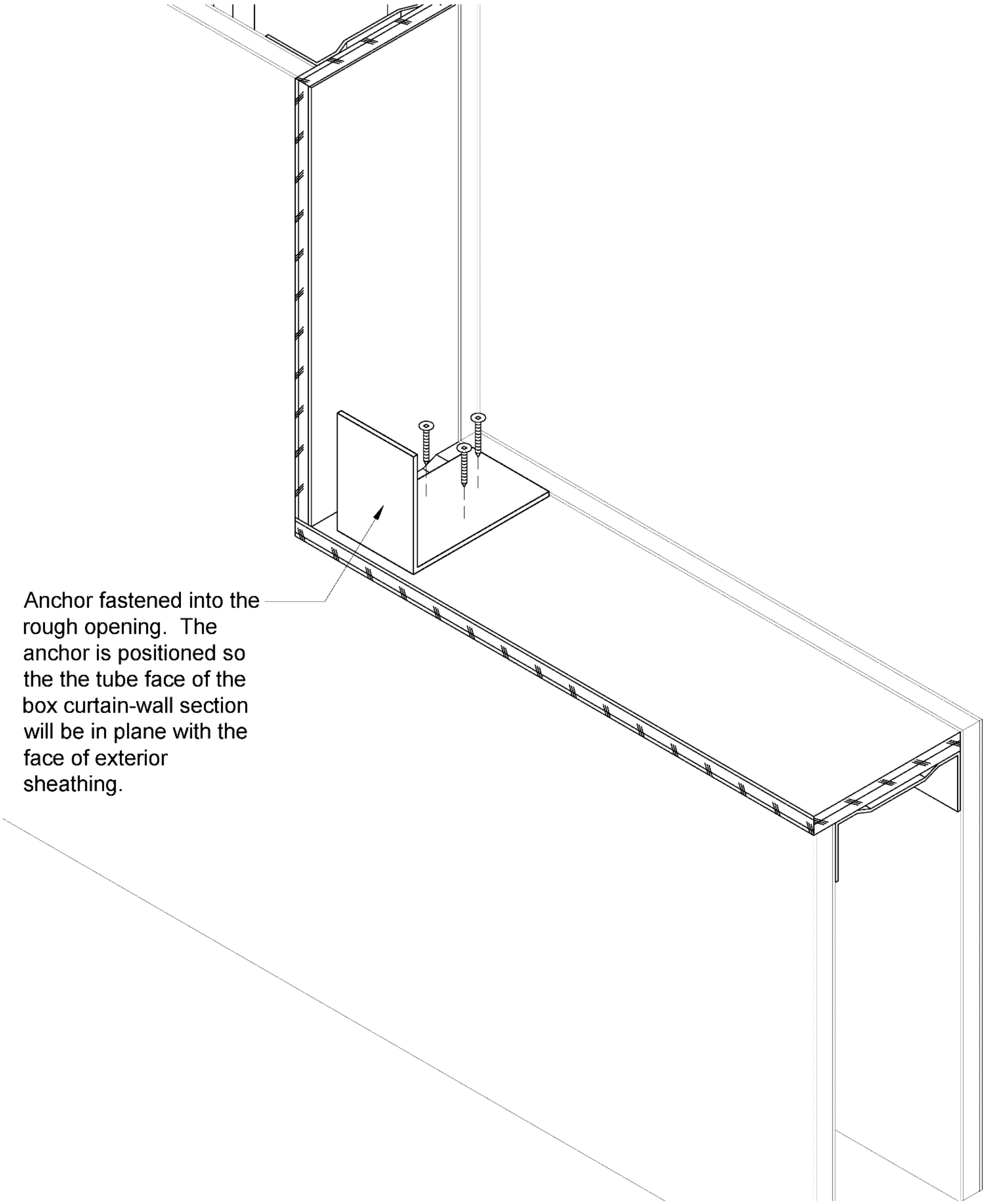
Alberta
Infrastructure

SERIES 04
INSTALLATION SEQUENCE
ISOMETRIC WINDOW SILL DETAILS

TECHNICAL SERVICES BRANCH

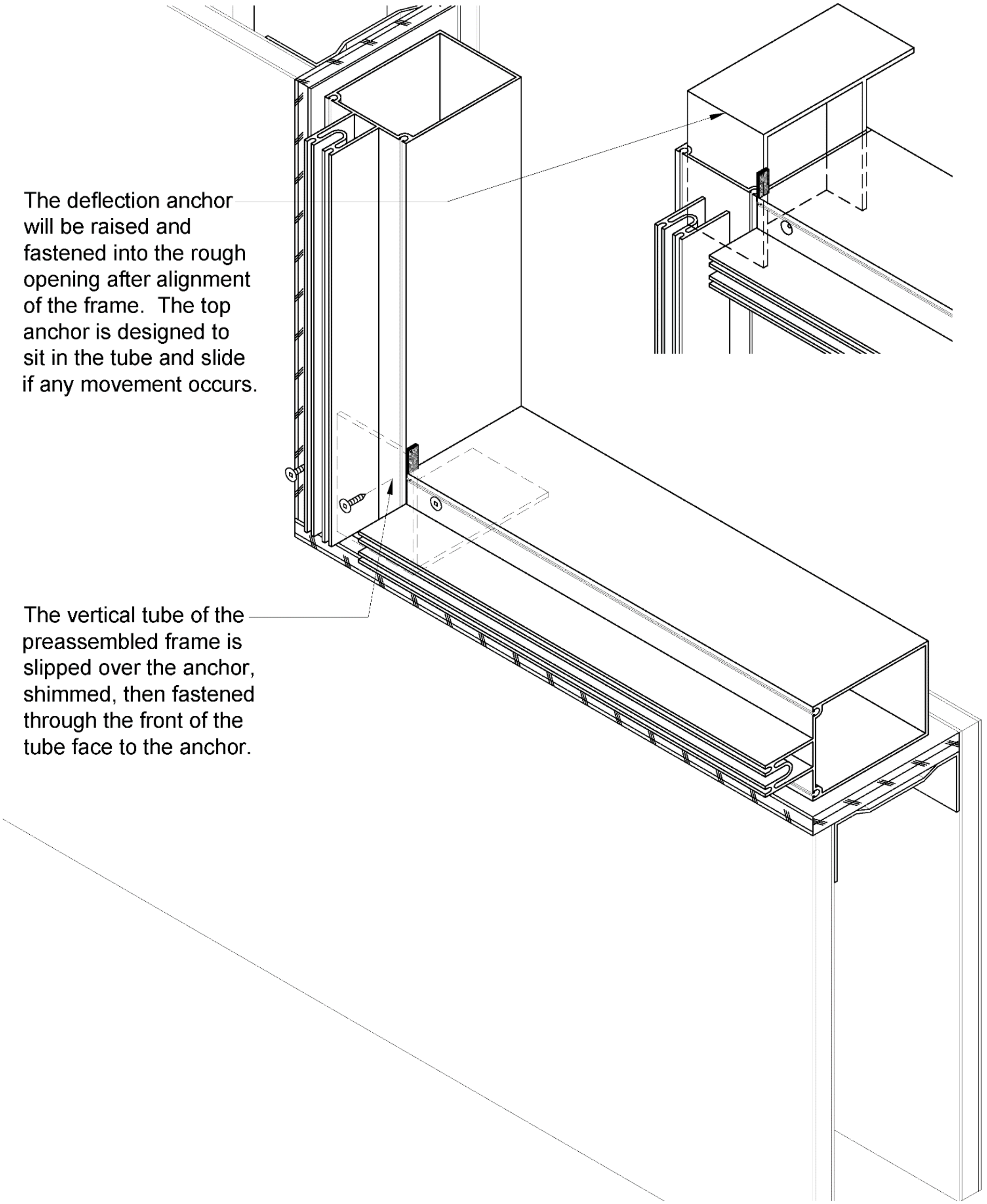
DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

DETAIL NUMBER
1



Anchor fastened into the rough opening. The anchor is positioned so the the tube face of the box curtain-wall section will be in plane with the face of exterior sheathing.

Alberta Infrastructure	SERIES 04 INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 2
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14



The deflection anchor will be raised and fastened into the rough opening after alignment of the frame. The top anchor is designed to sit in the tube and slide if any movement occurs.

The vertical tube of the preassembled frame is slipped over the anchor, shimmed, then fastened through the front of the tube face to the anchor.

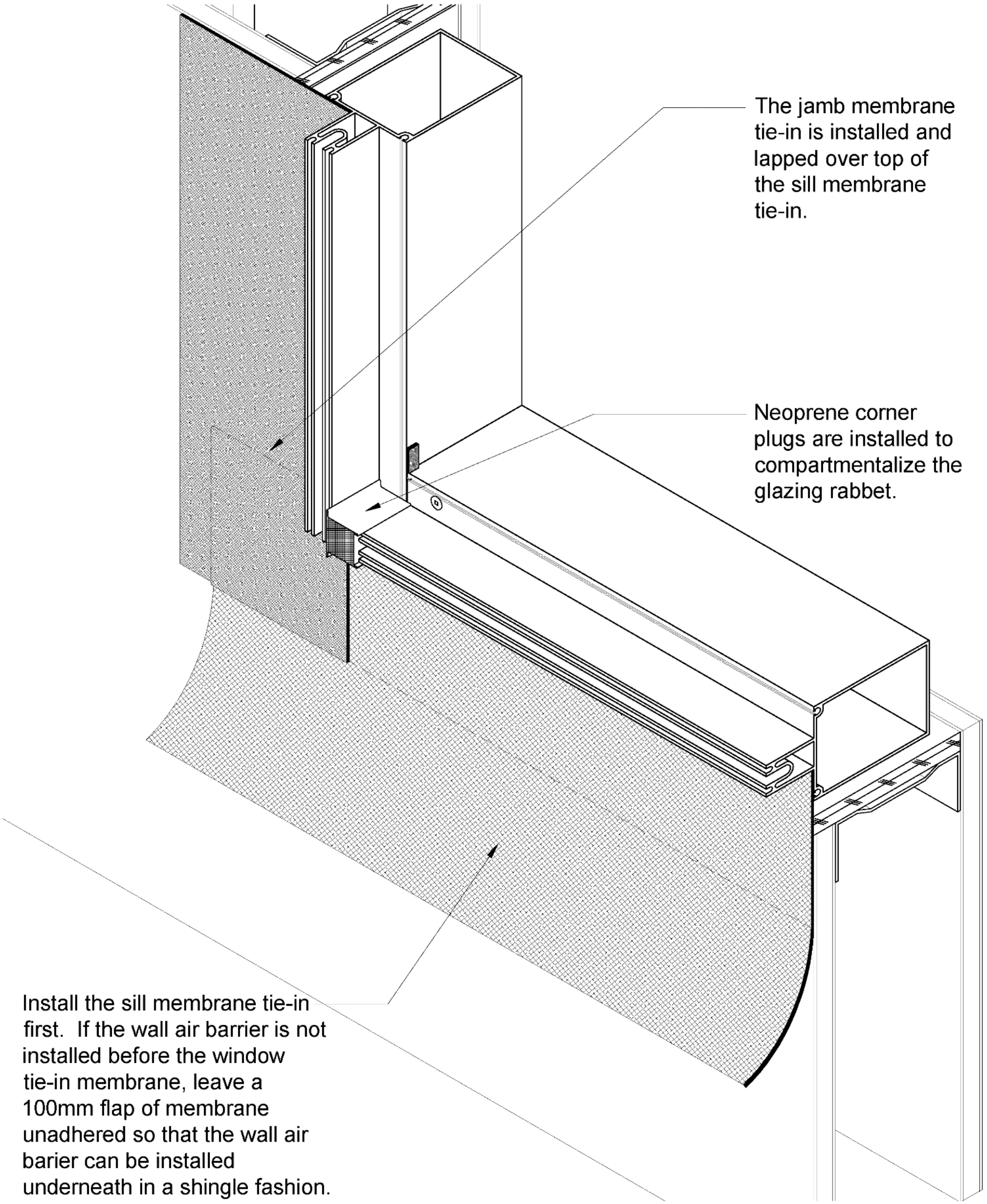
Alberta Infrastructure

SERIES 04
INSTALLATION SEQUENCE
ISOMETRIC WINDOW SILL DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
3

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

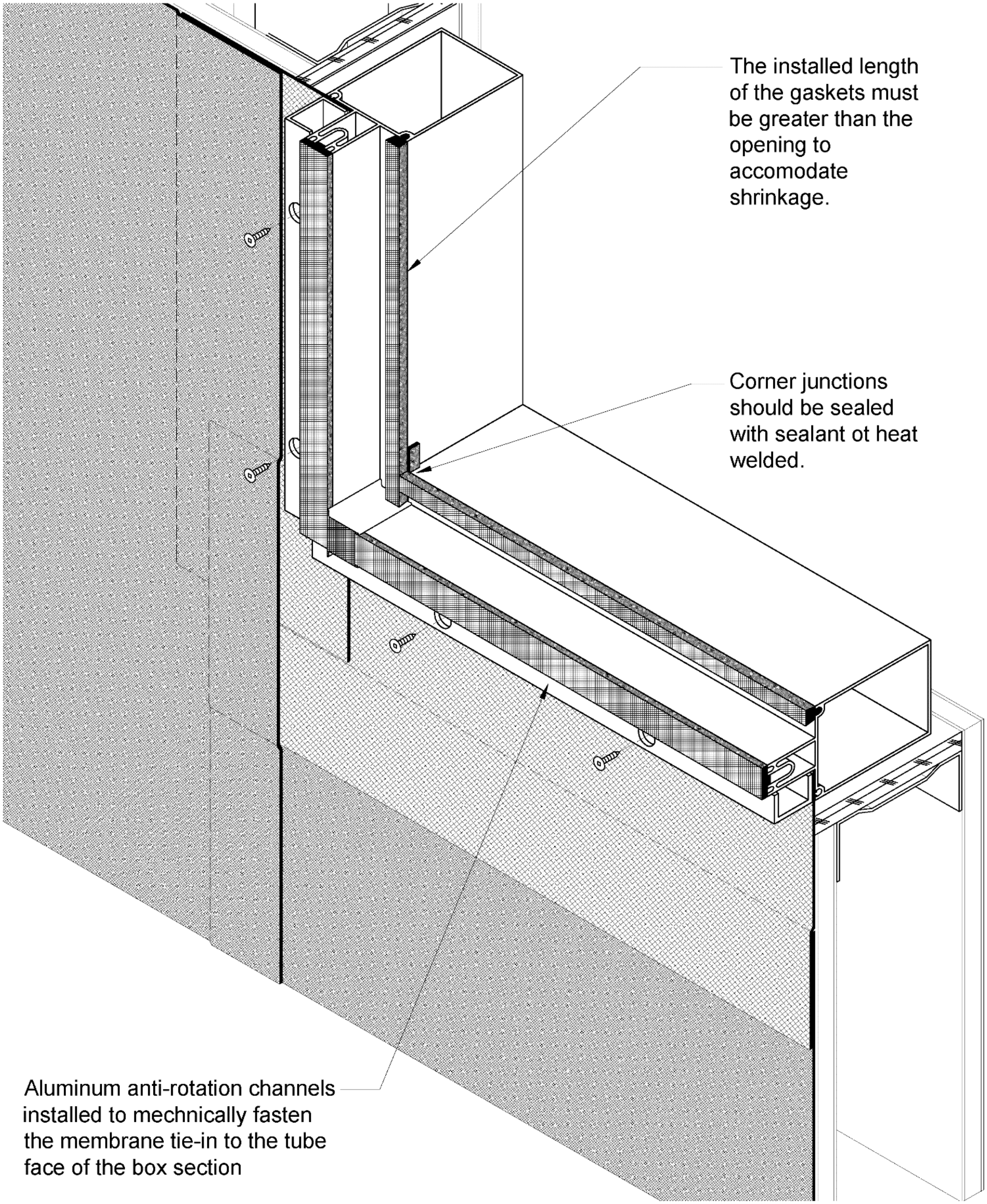


The jamb membrane tie-in is installed and lapped over top of the sill membrane tie-in.

Neoprene corner plugs are installed to compartmentalize the glazing rabbet.

Install the sill membrane tie-in first. If the wall air barrier is not installed before the window tie-in membrane, leave a 100mm flap of membrane unadhered so that the wall air barier can be installed underneath in a shingle fashion.

Alberta Infrastructure	SERIES 04 INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 4
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14



The installed length of the gaskets must be greater than the opening to accomodate shrinkage.

Corner junctions should be sealed with sealant ot heat welded.

Aluminum anti-rotation channels installed to mechnically fasten the membrane tie-in to the tube face of the box section

Alberta Infrastructure

SERIES 04
INSTALLATION SEQUENCE
ISOMETRIC WINDOW SILL DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
5

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

Air seal membrane stripped in over head flashing.

Bead of low expansion urethane foam used to deflect exterior moisture from penetrating into the rough opening.

Second bead of low expansion urethane foam used to complete the air seal between the air seal membrane and the window frame.

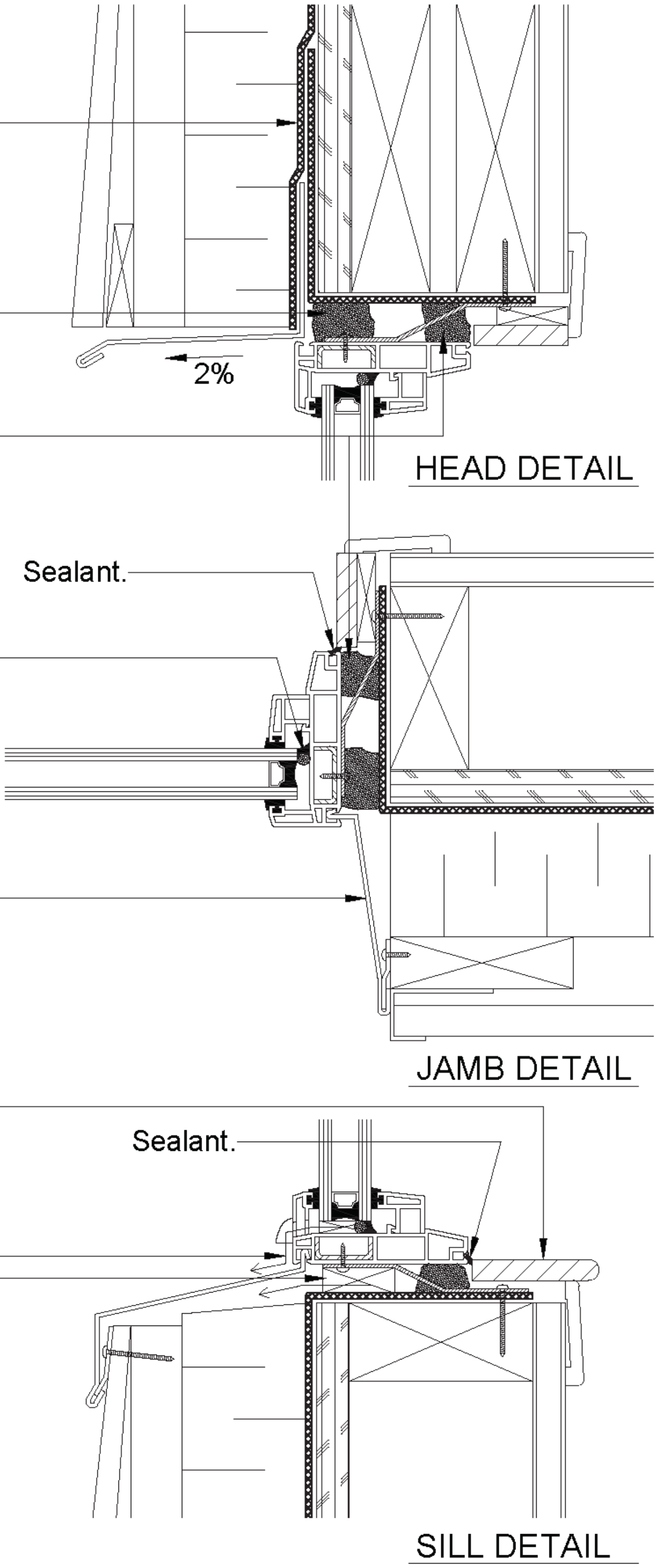
Heal bead to complete the air seal between the frame and the sealed unit

Many options are available for flashings and brick moulds depending on window manufacturer. Flashing and brick moulds should be installed after installation of urethane foam. Preferred concealed fastener option shown.

Interior durable trim installed after installation of the urethane foam.

Drainage.

No exterior bead of urethane foam at sill to allow the rough opening to drain to the exterior.



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Alberta
Infrastructure

EXTERIOR GLAZED WINDOW
INSTALLATION - SERIES 05
Punched [Heavy Duty] Window Option 1a

BUILDING SCIENCES SECTION

DETAIL NUMBER
1a

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V.SOLBAK	2012-02-23

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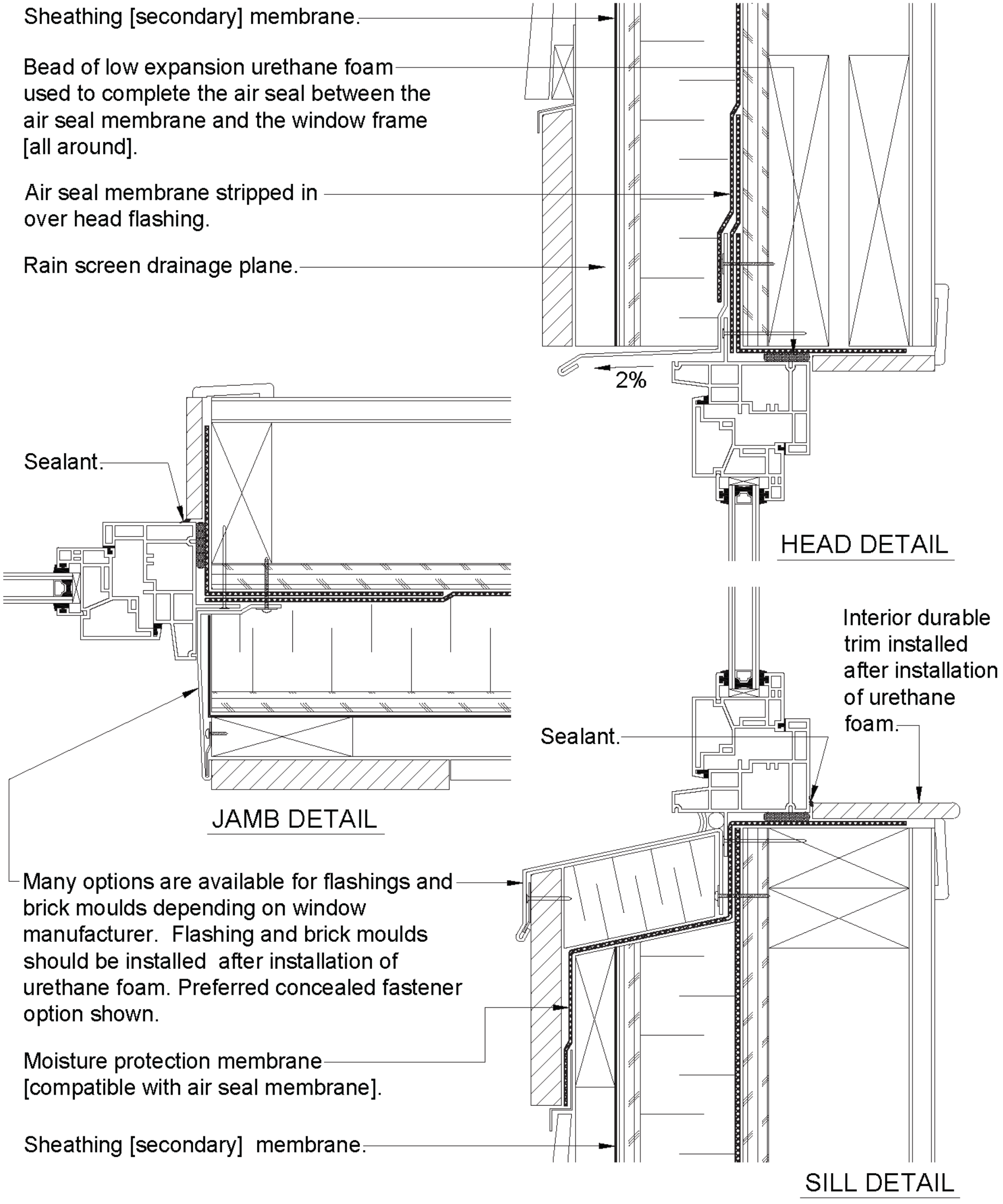

Sheathing [secondary] membrane.

Bead of low expansion urethane foam used to complete the air seal between the air seal membrane and the window frame [all around].

Air seal membrane stripped in over head flashing.

Rain screen drainage plane.

Sealant.

Many options are available for flashings and brick moulds depending on window manufacturer. Flashing and brick moulds should be installed after installation of urethane foam. Preferred concealed fastener option shown.

Moisture protection membrane [compatible with air seal membrane].

Sheathing [secondary] membrane.

Interior durable trim installed after installation of urethane foam.

Sealant.

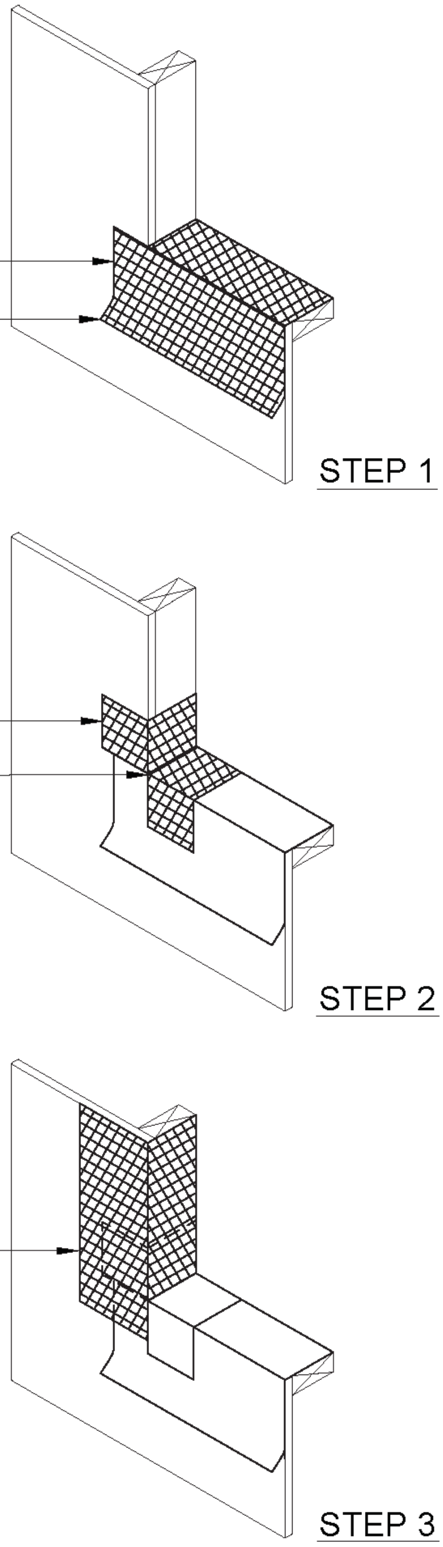
Alberta
Infrastructure

EXTERIOR GLAZED WINDOW
INSTALLATION - SERIES 05
Punched [Light Duty] Window Option 1b

BUILDING SCIENCES SECTION

DETAIL NUMBER
1b

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V.SOLBAK	2012-02-23



Sill membrane installed first.

If wall air seal membrane is not installed prior to window membrane, a flap of membrane at the sill should be left to allow for the wall membrane to be installed underneath creating a shingle lapped joint.

A small piece of membrane should be used in the corner at the transition between the sill and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.

A small amount of mastic that is compatible with the membrane should be used in the corner where the membranes meet.

Jamb membrane installed after sill and transition strips.

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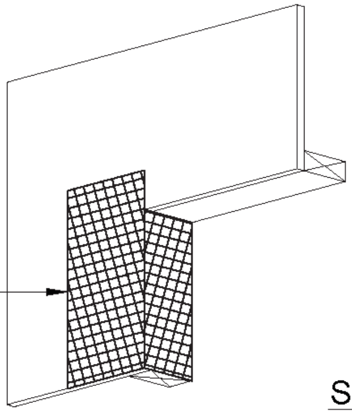
Alberta Infrastructure	EXTERIOR GLAZED WINDOW INSTALLATION - SERIES 05 MEMBRANE INSTALLATION AT SILL AND JAMB		BUILDING SCIENCES SECTION		DETAIL NUMBER 2a
	DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23	

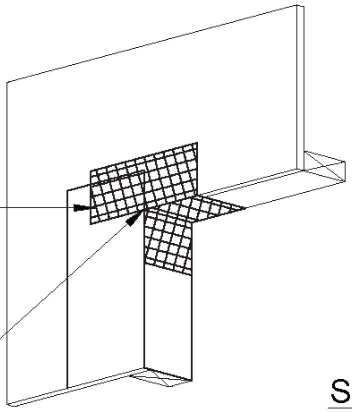
Continue jamb air seal membrane to top in single piece, if possible, or shingle lapped if not practical to do in a single piece. Extend past top of opening as indicated.



STEP 4

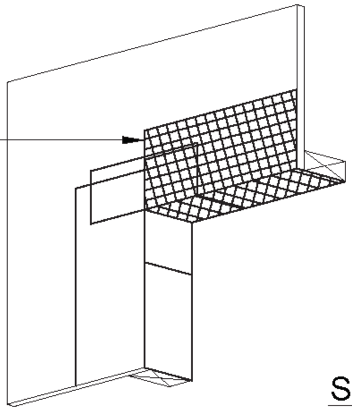
A small piece of membrane should be used in the corner at the transition between the head and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.

A small amount of mastic that is compatible with the membrane should be used in the corner where the membranes meet.



STEP 5

Head membrane installed last.



STEP 6

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Alberta
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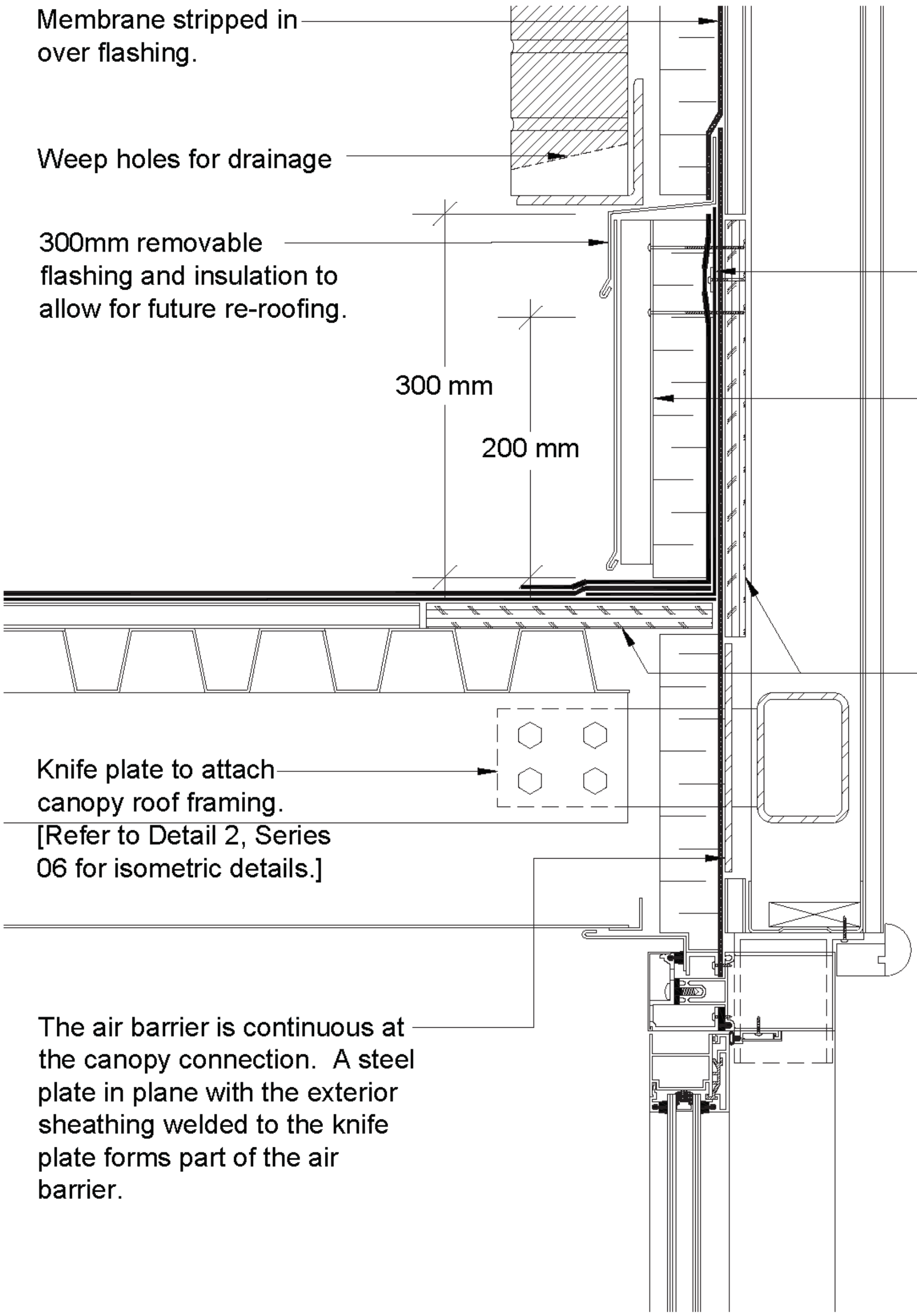
EXTERIOR GLAZED WINDOW
INSTALLATION - SERIES 05
MEMBRANE INSTALLATION AT JAMB AND HEAD

BUILDING SCIENCES SECTION

DETAIL NUMBER
2b

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23



Membrane stripped in over flashing.

Weep holes for drainage

300mm removable flashing and insulation to allow for future re-roofing.

Knife plate to attach canopy roof framing. [Refer to Detail 2, Series 06 for isometric details.]

The air barrier is continuous at the canopy connection. A steel plate in plane with the exterior sheathing welded to the knife plate forms part of the air barrier.

Termination bar to attach base membrane

Insulation attached using a cantilevered hat channel or z-bar fastened a minimum of 200mm above the roof membrane.

Plywood used at perimeter locations for durability during the construction process.

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Alberta Infrastructure	STRUCT. PENETRATION DETAILS - SERIES 06 UNHEATED CANOPY OPTION		BUILDING SCIENCES SECTION		DETAIL NUMBER 1
	DRAWN BY E.RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23	

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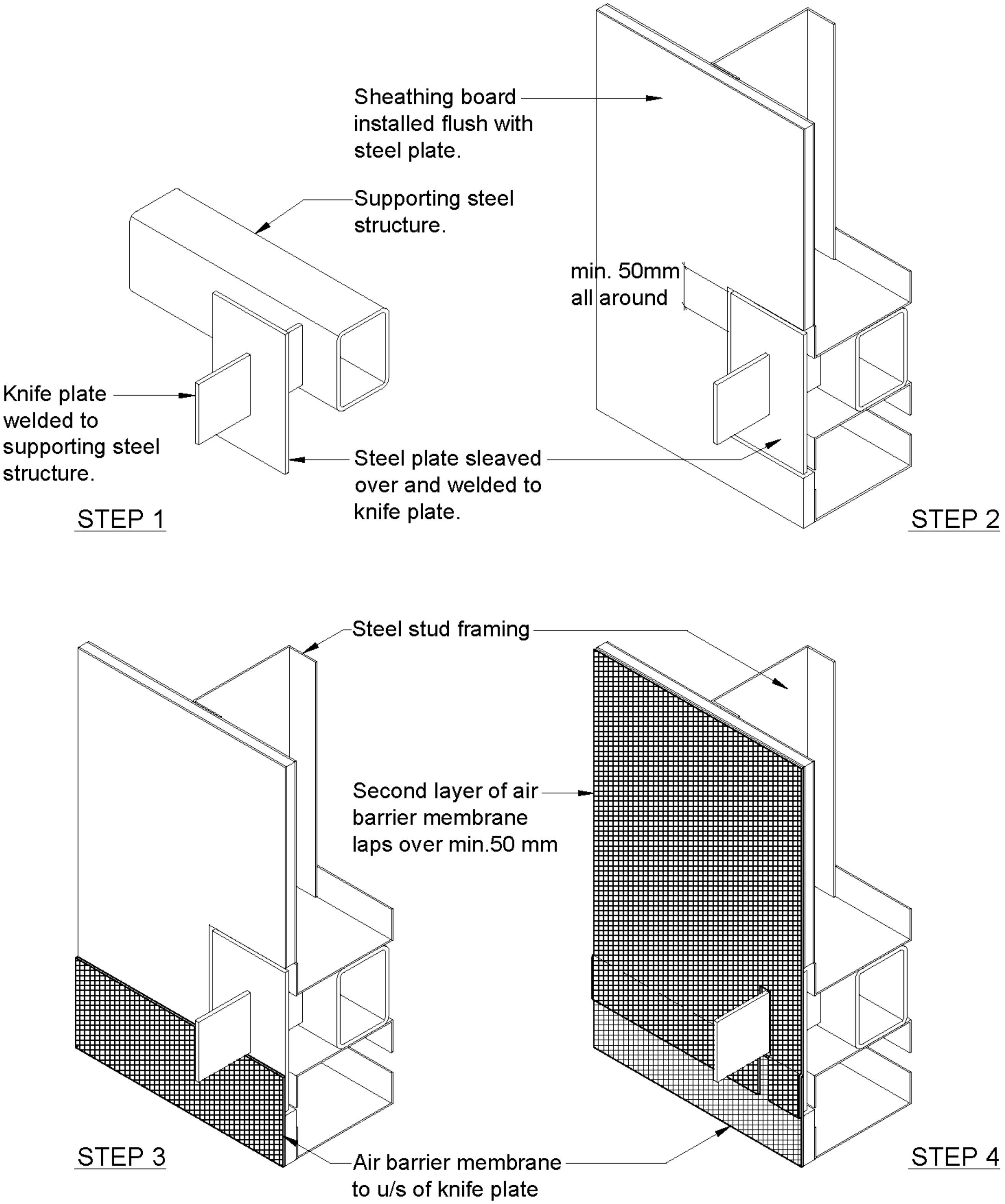


Alberta Infrastructure

STRUCT. PENETRATION DETAILS - SERIES 06

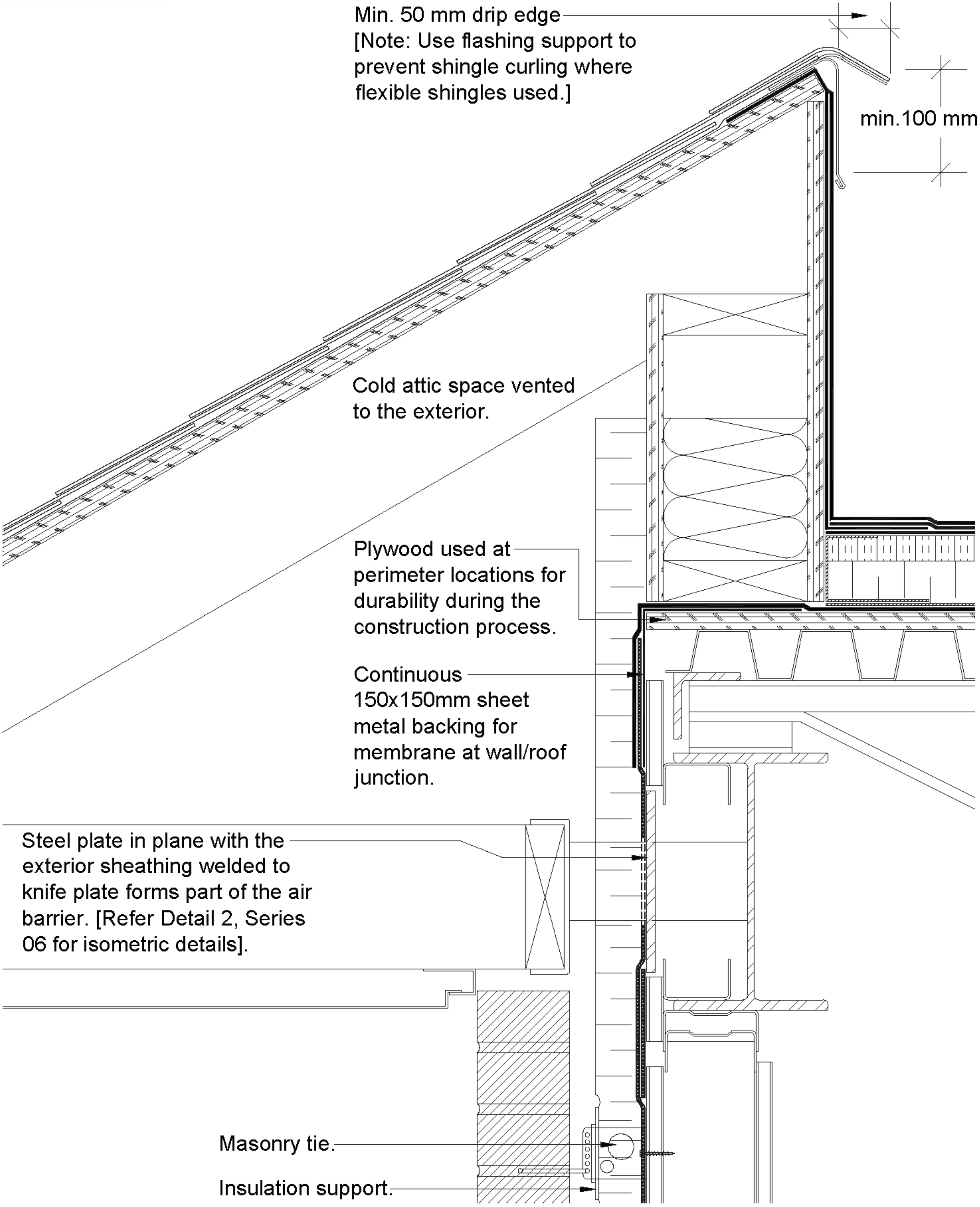
ISOMETRIC PLATE SEQUENCING DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23

DETAIL NUMBER

2



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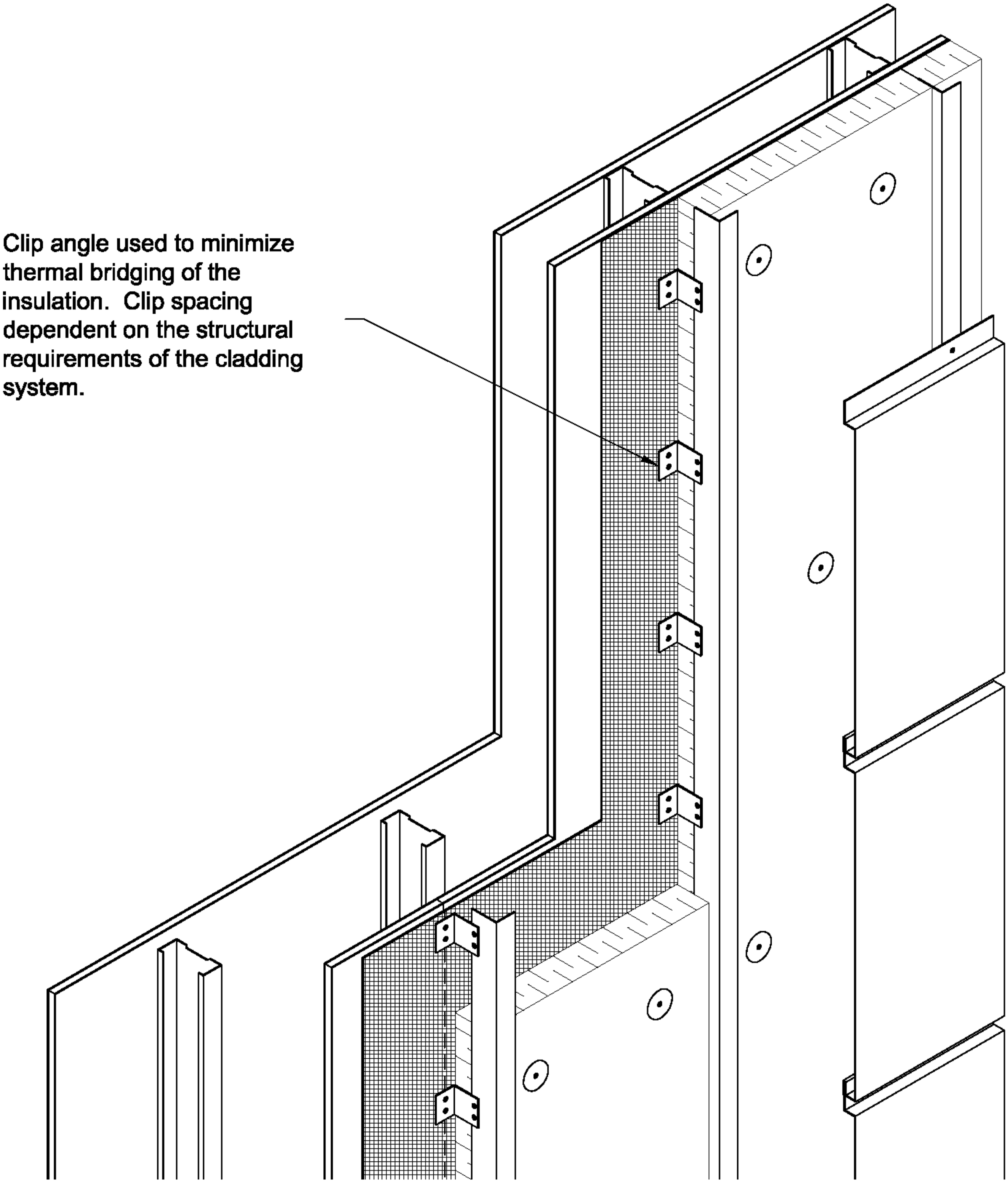
Alberta Infrastructure

STRUCT. PENETRATION DETAILS - SERIES 06
UNHEATED CANOPY OVERHANG OPTION

BUILDING SCIENCES SECTION

DETAIL NUMBER
3

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23


Clip angle used to minimize thermal bridging of the insulation. Clip spacing dependent on the structural requirements of the cladding system.

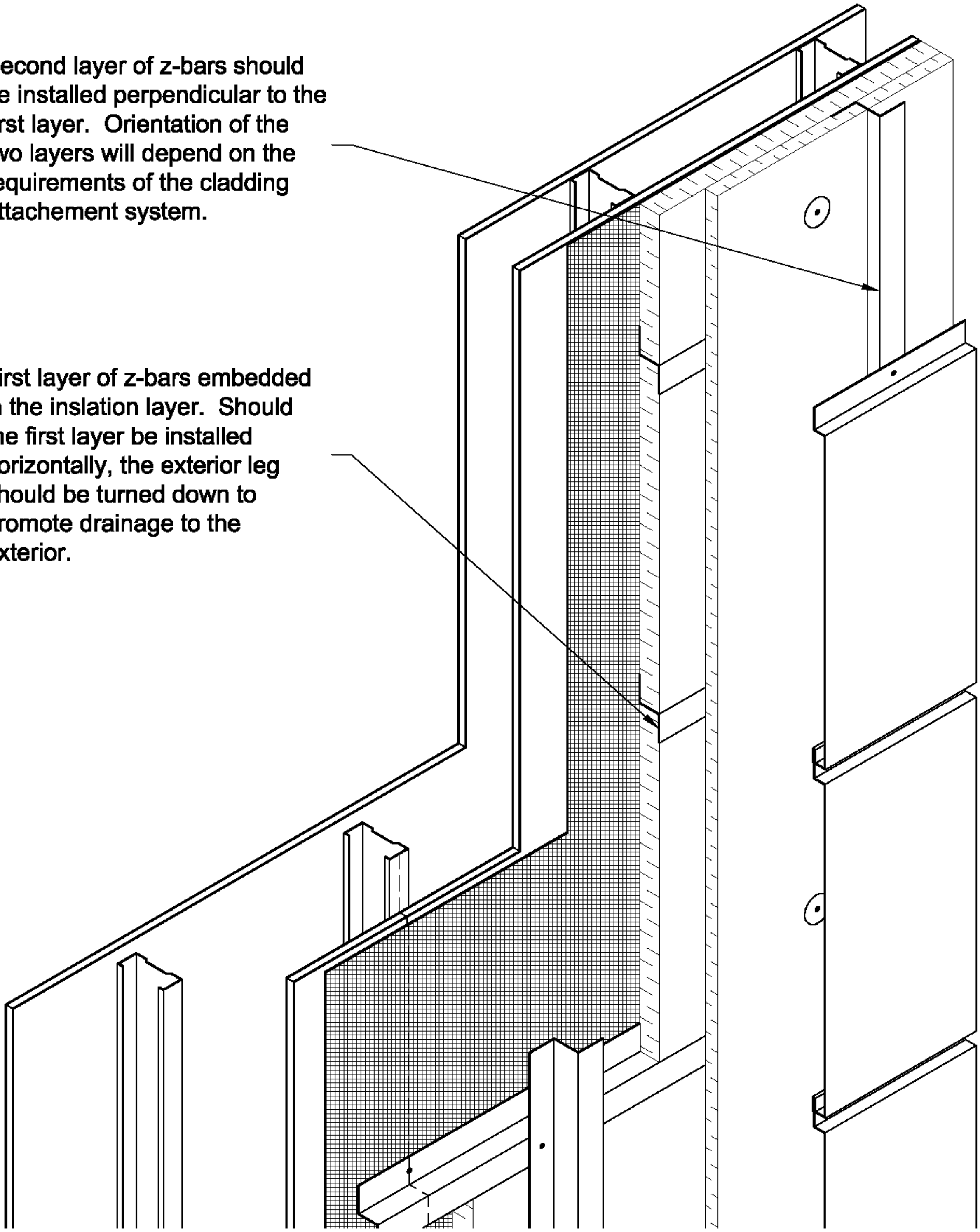
Alberta Infrastructure

THERMAL CLIPS

CLADDING ATTACHMENT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE	DETAIL NUMBER
PETER BAKER	01-01-2005			1



Second layer of z-bars should be installed perpendicular to the first layer. Orientation of the two layers will depend on the requirements of the cladding attachement system.

First layer of z-bars embedded in the inslation layer. Should the first layer be installed horizontally, the exterior leg should be turned down to promote drainage to the exterior.

Alberta Infrastructure

DOUBLE Z-BARS

CLADDING ATTACHMENT DETAILS

BUILDING SCIENCES SECTION

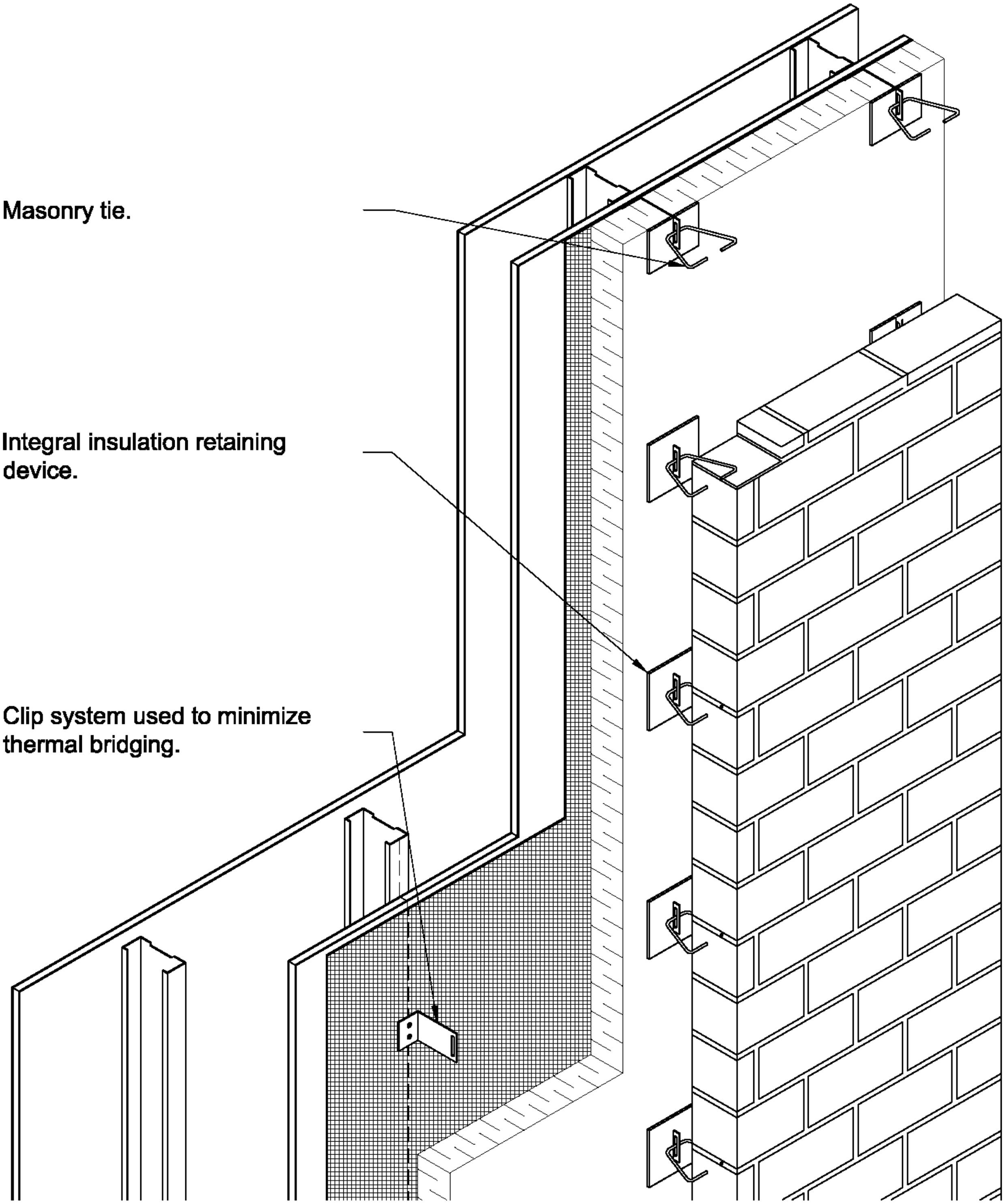
DETAIL NUMBER
2

DRAWN BY
PETER BAKER

DATE
01-01-2005

CHECKED BY

DATE



Masonry tie.

Integral insulation retaining device.

Clip system used to minimize thermal bridging.

Alberta
Infrastructure

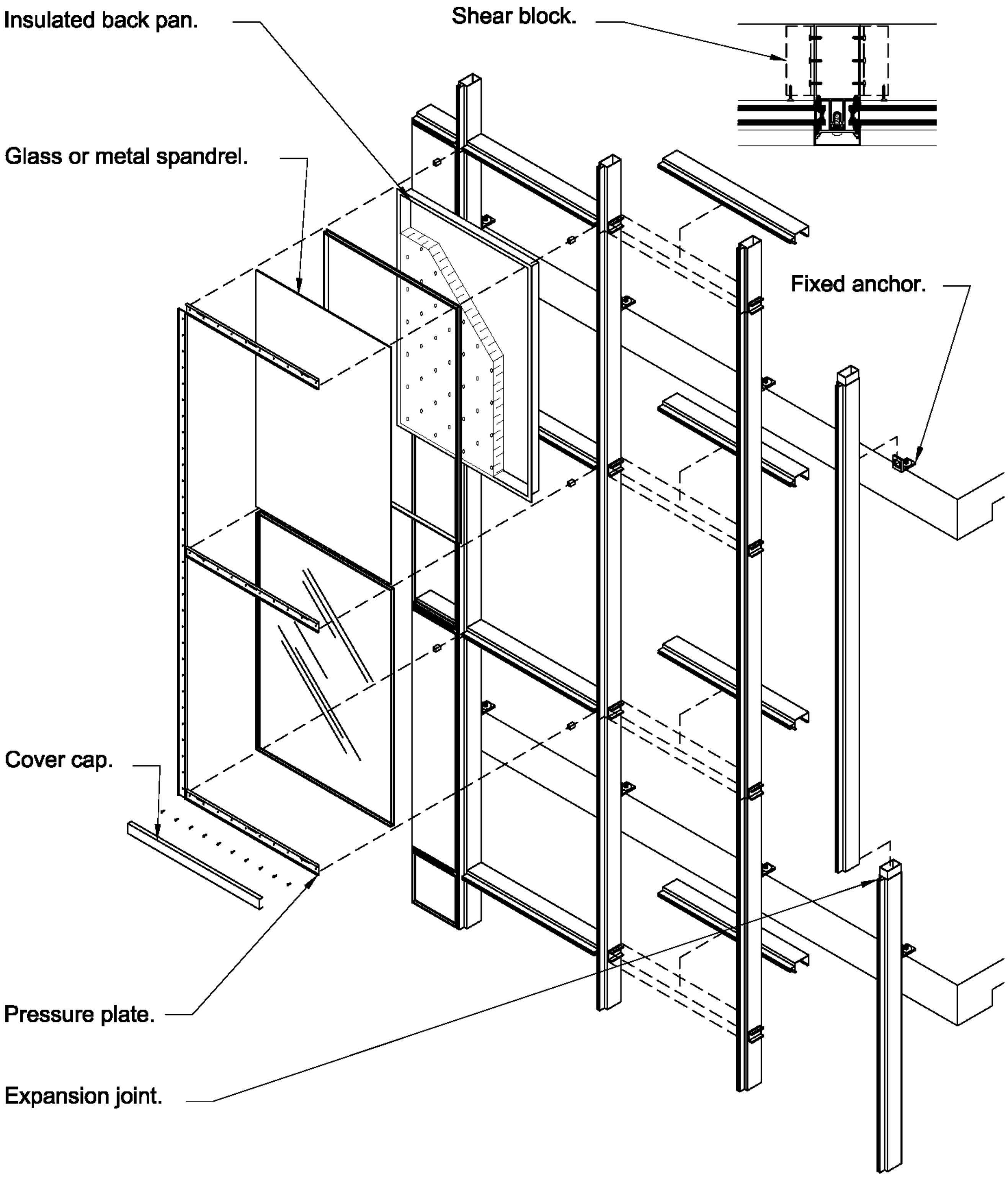
MASONRY TIES

CLADDING ATTACHMENT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

DETAIL NUMBER
3



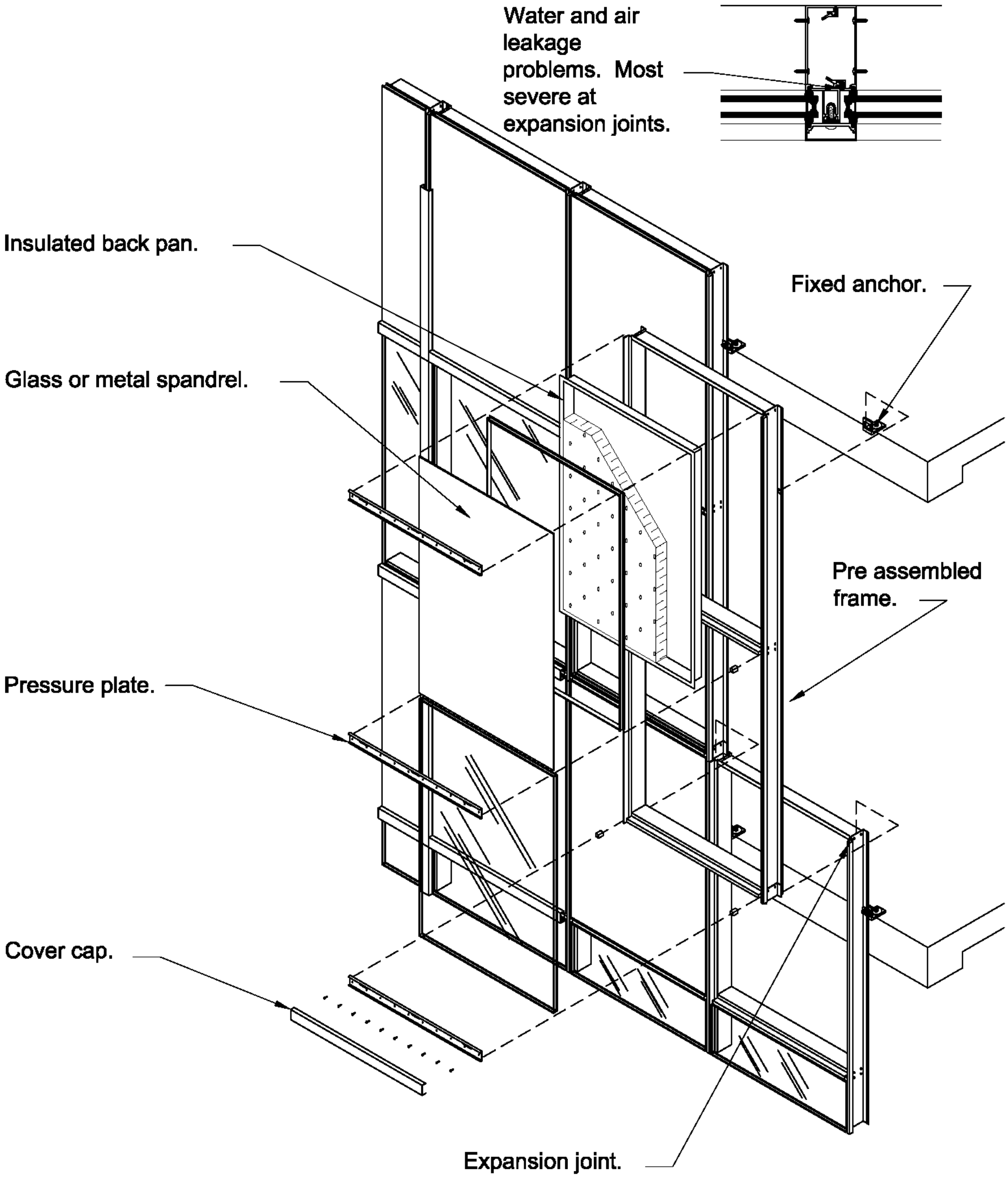
Alberta
Infrastructure

STICK SYSTEM

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE	DETAIL NUMBER
PETER BAKER	01-01-2005			1



Alberta
Infrastructure

SPLIT MULLION SYSTEM

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

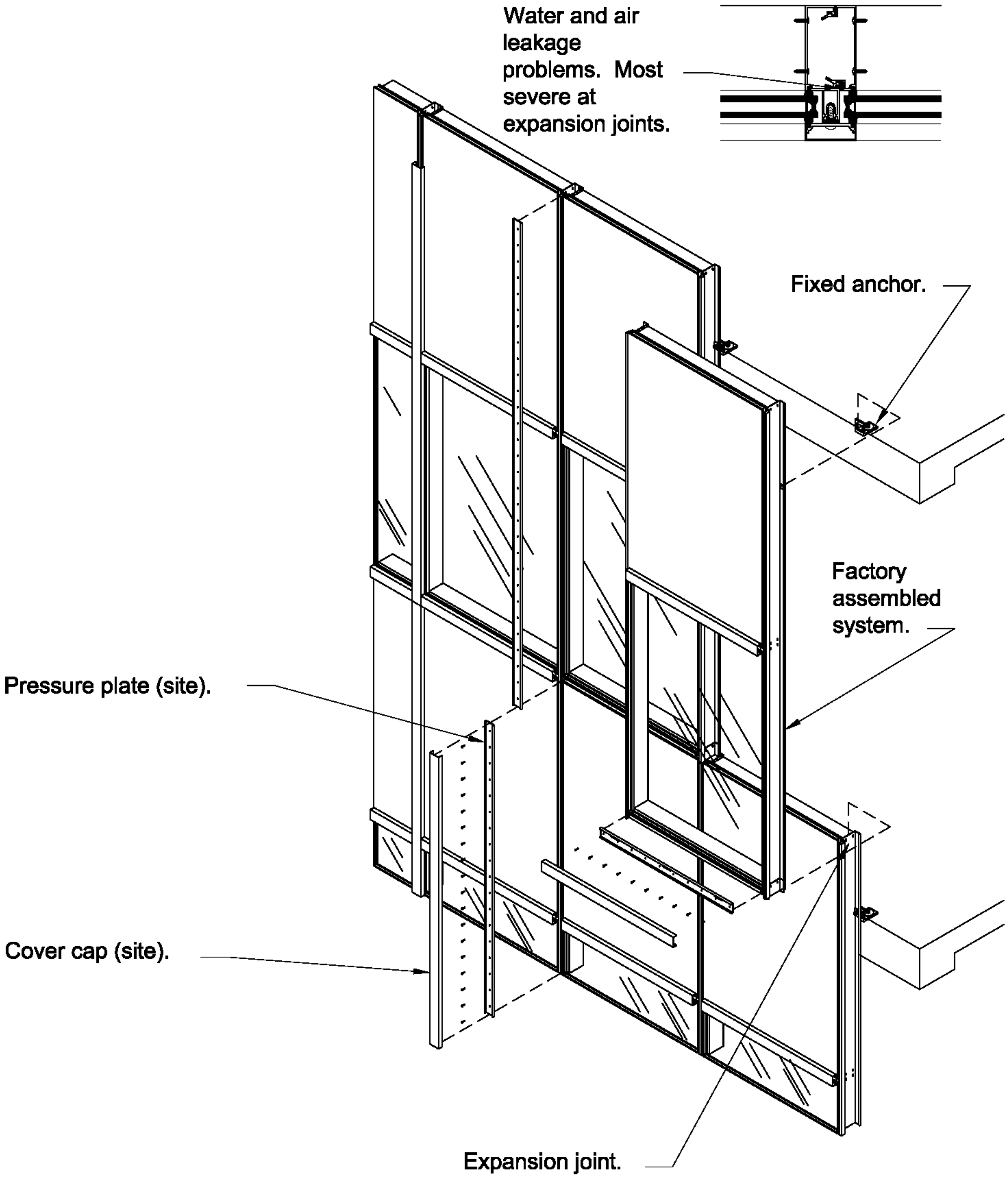
DETAIL NUMBER
2

DRAWN BY
PETER BAKER

DATE
01-01-2005

CHECKED BY

DATE



Alberta
Infrastructure

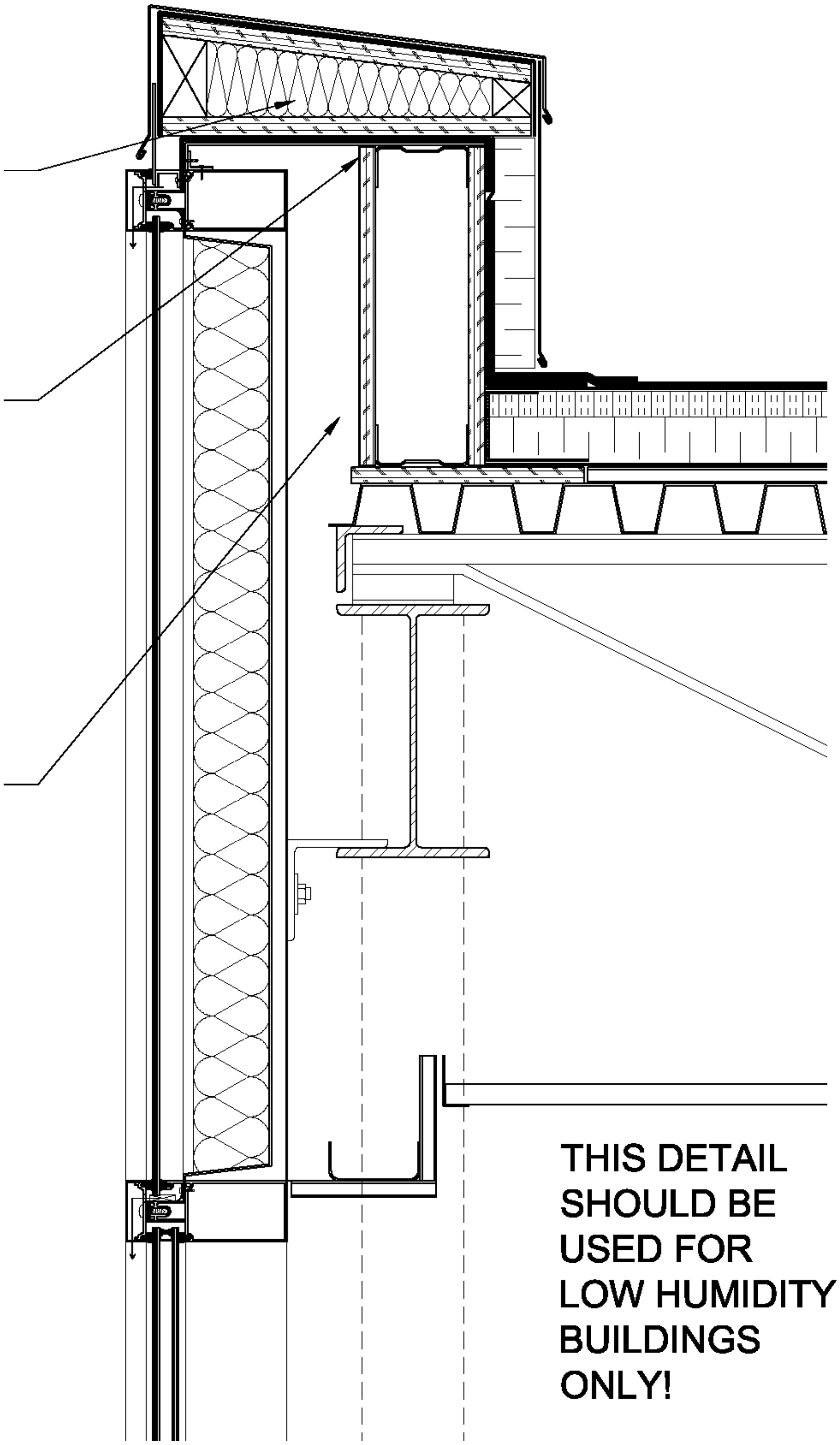
PANELIZED SYSTEM

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
3

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



Insulate exterior of the air barrier membrane.

Air seal membrane supported by sheet metal. The sheet metal is installed in plane with, but does not overlap, the tube face of the curtainwall section, allowing for the air seal membrane to be sealed directly to the tube face of the curtainwall.

Even though the parapet is insulated the construction surfaces may reach the dew point temperature resulting in condensation. An air space between the parapet curb and the curtainwall may allow for some air movement to reduce cooling of the parapet.

THIS DETAIL SHOULD BE USED FOR LOW HUMIDITY BUILDINGS ONLY!

Alberta
Infrastructure

PARAPET 1

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
4

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

Depending on the heigth of the parapet the curtain wall may require to be tied back to the structure.

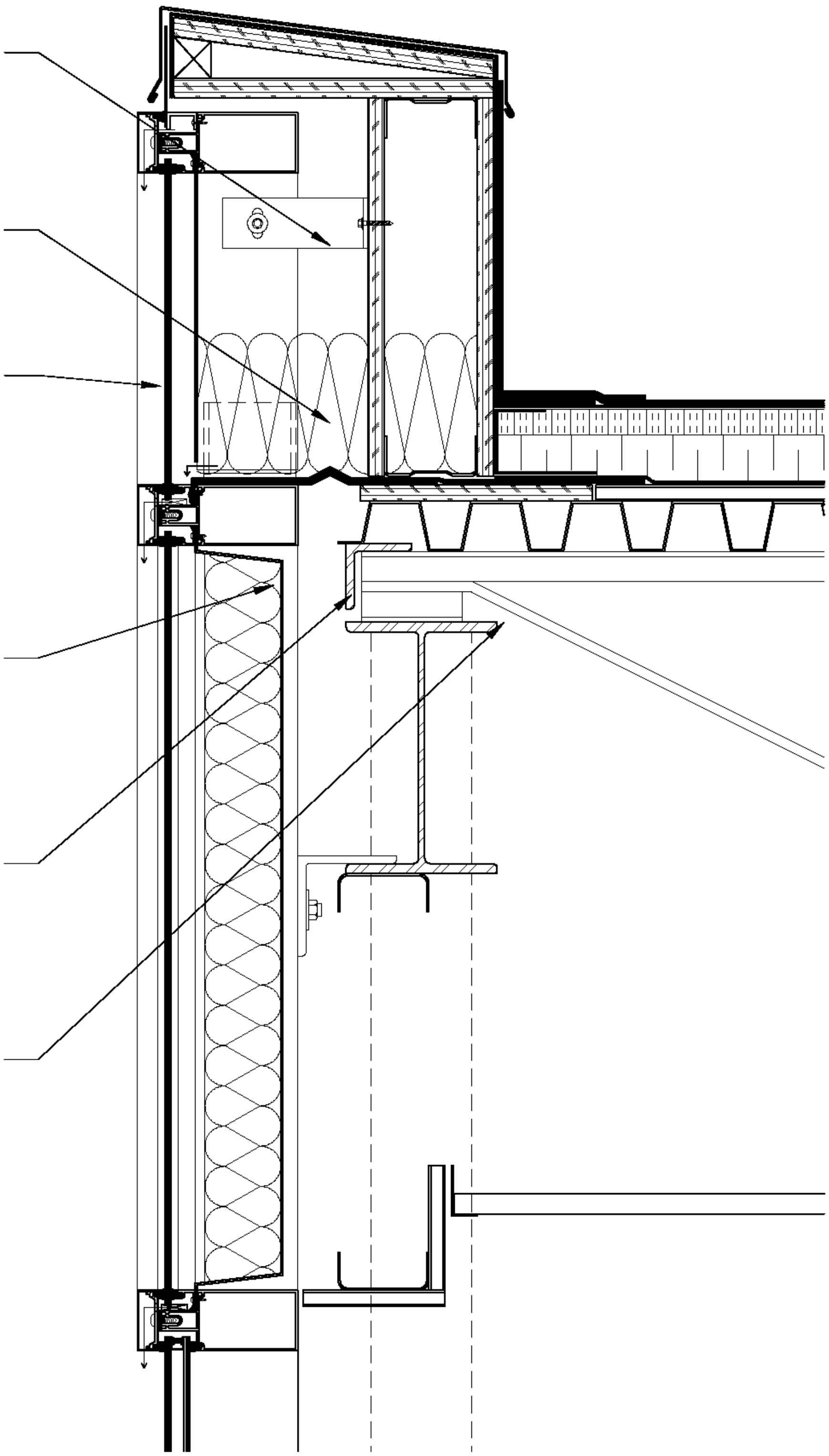
Insulate exterior of the air barrier membrane.

Sheet metal to minimize water from penetrating into the parapet construction and to contain insualtion. This must be drained at the bottom through the curtainwall system.

Air seal continued below parapet construction.and sealed to curtain wall frame.

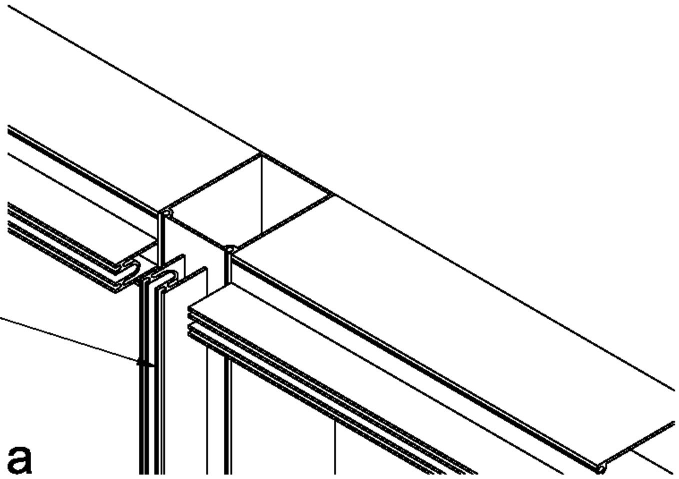
Bend in sheet metal to allow for differential movement between structure and curtain wall.

Plywood used at perimeter locations for durability during the construction process.



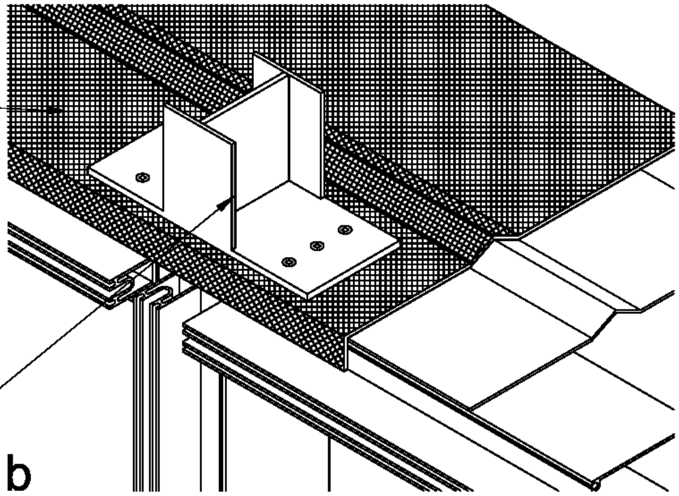
Alberta Infrastructure	**PARAPET 2** CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 5
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

Top of curtain wall at roof deck elevation.

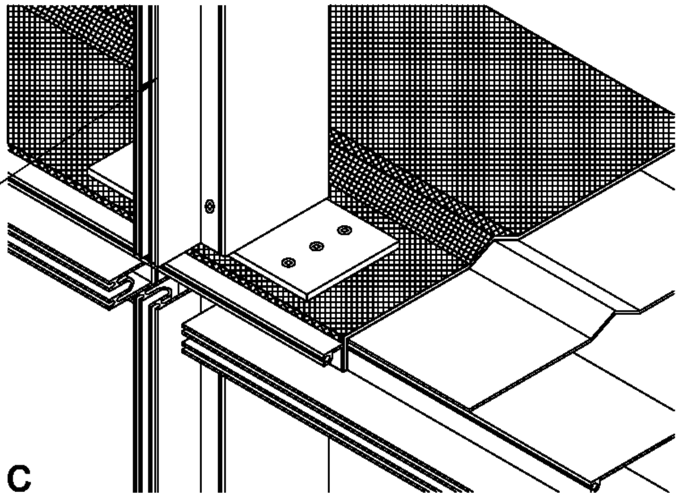

a

Install sheet metal and air seal membrane from roof vapour barrier and seal to the front face of the tube section. Any membrane overlaps should occur at mid points between verticals.

Slip anchor installed over air seal membrane.


b

Install extra curtain wall framing to the height of the parapet.


c

Alberta
Infrastructure

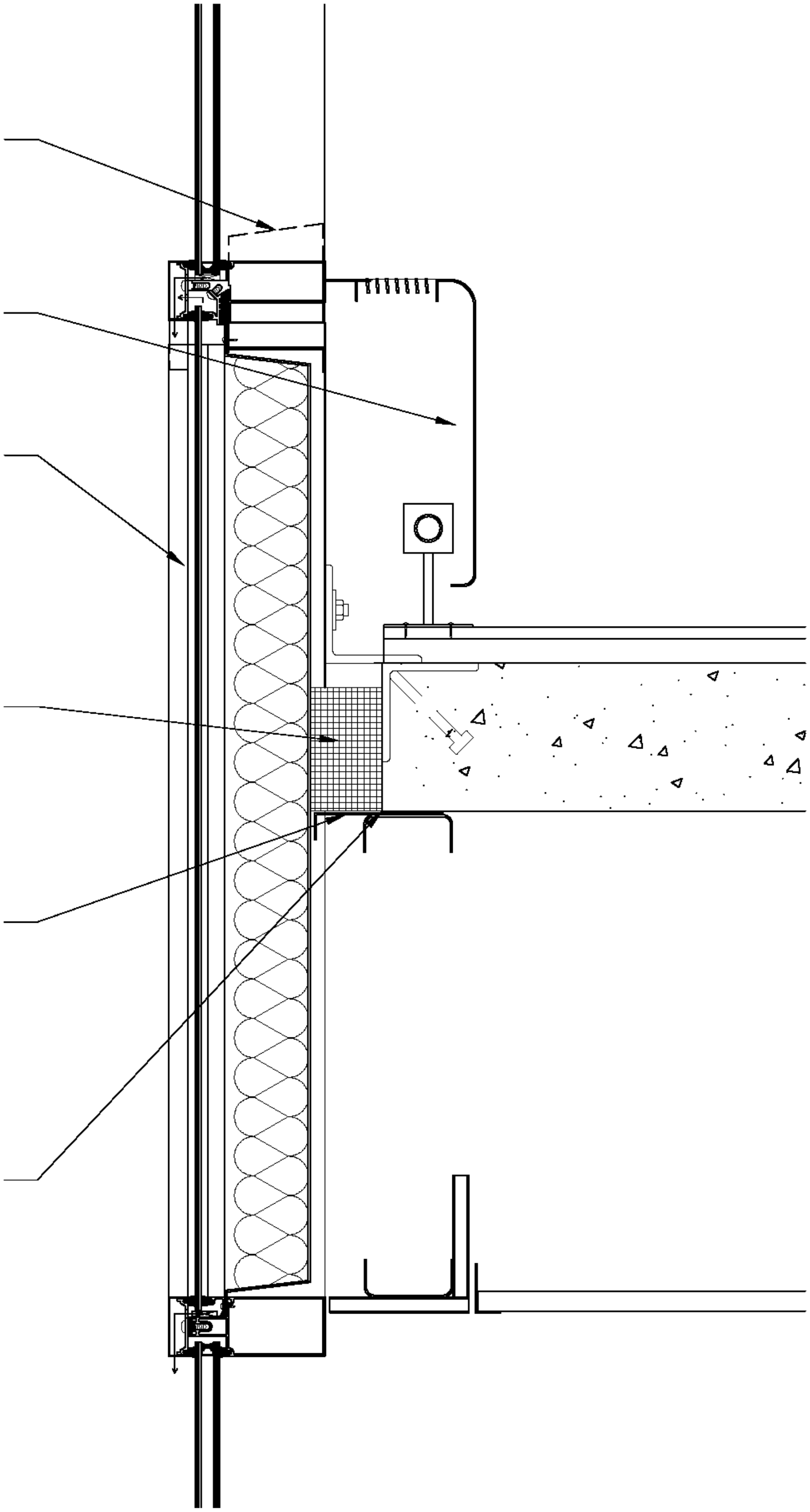
AIR SEAL DETAIL

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
6

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



Expansion joint. If large movemnts are expected within the system then a double mullion horizontal should be used.

Convector cabinet

Spandrel construction consists of cladding (glass, metal, or stone), and air space, and a back pan.

Firestop.

Retainer sheet to prevent the firestop insulation from dropping.

Minimum 50mm tolerance between the slab edge and the back of the curtainwall.

Alberta Infrastructure

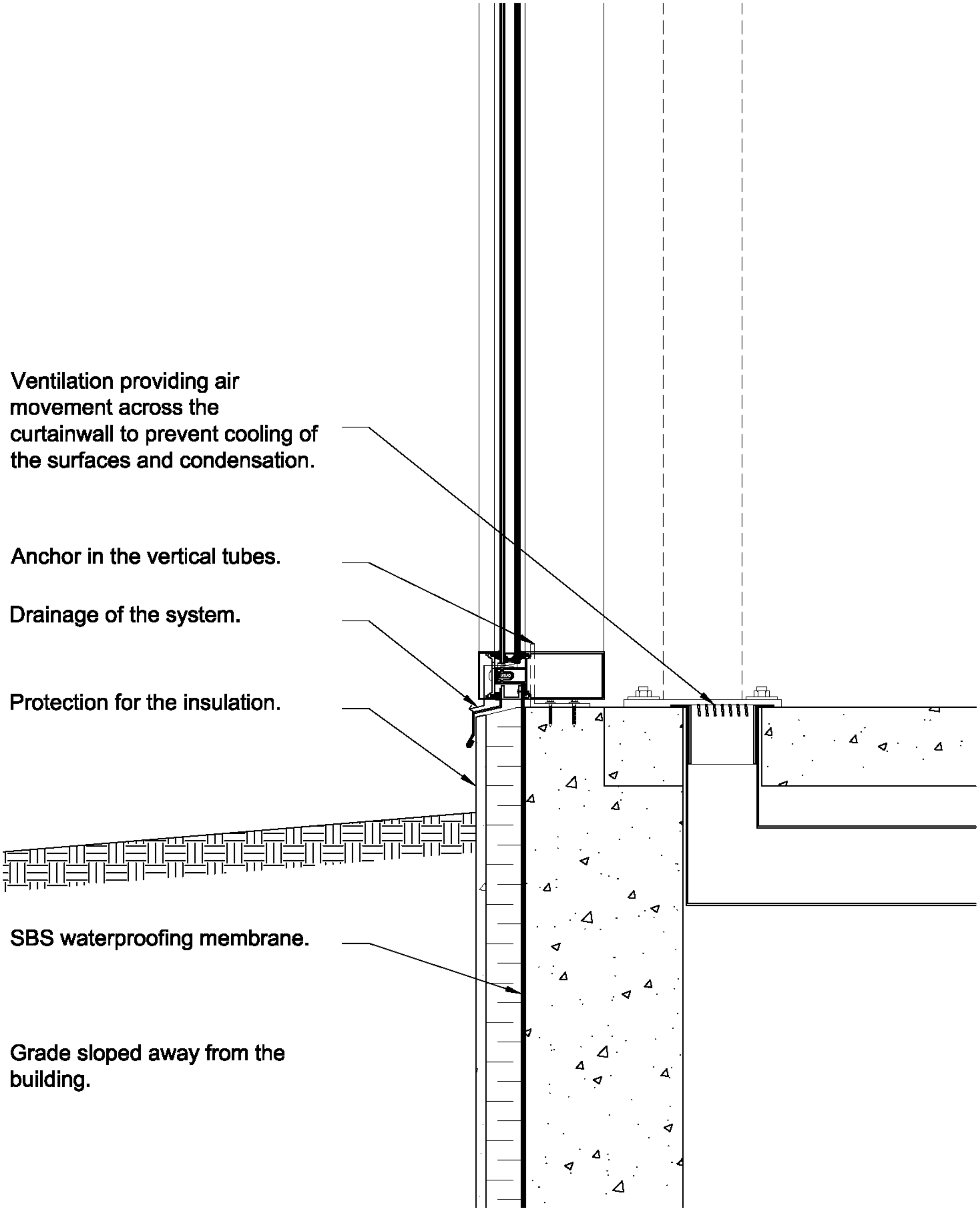
FLOOR SPANDREL

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

DETAIL NUMBER
7



Ventilation providing air movement across the curtainwall to prevent cooling of the surfaces and condensation.

Anchor in the vertical tubes.

Drainage of the system.

Protection for the insulation.

SBS waterproofing membrane.

Grade sloped away from the building.

Alberta Infrastructure

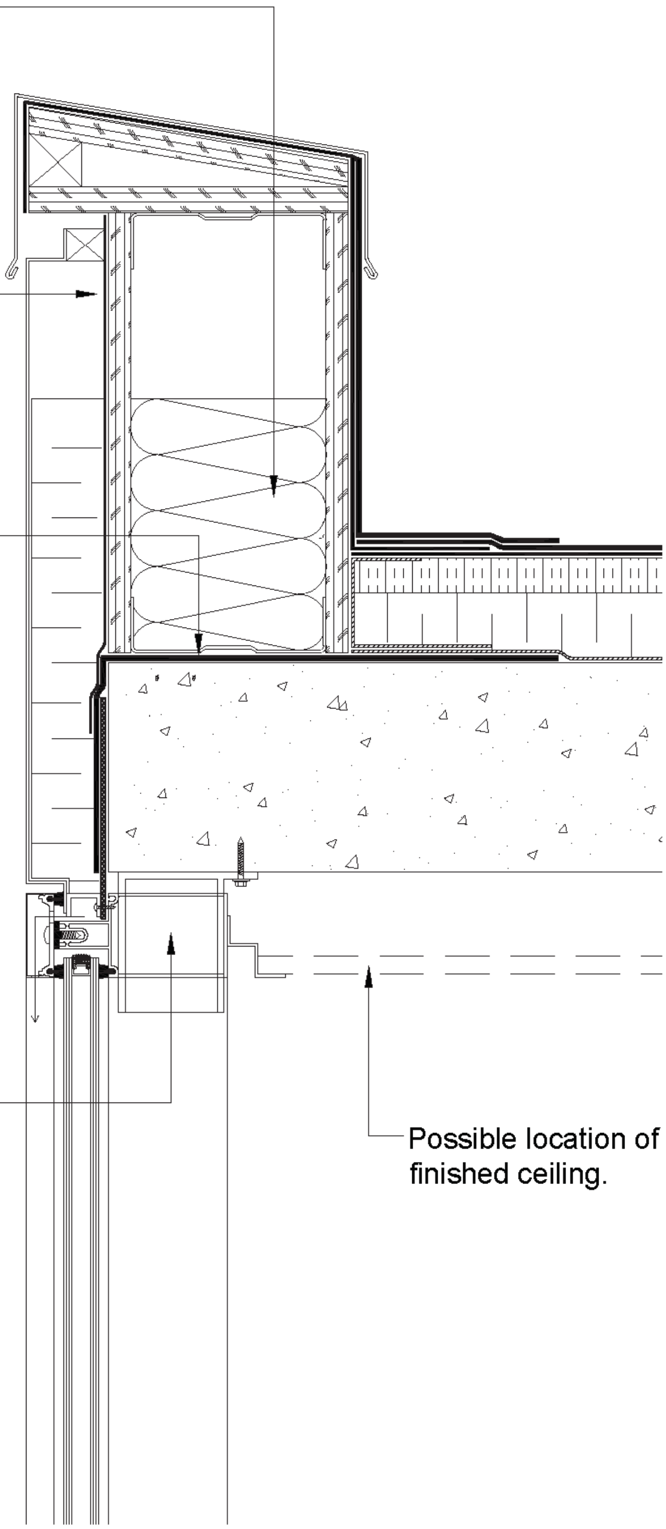
FOUNDATION

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
8

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



Insulation must be installed exterior of the membrane. (min 200mm)

Building paper installed to shed water while allowing the parapet construction to dry to exterior.

An internally reinforced peel and stick air seal membrane continues below parapet construction. Membrane must be compatible with both roof vapour barrier and wall air barrier.

Deflection anchor at window head to accomodate movement.

Possible location of finished ceiling.

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Alberta Infrastructure

SLAB TO SLAB CURTAIN WALL DETAILS - SERIES 09 PARAPET		BUILDING SCIENCES SECTION	
DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23

DETAIL NUMBER
1

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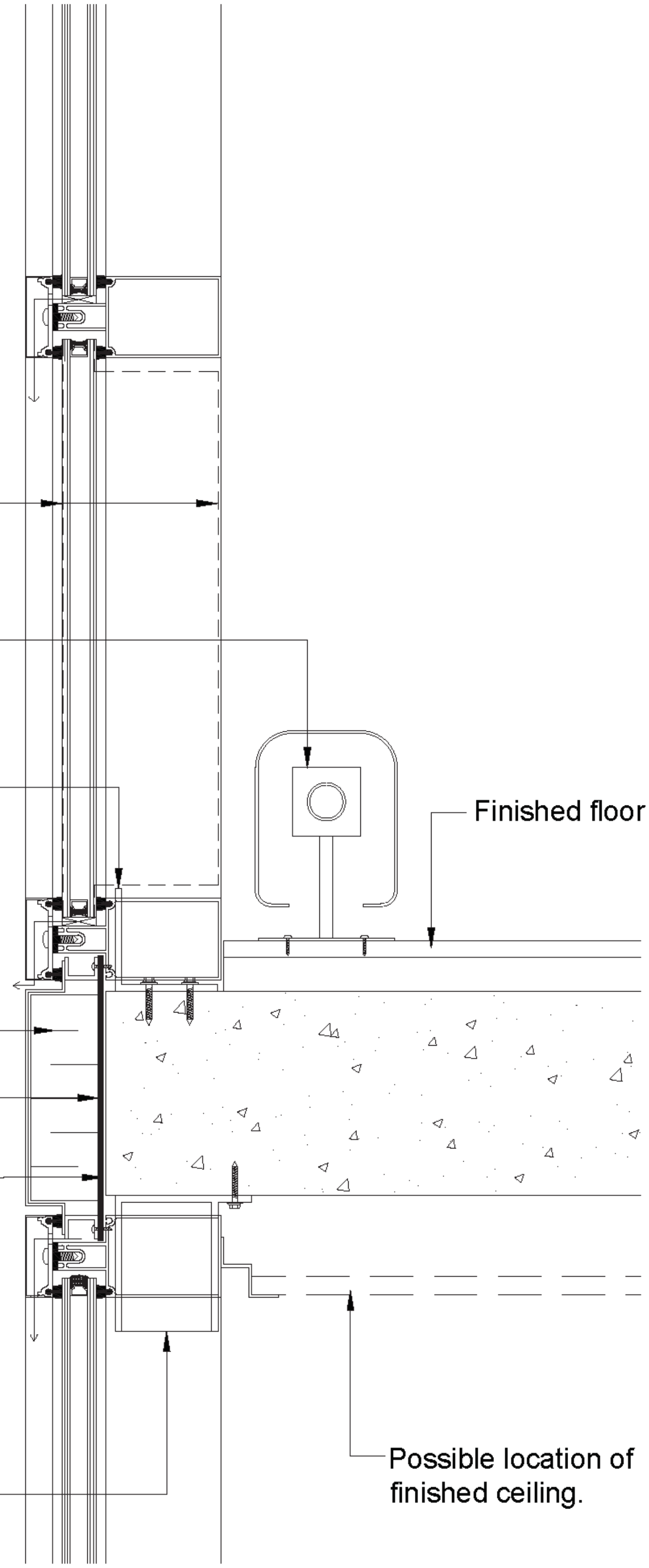

Spandrel panel with back-pan option, shown dotted-in.

Perimeter radiant heating option.

Fixed anchor at the sill. (inside vertical mullions)

Finished floor

Insulation installed exterior of the air seal membrane.

Membrane sealed directly to the structural tube face of the curtain wall section and mechanically fastened with an anti-rotation channel.

Tube face of curtain wall section in plane with the face of the slab edge to allow for a single plane of air seal membrane.

Possible location of finished ceiling.

Deflection anchor at window head to accommodate movement. (inside vertical mullion)

Alberta
Infrastructure

SLAB TO SLAB CURTAIN
WALL DETAILS - SERIES 09
INTERMEDIATE FLOOR

BUILDING SCIENCES SECTION

DETAIL NUMBER
2

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23

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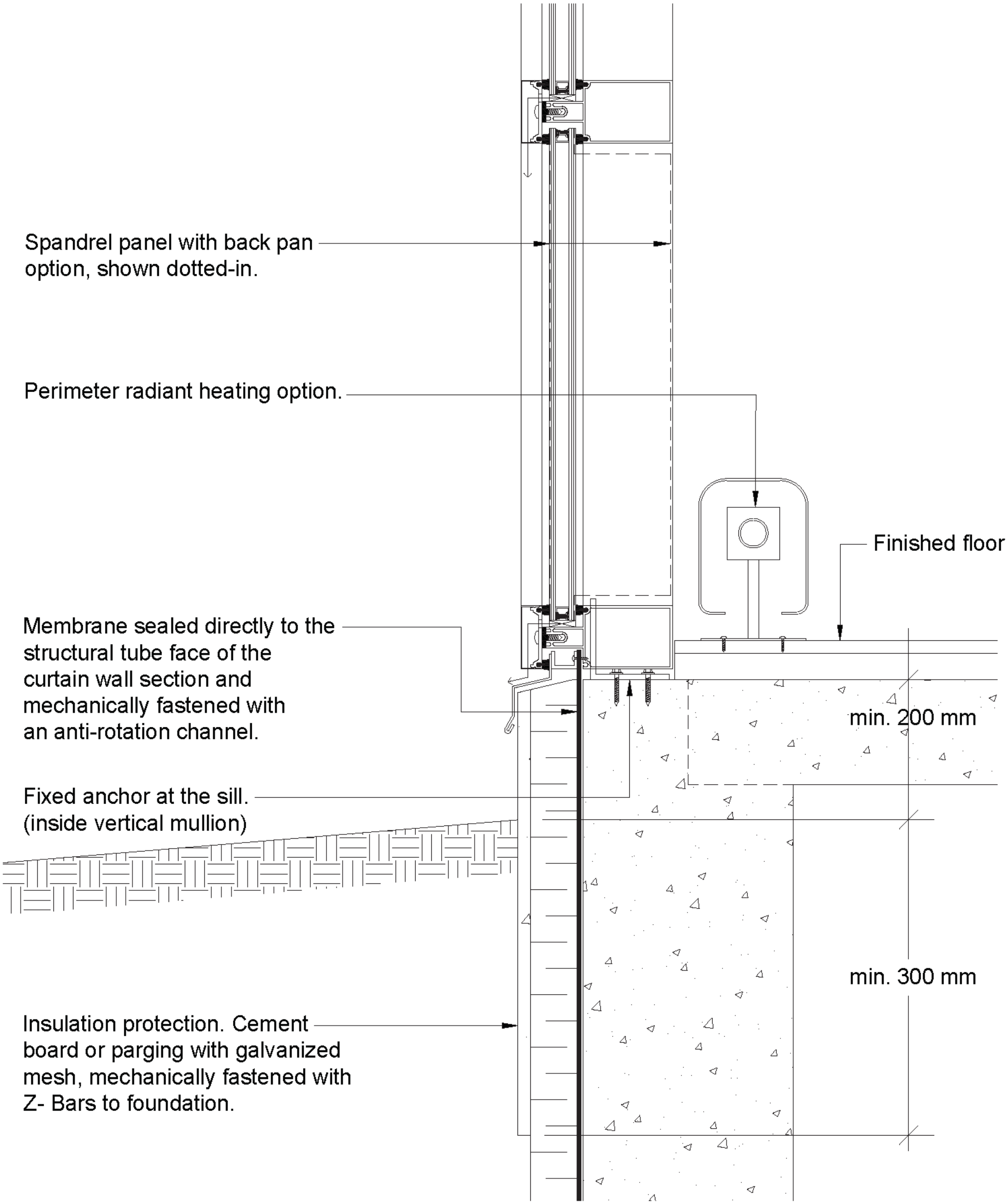

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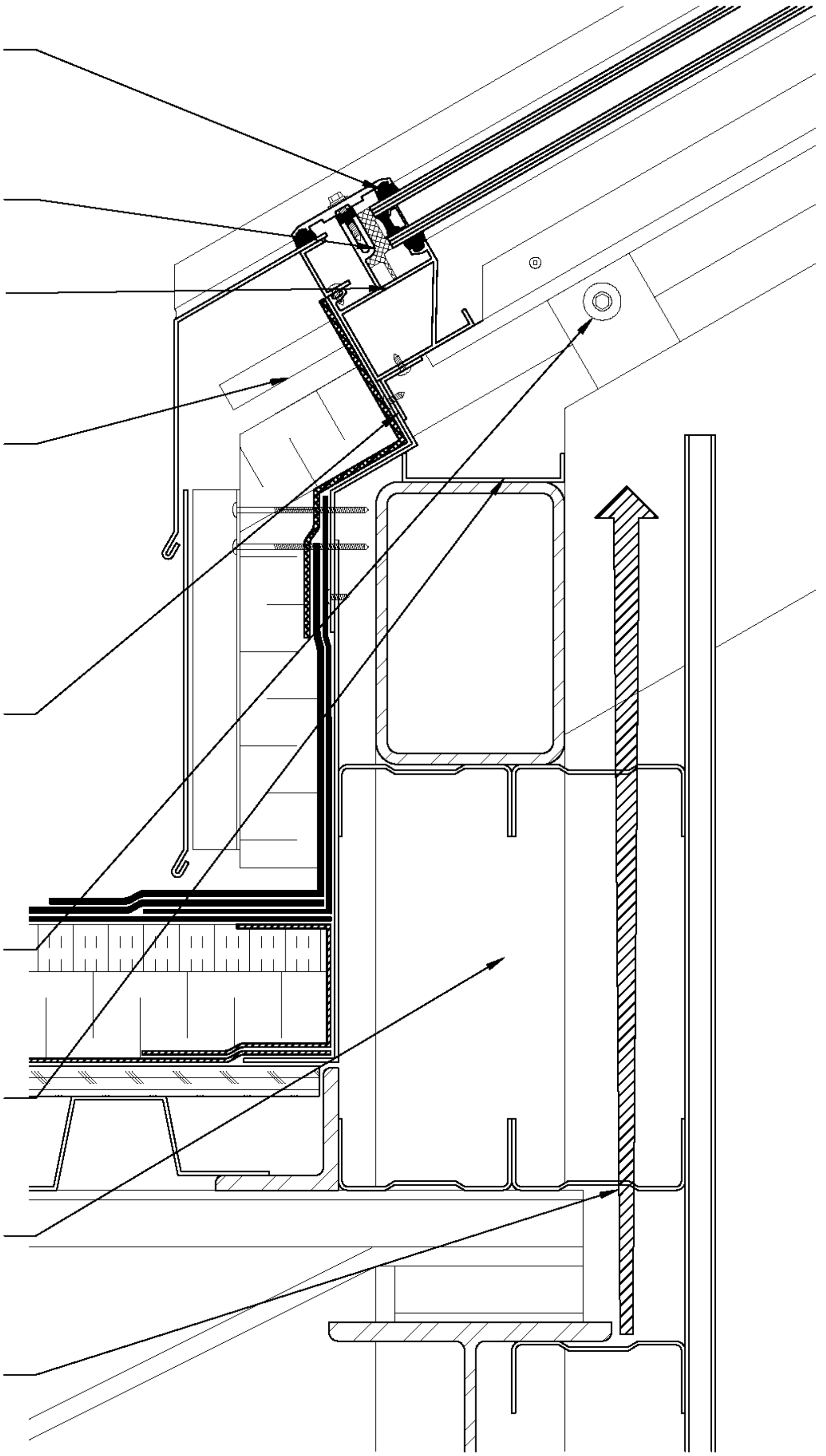
Infrastructure

SLAB TO SLAB CURTAIN WALL DETAILS - SERIES 09
FLOOR AT FOUNDATION LEVEL

BUILDING SCIENCES SECTION

DETAIL NUMBER
3

DRAWN BY	DATE	CHECKED BY	DATE
E . RIVERA	2012-02-23	V . SOLBAK	2012-02-23



Mechanically keyed-in gaskets both interior and exterior.

Setting block designed to support the sealed unit without blocking the drainage from the system.

Purlin.

Rafter drainage gutter elevated off of the plane of water proofing and air seal and extended beyond the purlin to carry water beyond the joints of the system.

Sheet metal support for air seal membrane. Exterior surface of the sheet metal is aligned with the mutin to allow for a smooth transition for the air barrier membrane.

Anchorage system should provide sufficient adjustment in all directions to accomodate the tolerances of the structural steel.

Condensation gutter.

Structural steel support system

Mechanical induced air movement (required for higher humidity buildings).

Alberta Infrastructure

SILL TO ROOF

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 1

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

Mechanically keyed-in gaskets both interior and exterior.

Setting block designed to support the sealed unit without blocking the drainage from the system.

Purlin.

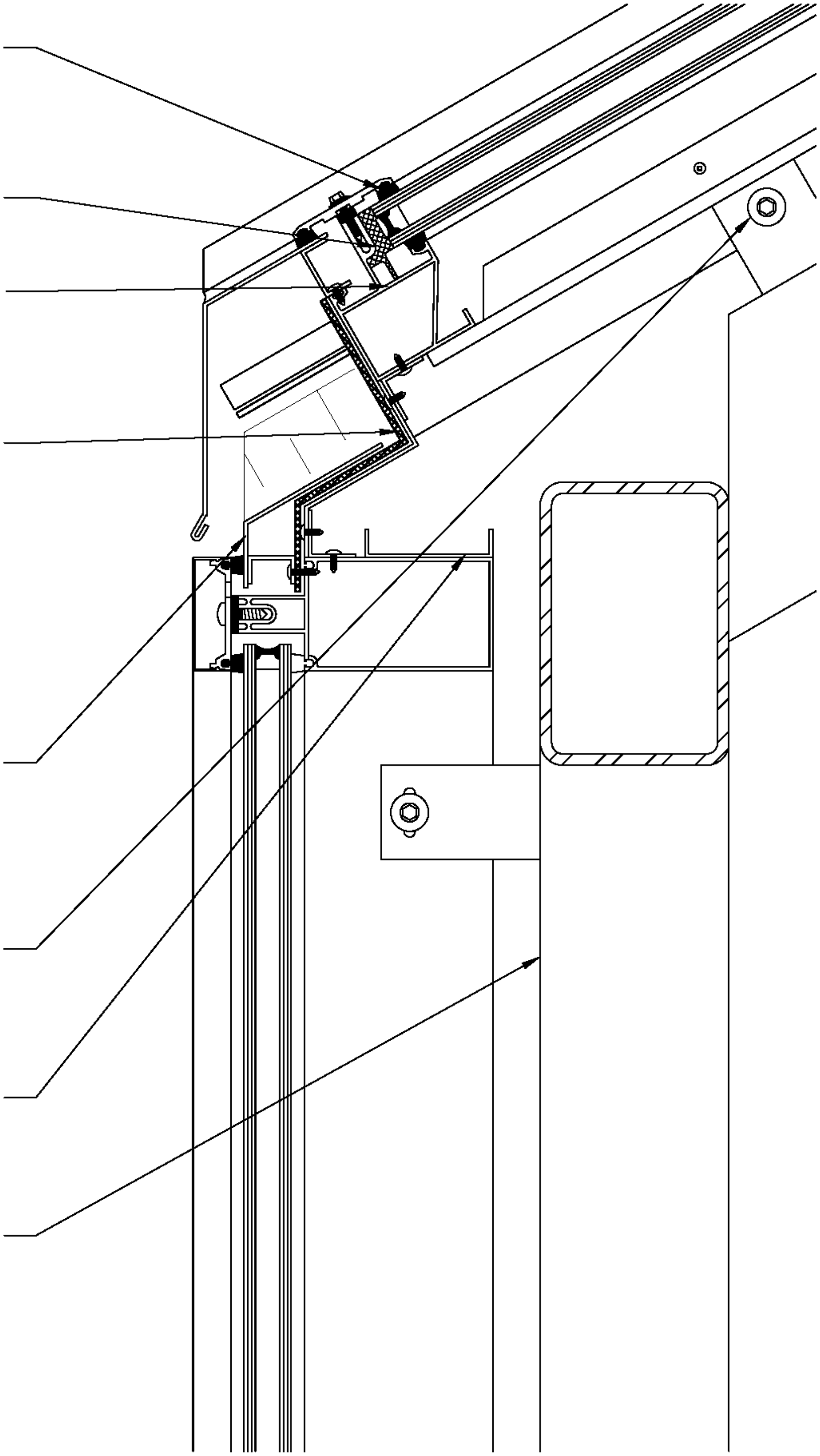
Sheet metal is used along with aluminum angles to support the air seal membrane from the curtainwall glazing rabbet to the sklylight sill purlin framing. The sheet metal should not interfere with the sealing of the membrane to the aluminum sections.

Flashing on membrane directs the majority of water to the exterior.

Anchorage system should provide sufficient adjustment in all directions to accomodate the tolerances of the structural steel.

Condensation gutter.

Structural steel support system



Alberta Infrastructure

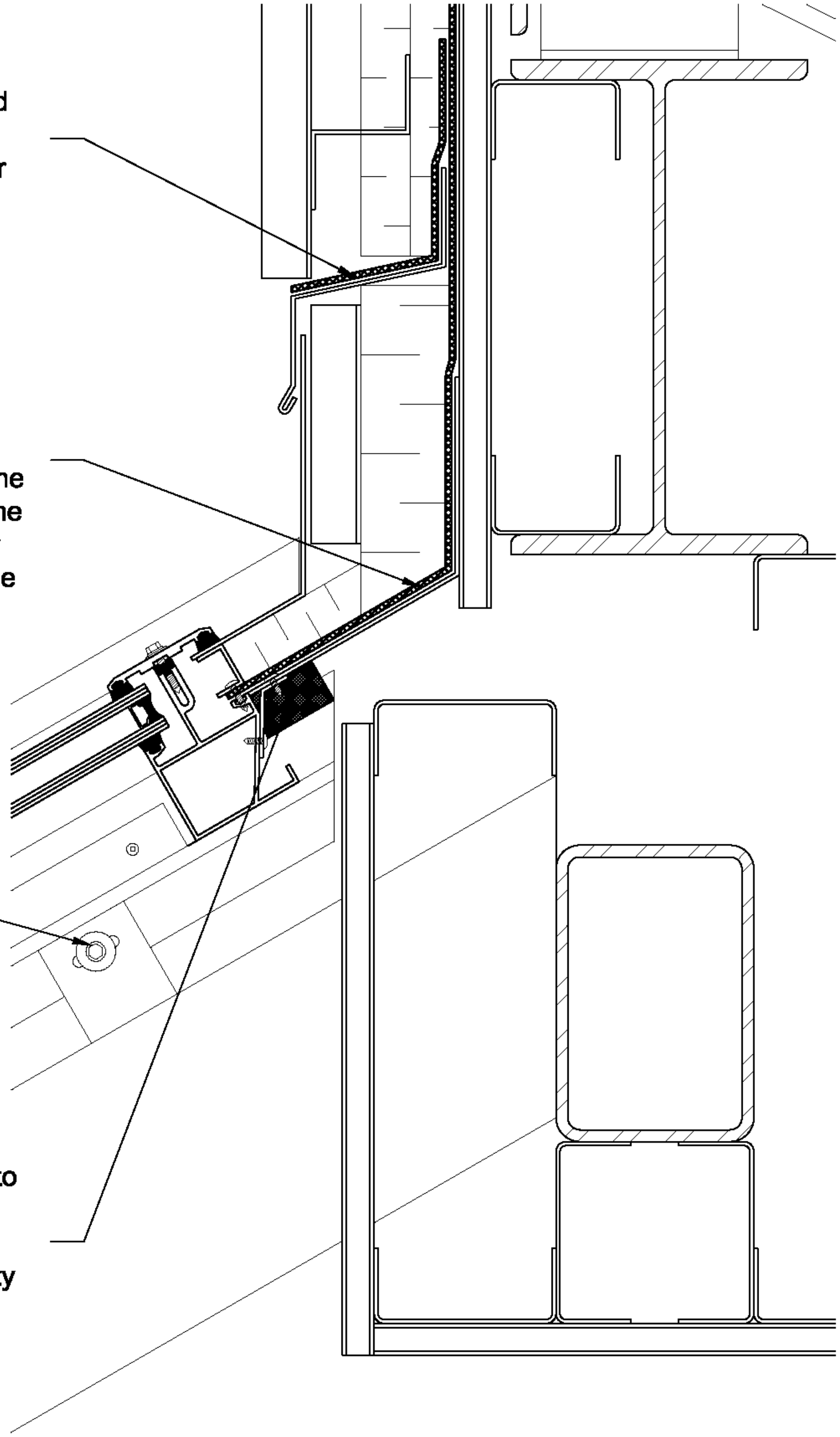
SILL TO CURTAIN WALL

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
2

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



Vertical wall should be drained at the termination of the cladding. Sufficient access for skylight the tie-in will provide separation of trade scopes.

Sheet metal and supports are connected from the frame to the wall to provide a backing for the air barrier membrane. The air barrier must be sealed from the keyway of the purlin to the air seal of the wall to ensure continuity of the air barrier.

Depending on span, additional structural support may be required. Slip anchor used at the head to allow for movement of the system.

Rafter extended above purlin to facilitate tie-in and sealing. Rafter gutter must be plugged and sealed to ensure continuity of the air barrier.

Alberta Infrastructure	**HEAD TO WALL** SKYLIGHT DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 3
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

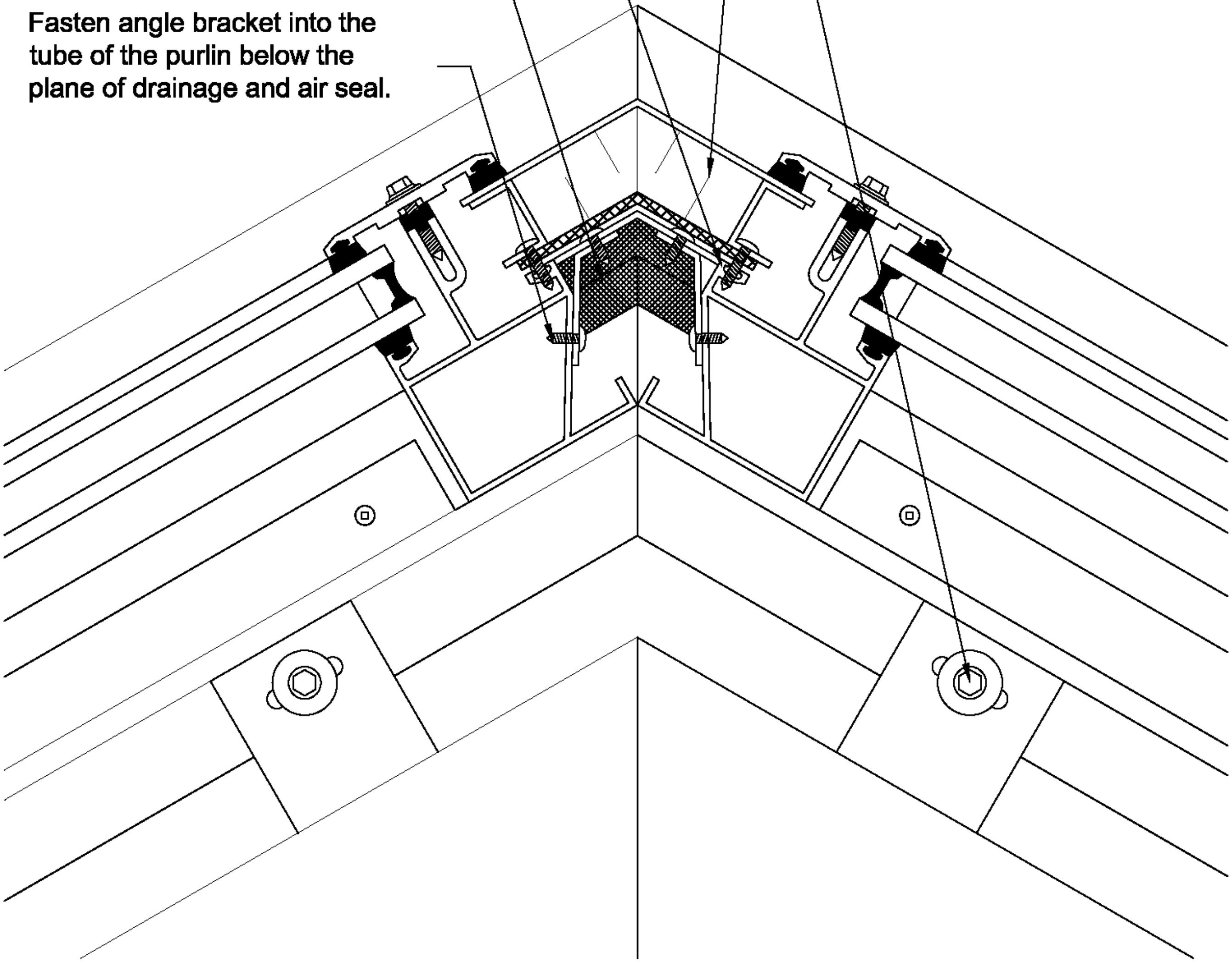
Air seal membrane sealed directly to the key-way of the frame. Butt sheet metal up against the frame. Do not overlap sheet metal onto key-ways.

Insulation installed exterior of the air barrier.

Depending on span, additional structural support may be required. Slip anchor used at the ridge to allow for movement of the system.

End of rafter gutters need to be plugged and sealed to ensue the continuity of the air seal.

Fasten angle bracket into the tube of the purlin below the plane of drainage and air seal.



Alberta Infrastructure

RIDGE

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
4

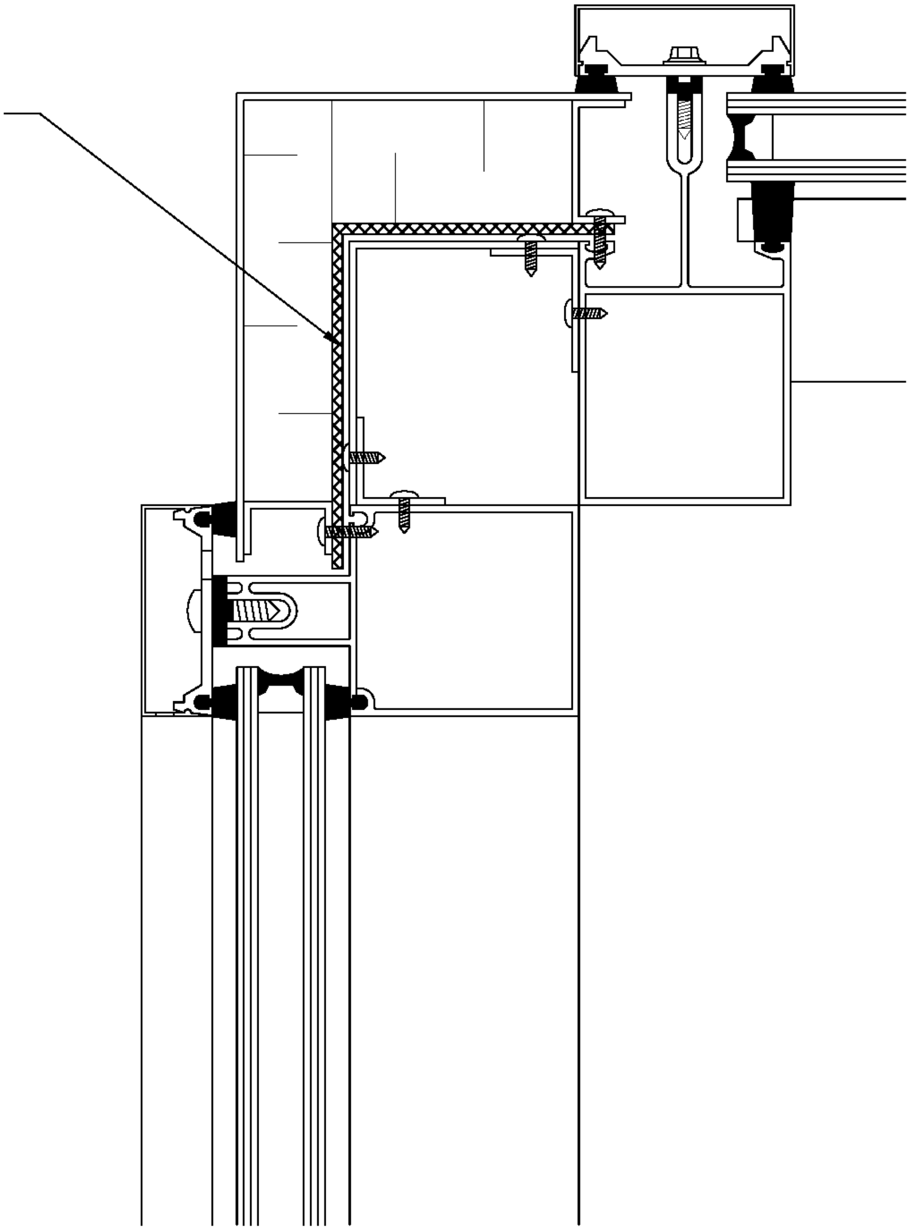
DRAWN BY
PETER BAKER

DATE
01-01-2005

CHECKED BY

DATE

Sheet metal is used along with aluminum angles to support the air seal membrane from the curtainwall glazing rabbet to the sklylight rafter framing. The sheet metal should not interfere with the sealing of the membrane to the aluminum sections.



Alberta Infrastructure

GABLE END

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

DETAIL NUMBER
5

Mechnically fastened overlap of the purlin on the rafter.

Butyl tape seal.

Drip edge created.

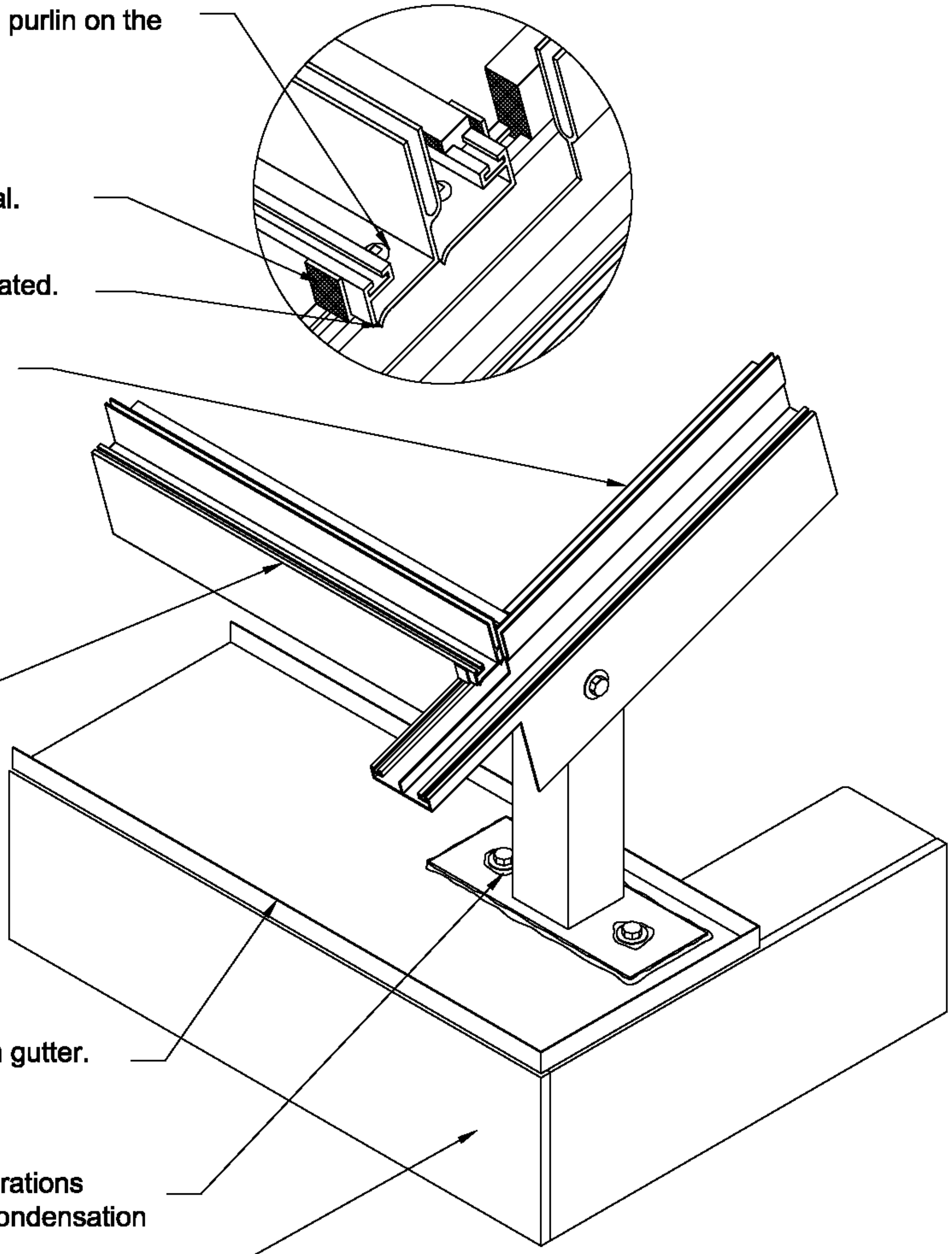
Rafter.

Purlin.

Condensation gutter.

Seal all penetrations through the condensation gutter.

Curb construction.



Alberta
Infrastructure

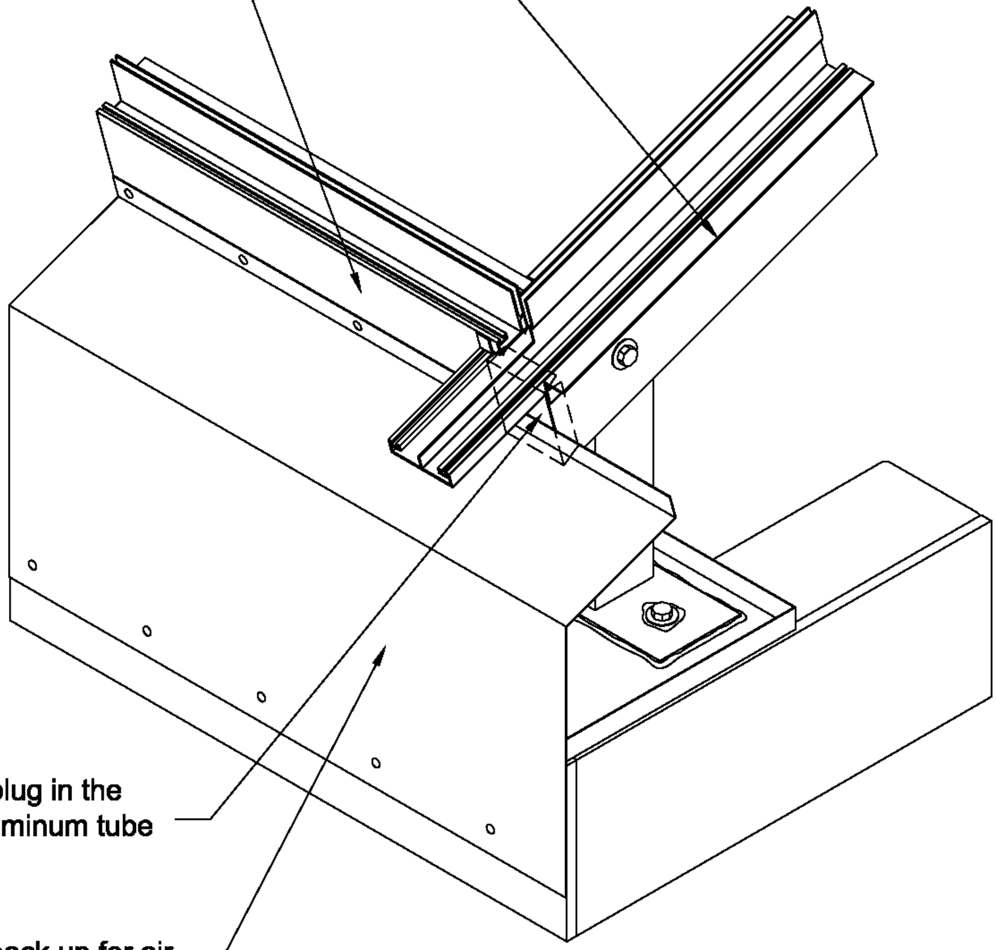
ASSEMBLY SEQUENCE 1

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
6

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



Angle used to support the sheet metal fastened into the tube section of the rafter.

Maximize the surface area of the face of the purlin for adhesion of the air barrier membrane.

Sheet metal plug in the end of the aluminum tube section.

Sheet metal back up for air seal membrane

Alberta Infrastructure

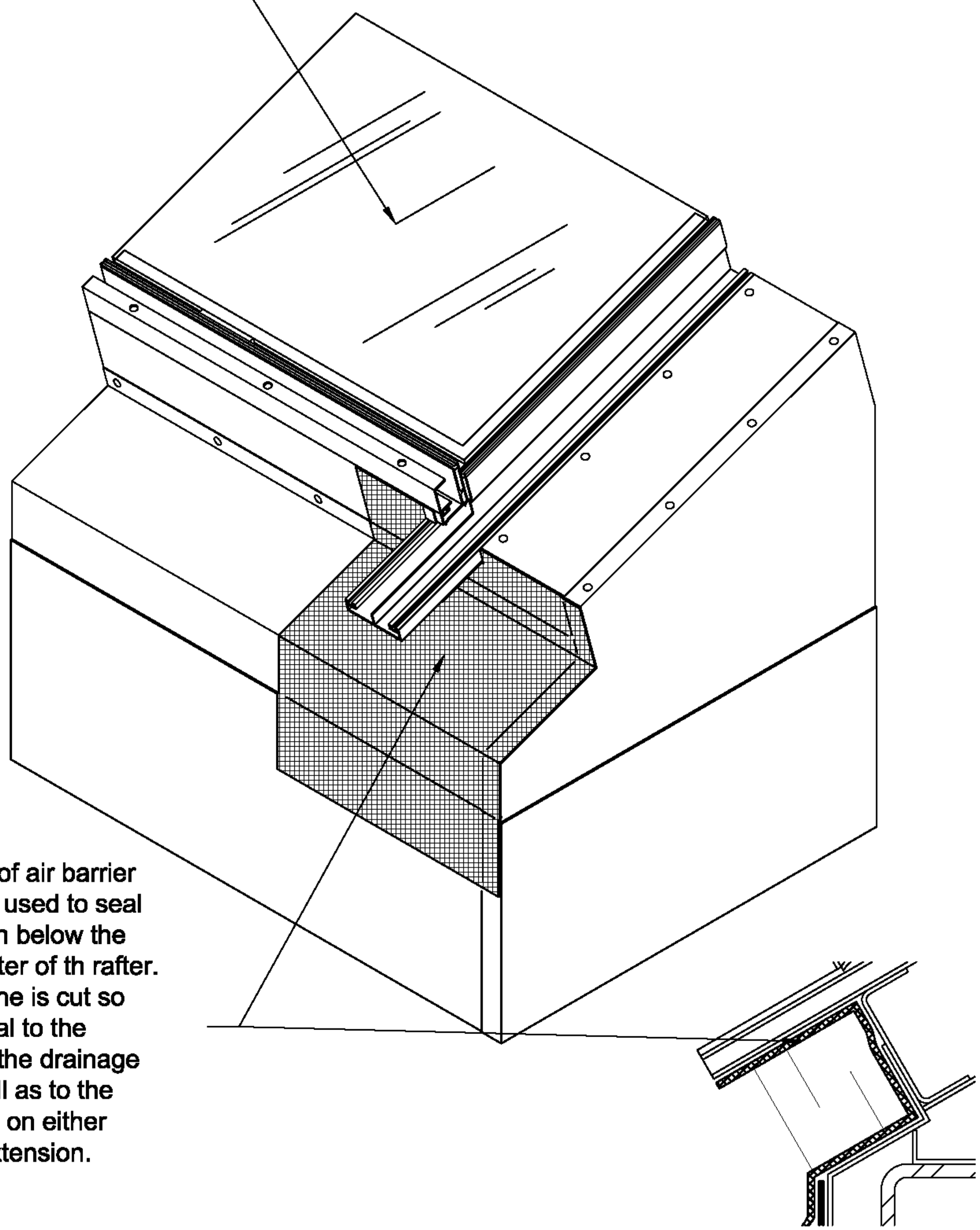
ASSEMBLY SEQUENCE 2

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

DETAIL NUMBER
7

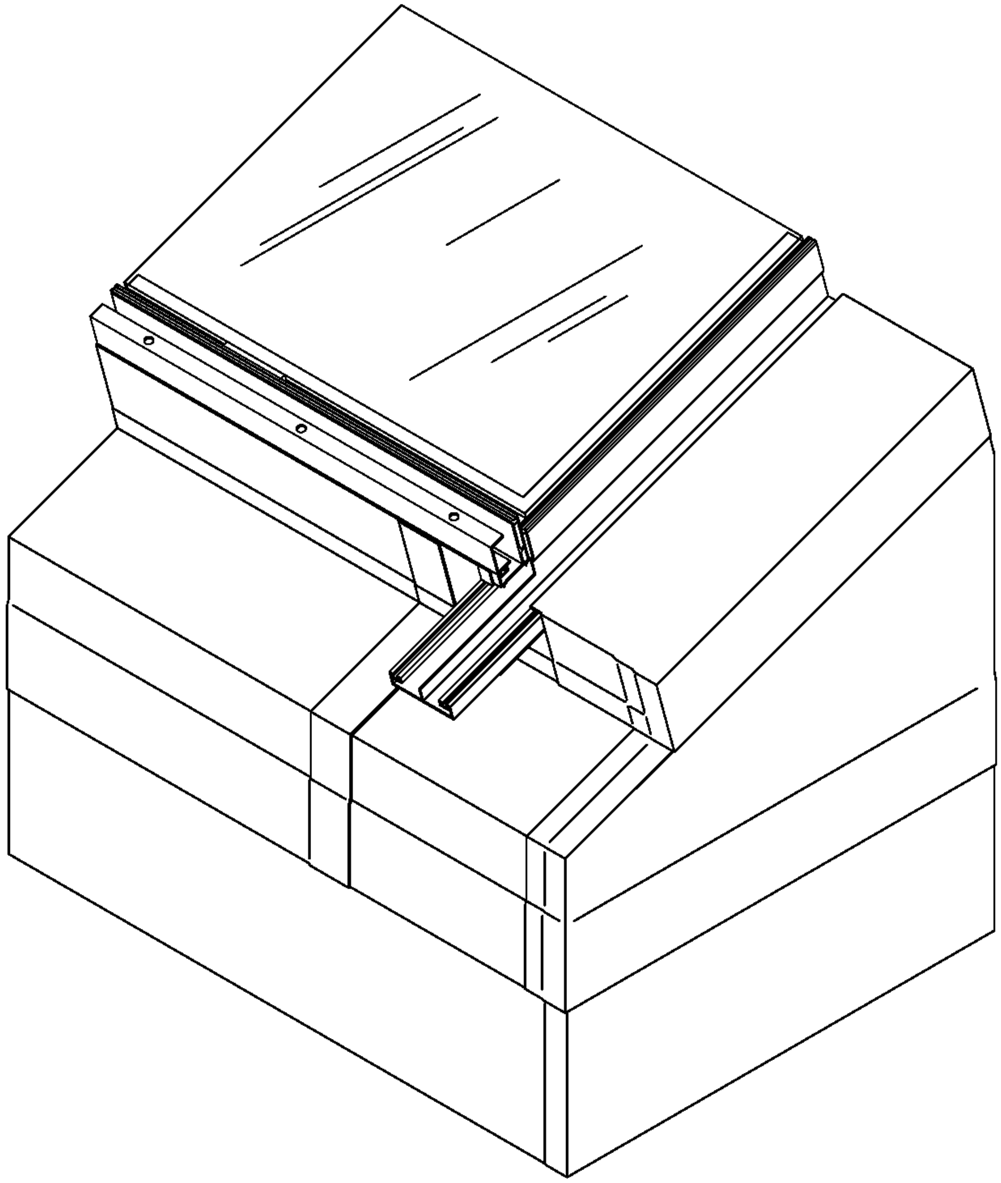


Glazing can be installed and temporarily retained.

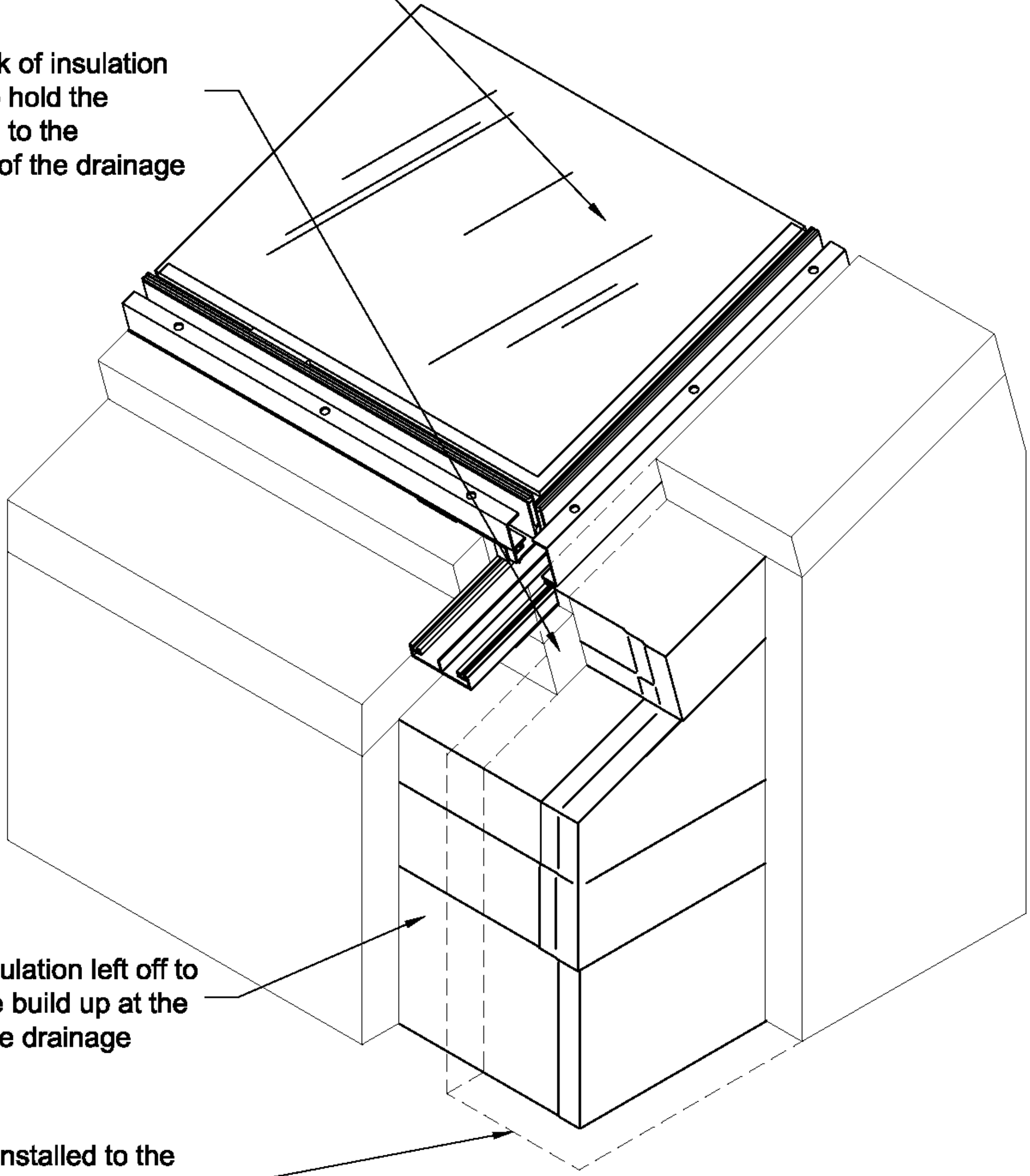
A small strip of air barrier membrane is used to seal at the location below the extended gutter of th rafter. The membrane is cut so that it can seal to the underside of the drainage gutter as well as to the vertical faces on either side of the extension.

Alberta Infrastructure	**ASSEMBLY SEQUENCE 3** SKYLIGHT DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 8
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

Completion of the
membrane seal.



Alberta Infrastructure	**ASSEMBLY SEQUENCE 4** SKYLIGHT DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 9
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE



Aluminum anti-rotation channel retains membrane to the gasket keyway.

Small block of insulation installed to hold the membrane to the underside of the drainage extension.

Strip of insulation left off to prevent ice build up at the outlet of the drainage extension.

Insulation installed to the exterior of the air barrier membrane.

Alberta Infrastructure

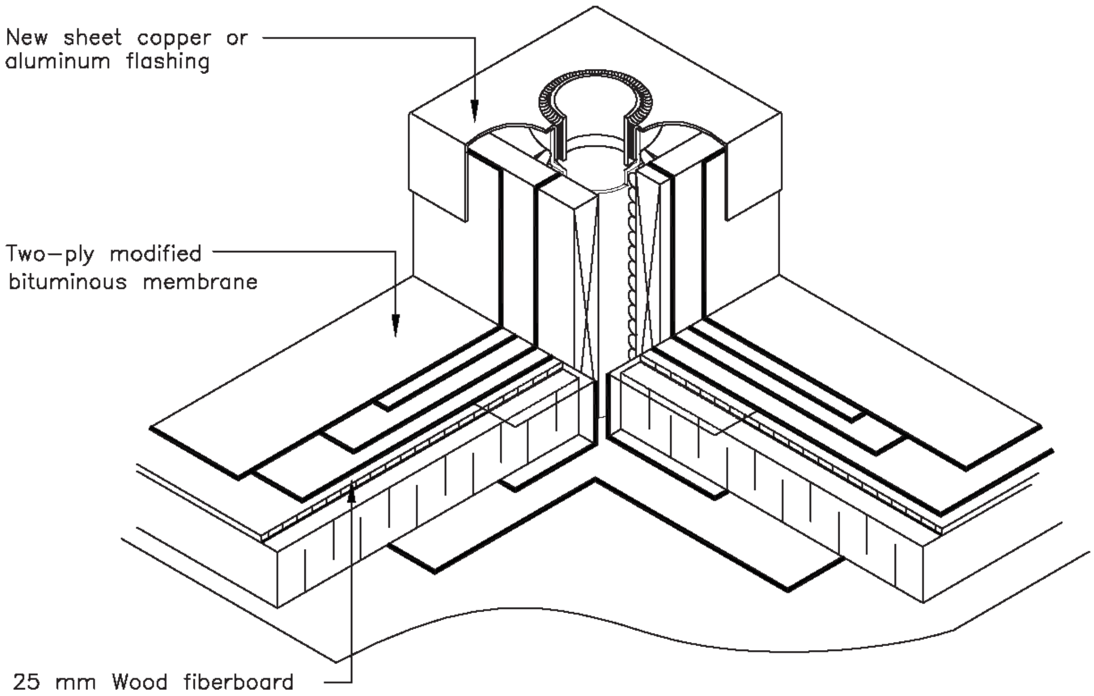
ASSEMBLY SEQUENCE 5

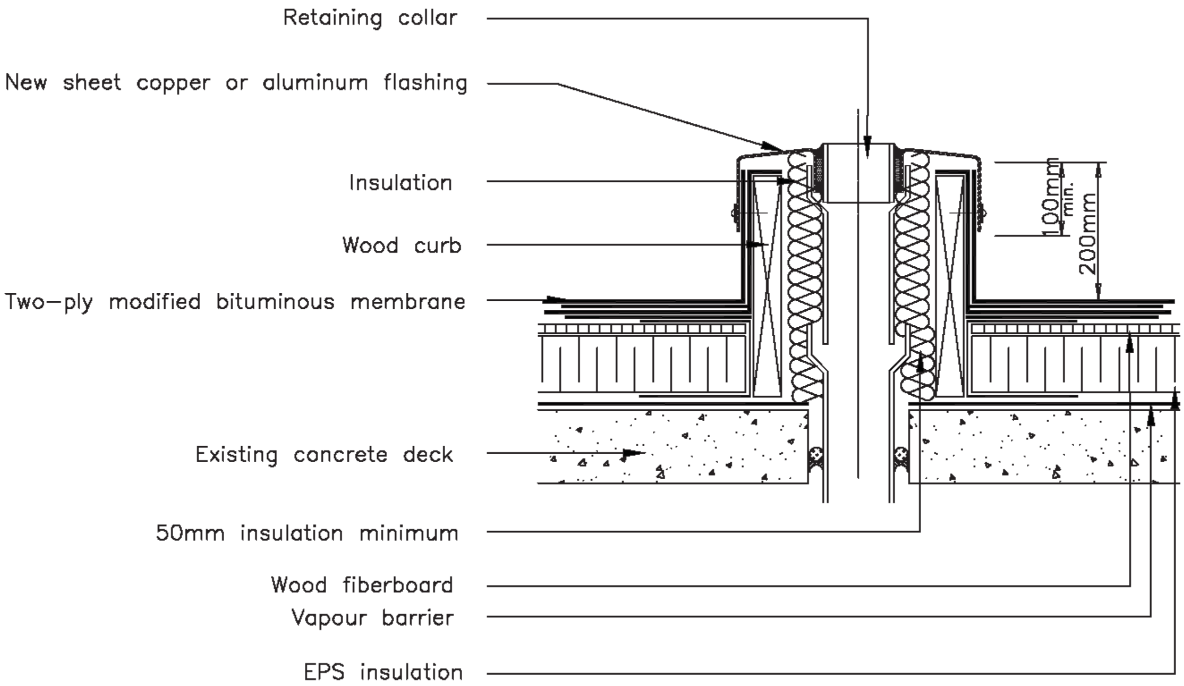
SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

DETAIL NUMBER
10





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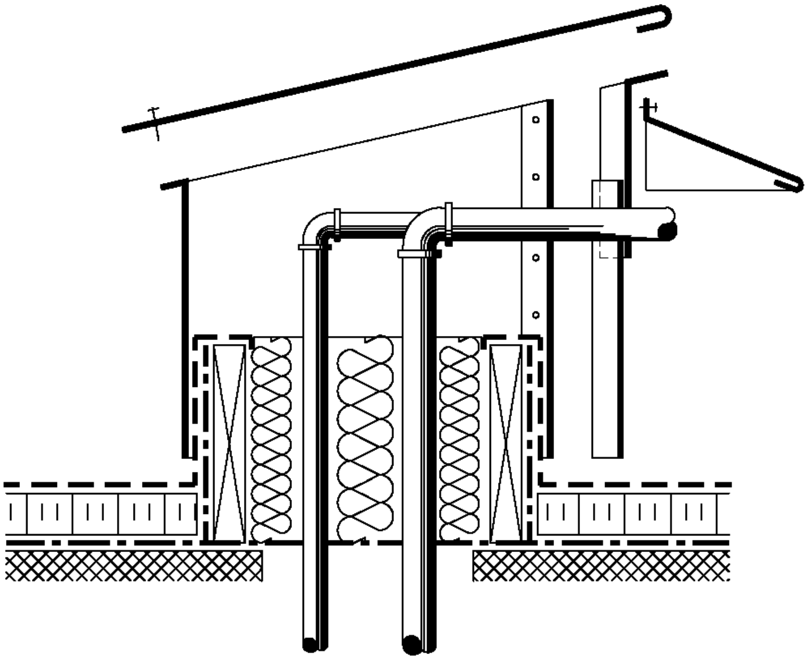
Alberta
Infrastructure

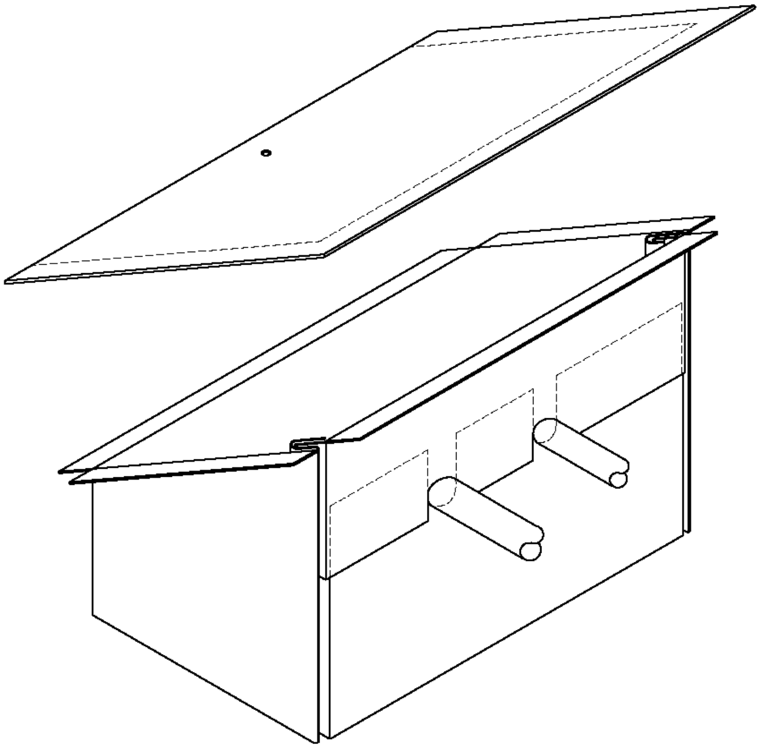
PLUMBING VENT

BUILDING SCIENCES SECTION
TSB

DETAIL NUMBER
1

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-05-03	V. SOLBAK	2012-05-03





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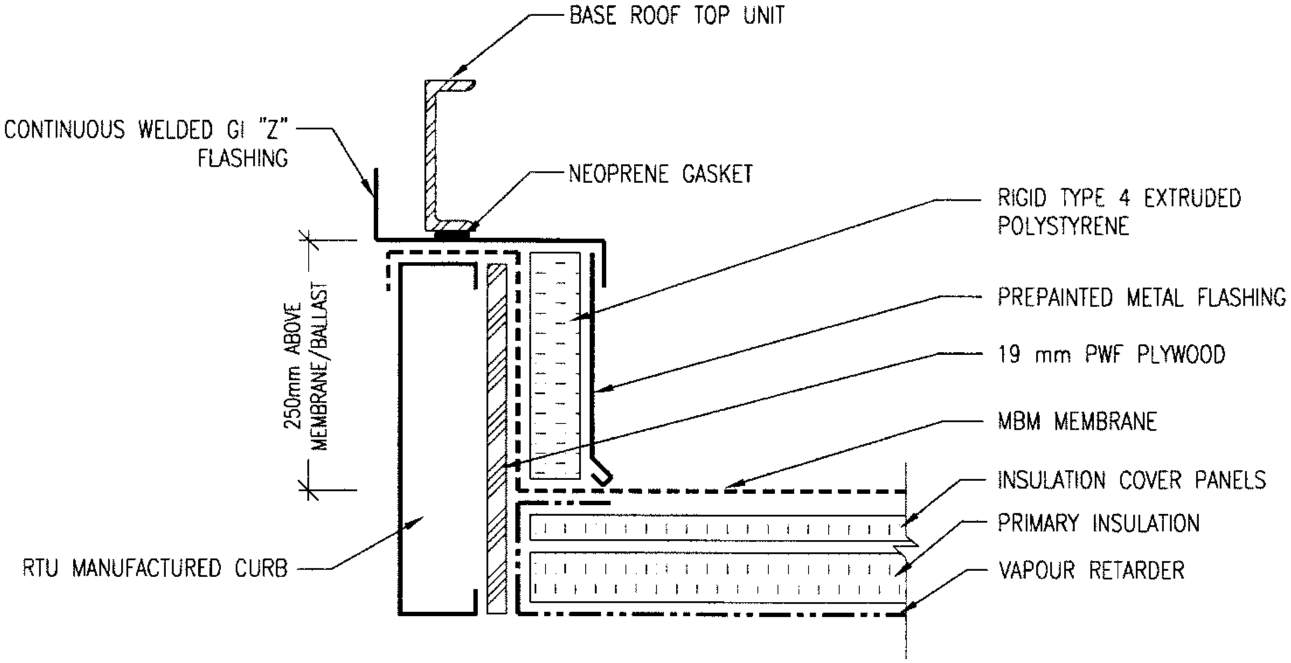
Alberta
Infrastructure

ROOF JACK DETAIL

BUILDING SCIENCES SECTION
TSB

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-07	V. SOLBAK	2012-02-07

DETAIL
NUMBER
1



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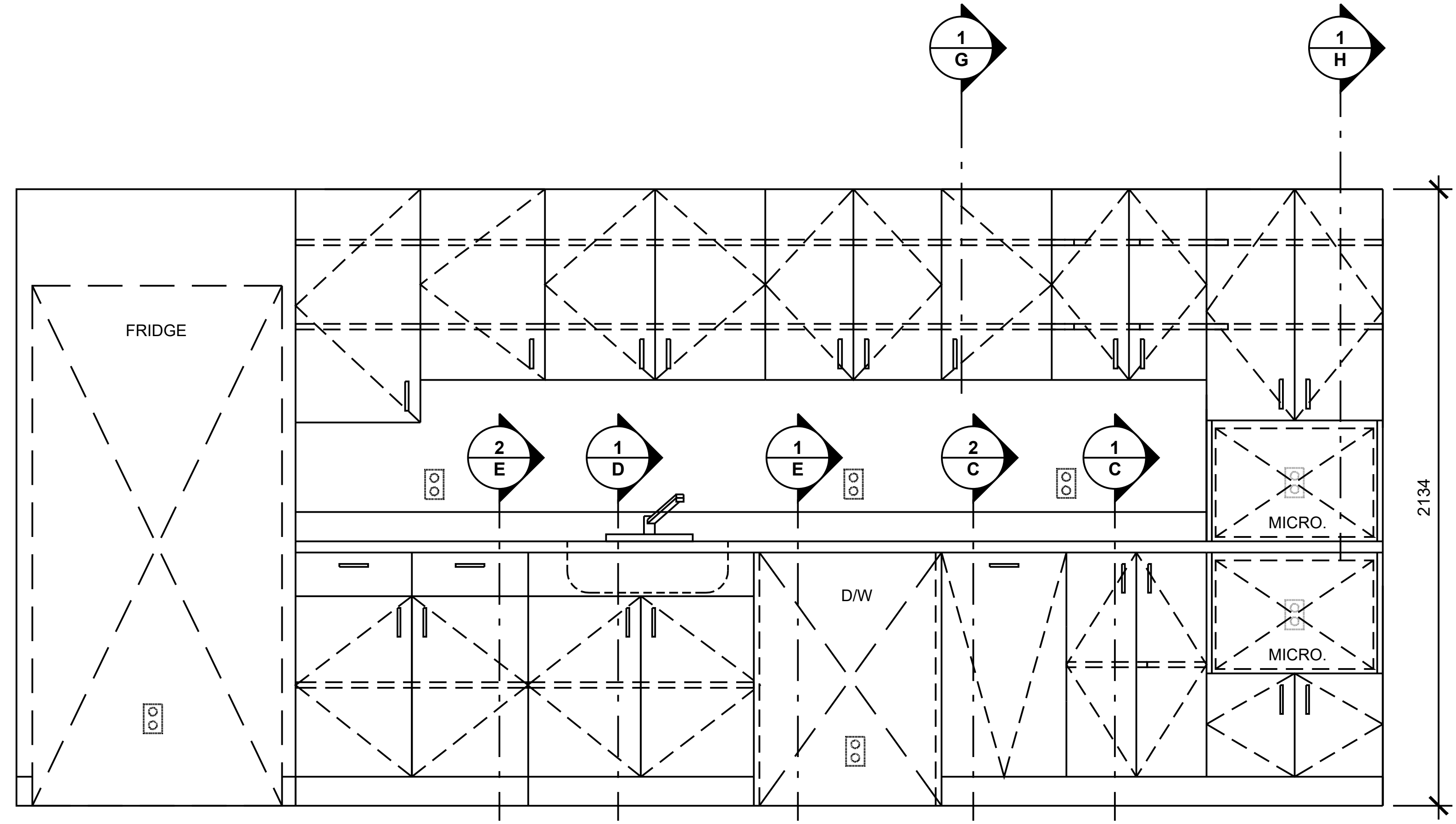
Alberta Infrastructure

LOCATION - BLDG NAME
BID #
ROOF TOP UNIT DETAIL

Building Sciences
TSB

project ID:	drawn by:	date:	checked by:	date:	scale:	drawing no.:
BID...	E. Gozdzik	M/YY	WJK	M/YY	NTS	R..

Appendix E – Standard Millwork Detail



1
A

STANDARD KITCHENETTE- TYPICAL

Scale: NTS

GENERAL NOTE:
APPLIANCES ARE SHOWN FOR
LOCATION PURPOSES ONLY.

Alberta Infrastructure

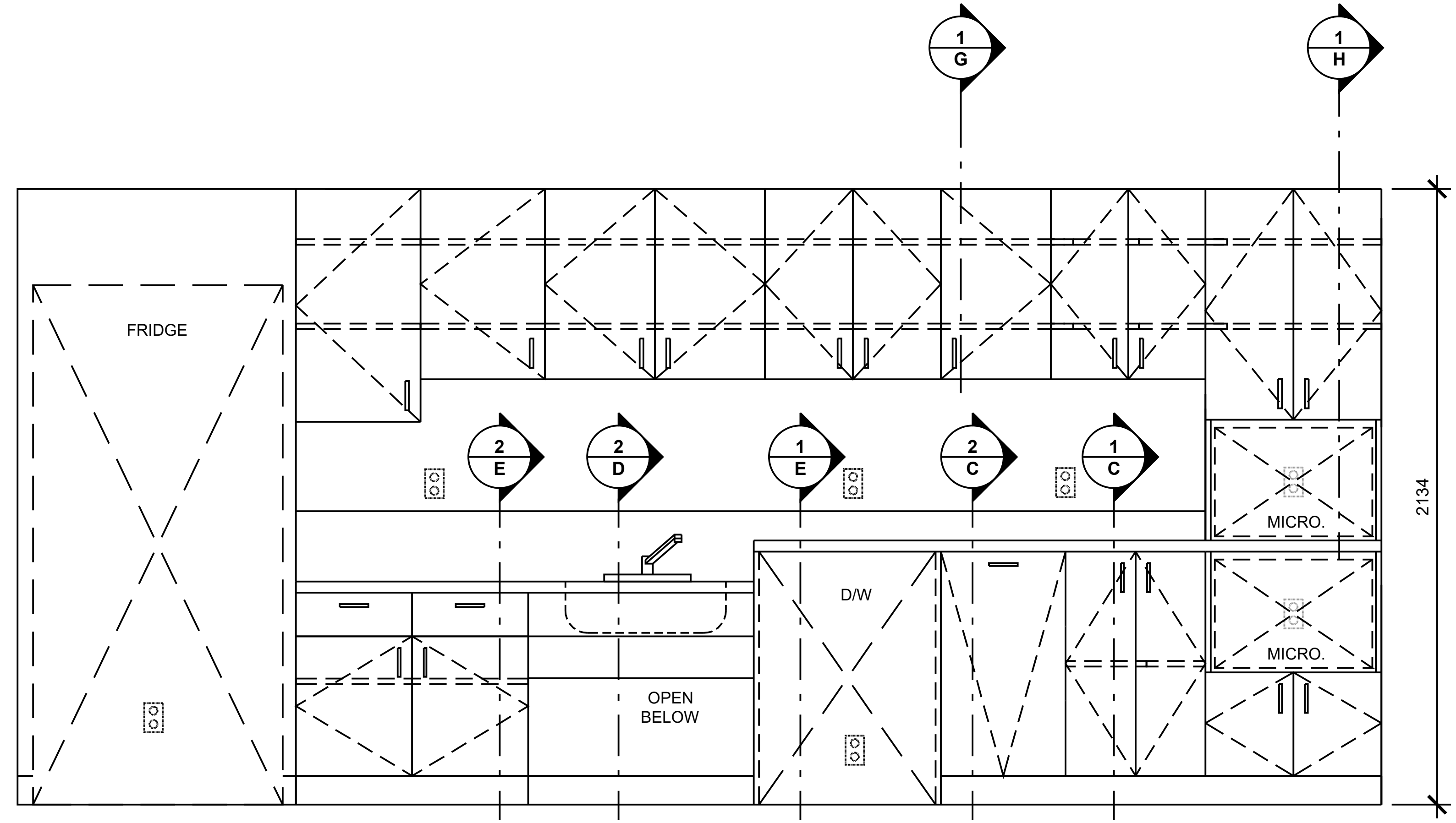
CONSULTANT

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7

PROJECT
Technical Design Requirements
Version 7

TITLE
MILLWORK ELEVATION
STANDARD KITCHENETTE- TYPICAL

DRAWN BY **JH**	CHECKED BY **LJ**	SCALE **NTS**
DATE **2022-08-02**	SITE ID **-**	BUILDING ID **-**
PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
PROJECT ID. **Appendix E**	SHEET NO. **A**	



1
B
BARRIER-FREE KITCHENETTE- TYPICAL
Scale: NTS

GENERAL NOTE:
APPLIANCES ARE SHOWN FOR
LOCATION PURPOSES ONLY.

Alberta
Infrastructure

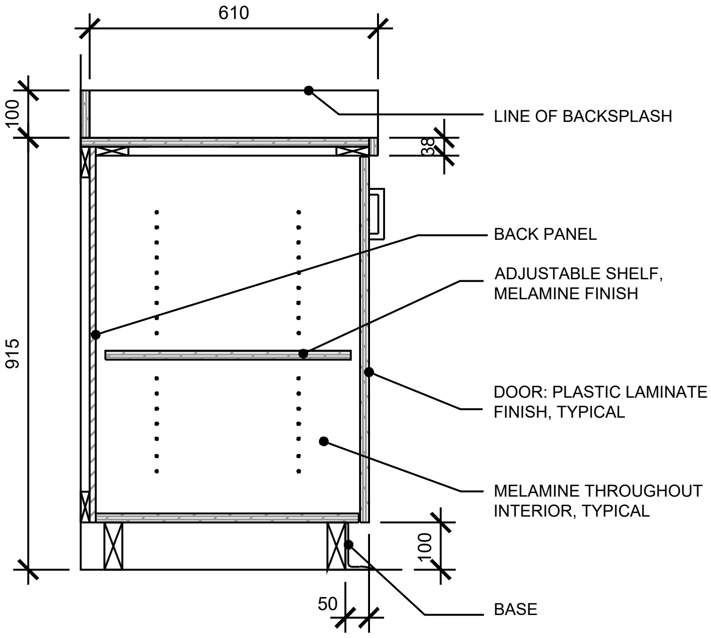
CONSULTANT

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7

PROJECT
Technical Design Requirements
Version 7

TITLE
MILLWORK ELEVATION
BARRIER-FREE KITCHENETTE- TYPICAL

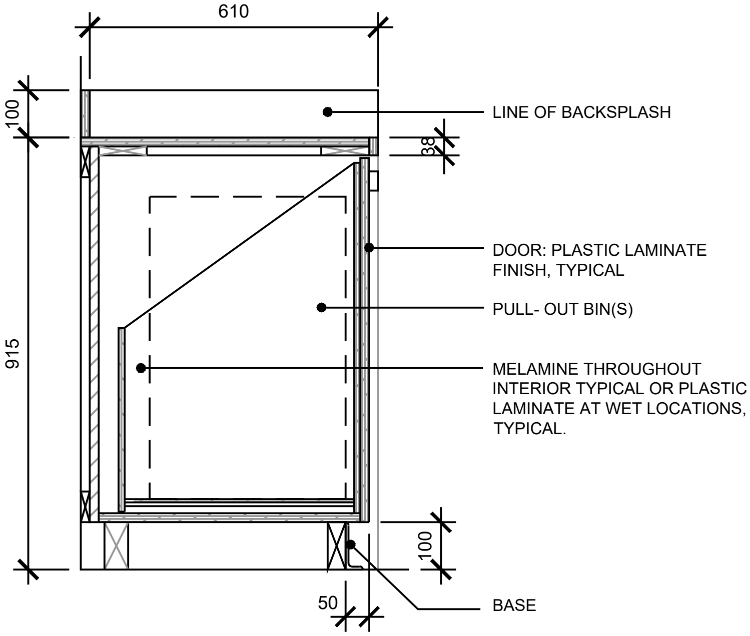
DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix E	**B**	



1
C
STANDARD COUNTER
Scale: NTS

DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE ALBERTA BUILDING CODE.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.



2
C
COUNTER WITH WASTE
Scale: NTS

Alberta
Infrastructure

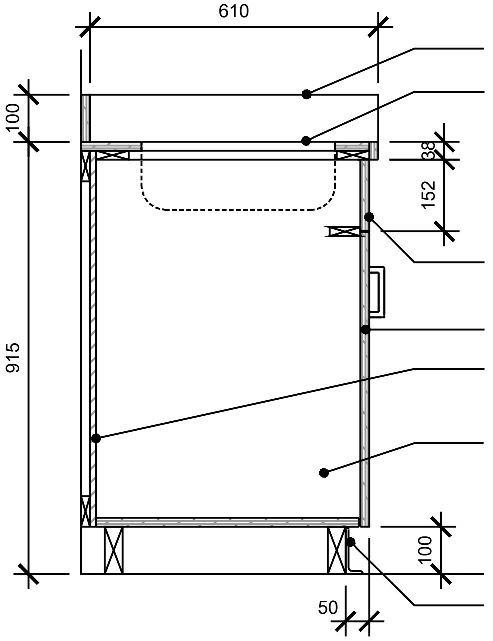
CONSULTANT

PROJECT
Technical Design Requirements
Version 7

TITLE
MILLWORK SECTION
DETAIL 'C'

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix E	**C**	



LINE OF BACKSPLASH

REFER TO MECHANICAL SPECIFICATION FOR ADDITIONAL INFORMATION ON SINK. SINK TO BE ON SITE DURING MILLWORK INSTALLATION.

FILLER PANEL: PLASTIC LAMINATE FINISH

DOOR: PLASTIC LAMINATE FINISH

BACK PANEL

MELAMINE THROUGHOUT INTERIOR, TYPICAL OR PLASTIC LAMINATE IF AT WET LOCATION

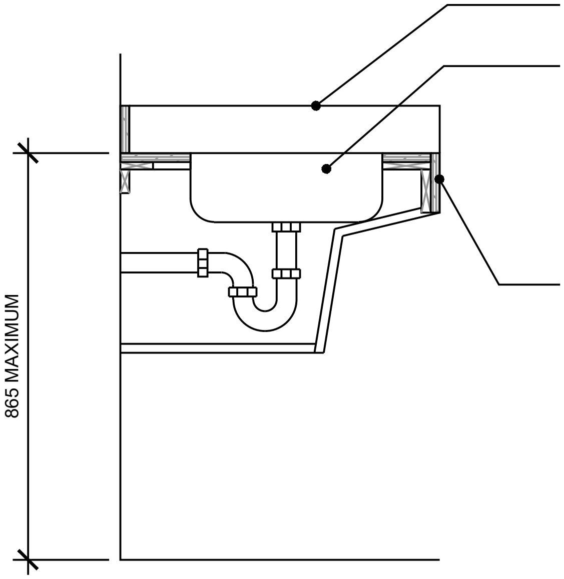
BASE

1/D COUNTER WITH SINK

Scale: NTS

DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE ALBERTA BUILDING CODE.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.
- PROVIDE MARINE-GRADE PLYWOOD AT ALL WET AREAS.



LINE OF BACKSPLASH

REFER TO MECHANICAL SPECIFICATION FOR ADDITIONAL INFORMATION ON SINK. SINK TO BE ON SITE DURING MILLWORK INSTALLATION.

FIXED PANEL AT SINK LOCATION. PLASTIC LAMIATE FINISH,TYPICAL.

2/D BARRIER-FREE COUNTER WITH SINK

Scale: NTS

Alberta Infrastructure

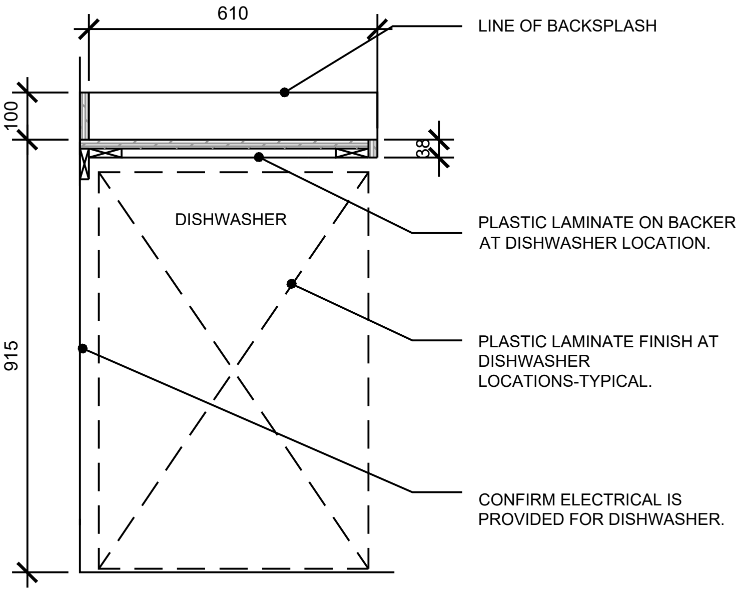
CONSULTANT

PROJECT
Technical Design Requirements
Version 7

TITLE
MILLWORK SECTION DETAIL 'D'

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**
PROJECT ID.	SHEET NO.	
Appendix E	**D**	



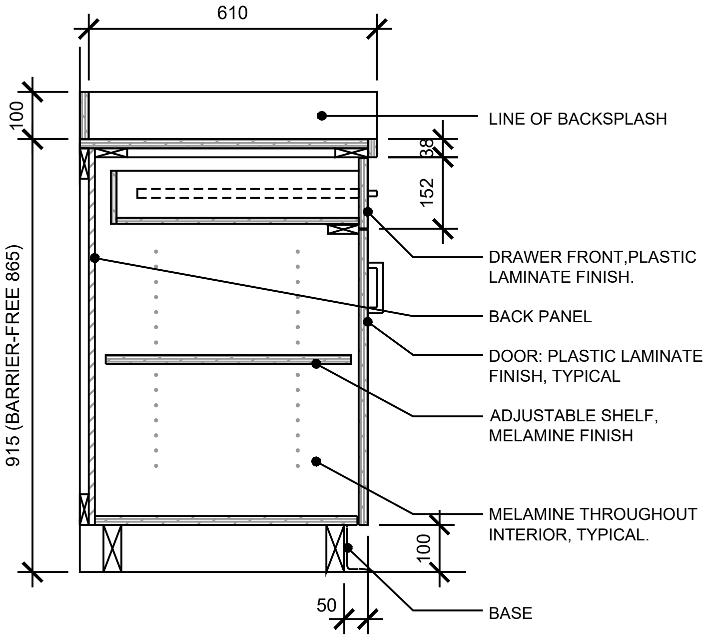
DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE ALBERTA BUILDING CODE.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

1
E

COUNTER WITH DISHWASHER

Scale: NTS



2
E

COUNTER WITH SINGLE DRAWER

Scale: NTS

Alberta Infrastructure

CONSULTANT

PROJECT
Technical Design Requirements
Version 7

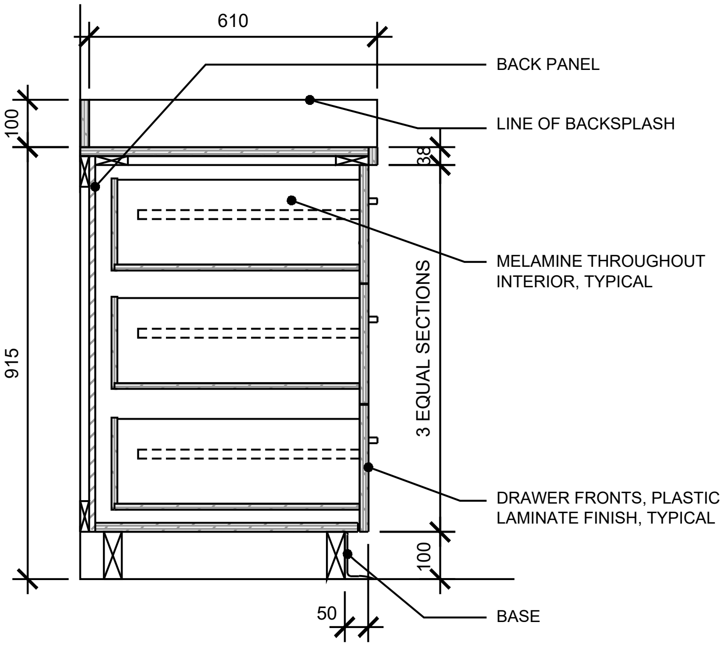
DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**

TITLE
MILLWORK SECTION
DETAIL 'E'

PROJECT ID.
Appendix E

SHEET NO.
E

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7



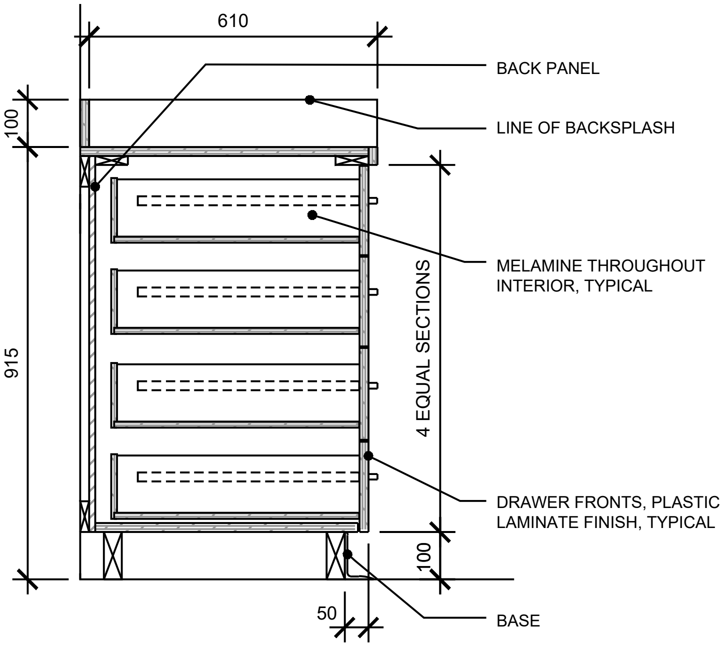
1
F

COUNTER WITH 3 DRAWERS

Scale: NTS

DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE ALBERTA BUILDING CODE.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.



2
F

COUNTER WITH 4 DRAWERS

Scale: NTS

Alberta
Infrastructure

CONSULTANT

PROJECT
Technical Design Requirements
Version 7

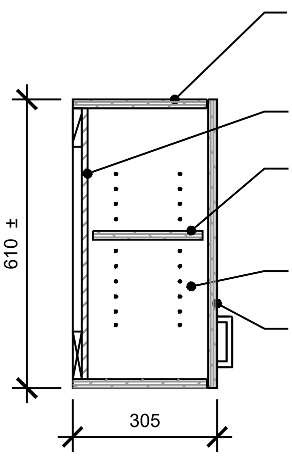
DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-

TITLE
MILLWORK SECTION
DETAIL 'F'

PROJECT ID.
Appendix E

SHEET NO.
F

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7



PLASTIC LAMINATE TO ALL EXPOSED SURFACES, TYPICAL.

BLOCKIING AND BACKING TO SUIT AWMAC STANDARDS

ADJUSTABLE SHELVES, MELAMINE FINISH.

MELAMINE THROUGHOUT INTERIOR CABINET, TYPICAL.

DOOR: PLASTIC LAMINATE FINISH, TYPICAL.

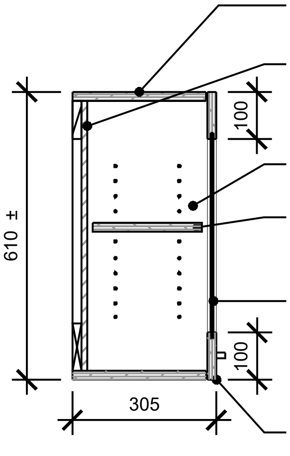
DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

1
G

OVERHEAD CABINET

Scale: NTS



PLASTIC LAMINATE TO ALL EXPOSED SURFACES, TYPICAL.

BLOCKING AND BACKING TO SUIT AWMAC STANDARD

INTERIOR FINISH TO MATCH EXTERIOR

ADJUSTABLE SHELVES MELAMINE FINISH

6mm TEMPERED FROSTED FINISH GLASS INSTALLED TO AWMAC STANDARDS BY MILLWORKER UNLESS SPECIFIED OTHERWISE. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

DOOR: PLASTIC LAMINATE FINISH.

2
G

OVERHEAD CABINET WITH GLASS

Scale: NTS

Alberta
Infrastructure

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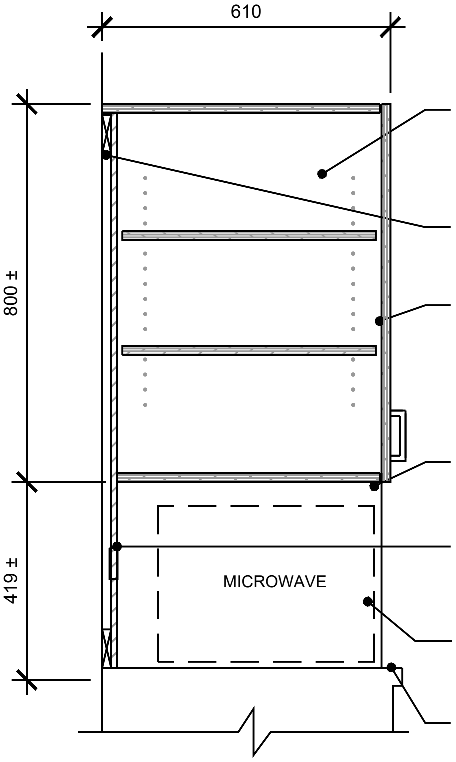
PROJECT
Technical Design Requirements
Version 7

TITLE
MILLWORK SECTION
DETAIL 'G'

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7

DRAWN BY: **JH**
CHECKED BY: **LJ**
SCALE: **NTS**
DATE: **2022-08-02**
SITE ID: -
BUILDING ID: -
PLAN NO.: -
PHASE: -
DISCIPLINE: -
PROJECT ID.: **Appendix E**
SHEET NO.: **G**



MELAMINE FINISH THROUGHOUT INTERIOR, TYPICAL.

BLOCKING AND BACKING TO MEET AWMAC STANDARDS

DOOR: PLASTIC LAMINATE FINISH.

PLASTIC LAMINATE AT UNDERSIDE, TYPICAL.

PROVIDE ACCESS HOLE FOR ELECTRICAL. CONFIRM EXACT LOCATION WITH GENERAL CONTRACTOR AND CUT ON SITE DURING MILLWORK INSTALLATION. ADD TRIM. REFER TO ELECTRICAL DRAWINGS.

PLASTIC LAMINATE FINISH TO MATCH EXPOSED SURFACES FOR MICROWAVE CABINET INTERIOR, TYPICAL.

COUNTERTOP

1
H

SINGLE MICROWAVE CABINET

Scale: NTS

DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE ALBERTA BUILDING CODE.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- CONFIRM MICROWAVE SIZE WITH CLIENT.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

Alberta
Infrastructure

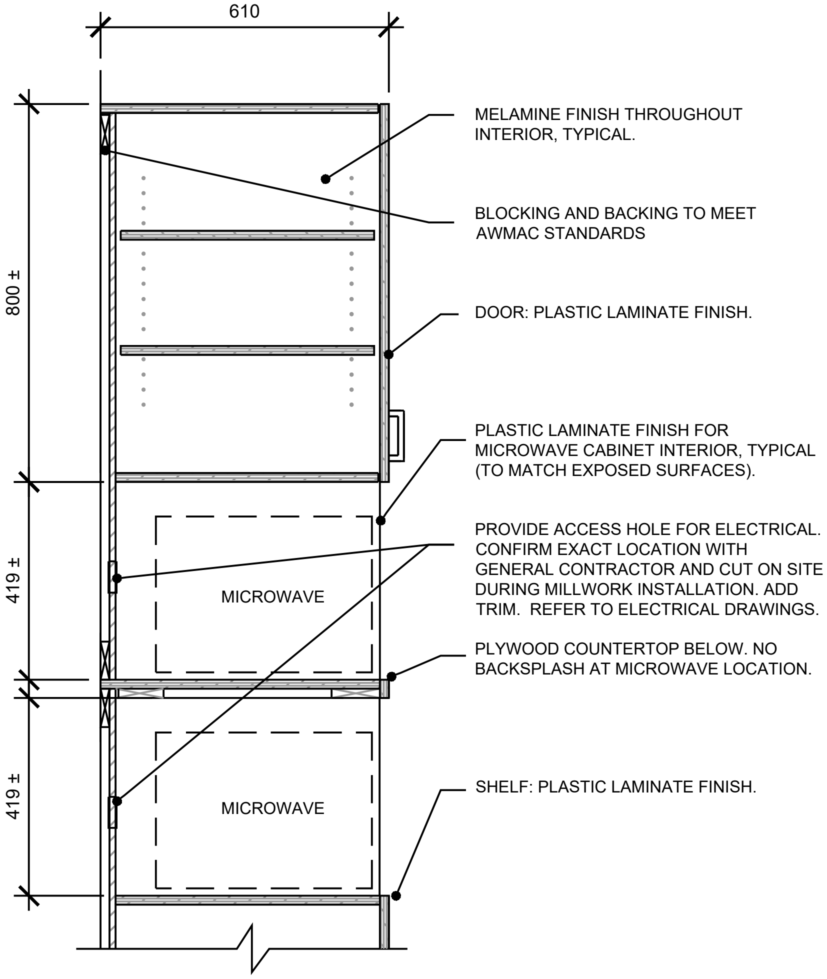
CONSULTANT

PROJECT
Technical Design Requirements
Version 7

TITLE
MILLWORK SECTION
DETAIL 'H'

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**
PROJECT ID.	SHEET NO.	
Appendix E	**H**	



1
I

DOUBLE MICROWAVE CABINET

Scale: NTS

DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE ALBERTA BUILDING CODE.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- CONFIRM MICROWAVE SIZE WITH CLIENT.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

Alberta Infrastructure

CONSULTANT

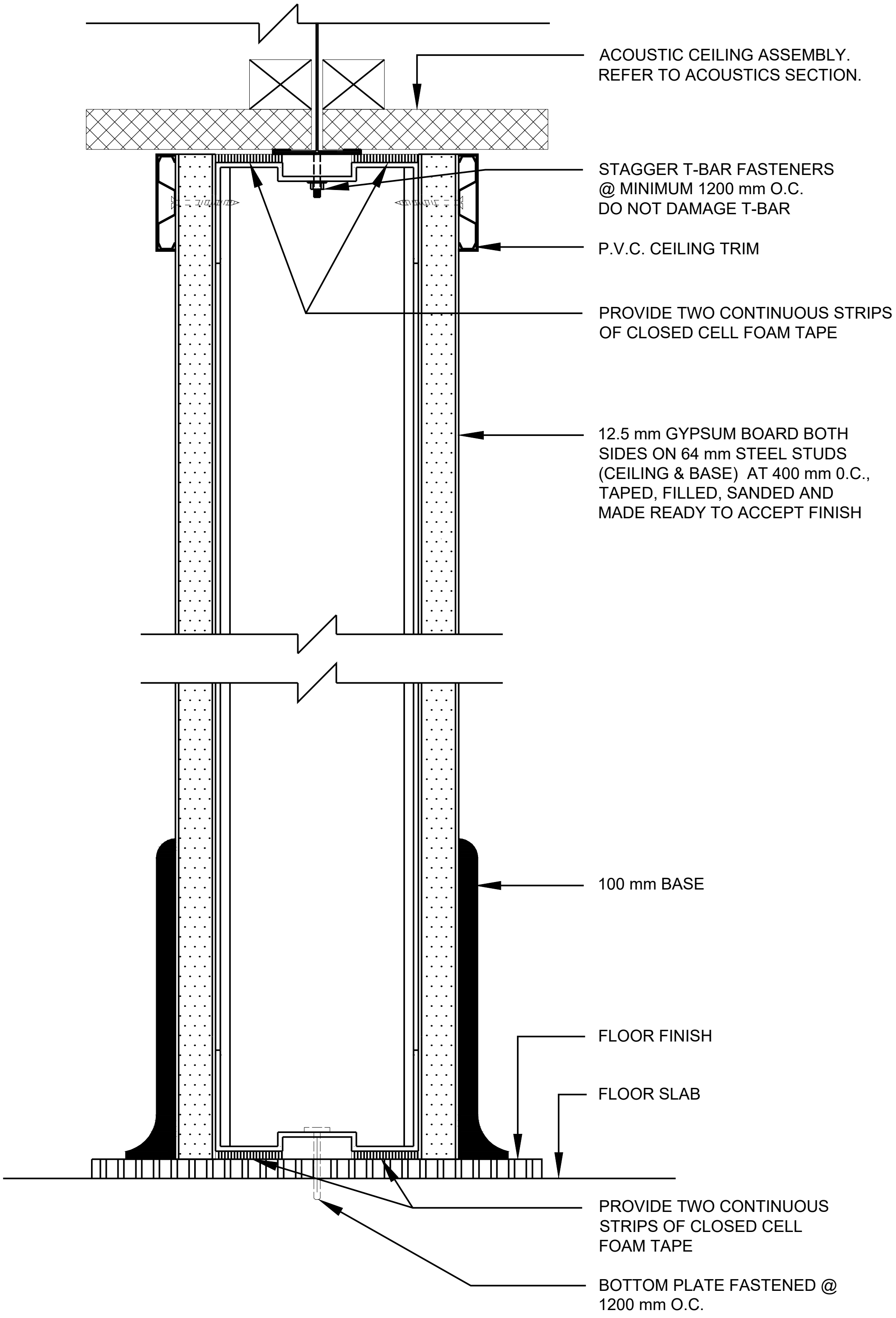
PROJECT
Technical Design Requirements
Version 7

TITLE
MILLWORK SECTION
DETAIL 'I'

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**
PROJECT ID.	SHEET NO.	
Appendix E	**I**	

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_2022-TDR.V7

Appendix F – Standard Interior Details



A GYPSUM BOARD PARTITION

SCALE:NTS

Alberta Infrastructure

CONSULTANT

PROJECT
Technical Design Requirements
Version 7

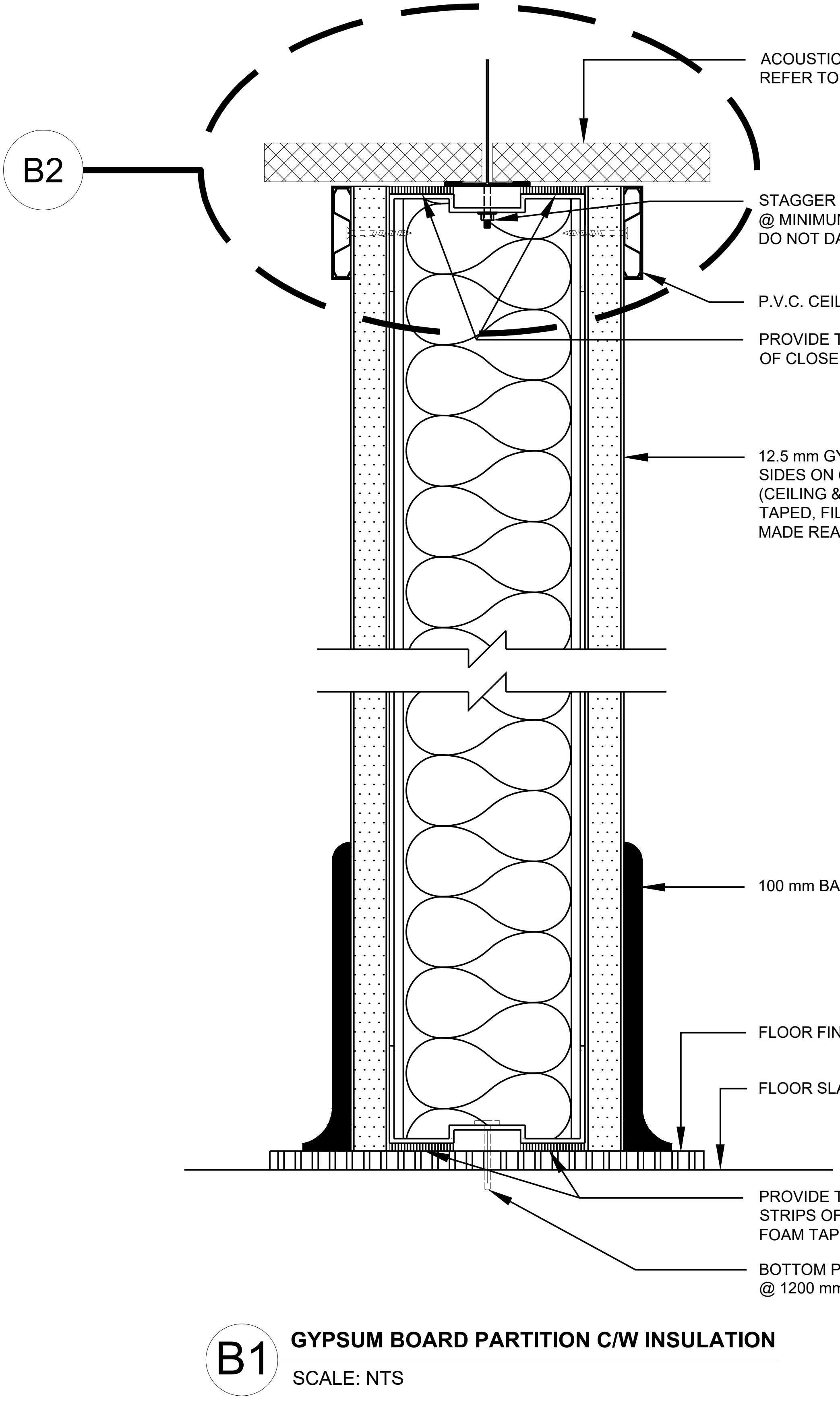
DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**

TITLE
INTERIOR DETAILS
PARTITION DETAIL 'A' (TYPICAL)

PROJECT ID.
Appendix F

SHEET NO.
A

DOCUMENT CODE
STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7

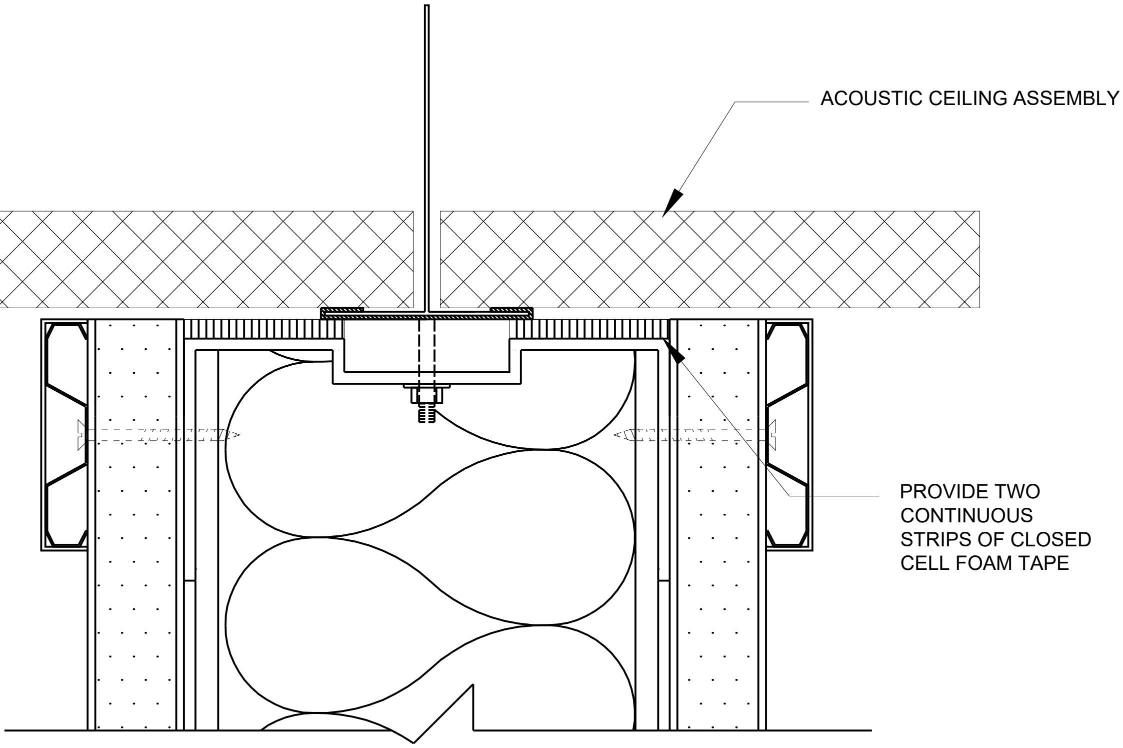


B1

GYPSUM BOARD PARTITION C/W INSULATION

SCALE: NTS

Alberta Infrastructure	CONSULTANT	PROJECT **Technical Design Requirements** Version 7	DRAWN BY **JH**	CHECKED BY **LJ**	SCALE **NTS**
			DATE **2022-08-02**	SITE ID -	BUILDING ID -
DOCUMENT CODE STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7		TITLE **INTERIOR DETAILS** **PARTITION DETAIL 'B1' (TYPICAL)**	PLAN NO. -	PHASE -	DISCIPLINE -
			PROJECT ID. **Appendix F**	SHEET NO. **B1**	



B2 **DETAIL OF T-BAR AND CLIP CONNECTION**

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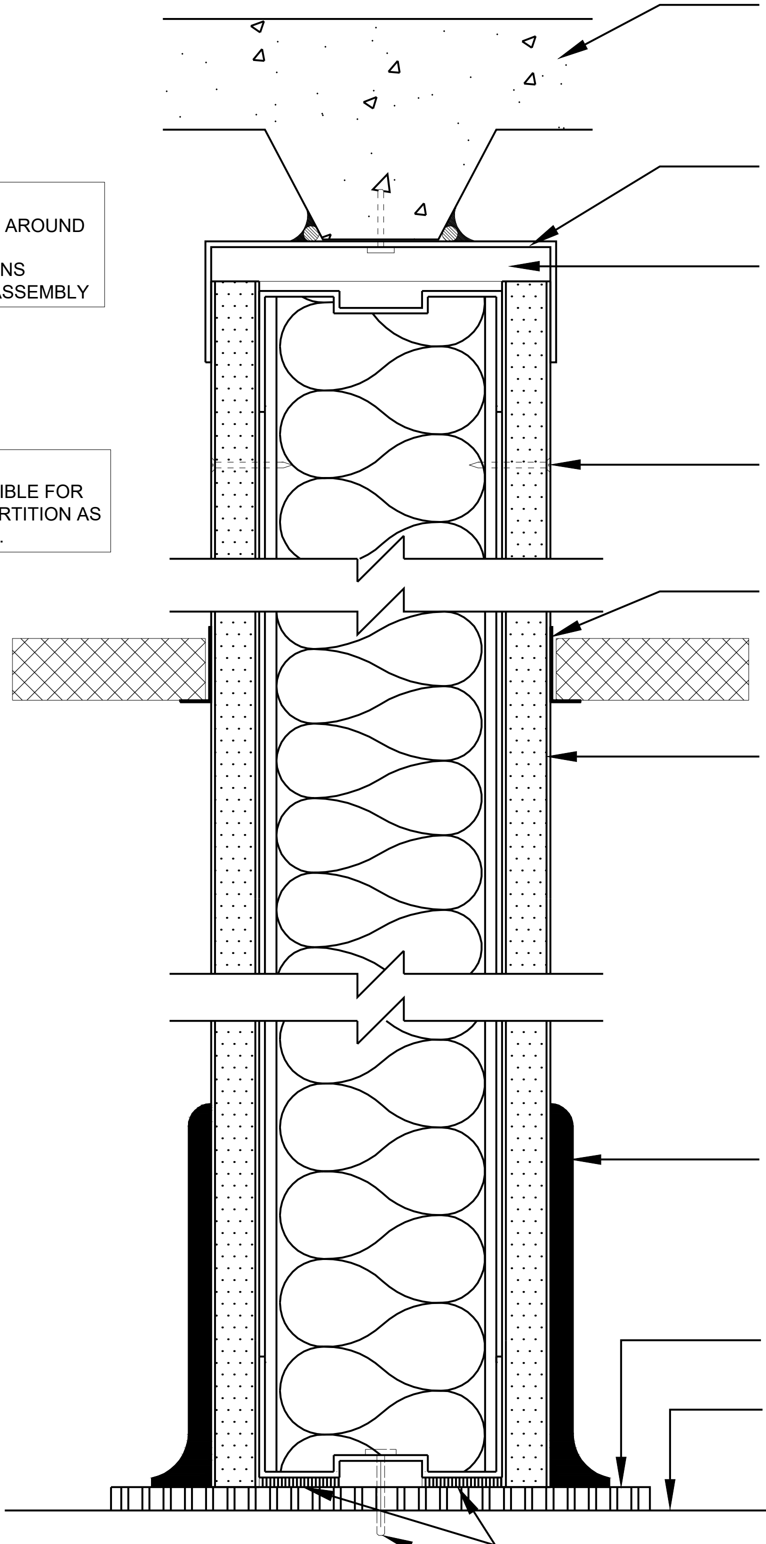
		DATE **2022-08-02**	SITE ID **-**	BUILDING ID **-**
	TITLE **INTERIOR DETAILS** **PARTITION DETAIL 'B2' (TYPICAL)**	PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
DOCUMENT CODE STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7		PROJECT ID. **Appendix F**	SHEET NO. **B2**	

NOTE:
PROVIDE AIR TIGHT SEALS AROUND ALL PIPING AND OTHER MECHANICAL PENETRATIONS THROUGH WALL CEILING ASSEMBLY

NOTE:
CONSULTANT IS RESPONSIBLE FOR DETAILING FIRE RATED PARTITION AS APPLICABLE UNDER CODE.



STRUCTURE ABOVE

DEEP TRACK CHANNEL FASTENED TO U/S OF DECK

DEFLECTION JOINT

FASTEN GYPSUM WALL BOARD BELOW TRACK CHANNEL TO ALLOW FOR MOVEMENT

WALL ANGLE AND ACOUSTIC CEILING ASSEMBLY. REFER TO ACOUSTICS SECTION

RATED PARTITION:
- TYPE X GWB
- STEEL STUDS @ 400 mm O.C.
- BATT INSULATION TO ALL VOIDS
- CONSTRUCT TO U/S OF DECK
- TAPE, FILL, SAND, MAKE READY TO RECEIVE NEW WALL FINISH

100 mm BASE

FLOOR FINISH

FLOOR SLAB

PROVIDE TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE

BOTTOM PLATE FASTENED @ 1200 mm O.C.

C **FIRE RATED PARTITION**

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Technical Design Requirements
Version 7

TITLE
INTERIOR DETAILS
PARTITION DETAIL 'C' (TYPICAL)

DOCUMENT CODE
STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7

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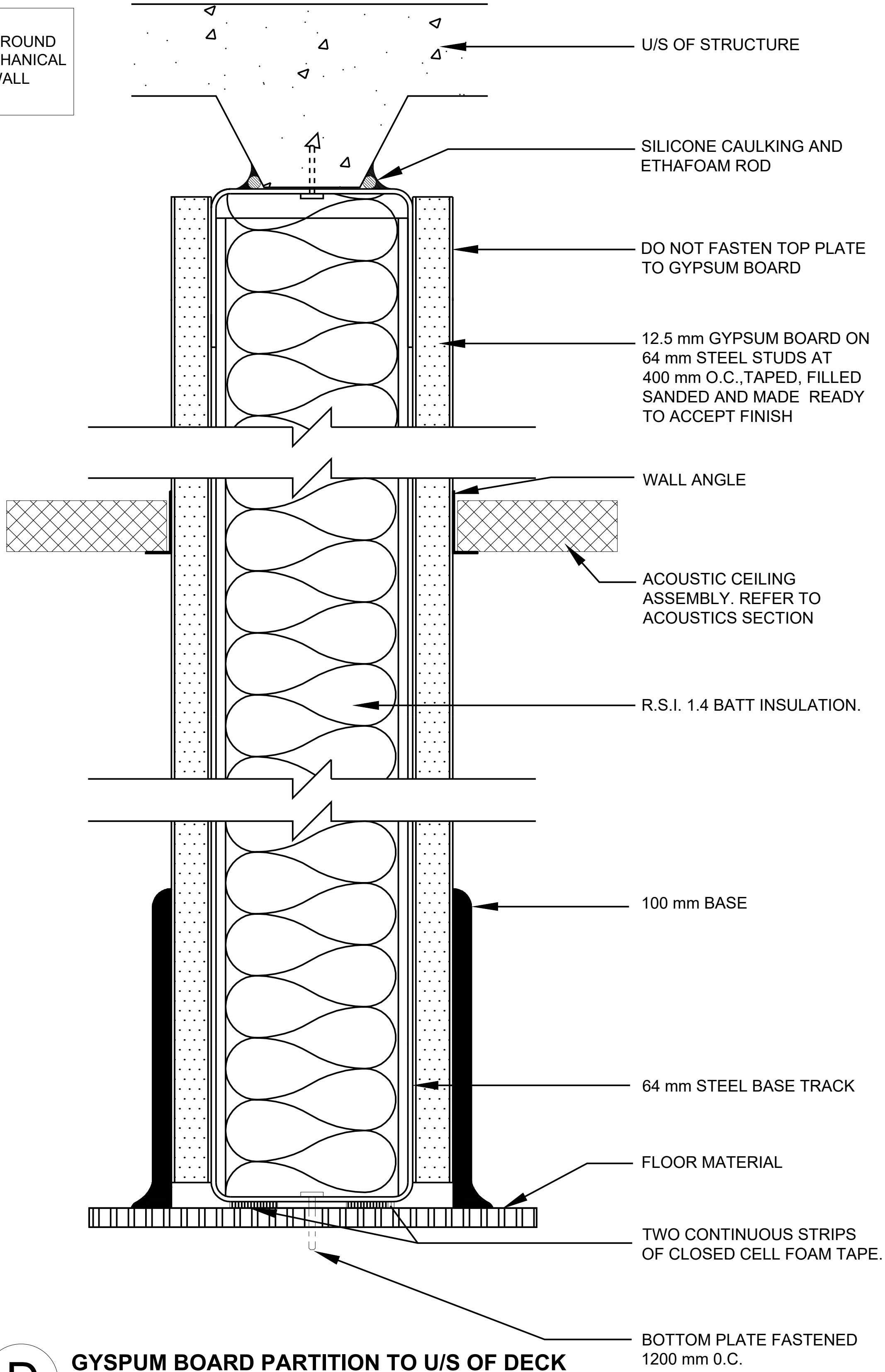
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**

PROJECT ID.	SHEET NO.
Appendix F	**C**

NOTE:
PROVIDE AIR TIGHT SEALS AROUND ALL PIPING AND OTHER MECHANICAL PENETRATIONS THROUGH WALL CEILING ASSEMBLY.



D GYSPUM BOARD PARTITION TO U/S OF DECK

SCALE: NTS

Alberta Infrastructure

CONSULTANT

PROJECT
Technical Design Requirements
Version 7

TITLE
INTERIOR DETAILS
PARTITION DETAIL 'D' (TYPICAL)

DOCUMENT CODE
STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7

DRAWN BY	CHECKED BY	SCALE
JH	LJ	NTS
DATE	SITE ID	BUILDING ID
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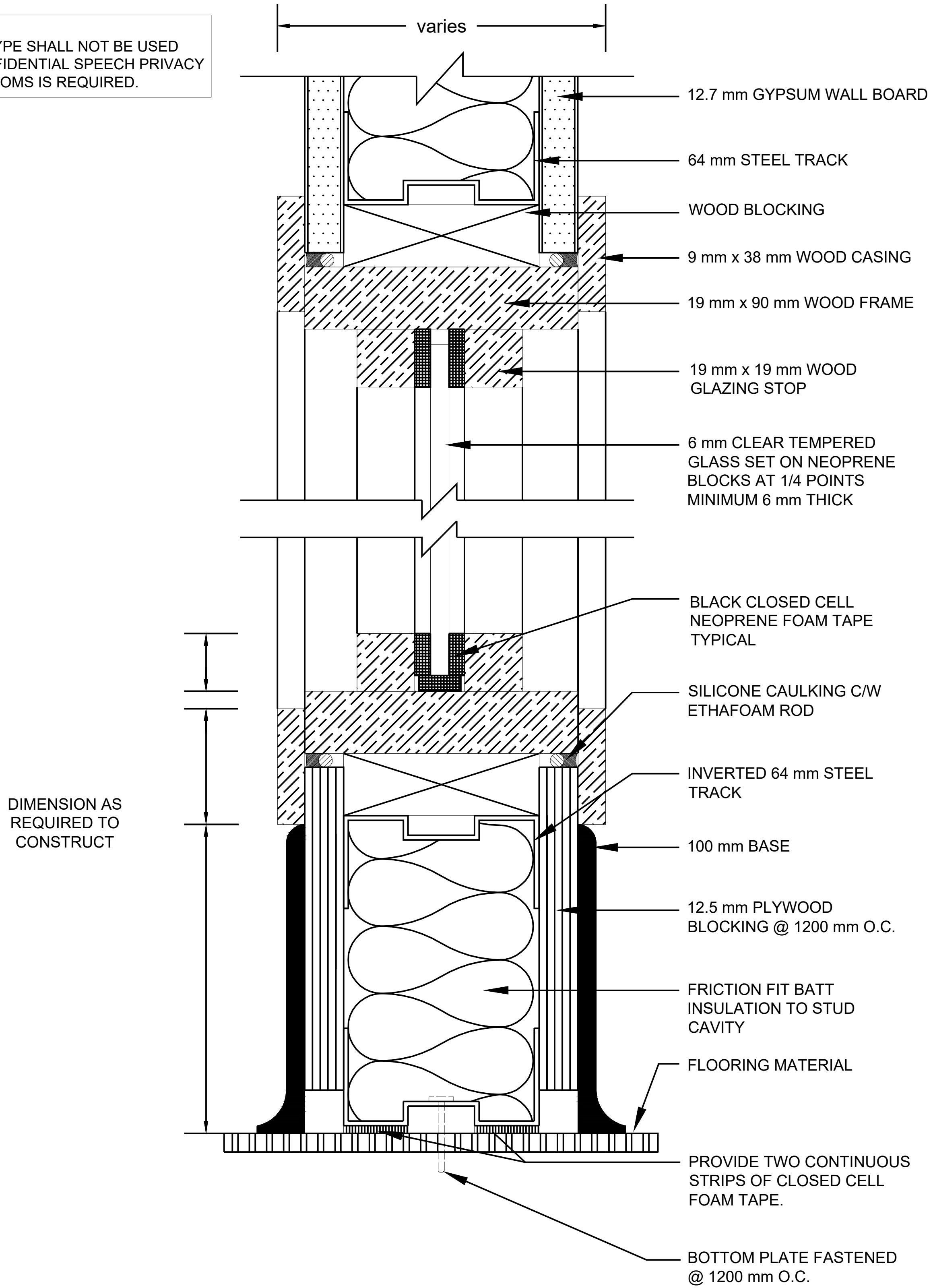
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix F	D	

NOTE:
PARTITION TYPE SHALL NOT BE USED
WHERE CONFIDENTIAL SPEECH PRIVACY
BETWEEN ROOMS IS REQUIRED.



varies

12.7 mm GYPSUM WALL BOARD

64 mm STEEL TRACK

WOOD BLOCKING

9 mm x 38 mm WOOD CASING

19 mm x 90 mm WOOD FRAME

19 mm x 19 mm WOOD
GLAZING STOP

6 mm CLEAR TEMPERED
GLASS SET ON NEOPRENE
BLOCKS AT 1/4 POINTS
MINIMUM 6 mm THICK

BLACK CLOSED CELL
NEOPRENE FOAM TAPE
TYPICAL

SILICONE CAULKING C/W
ETHAFOAM ROD

INVERTED 64 mm STEEL
TRACK

DIMENSION AS
REQUIRED TO
CONSTRUCT

100 mm BASE

12.5 mm PLYWOOD
BLOCKING @ 1200 mm O.C.

FRICTION FIT BATT
INSULATION TO STUD
CAVITY

FLOORING MATERIAL

PROVIDE TWO CONTINUOUS
STRIPS OF CLOSED CELL
FOAM TAPE.

BOTTOM PLATE FASTENED
@ 1200 mm O.C.

E — INSULATED GYPSUM WALL BOARD PARTITION C/W SINGLE GLAZING

SCALE: NTS

Alberta Infrastructure

CONSULTANT

PROJECT
Technical Design Requirements
Version 7

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PLAN NO.	PHASE	DISCIPLINE
-	-	-

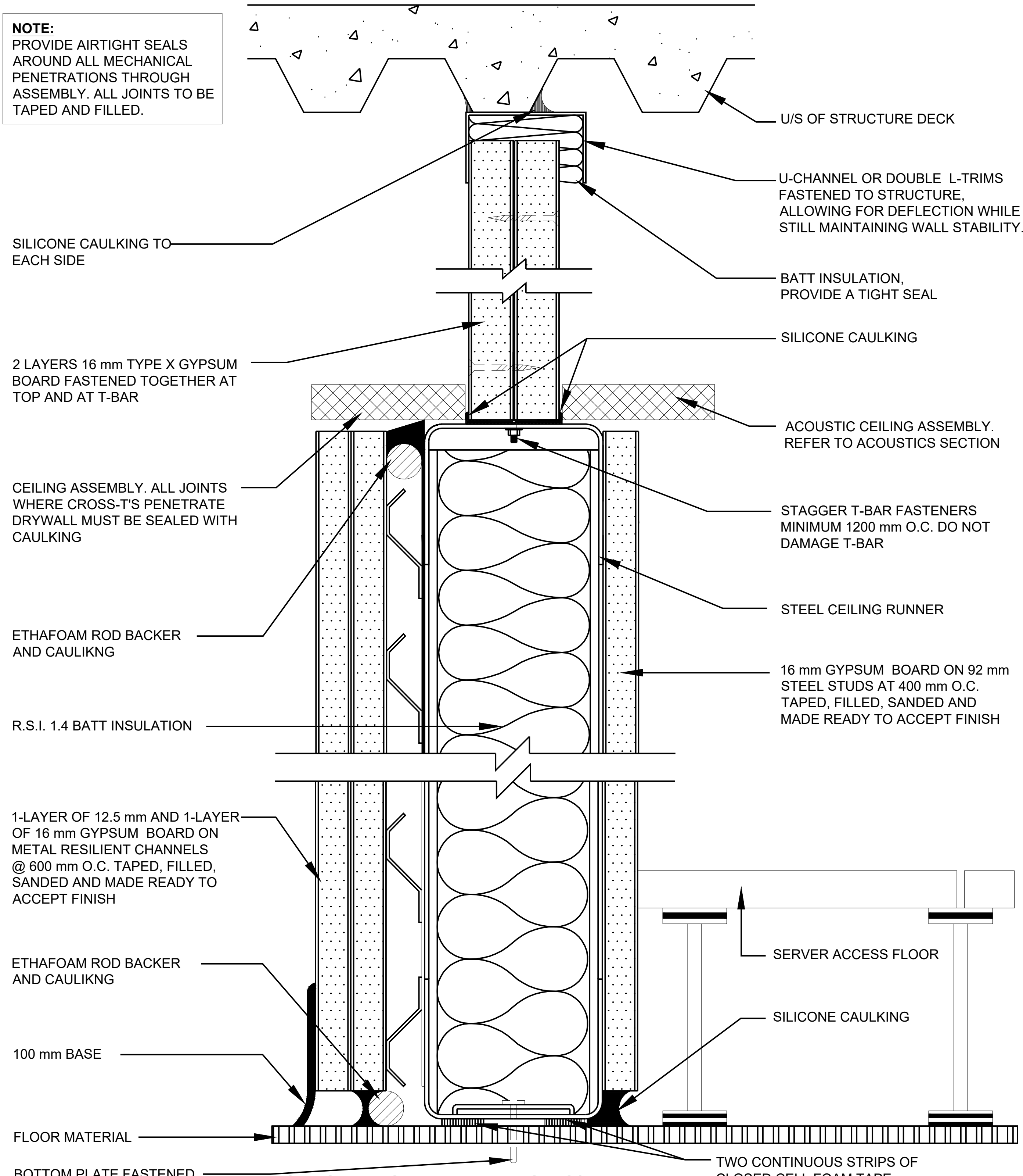
TITLE
INTERIOR DETAILS
PARTITION DETAIL 'E' (TYPICAL)

DOCUMENT CODE
STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7

PROJECT ID.
Appendix F

SHEET NO.
E

NOTE:
PROVIDE AIRTIGHT SEALS AROUND ALL MECHANICAL PENETRATIONS THROUGH ASSEMBLY. ALL JOINTS TO BE TAPED AND FILLED.



F

GYPSUM BOARD PARTITION C/W PLENUM SOUND BARRIER- SERVER ROOM

SCALE: NTS

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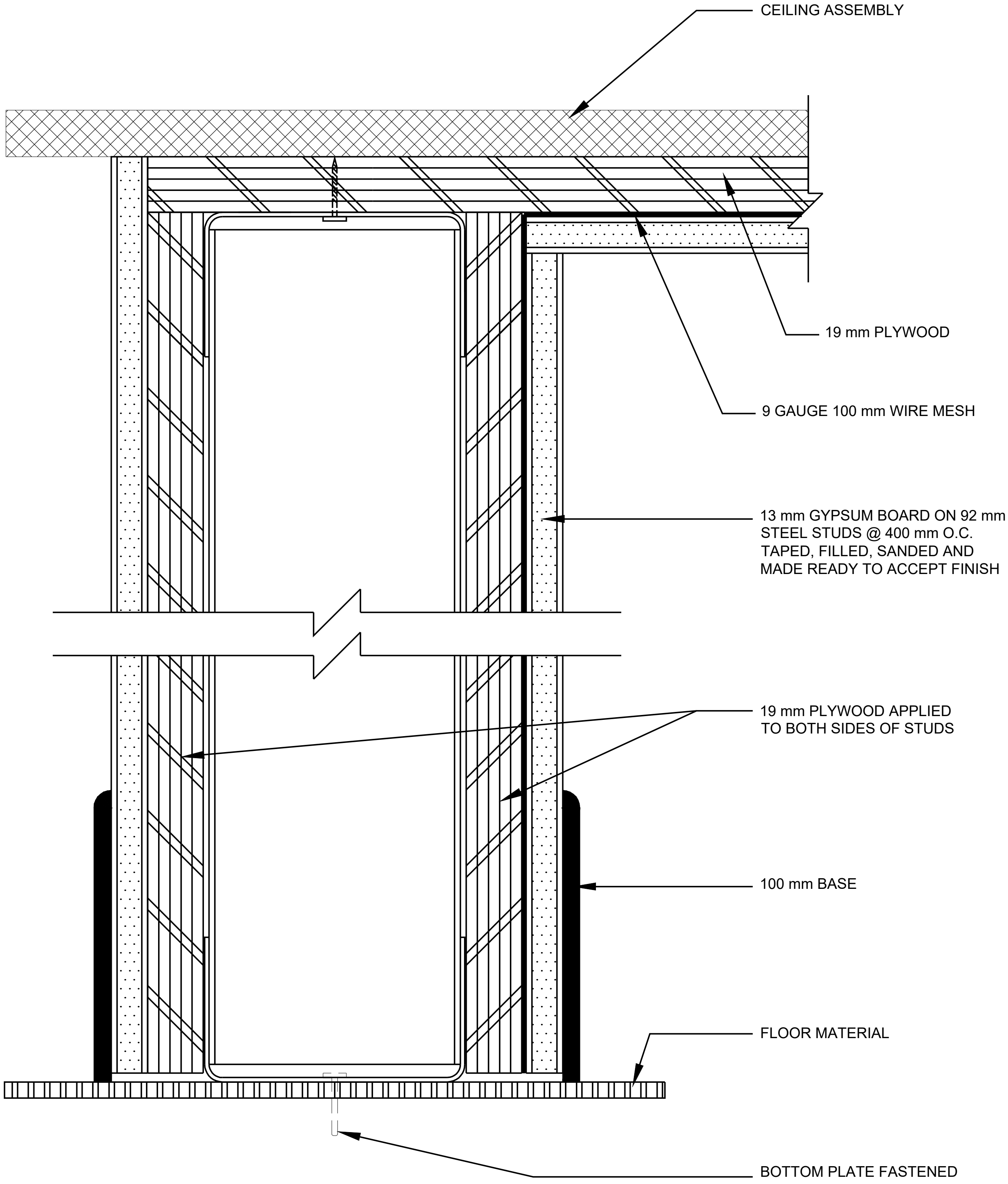
			DATE **2022-08-02**	SITE ID **-**	BUILDING ID **-**
		TITLE **INTERIOR DETAILS** **PARTITION DETAIL 'F' (TYPICAL)**	PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
DOCUMENT CODE STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7			PROJECT ID. **Appendix F**	SHEET NO. **F**	



G

GYPSUM BOARD/PLYWOOD PARTITION AND CEILNG- SECURE STORAGE

SCALE: NTS

Alberta Infrastructure

CONSULTANT

PROJECT
Technical Design Requirements
Version 7

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**

TITLE
INTERIOR DETAILS
PARTITION DETAIL 'G' (TYPICAL)

PROJECT ID.
Appendix F

SHEET NO.
G

DOCUMENT CODE
STANDARD INTERIOR DETAILS_ APPENDIX F_2022-TDR.V7

Appendix G – Geotechnical Investigation Guidelines for Alberta Infrastructure Projects

Alberta
Infrastructure

Geotechnical Investigation Guidelines for Alberta Infrastructure Projects

Version 1.0

Published March 28, 2022

Technical Services & Procurement Branch

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1 Introduction

1.1 Purpose of Guidelines

The Guidelines have been prepared to set out the standards of practice which geotechnical consultants should meet and follow while providing professional engineering services for Alberta Infrastructure projects.

Following are the specific objectives of these guidelines:

1. Describe the standard of practice that Engineering Professionals should follow when providing professional services related to geotechnical professional activities.
2. Specify the tasks and/or services that Engineering Professionals should complete or provide to meet the appropriate standard of practice and fulfill their professional obligations under the Act. These obligations include the Engineering Professional's primary duty to protect the safety, health, and welfare of the public and the environment.
3. Describe the roles and responsibilities of the various participants/stakeholders involved in these professional activities. The document should assist in delineating the roles and responsibilities of the various participants/stakeholders, which may include the Registered Professional of Record, the Geotechnical Engineer of Record (GER), Province, Authorities Having Jurisdiction, Supporting Registered Professionals, and contractors.
4. Define the skill sets that are consistent with the training and experience required to carry out these professional activities.

1.2 Geotechnical Engineering

Geotechnical engineering is to study the behaviour of soils and rock under the influence of loading forces and soil-water interactions. This knowledge is applied to the design of site grading (cut/fill), foundations, retaining walls, earth dams, and the stability of natural and man-made slopes, and etc.

Geotechnical investigation is performed by geotechnical engineers to obtain the subsurface information of a proposed development site. It helps to understand the foundation requirements and constraints posed by soil and groundwater conditions for construction of any new infrastructures, underground utilities, parking lots, and roads. A geotechnical investigation is required for all new infrastructure projects. Insufficient geotechnical information is the main cause of project's delays, disputes, claims, and cost overruns. Inadequate information of subsurface conditions could cause a significant, over-designed solution (high cost) or under-designed solution (potential failures).

The geotechnical report is a communication tool used by geotechnical engineers to provide site specific design parameters, and construction recommendations related to the geotechnical component of the project, such as foundations, excavation, groundwater conditions, retaining walls, ground anchors, earth works, utility installation, etc.

2 Roles and Responsibilities

The geotechnical engineer, working for the Province, must be licensed by the Association of Professional Engineers and Geoscientists of Alberta (APEGA) to practice in Alberta, and must be qualified, based on experience in the profession, to provide geotechnical engineering services.

2.1 Project Organization and Delivery Methods

Project organizations vary according to the needs of the project and the parties. The Geotechnical Engineer of Record (GER) is usually engaged by the Province, but may be engaged by the Province's Coordinating Registered Professional, the Structural Engineer of Record, a design/build contractor, or other persons responsible for the delivery of part or the entire project. The common forms of project organization / delivery methods are:

1. Design-Bid-Build Delivery
2. Design-Build Delivery
3. Construction Management
4. Public Private Partnership Delivery

2.2 Responsibilities

2.2.1 The Province

In order that the design and construction of the project is carried out in a manner that meets appropriate standards of public safety and requirements of applicable codes and regulation, the Province should:

1. Retain or cause to be retained qualified Professional Engineers including a Prime Consultant and a GER with responsibility for providing the necessary geotechnical design parameters used in foundation design and construction;
2. Cooperate with GER to set out a written description of the scope of GER's services and adequate written description of the project;
3. Before the commencement of the GER's services, finalize a written agreement with GER and other Professional Engineers. It specifies the agreed scope of services, schedules, deliverables, and associated compensation;
4. Authorize in writing any additional services that may be beyond the original scope of the GER's services, based on recommendations from the GER or other members of the project team;
5. Ensure that all required approvals, licences and permits from the Authorities Having Jurisdiction are obtained;
6. Provide the GER with the right of entry onto the project site for exploration purpose;
7. Recognize that drawings, specifications and other documents prepared by the GER are specific to the project and site and shall not be used or copied for other projects;
8. Disclose fully and promptly all information that may affect the GER's analysis, work, scheduling of tasks, design, or payment for services, including among other things, any existing geotechnical reports or data, any situations that may require special testing or equipment, and all known potential environmentally sensitive or hazardous site conditions;
9. Recognize that geotechnical investigations surveyed the subsurface and that unanticipated conditions may be encountered and a reasonable contingency should be included in the Province's budget; and
10. If the original GER is replaced, the new GER may require additional resources beyond which were originally budgeted and scheduled.

2.2.2 Prime Consultant

To enable the GER to perform his duties properly, the Prime Consultant should do the following, but not limited to:

1. Interpret and define the needs of the Province. The Prime Consultant should identify any special design criteria and advise the GER accordingly;
2. Outline the scope of assignment to each design professional for design, preparation of contract documents, review of work during construction and contract administration;
3. Provide timely information in sufficient detail required by the GER to adequately perform GER's duties;
4. Coordinate and review the designs, drawings and other contract documents produced by all participants of the design team;
5. Coordinate communication of information between the Province, the contractor and the design professionals, including the GER, so that the work proceeds in a manner that complies with applicable codes and regulations and meets the Province's needs.

2.2.3 Geotechnical Engineer of Record (GER)

The GER should work with the Province to develop a scope of work that allows the GER to meet the design and field review requirements of these guidelines, applicable codes and regulations.

Overall, the GER has responsibilities for, but not limited to:

1. Selecting investigation methods and testing soil samples to assess physical characteristics or properties, such as strength and compressibility;
2. Providing geotechnical and foundation parameters on which the geotechnical aspects are designed;
3. Ensuring that the design parameters provided meet acceptable engineering standards;
4. Reviewing final design to determine if the information and parameters provided have been correctly interpreted.

The GER may also provide recommendations for other elements of a building project or other types of projects requiring geotechnical expertise, such as slope stability, earthworks, pavement structures, criteria for design of temporary or permanent earth-retention systems, etc.

If the Province or Prime Consultant fails or refuses to carry out the obligations as set out in sections 2.2.1 and 2.2.2, the GER should consider giving written notice to the Province advising the Province of what GER requires in order to properly perform their duties.

2.2.4 General Contractor

It is not the mandate of this guideline to stipulate the responsibilities of the General Contractor, however, following should be clearly stated in the Contract Documents:

1. The General Contractor is responsible for all labour, materials, and equipment required to completed the work;
2. The General Contractor is responsible for the construction methods, techniques, sequences, procedures, safety precautions and programs associated with the construction work, all as set out in the Contract Documents;
3. The General Contractor is responsible for coordinating the work of the sub-contractors and for checking the sub-contractor's work;
4. The General Contractor is responsible for providing reasonable notice to the GER when the work is ready for field inspection and testing;
5. The General Contractor is responsible for providing safe access to the GER or their delegates to and within the site for review, inspection, material sampling and testing; and
6. The GER's field inspection and testing does not relieve the General Contractor from his responsibilities to complete the work in conformance with the Contract Documents.

3 Guidelines for Providing Geotechnical Engineering Services

This section outlines the services the Geotechnical Engineer of Record (GER) should consider providing as part of good practice. These guidelines should not be considered to be exhaustive and interpreted to limit the GER's responsibilities.

3.1 Scope of Services

Before commencement of design services, the GER should meet with the Province to:

- Determine the terms of reference and the scope of work for basic services and additional services;
- Clarify the required design life of proposed structure;
- Clarify the professional responsibilities for geotechnical design and field review in order to satisfy Occupational Health and Safety Alberta (OHSA) since they relate to excavation and shoring safety;

- Reach agreement on fees, payment schedule, and professional liability insurance coverage; and
- Reach agreement on other contractual terms and conditions.

3.2 Basic Geotechnical Engineering Services

The typical components of the basic geotechnical services, as discussed below, are generally organized in an agreement according to the sequential stages of a typical geotechnical investigation project.

3.2.1 Desktop Study

During the conceptual planning of a project, a desktop study should be carried out. The GER may attend, as required, periodic meetings with the Province and design team to obtain the Province's instructions regarding project requirements. For the desktop study, the GER may provide the following:

3.2.1.1 Air Photo Interpretation

The following might be indicated on the air photographs for the site and surrounding area terrain:

1. General drainage patterns;
2. General surficial soil types (fill or native material);
3. General slopes and ranges of gradient;
4. Bedrock outcrops, where present;
5. Poorly drained or bog areas (peat or muskeg);
6. Erosion features;
7. Old or potential slope failure areas; and
8. Previous land use history: Identify what were the previous uses of the site including but not limited to the following within the area of the site:
    a. Mining activity;
    b. Abandoned mines; and
    c. Landfills.

Some specific projects may also require the review of LiDAR images. Summarize any risks associated with the above findings regarding the proposed project.

3.2.1.2 Literature Search

The following information may be searched:

1. The geology of the area;
2. Physiographical data;
3. Previous site investigation data; and
4. Available water well records.

3.2.1.3 Site Reconnaissance

A preliminary site reconnaissance may be made to physically examine land forms, drainage, erosion features, and site access constraints. In addition, hand auger holes may be put down to confirm the general surficial soil conditions.

3.2.2 Extent of Investigation

Upon completion of the desktop study, the GER may attend, if required, meetings with the Province and design team to review the data and plan the field investigation. The extent of the ground investigation is determined by the expected soil type, variability of soils and groundwater conditions, the type of project, and the amount of existing information.

3.2.2.1 Methods of Investigation

There are many different methods available for geotechnical investigation. However, this section summarizes the general local practice in Alberta.

Borehole drilling:

In Alberta, boreholes in the overburden are typically drilled with solid-stem augers. In some areas where boreholes must be cased to remain open due to the presence of high groundwater levels and soft or loose soils, hollow-stem auger drilling may be required. Other forms of drilling may at times be feasible depending on site condition such as: wash boring, air-rotary, sonic, CPTu, and etc.

Drilling into bedrock and retrieving bedrock core samples is typically carried out using rotary diamond drilling equipment.

Test pits:

Test pits excavated by a backhoe can often provide valuable information on soil characteristics at shallow depth. ‘Grab’ samples can be obtained from the sides of the test pits or from the excavated spoil. Extra caution should be taken if test pits are excavated in loose sands, soft clays, or close to the water table.

3.2.2.2 Depth and spacing of boreholes

The depth of investigation is determined by many factors, including the type of structure and the associated magnitude of the loading, the subsurface conditions and their variability, the depth of planned excavation, and the types of foundations to be constructed. It is recommended that the site investigation should be carried to a depth that the entire zone of soil affected by changes caused by the structure and construction. However, the foundation type and design may not be finalized or unknown at the beginning of the site investigation, it is prudent to drill holes deeper than originally estimated to allow some variation during project development.

The spacing of boreholes is based on variability of site conditions, size/footprint of structure, type of project, performance requirements, past experiences, and judgement. For less developed areas where previous experiences are limited, more boreholes and closer spacing are generally recommended.

(see table on following page)

Table 1 Guidelines for Depth and Spacing of Boreholes

Development	Test Spacing	Approximate Depth of Investigation
Building	20 m – 50 m (A minimum of three boreholes is required)	• The depth of investigation will depend on the expected load and site condition: Low rise (≤2 Storeys): 8-10 m depth Mid rise (3 to 5 storeys): 10-15 m depth High rise (≥ 6 storeys): ≥ 20 m depth (*If the structure has a basement or underground parkade, deeper holes may be required*.) • Canadian Foundation Engineering Manual (4th Edition, 2006) recommends to extend the boreholes to such a depth that the net increase in soil stress under the weight of the structure is less than 10% of the applied load, or less than 5% of the effective stress in the soil at that depth, whichever is less. A reduction in the depth may be considered if bedrock or dense soil is encountered within the minimum depth. If very compressible normally consolidated clay soil is encountered, it is recommended extending boreholes deeper than determined by the 10% and 5% rules.
Pavements /roads	250 m to 500 m	5 m below existing surface
Local roads < 150 m	2 to 3 locations	
Local roads >150 m	50 m to 100 m (3 minimum)	
Parking lot	2Bhs for <50 parks 3Bhs for 50-100 4Bhs for 100-200 5Bhs for 200-400	5 m below existing surface

Note: Bhs = Boreholes

3.2.2.3 Soil Sampling and In-Situ Testing of Soil

Exploration and field sampling work must be carried out in accordance with the Canadian Foundation Engineering Manual, ASTM, and CSA Standards.

3.2.2.3.1 Field Sampling

The frequency and type of sampling may be varied by the requirements of the project and site condition.

In local practice, for investigation by boreholes, soil sampling is typically obtained by grabbing from drilling auger and using split spoon in conjunction with the Standard Penetration Test. Relatively undisturbed samples can be obtained using Shelby tube samplers.

Standard sampling frequency:

- Grab disturbed samples from auger at 0.75 m depth interval and at changes in strata;
- Obtain samples using split spoon at 1.5 m depth intervals; and
- Obtain undisturbed samples at depths recommended by GER.

In test pit excavation, it is good practice to obtain at least one (grab) sample per test pit and / or one sample per strata encountered in each test pit.

3.2.2.3.2 In-Situ Testing

Field testing must be carried out in accordance with ASTM or CSA Standards or special instructions set out by the equipment manufacturer.

The common field tests are:

1. Standard Penetration Test
2. Pocket Penetrometer Test
3. Cone Penetration Test
4. Field Vane test
5. Pressuremeter test
6. Dilatometer test

Field tests must be carried out properly and at the appropriate place to obtain in-situ soils or bedrock parameters.

Where possible, Standard Penetration Tests should be carried out at 1.5 m depth interval in all boreholes.

3.2.2.4 Groundwater Monitoring

Groundwater level is expected to fluctuate with seasonal variations and rainfall events. The groundwater level should be monitored by standpipes installed during geotechnical investigation. The installation of such instrument should be in accordance with recognized standards and as directed by GER.

It is essential that the field logs record all observations of encountered water seepage, sloughing, and initial water percolation into test pits. The rate of inflow and rise of water levels should be recorded at the time of the initial observations to assess the apparent influence. The water flow may have impact on the project design and construction procedures.

The number of wells required depends on the geology, uniformity, topography and hydrological. It is recommended to complete 50% of the boreholes for short term groundwater monitoring. A minimum of three groundwater monitoring wells is required.

For standpipes in lower permeability soils, the groundwater levels could take up to two weeks to stabilize. The groundwater levels should be measured after stabilization is reached.

Standpipes shall be decommissioned after groundwater levels have been measured by filling the standpipes with Bentonite chips and then removing the top 300 mm (from the ground surface) of the standpipes.

3.2.2.5 Laboratory Testing

It is required that representative samples from the field investigation be tested in the laboratory for the determination of soil properties essential to the preparation of the geotechnical report. After completing the laboratory testing program, the report and recommendations should be provided based on the results obtained.

Conventional laboratory testing includes:

- Visual inspection on all soil samples including disturbed and relatively undisturbed samples;
- Water content;
- Atterberg limits;
- Grain size distribution;
- Laboratory oedometer consolidation testing on compressible clay soils;
- unconfined compressive strength;
- Soil water-soluble sulphate; and
- Soil corrosivity.

All tests must be carried out in accordance with standard procedures outlined by ASTM and CSA Standards. Laboratory testing can only be performed by trained and qualified technicians working under supervision of an experienced GER.

Only necessary tests required to provide data for the geotechnical analyses should be carried out.

3.2.2.6 Frost Penetration:

Provide 50 year return period frost penetration depth/burial depth for both heated and unheated structure, and utility lines that are susceptible to freezing.

3.2.2.7 Geotechnical Reports

Geotechnical report should be clear, concise, and accurate. An adequate, and comprehensive geotechnical report is necessary to carry out a safe, cost-effective project.

A geotechnical report summarizes the results of the site work, laboratory work, and analyses. And it should include recommendations for the geotechnical aspects of design and construction of the project. Generally, the report shall contain:

1. An Executive summary including potential risks for the proposed development;
2. A description of the site location, current land use, and topography;
3. A description of the planned development, including the proposed buildings, site grading (if known), and any significant excavations;
4. A summary of desktop study results;
5. A description of site investigation (e.g., borehole drilling and sampling, in situ testing, laboratory testing, and groundwater condition);
6. A summary of the subsurface conditions on the site and the results of the in situ and laboratory testing;
7. A scaled plan showing the site and the locations of the boreholes and test pits;
8. Drawings or tables showing the findings of the investigation;
9. Drawings or tables showing the factual results of the laboratory testing;
10. Geotechnical recommendations for:
    a. Site grading / surface drainage;
    b. Subgrade preparation;
    c. Foundation options and feasibility;
    d. Design parameters for shallow foundations (bearing capacity for strip and spread footings, minimum depth of burial);
    e. Design parameters for deep foundations;

    f. Design and construction provisions for groundwater control;
    g. Grade-supported floor slab including sub-grade preparation required to limit the slab settlement to a maximum of 25 mm
    h. Subsurface drainage;
    i. Design and construction of excavation support system;
    j. Soil swelling and frost heaving mitigation measures;
    k. Lateral earth pressure parameters for basement and retaining walls if required;
    l. Backfill material and compaction;
    m. Cement type related to soluble sulphate concentrations, freeze-thaw cycles from groundwater level fluctuations;
    n. 1-in-50 year frost penetration depth for both heated and unheated structures, and deep utilities;
    o. Pavement design and construction, including surfacing type(granular, concrete, asphalt);
    p. Seismic considerations – seismic site class and potential for ground liquefaction
    q. Earthworks related to site servicing; and
    r. Slope stability and retaining walls (if required).
11. Appendices containing:
    a. A list of references;
    b. Borehole and test pits logs;
    c. Site photographs;
    d. Laboratory test result sheets;
    e. Plan drawing with borehole locations; and
    f. Two (2) stratigraphic cross-sections (along the major and minor axes of the footprint of the proposed development).

Geotechnical report should be prepared, signed, and sealed by a qualified geotechnical engineer licensed in the Province of Alberta.

3.2.3 Services During Construction

Further to the carrying out of a geotechnical investigation and provide a geotechnical report, the GER should also be involved in various supplementary activities during the construction phase. The supplementary services might include, but not limited to:

1. Foundation Subgrade Inspection
   The GER or a qualified and experienced technician under the supervision of the GER should inspect the foundation bearing materials during construction.

The GER should verify the expected soil conditions at the bottom of the excavation and confirm that no part of the excavation encounters soil conditions substantially different than anticipated. The foundation designer or structural engineer should verify that the specified bearing values have been achieved at the foundation level.

2. Pile Installation Inspection
   During pile installation, an independent inspection should be carried out by a qualified and experienced technician under the supervision of the GER to ensure installations are in accordance with specifications.

3. Pile Load Test Supervision
   The GER and the Structural Engineer of Record provide recommendations on whether a pile load test should be carried out for the proposed project. The pile load testing should be carried out under the supervision of an engineer working for the GER. All load tests should be carried out in accordance with ASTM. (ASTM-D1143, ASTM-D3689, and ASTM-D3966, as applicable)

4. Fill Compaction Testing
   If fill placement is required, a qualified, experienced technician under supervision of the GER should inspect and test the soil and provide recommendation on whether the fill materials are acceptable or not. Where standards of compaction are required, the physical testing of the fill material should be carried out by a qualified and experienced technician under the supervision of the GER. A report should be submitted to the Province indicating acceptance or rejection of the work as it is performed.

5. Pavement Subgrade Testing
   Road and parking lot subgrade should be inspected and tested by a qualified, experienced technician under supervision of the GER to ensure the soil condition is consistent with what is encountered during investigation. Pavement subgrade tests shall include laboratory testing of samples recovered from the site and in-situ testing of the subgrade in its prepared condition.

6. Slope Stability Monitoring (if required)
   Slope stability monitoring prior to, during and following construction of civil works is essential to the safety of the facility. The installation and monitoring of slope indicators should only be carried out by qualified and experienced engineering technicians under the supervision of a GER.

7. Field Instrumentation-Settlement (if required)
   The GER is frequently required to provide the monitoring of instrumentation established during construction to determine settlement and stress changes. This work should be carried out by qualified experienced technicians acting under the supervision of a GER.

3.3 Additional Geotechnical Engineering Services

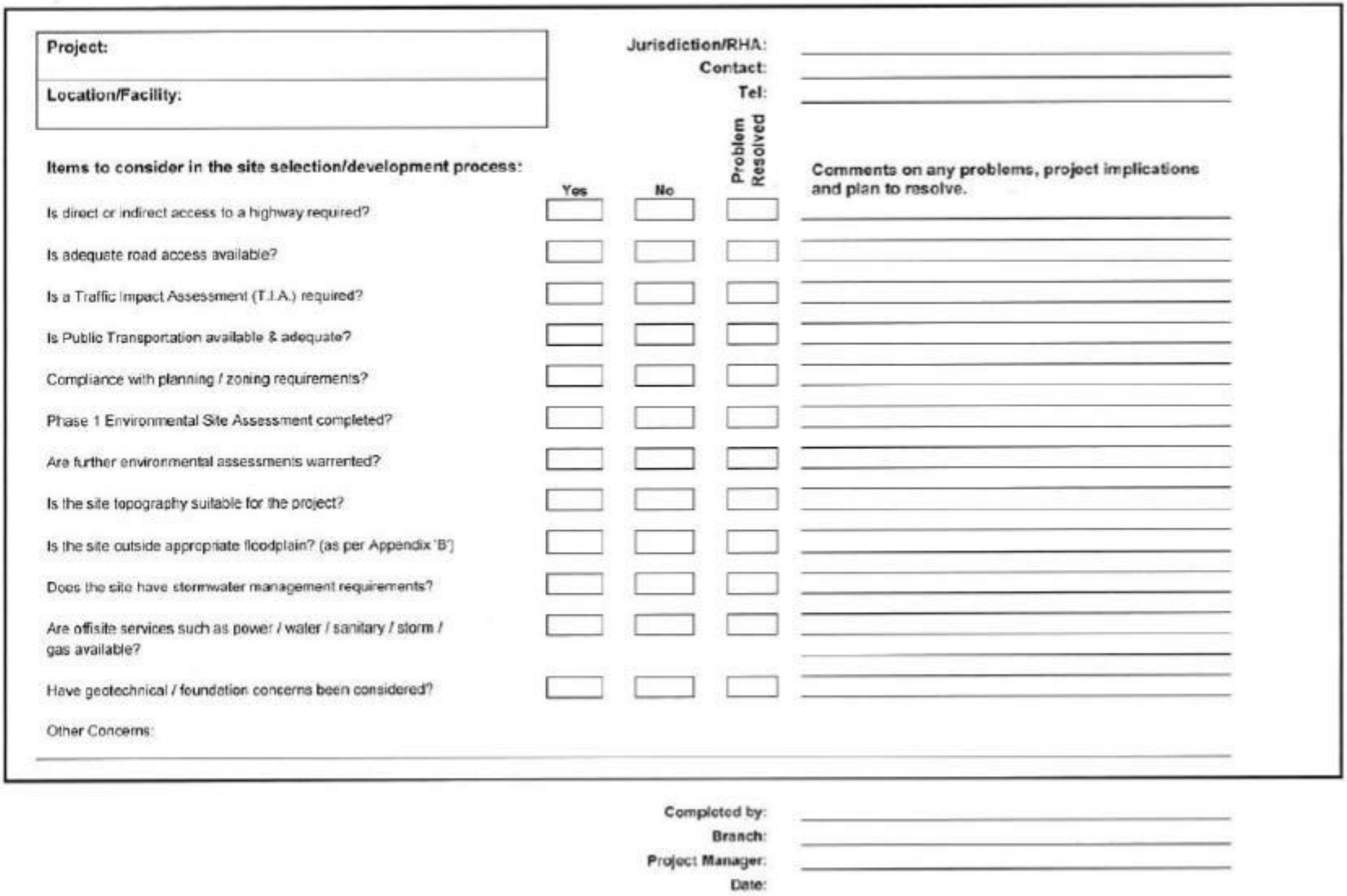
In addition to the Basic Services, the GER may provide the following additional services if the GER and the Province reach appropriate mutual agreements. The additional services are not considered intrinsic parts of the basic geotechnical design services as discussed in the Section 3.2.

Examples of Additional Services are:

1. Review of design drawings and / or specifications prepared by others to determine suitability;
2. Geotechnical engineering work resulting from changes to the project as originally described and agreed to under the contract between the GER and Province, such as changes in scope, complexity, diversity or magnitude of the project;
3. Work related to preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
4. Review of alternative designs or products after completion of the Contract Documents;
5. Special dynamic analysis beyond that required by codes such as ground-foundation response;
6. Field investigation of existing buildings and structures including surveys of existing construction;
7. Design review or field observations of shoring or bracing for excavation and building or under pinning of adjacent structures;
8. Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor;
9. Extra work arising from disputes due to problems outside the control of the GER;
10. Review of the contractor’s methods, procedures and construction equipment with respect to the effect on the project;
11. Work due to extended time schedules for design or construction, beyond the control of the Prime Consultant or GER;
12. Services as an expert witness in connection with any public hearing, arbitration, or court proceedings concerning the project, including attendant preparation for same;
13. Work resulting from damage as the result of fires, flood, man-made disasters or natural disasters;
14. Overtime work requiring premium pay when authorized;

15. Travelling time outside of normal requirements;
16. Provision of special clauses to be included in the specifications where unusual soil, bedrock or groundwater conditions exist and where special expertise is required;
17. Provision of special sketches for drainage, special foundation measures, safe slopes and shoring requirements; and
18. Attendance at special site meetings to review problems of an unforeseen nature that have arisen during foundation or earthworks construction.

Appendix H – Transportation and Site Requirements



Project:

Location/Facility:

Jurisdiction/RHA: ______

Contact: ______

Tel: ______

Items to consider in the site selection/development process:	**Yes**	**No**	**Problem Resolved**	**Comments on any problems, project implications and plan to resolve.**
Is direct or indirect access to a highway required?	☐	☐	☐	
Is adequate road access available?	☐	☐	☐	
Is a Traffic Impact Assessment (T.I.A.) required?	☐	☐	☐	
Is Public Transportation available & adequate?	☐	☐	☐	
Compliance with planning / zoning requirements?	☐	☐	☐	
Phase 1 Environmental Site Assessment completed?	☐	☐	☐	
Are further environmental assessments warrented?	☐	☐	☐	
Is the site topography suitable for the project?	☐	☐	☐	
Is the site outside appropriate floodplain? (as per Appendix 'B')	☐	☐	☐	
Does the site have stormwater management requirements?	☐	☐	☐	
Are offsite services such as power / water / sanitary / storm / gas available?	☐	☐	☐	
Have geotechnical / foundation concerns been considered?	☐	☐	☐	

Other Concerns:

Completed by: ______

Branch: ______

Project Manager: ______

Date:

Appendix I – Workspace Furniture Typicals

WORKSPACE LEGEND:

ELECTRICAL/VOICE/DATA LEGEND (TYPICAL):

⦶	DUPLEX OUTLET
◭	VOICE/DATA
☒	POWER FEED

NOTE:

1. PROVIDE ALL NECESSARY ELECTRICAL AND POWER HARNESSES/CABLING REQUIRED.
2. IN PANELED WORKSPACES, LOCATE ELECTRICAL IN BASE. PROVIDE CABLE MANAGEMENT.

PANELS:

PANELS SHALL BE COMPRISED OF 1 (ONE) MANUFACTURER'S STANDARD HEIGHT BASE PANEL AND 1 (ONE) LOAD BEARING STACKED PANEL TO ACHIEVE AN OVERALL HEIGHT OF 54"± (1372 mm±) TO 60"(1524mm).

PANEL WIDTHS SHALL BE 24" (610mm) , 30" (762mm), OR 42" (1067mm) AS REQUIRED TO ACHIEVE THE OVERALL LAYOUT.

NOTE:

DRAWINGS TO BE READ IN CONJUNCTION WITH TECHNICAL DESIGN REQUIREMENTS (TDR).

TOP PANEL TO BE CLEAR GLASS ON CORRIDOR SIDE. IF ADJACENT TO A HIGH TRAFFIC AREA, GLASS MAY BE FROSTED OR OBSCURED.

ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF TECHNICAL SERVICES.

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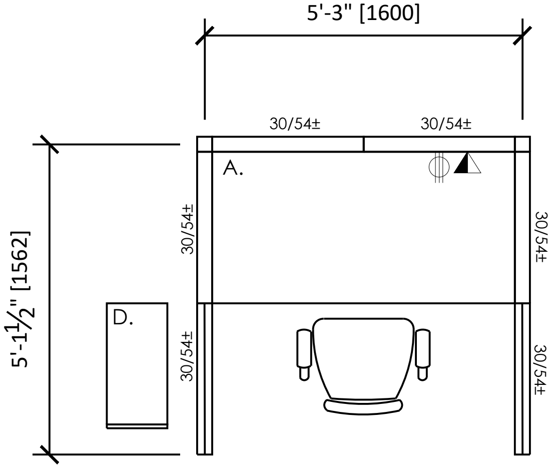
DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE- LEGEND AND NOTES

DRAWN BY **JH**	CHECKED BY **LJ**	SCALE **NTS**
DATE **2022-08-02**	SITE ID **-**	BUILDING ID **-**
PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
PROJECT ID. **Appendix I**	SHEET NO. **A**	



1 HOTELING WORKSPACE

2.5 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOODGRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

STORAGE TOWER: LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (ADA COMPLIANT)

PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

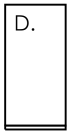
PANEL FABRIC: GRADE 2/B FABRIC

TOP, END & CORNER TRIMS: FULL-LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

WORKSPACE KIT-OF-PARTS LEGEND:

A. PRIMARY WORKSURFACE

- 30” D x 60” W (762 mm D x 1372 mm W)
- PIN HEIGHT ADJUSTABLE LEGS
- CABLE MANAGEMENT ALONG BACK



D. STORAGE TOWER

- 12” W x 24” D x 54” ± H (305 mm W x 610 mm D x 1372 mm ± H)
- COAT ROD INCLUDED
- ANTI-TIP
- SIMILAR OVERALL HEIGHT AS STACKED PANEL
- LOCATE OUTSIDE OF WORKSPACE

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3”± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTERLINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.

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Infrastructure

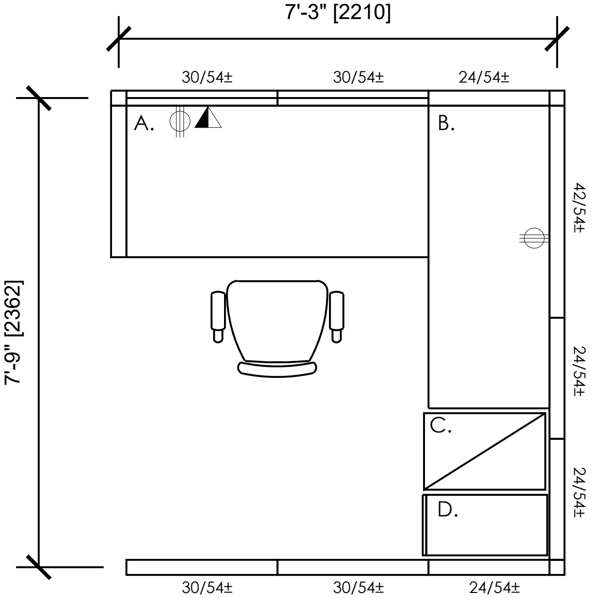
CONSULTANT

DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

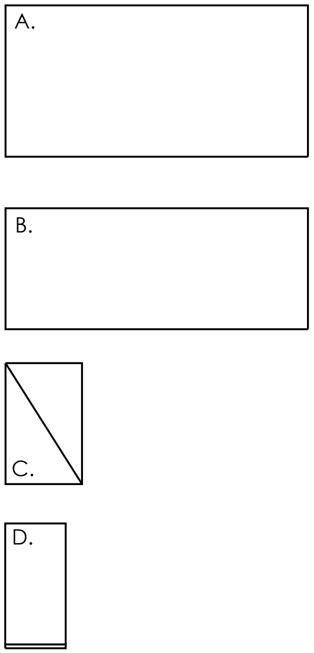
TITLE
TYPICAL WORKSPACE- HOTELING

DRAWN BY **JH**	CHECKED BY **LJ**	SCALE **NTS**
DATE **2022-08-02**	SITE ID **-**	BUILDING ID **-**
PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
PROJECT ID. **Appendix I**	SHEET NO. **1**	



2 ROVER WORKSPACE
5.2 m ²

WORKSPACE KIT-OF-PARTS LEGEND:



A. PRIMARY WORKSURFACE
- 30” D x 60” W (762 mm D x 1524 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- CABLE MANAGEMENT ALONG BACK

B. SECONDARY WORKSURFACE
- 24” D x 60” W (610 mm D x 1524 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL w/ CUSHION TOP
- 18"-24” D (450mm x 610 mm D)
- BOX/FILE DRAWERS c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS, PENCIL TRAY

D. STORAGE TOWER
- 12” W x 24” D x 54”± H (305 mm W x 610 mm D x 1372 mm ± H)
- COAT ROD INCLUDED
- ANTI-TIP
- SIMILAR OVERALL HEIGHT AS STACKED PANEL

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOOD GRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

MOBILE BOX, FILE PEDESTAL w/ CUSHION TOP:

CUSHION TOP: GRADE 2/B FABRIC

BODY: STANDARD PAINTED METAL FINISH

STANDARD PULLS (ADA COMPLIANT)

STORAGE TOWER: LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (ADA COMPLIANT)

PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

PANEL FABRIC: GRADE 2/B FABRIC

TOP, END & CORNER TRIMS: FULL-LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3”± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTERLINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
7. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.

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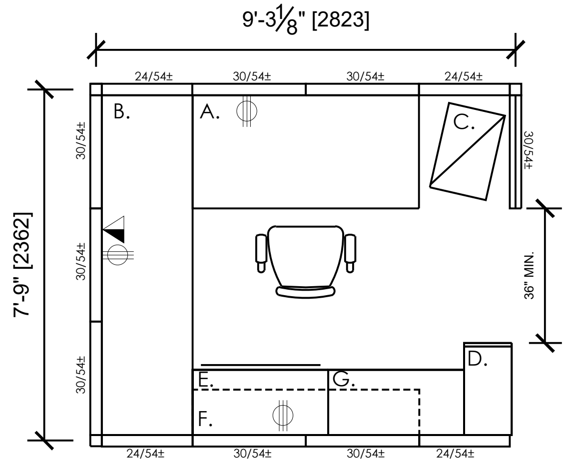
DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE- ROVER

DRAWN BY **JH**	CHECKED BY **LJ**	SCALE **NTS**
DATE **2022-08-02**	SITE ID **-**	BUILDING ID **-**
PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
PROJECT ID. **Appendix I**	SHEET NO. **2**	

WORKSPACE KIT-OF-PARTS LEGEND:



③ RESIDENT WORKSPACE
6.7 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOODGRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

MOBILE BOX, FILE PEDESTAL w/ CUSHION TOP:

CUSHION TOP: GRADE 2/B FABRIC

BODY: STANDARD PAINTED METAL FINISH

STANDARD PULLS (ADA COMPLIANT)

STORAGE TOWER: LAMINATE OR STANDARD PAINTED METAL FINISH

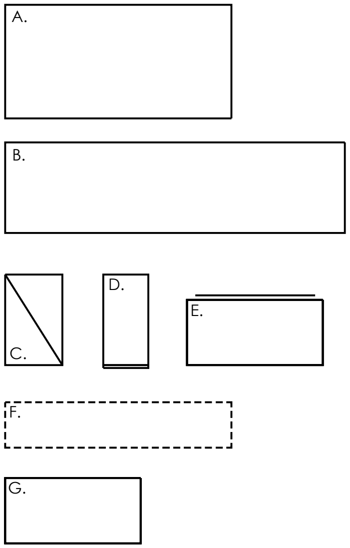
STANDARD PULL (ADA COMPLIANT)

LOW STORAGE:

LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (ADA COMPLIANT)

OPEN SHELF:
STANDARD PAINTED METAL FINISH



PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

PANEL FABRIC: GRADE 2/B FABRIC

TOP, END & CORNER TRIMS: FULL LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3”± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTRELINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
7. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
8. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.

A. PRIMARY WORKSURFACE
- 30” D x 60” W (762 mm D x 1524 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- CABLE MANAGEMENT ALONG BACK

B. SECONDARY WORKSURFACE
- 24” D x 90” W (610 mm D x 2286 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL w/ CUSHION TOP
- 18"-24” D (450mm x 610 mm D)
- BOX/FILE DRAWERS c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS, PENCIL TRAY

D. STORAGE TOWER
- 12” W x 24” D x 54”± H (305 mm W x 610 mm D x 1372 mm ± H)
- COAT ROD INCLUDED
- ANTI-TIP
- SIMILAR OVERALL HEIGHT AS STACKED PANEL

E. LOW FILE STORAGE (OPTIONAL)
- 36” W x 18” D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

F. OPEN SHELF (OPTIONAL)
- 60” W (1524 mm W)
- UNDERMOUNT TASK LIGHT (OPTIONAL)

G. LOW OPEN STORAGE (OPTIONAL)
- 36” W x 18” D x 27”± H (914 mm W x 457 mm D x 686 mm ± H)
- ONE SHELF
- FLUSH BACK AND FINISHED TOP

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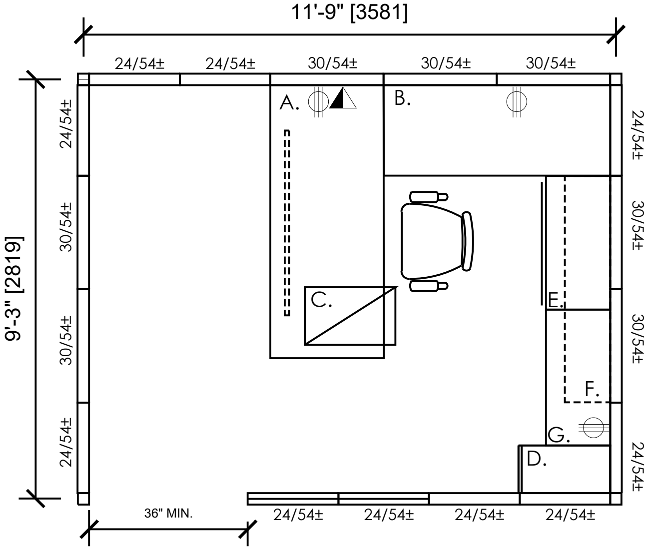
DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE- RESIDENT

DRAWN BY	CHECKED BY	SCALE
JH	LJ	NTS
DATE	SITE ID	BUILDING ID
2022-08-02	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-

PROJECT ID.	SHEET NO.
Appendix I	3



4 DIRECTOR (AND EQUIVALENT) WORKSPACE
10.1 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOODGRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

MOBILE BOX, FILE PEDESTAL w/ CUSHION TOP:

CUSHION TOP: GRADE 2/B FABRIC

BODY: STANDARD PAINTED METAL FINISH

STANDARD PULLS (ADA COMPLIANT)

STORAGE TOWER: LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (ADA COMPLIANT)

LOW STORAGE: LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (ADA COMPLIANT)

OPEN SHELF:
STANDARD PAINTED METAL FINISH

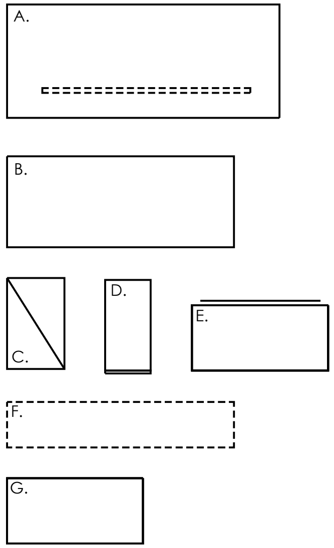
PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

PANEL FABRIC: GRADE 2/B FABRIC

END, TOP, & CORNER TRIMS: FULL LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

WORKSPACE KIT-OF-PARTS LEGEND:



A. PRIMARY WORKSURFACE
- 30” D x 72” W (762 mm D x 1829 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- HALF HEIGHT MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE
- 24” D x 60” W (610 mm D x 1524 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL w/ CUSHION TOP
- 18"-24” D (450mm x 610 mm D)
- BOX/FILE DRAWERS c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS, PENCIL TRAY

D. STORAGE TOWER
- 12” W x 24” D x 54”+/- H (305 mm W x 610 mm D x 1372 mm +/- H)
- COAT ROD INCLUDED
- ANTI-TIP
- SIMILAR OVERALL HEIGHT AS STACKED PANEL

E. LOW FILE STORAGE (OPTIONAL)
- 36” W x 18” D x 27”± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

F. OPEN SHELF (OPTIONAL)
- 60” W (1524 mm W)
- UNDERMOUNT TASK LIGHT (OPTIONAL)

G. LOW OPEN STORAGE (OPTIONAL)
- 36” W x 18” D x 27”± H (914 mm W x 457 mm D x 686 mm ± H)
- ONE SHELF
- FLUSH BACK AND FINISHED TOP

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3”± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTRELINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
7. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
8. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.

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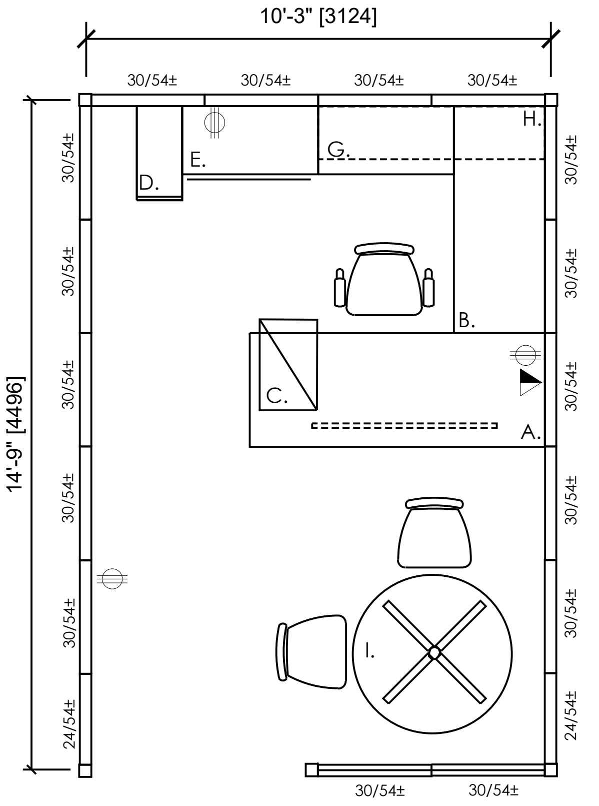
DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE-
DIRECTOR (& EQUIVALENT)

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**
PROJECT ID.	SHEET NO.	
Appendix I	**4**	



5A EXECUTIVE DIRECTOR AND EQUIVALENT OPEN WORKSPACE OPTION

14.0 m^2

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOOD GRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

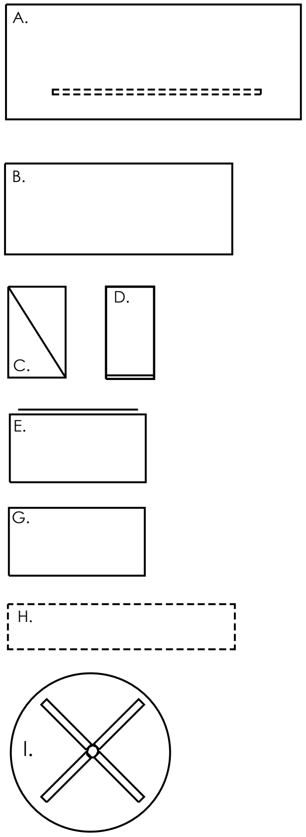
PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

PANEL FABRIC: GRADE 2/B FABRIC

END, TOP, & CORNER TRIMS: FULL-LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

WORKSPACE KIT-OF-PARTS LEGEND:



A. PRIMARY WORKSURFACE
- 30" D x 78" W (762 mm D x 1982 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- HALF HEIGHT MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE
- 24" D x 60" W (610 mm D x 1524 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL w/ CUSHION TOP
- 18"-24" D (450mm x 610 mm D)
- BOX/FILE DRAWERS c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS, PENCIL TRAY

D. STORAGE TOWER
- 12" W x 24" D x 54"± H (305 mm W x 610 mm D x 1372 mm ± H)
- COAT ROD INCLUDED
- ANTI-TIP
- SIMILAR OVERALL HEIGHT AS STACKED PANEL

E. LOW FILE STORAGE (OPTIONAL)
- 36" W x 18" D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

G. LOW OPEN STORAGE (OPTIONAL)
- 36" W x 18" D x 27" ±H (914 mm W x 457 mm D x 686 mm ± H)
- ONE SHELF
- FLUSH BACK AND FINISHED TOP

H. PANEL MOUNTED CLOSED OVERHEAD (OPTIONAL)
- 60" W x 14"± D (1524 mm W x 356 mm ± D)
- C/W TASK LIGHT

I. DESK HEIGHT TABLE
- 42" Dia. (1067 mm Dia.)
- METAL "X" BASE

MOBILE BOX, FILE PEDESTAL w/ CUSHION TOP:

CUSHION TOP: GRADE 2/B FABRIC

BODY: STANDARD PAINTED METAL FINISH

STANDARD PULLS (ADA COMPLIANT)

STORAGE TOWER:

LAMINATE OR STANDARD PAINTED METAL FINISH, STANDARD PULL (ADA COMPLIANT)

LOW STORAGE:

LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (ADA COMPLIANT)

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3"± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTRELINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
7. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
8. THE EXECUTIVE DIRECTOR (AND EQUIVALENT) WORKSPACE IS EITHER AN OPEN WORKSTATION OPTION OR AN ENCLOSED OPTION.
9. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.

Alberta
Infrastructure

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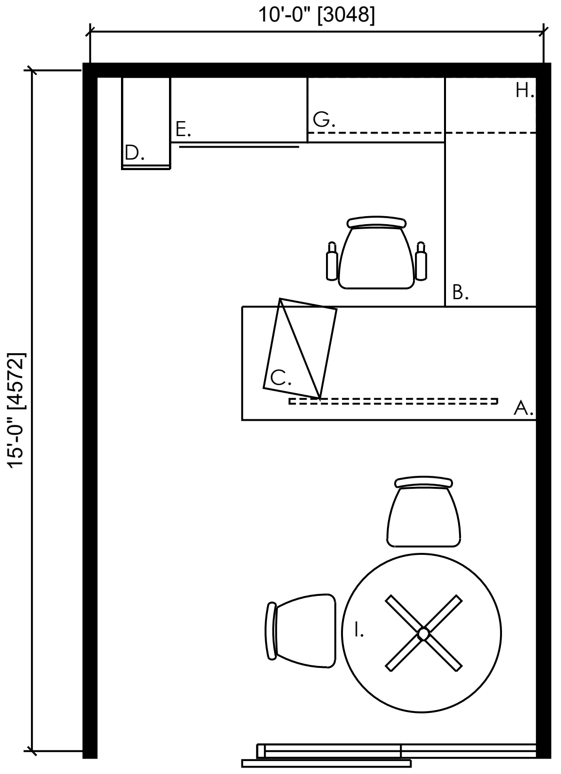
DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE- OPEN OPTION
EXECUTIVE DIRECTOR (& EQUIVALENT)

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**
PROJECT ID.	SHEET NO.	
Appendix I	**5A**	



5B EXECUTIVE DIRECTOR (AND EQUIVALENT) ENCLOSED OFFICE OPTION
14.0 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS AND TABLE: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOOD GRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

MOBILE BOX, FILE PEDESTAL w/ CUSHION TOP: GRADE 2/B FABRIC

BODY: STANDARD PAINTED METAL FINISH

STANDARD PULLS (ADA COMPLIANT)

STORAGE TOWER:

LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULLS (ADA COMPLIANT)

LOW STORAGE:

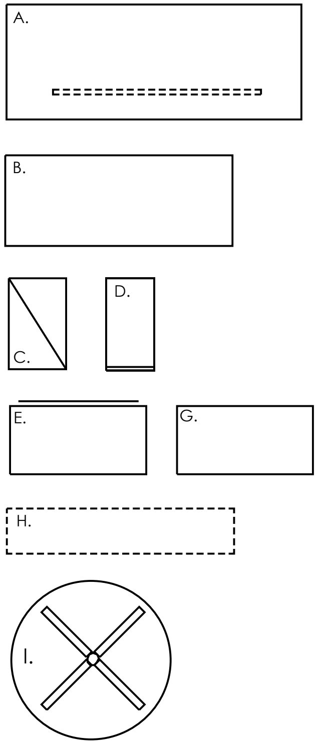
LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL - METAL FINISH (ADA COMPLIANT)

CLOSED OVERHEAD:

LAMINATE OR STANDARD PAINTED METAL FINISH

WORKSPACE KIT-OF-PARTS LEGEND:



A. PRIMARY WORKSURFACE
- 30" D x 78" W (762 mm D x 1982 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- HALF HEIGHT MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE
- 24" D x 60" W (610 mm D x 1524 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL w/ CUSHION TOP
- 18"-24" D (450mm x 610 mm D)
- BOX/FILE DRAWERS c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS, PENCIL TRAY

D. STORAGE TOWER
- 12" W x 24" D x 54"± H (305 mm W x 610 mm D x 1372 mm ± H)
- COAT ROD INCLUDED
- ANTI-TIP

E. LOW FILE STORAGE (OPTIONAL)
- 36" W x 18" D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

G. LOW OPEN STORAGE (OPTIONAL)
- 36" W x 18" D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)
- ONE SHELF
- FLUSH BACK AND FINISHED TOP

H. CLOSED OVERHEAD WALL-MOUNTED BIN (OPTIONAL)
- 60" W x 14"± D (1524 mm W x 356 mm ± D)
- C/W TACKBOARD AND TASK LIGHT

I. DESK HEIGHT TABLE
- 42" Dia. (1067 mm Dia.)
- METAL "X" BASE

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
3. WORKSPACE IS MEASURED FROM CENTRELINE OF WALL TO CENTRELINE OF WALL.
4. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
5. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
6. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
7. THE EXECUTIVE DIRECTOR (AND EQUIVALENT) WORKSPACE IS EITHER AN OPEN WORKSTATION OPTION OR AN ENCLOSED OPTION.
8. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
9. THE OVERALL LENGTH AND WIDTH OF THE ENCLOSED OFFICES MAY VARY TO SUIT SITE CONDITIONS, SO LONG AS THE SPACE REMAINS USEABLE, AND THE SIZE (SQ.M) IS MAINTAINED.

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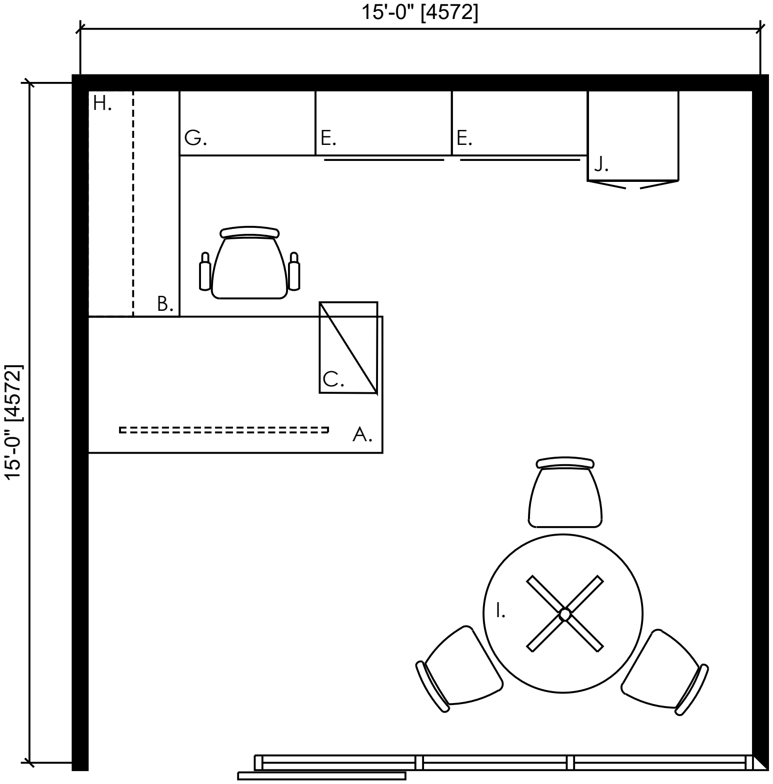
DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE- ENCLOSED OPTION
EXECUTIVE DIRECTOR (& EQUIVALENT)

DRAWN BY	CHECKED BY	SCALE
JH	LJ	NTS
DATE	SITE ID	BUILDING ID
2022-08-02	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix I	5B	



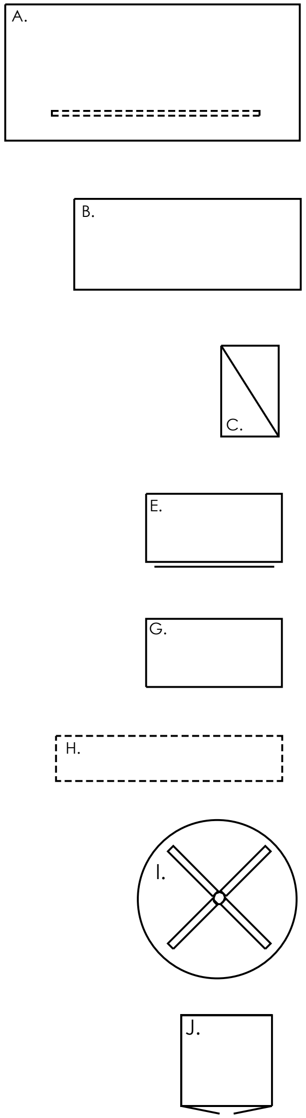
6 ASSISTANT DEPUTY MINISTER (AND EQUIVALENT) OFFICE

20.9 m^2

FINISHES:

- WOOD VENEER TOP AND BODY (STANDARD GRADE)
- SQUARE PROFILE EDGE
- FLUSH BACKS AND FINISHED TOPS
- STANDARD METAL PULLS (ADA COMPLIANT)
- TACKBOARD FABRIC: MID-GRADE

WORKSPACE KIT-OF-PARTS LEGEND:



A. PRIMARY WORKSURFACE
- 36” D x 78” W (914 mm D x 1982 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- HALF HEIGHT MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE
- 24” D x 60” W (610 mm D x 1524 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL (FINISHED TOP, NO CUSHION)
- 18"-24” D (450mm x 610 mm D)
- BOX/FILE DRAWERS c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS, PENCIL TRAY

E. LOW FILE STORAGE (OPTIONAL)
- 36” W x 18” D x 27” ± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

G. LOW OPEN STORAGE (OPTIONAL)
- 36” W x 18” D x 27”± H (914 mm W x 457 mm D x 686 mm ± H)
- ONE SHELF
- FLUSH BACK AND FINISHED TOP

H. CLOSED OVERHEAD WALL-MOUNTED BIN (OPTIONAL)
- 60” W x 14”± D(1524 mm W x 356 mm ± D)
- C/W TACKBOARD AND TASK LIGHT

I. DESK HEIGHT TABLE
- 42” Dia. (1067 mm Dia.)
- METAL “X” BASE

J. CLOSED COMBINATION WARDROBE AND STORAGE CABINET
- 24" D x 24" W (610 mm D x 610 mm W)
- ANTI-TIP

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. WORKSPACE IS MEASURED FROM CENTRELINE OF WALL TO CENTRELINE OF WALL.
3. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
4. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
5. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
6. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
7. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
8. THE OVERALL LENGTH AND WIDTH OF THE ENCLOSED OFFICES MAY VARY TO SUIT SITE CONDITIONS, SO LONG AS THE SPACE REMAINS USEABLE, AND THE SIZE (SQ.M) IS MAINTAINED.

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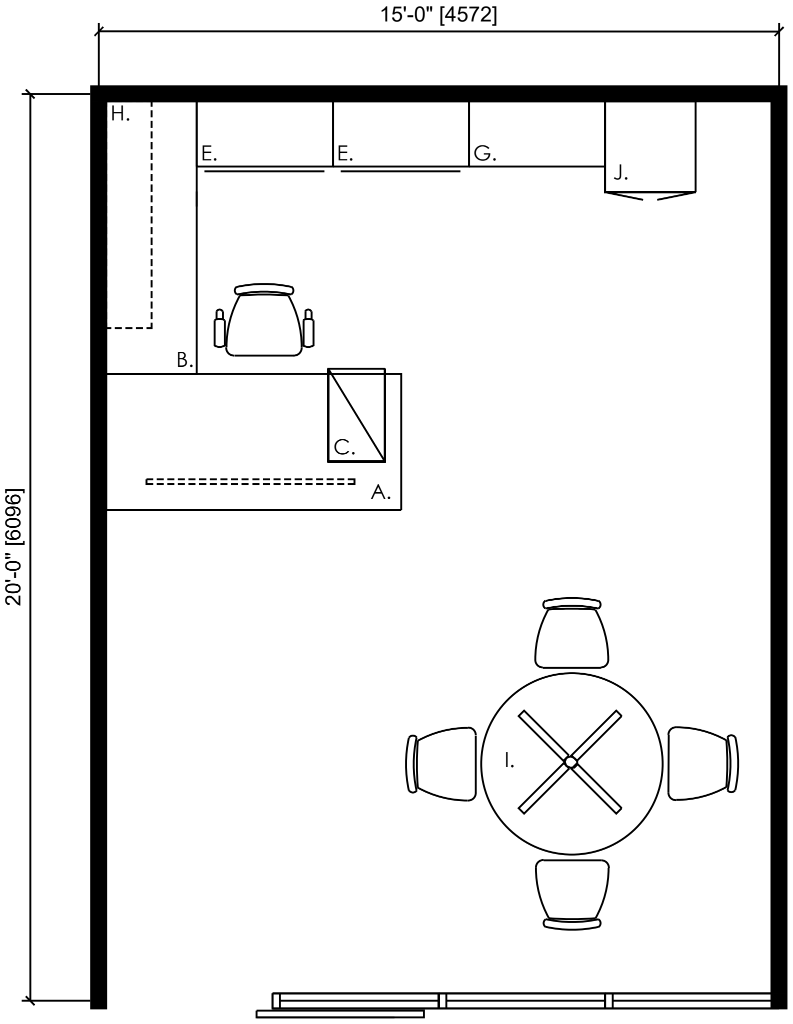
CONSULTANT

DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE-
ASSISTANT DEPUTY MINISTER (& EQUIVALENT)

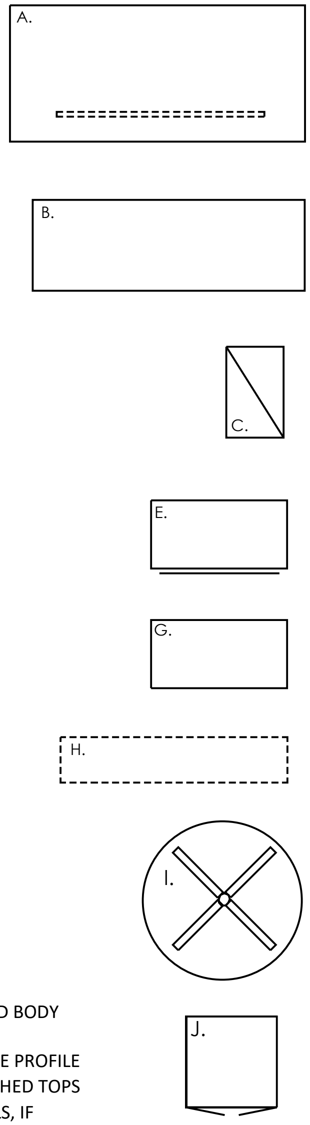
DRAWN BY **JH**	CHECKED BY **LJ**	SCALE **NTS**
DATE **2022-08-02**	SITE ID **-**	BUILDING ID **-**
PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
PROJECT ID. **Appendix I**	SHEET NO. **6**	



7 DEPUTY MINISTER (AND EQUIVALENT) OFFICE
27.9 m²

FINISHES:
- WOOD VENEER TOP AND BODY (STANDARD GRADE)
- REVERSE CHAMFER EDGE PROFILE
- FLUSH BACKS AND FINISHED TOPS
- UPGRADED METAL PULLS, IF AVAILABLE (ADA COMPLIANT)
- TACKBOARD FABRIC: MID-GRADE

WORKSPACE KIT-OF-PARTS LEGEND:



A. PRIMARY WORKSURFACE
- 36” D x 78” W (914 mm D x 1982 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- HALF HEIGHT MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE
- 24” D x 72” W (610 mm D x 1828 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL (FINISHED TOP, NO CUSHION)
- 18"-24” D (450mm x 610 mm D)
- BOX/FILE DRAWERS c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS, PENCIL TRAY

E. LOW FILE STORAGE (OPTIONAL)
- 36” W x 18” D x 27”± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

G. LOW OPEN STORAGE (OPTIONAL)
- 36” W x 18” D x 27”± H (914 mm W x 457 mm D x 686 mm ± H)
- ONE SHELF
- FLUSH BACK AND FINISHED TOP

H. CLOSED WALL-MOUNTED OVERHEAD BIN (OPTIONAL)
- 60” W x 14”± D(1524 mm W x 356 mm ± D)
- C/W TACKBOARD AND TASK LIGHT

I. DESK HEIGHT TABLE
- 48” Dia. (1219 mm Dia.)
- METAL TULIP BASE

J. CLOSED COMBINATION WARDROBE AND STORAGE CABINET
- 24” D x 24” W (610 mm D x 610 mm W)
- ANTI-TIP

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. WORKSPACE IS MEASURED FROM CENTRELINE OF WALL TO CENTRELINE OF WALL.
3. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
4. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
5. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
6. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
7. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
9. THE OVERALL LENGTH AND WIDTH OF THE ENCLOSED OFFICES MAY VARY TO SUIT SITE CONDITIONS, SO LONG AS THE SPACE REMAINS USEABLE, AND THE SIZE (SQ.M) IS MAINTAINED.

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DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_2022-TDR.V7

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 7

TITLE
TYPICAL WORKSPACE-
DEPUTY MINISTER (& EQUIVALENT)

DRAWN BY	CHECKED BY	SCALE
JH	**LJ**	**NTS**
DATE	SITE ID	BUILDING ID
2022-08-02	**-**	**-**
PLAN NO.	PHASE	DISCIPLINE
-	**-**	**-**
PROJECT ID.	SHEET NO.	
Appendix I	**7**	