Government
of Alberta ■
Infrastructure

Technical Design Requirements for Health Care Facilities

"The Blue Book"
Third Edition

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The purpose of this document is to provide architects, engineers, health care providers, facility administrators and operators involved in designing health care facilities with a comprehensive set of guidelines.

The guidelines are intended as a reference rather than detailed instruction and should be useful for planning new facilities, and renovating and operating existing facilities.

The guidelines evolved with input from consultants, health care facility operators, and staff at Alberta Infrastructure, and Health and Wellness 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. Consideration of new equipment, technology, components and systems is encouraged, but with value analysis and consideration of life cycle and operational cost implications.

The guidelines will be updated to address the ongoing changes in health care delivery, health care facilities design and technology. The latest version can be viewed or downloaded in electronic format, through the Technical Resource Centre on the Alberta Infrastructure website.

Your input to the progressive updating of this document is invited. Please direct comments to the:

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General

The most significant change in this edition is the inclusion of a section on Sustainability to reflect the department's adoption of LEED Silver as a standard for government funded buildings. The construction sector contributes significantly to the global depletion of natural resources, clean air and water and the generation of significant amounts of waste and emissions. The majority of the energy consumed by buildings occurs over the duration of their service lives, energy required for operations. Operating buildings accounts for a large proportion of Canada's secondary energy use. The amount of energy required to operate a building is directly affected by decisions made during design.

Building Envelope

1. A number of changes were made to requirements of roofs.
2. Designers are alerted to changes highlighting design considerations for improving energy efficiency.
3. Revised recommended minimum thermal insulation values.
4. Interaction with other disciplines:
   - Mechanical and Architectural/Building Envelope disciplines shall coordinate to ensure the whole building envelope, including glazing systems are designed to accommodate interior environmental conditions and optimize operating energy efficiency.

Structural

1. Relocated vibration requirements from Acoustics.

Mechanical

1. Added new reference guide CSA-Z7396.1 Pipelines for medical gases and vacuum.
2. Updated design parameters in Tables 3.2.1 through 3.2.6.
   - Revised noise levels in a number of rooms
   - Converted air filter efficiency from percentage to Minimum Efficiency Reporting Value (MERV)
3. Included a minimum number for medical air compressors and vacuum pumps.
4. Updated Table 3.10-4 Medical Gas Outlets in Acute Care Facilities.
5. Added emergency power requirement to essential equipment controls and UPS for central control stations.

Electrical

1. Added References of guidelines and standards to various technical body and APEGGA guideline for documents.
2. Added grounding to single line drawing requirements.
3. Added transient voltage surge suppressors to Electrical Services requirements.
4. Added requirement for Arc Flash Study.
5. Changed requirement for digital metering to include all services.
6. Added requirement for digital metering communication protocol.
7. Added requirement for Service & Distribution panel busses to be copper.
8. Added requirements for additional clearances around major electrical equipment.
9. Relocated and renumbered section on motor control and added requirements regarding Variable Frequency Drives.
10. Added reference to IEEE Orange Book for Emergency Power requirements.
11. Added requirement prohibiting use of skin-tight enclosures for emergency generators. Included provision to use walk-in enclosures.
12. Added requirements to Lighting Control regarding low voltage switches.
13. Minor working change to requirements related to wiring in wood frame construction.
14. Deleted clause regarding PVC raceway for IPS wiring.
15. Changed requirement regarding use of THHN wire insulation.
16. Added insulation voltage rating requirement for conductors.
17. Added requirements for car block heater controls.
18. Added requirement covering type and use of walk-in enclosures for Emergency Generators.

Acoustics

1. Minor editorial changes throughout.
2. Provide additional design guidance on vibration limits for operating rooms and laboratories with vibration sensitive equipment.
3. Revise mechanical ambient noise requirements for several types of rooms.
4. Delete requirement for silencing emergency generators used for continuous operation.
5. Expand requirements for diffuser inlet conditions to control noise.

Site Services

1. Added new Section 6.3 "Site Survey Plan and Site Plan" and renumbered subsequent sections.
2. Updated titles of Standards and Guidelines referenced in Sections 6.1, 6.2 and 6.9 (previously 6.8) to be currently accurate.
3. Added requirement to complete a 'Transportation and Site Requirement' checklist in Section 6.2 "Site Selection" and revised some wording.
4. Expanded on criteria in section 6.7 "Roads, Walks and Paving", points .2 through .4, and renumbered subsequent lines. Added a requirement (point .13) that addresses "potential safety concern."
5. Amended the wording in Section 7.1 to reflect the change in ministry name to "Agriculture and Food".

End of Summary

Section Contents

1.1 References

.1 *ASHRAE Handbook of Fundamentals*, American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., Atlanta, 1993.

.2 Brand, Ronald "Part 2" in *Architectural Details For Insulated Buildings*, Van Nostrand Reinhold, 1990.

.3 *CSC TEK-AID AIR BARRIERS - DIGEST*, Construction Specifications Canada, Toronto, March 1990. This publication includes a comprehensive listing of other publications, including the above, presents basic design principles and addresses building envelope problems that have concerned designers and building forensic experts.

.4 CSA S478-95, *Guideline on Durability of Buildings*, CSA, Etobicoke, ON, 1995.

.5 Hutcheon, N, Handegord, G, *Building Science for a Cold Climate*, John Wiley & Sons, 1984, ISBN-0471797634.

.6 Model National Energy Code for Buildings. National Research Council Canada, Ottawa, ON, 1997.

1.2 General

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

.2 The design approach recommended 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 pressure equalized with the exterior and drained to the exterior.

  .2 Insulation:

    .1 mainly located to the exterior of structural components
    .2 in direct contact with an air barrier system
    .3 exterior of an air barrier system.

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

Alberta Infrastructure 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
  .3 moisture
  .4 differential pressures exerted across air barrier

.3 thermally induced movement of structural elements and any connected air barrier.

.3 Detail the building envelope to ensure that water, snow and ice sheds safely from exterior surfaces and is not trapped in the assembly to cause deterioration or staining.

.4 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.

.5 Obtain prior Alberta Infrastructure approval before using exterior cladding materials requiring frequent maintenance.

.6 Avoid combining design approaches, e.g. the Airtight Drywall Approach (ADA), or Structural Insulated Panel Systems (SIPS), in combination with the PERSIST approach.

1.3 High Interior Humidity

.1 Indoor relative humidity of 30% or greater can result in excessive condensation on or within the building envelope during 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 buffer spaces.

.3 Where high humidity space cannot be “buffered” from the building envelope, design to prevent condensation within the building envelope.

1.4 Air Barrier

.1 Air leakage through the building envelope results in significant energy losses from the uncontrolled movement of conditioned air.

.2 Design envelope components to meet the characteristics of an air barrier system as required in the Alberta Building Code and as discussed in the *CSC TEC-AID AIR BARRIERS - DIGEST*.

.3 Locate the plane of the air sealing element (usually a membrane) exterior to the major structural elements.

.4 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. Do not consider plastic film or spun-woven fibre film as an air sealing element.

.5 Minimize the number of changes of plane in the air barrier system. Where practicable, avoid changes of plane at air barrier membrane connection to window frames.

.6 Air barrier continuity and constructability must be given particular attention at:

.1 window and door frames
.2 mechanical and electrical penetrations
.3 wall/roof connections
.4 changes in plane
.5 joints between like and dissimilar materials

.7 Provide large scale details to show how air barrier continuity will be achieved and how differential movements and construction sequences will be accommodated.

1.5 Insulation

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

.2 Insulation thickness should be based on life cycle cost analysis in conjunction with mechanical systems design and as required to achieved a minimum level of LEED Silver rating. As a minimum, RSI values of 2.6 (R15) for walls, 3.9 (R22) for roofs and soffits, and 2.1 (R12) for foundation perimeters, should be used.

.3 Additional insulation is recommended to prevent ice damming on steep roofs (refer to “Steep Roof” article). RSI 3.52 (R20) insulation is recommended. Minimize thermal bridging.

.4 Design to avoid heat loss, condensation and to control temperature of interior surfaces due to thermal bridging. For example, use insulated double Z-bars or thermal clips to support cladding and metal roofing, use structural neoprene thermal breaks for projecting steel elements, and along concrete fins projecting from the interior of the insulated structural plane, extend insulation out four times fin thickness. Significant heat loss can result from thermal bridging; when using continuous conductive cladding support systems that cross the plane of insulation, insulation effectiveness may lose up to 50% of nominal values.

1.6 Roofs

1.6.1 General

.1 Alberta Infrastructure Master Specifications are recommended.

.2 Design roofs with the plane of waterproofing membrane/air barrier following a plane exterior to the major structural roofing elements. Avoid ventilated attics.

.3 Prepare roof plans showing elevations for slopes to drain. Show locations of drains, roof mounted equipment and penetrations. Reference standard roofing detail drawings to the roof plan.

.4 Metal Roofing Considerations:

- .1 Generally consider metal roofing and flashings to be water-shedding and not waterproofing.
- .2 Provide a membrane below all metal roofing and flashings.
- .3 Design of a suitable system to prevent damage to building from ice and snow sliding and prevent injury to pedestrians.
- .4 Management of drain water to prevent slipping hazards from ice formation at drain discharges.
- .5 Fasteners and roof penetration details that will accommodate thermal movement are required.
- .6 Use an installation system with adequate thermal breaks to prevent “short circuiting” of the insulation.

.5 Locate the outlet of interior drainage pipes which discharge to the outside, a minimum 1.0 m above grade. Place a thermostatically controlled immersion heater at the exit elbow cleanout, extending to the discharge.

.6 Avoid using scuppers except as overflow devices.

.7 Provide main access to rooftop from inside the building, with all separate levels connected at least by external wall mounted ladders.

.8 Locate mechanical, electrical and roof access hatches at least 2.0 m from parapets as per O.H.S. regulations.

1.6.2 Near-Flat Roofs (minimum slope of 1:50)

.1 Slope all roof surfaces to drains, including valleys and transverse slopes across top of parapets. Provide minimum slope to drain of 1:50 for field of roof.

.2 Preferably use internal roof drainage systems with open flow drains and minimum 100 mm pipes. Avoid the use of control flow drains.

.3 Generally use a minimum of two roof drains per contained drainage area. Overflow scuppers should be used where this is not practicable and where structural hazard would result from blockage in drain leaders. Emergency overflow scuppers should be provided at a height of 50mm above the roof membrane for roof areas contained with parapets greater than 150mm in height.

.4 Form slopes in the structure. Avoid the widespread use of insulating fill or tapered insulation to obtain slopes.

.5 Parapet details are generally recommended for roofs at the perimeter, parapets should be a minimum of 100mm above adjacent roof membrane. Maintain if practicable, a constant elevation around the parapet of a contained roof area. If a varying parapet height can not be avoided, provide dimensioned details of low and high edge conditions.

.6 Provide curbs 250mm above the roof membrane level for all penetrations. Locate penetration and equipment curbs so that they do not impede drainage and have minimum 1.0 m clearance around to allow for roofing application.

.7 Support large roof top units on structural pedestals or raised framework with at least 765 mm clearance between the roofing system and the underside of the framework. This will provide access for roofing maintenance and not necessitate the removal of the roof top unit for subsequent reproofing.

.8 Where a roof joins a wall extending above the roof, locate wall cladding, windows, doors, louvers and other wall penetrations a minimum of 300mm above the top surface of the roof. Roofing connections to walls are recommended to be designed as protected membrane transitions in both conventional and protected membrane designs.

.9 Generally use gravel ballast with filter fabric for protected membrane systems with removable precast paver units around roof perimeters, around curbs (greater than 3 meters any side) and for access paths and plaza decks. Avoid cast-in-place concrete top surfaces as this type of system is not eligible for roofing warranties and commonly create re-roofing and roof maintenance problems.

.10 Avoid the use of pitch pans/gum boxes for electrical and mechanical roof penetrations. Curb all roof penetrations a minimum of 250mm above the roof membrane and specify a galvanized iron sheet metal enclosure over the curb, with the piping and or conduit running horizontally out the side of the metal enclosure 50 to 100 mm above the roof curb.

1.6.3 Intermediate Roofs (slopes greater than 1:50 and less than 1:3)

.1 Use 2 ply MBM membrane system.

1.6.4 Steep Roofs (slopes greater than 1:3)

.1 Design steep roofs with a plane of waterproofing membrane/air barrier following the plane of ventilated cladding.

.2 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. Ventilation of upper sheathing cavity is encouraged, but use of whirlybirds is not.

.3 Size eavestroughs to accommodate water from contributory roof and wall areas and to resist expected snow and ice loads. Locate eavestroughs so they are accessible for maintenance and will not cause leakage into the building.

.4 Observe the following minimum slopes for standard applications of shingles and shakes:

- .1 1:3 for triple tab strip shingles
- .2 1:2 for cedar shingles and shakes

.5 Provide 1.8 meters of peel and stick ice dam eave protection and one meter of peel-and-stick membrane up the valleys for strip shingle application.

.6 Provide shingled #15 asphalt felt underlayment up roof slope under strip shingle roofing beyond ice dam membrane.

1.7 Walls

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

- .1 exterior cladding
- .2 air space
- .3 thermal insulation
- .4 air barrier system
- .5 structural elements

.2 Size wall cavities to provide minimum 25 mm clearance between maximum thickness of insulation allowed in the specifications and exterior cladding (this would typically be at least 100 mm). Provide additional clearance as required to suit construction tolerances, e.g. for concrete structures and high-rise buildings.

.3 Provide openings in the cladding and design to permit drainage and pressure equalization of the air space.

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

1.8 Windows, Doors and Glass

.1 Specify window performance using Alberta Infrastructure Master Specifications to prevent condensation from forming on the frame or glass at the interior design conditions specified in Section ??? – Mechanical and the 2.5% January design temperature. The specification is based on the use of an exterior glazed small box curtain-wall section. Contact Alberta Infrastructure, Building Sciences Section for isometric details.

.2 Consider whole window performance, glazing, frame and perimeter, as part of the building envelope design. Coordinate with design of heating, cooling, ventilation and daylighting.

.3 Design window assemblies as pressure equalized, rainscreen systems with the main mass of the frame located to the interior of the thermal break and interior of the plane of the air barrier.

.4 Anchors for the framing are to be located within the vertical tube sections or on the sides of the tubes as strap anchors. The anchors are to be designed to allow for thermal expansion and contraction of the frame. The design of the anchors should not interfere with the adhesion of the air seal membrane from the wall directly to the tube face of the section.

.5 Mechanically retain the air seal membrane to the tube face of the section with the use of an aluminum anti-rotation channel.

.6 Gaskets and weather seals should be mechanically keyed in dry glazing systems for both interior and exterior applications (Visionstrip is not considered a mechanically keyed gasket).

.7 For all penetrations of the wall system (windows, doors and louvers), bridge the cavity of the wall by means of flashing (not by use of the frame or cover cap). Do not caulk cover caps to flashing.

.8 Design windows and interior surrounds to allow uniform, unobstructed movement of heated room air across the glass and frame.

.9 Provide vestibules at building entrances intended for public access, where interior humidity may otherwise result in frost buildup on doors and frames, and to minimize cold drafts. All other doors require adequate mechanical treatment to minimize ice buildup.

.10 Co-ordinate the selection of glazing with the lighting and mechanical systems to avoid glare and solar overheating.

.11 In the absence other requirements, specify sealed double glazing units with low emissivity coating on surface #2.

1.9 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 condensation, overheating and solar glare.

.2 Skylights and sloped glazing systems frequently become building envelope problems, triggering significant operation and maintenance costs to building owners. If either is going to be incorporated into a design, it is recommended that Alberta Infrastructure be consulted early in the design and detailing stages.

.3 Acrylic skylight systems are not to be used.

.4 If, after considering the risks and alternatives, designers still opt for skylights or sloped glazing and clients accept the risks associated with them, the following design notes are offered to help minimize adverse consequences:

- .1 Slope glazing minimum 30 degrees from horizontal.
- .2 Design air seal connections to skylight and sloped glazing curbs and adjacent walls to be fully accessible and not dependent on construction sequence.
- .3 Design skylights and sloped glazing so that they are accessible for maintenance and cleaning from building interior and exterior.
- .4 Make provision to drain water entering the glazing system back to the exterior, during all seasons. Water entering the glazing system should be contained within the glazing rabbet and drained in an overlapped shingle fashion back out to the exterior. Water should not contact caulked joints or seals.
- .5 Provide an interior condensation gutter system. In high humidity buildings, it may be necessary to drain the collected condensation at the sill to the mechanical system rather than relying on evaporation. This requirement should be addressed at the initial design stage.
- .6 Use mechanically keyed-in dry glazing seals for interior and exterior of the system. Do not depend on sealants.
- .7 Glazing should be at minimum heat strengthened exterior lite, 12mm airspace, 0.060 PVB laminated interior lite.

1.10 Unoccupied Spaces

.1 Avoid sealed cavities and “dead space” in and adjacent to the building envelope. Where possible exterior features (overhangs and entrance canopies) should be designed as cold spaces and vented to the exterior. Provide access to exterior concealed spaces from the exterior.

.2 If heated concealed spaces cannot be avoided, mechanical heating of the space should be done and access to the space from the interior should be provided.

End of Building Envelope Section

Section Contents

2.1 Design Loads

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

.2 General office areas: Minimum floor occupancy live load 3.6 kPa or 9 kN concentrated, whichever produces the more critical effect.

.3 Records storage areas: Design live load to be based on type and layout of proposed storage system, but not less than 7.2 kPa.

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

.5 Mechanical loads: Obtain loads from mechanical consultant. In mechanical rooms, allow for a minimum of 100 mm thick concrete housekeeping pads or 100 mm thick concrete floating slab. Refer to requirements in Acoustics Section, “Structural”, and coordinate with mechanical consultant. Ensure that the structure contains adequate access routes for heavy equipment. Ensure that the structure has adequate capacity for suspended piping loads.

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

.7 Minimum roof design live load: 1.5 kPa or 1.5 kN concentrated, whichever produces the more critical effect. 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 ponded rain load associated with a plugged roof drain.

.8 For buildings that are to be close to property lines on urban sites, assume the neighbouring property will be built higher than the hospital. The assumed height of the neighbouring property shall be based on the local zoning by-law. This typically will produce a triangular snow load with an accumulation factor, C_a, of 3.75 at the property line.

.9 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.

2.2 Foundations

.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 associated 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.

2.3 Structure

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

.2 Design cantilever or continuous steel beams according to *Roof Framing With Cantilever (Gerber) Girders and Open Web Steel Joists*, published by the Canadian Institute of Steel Construction, July 1989. Gerber Systems shall not be used in floor construction.

.3 Design exterior slabs at doorways to avoid interference with outward door swings as a result of upward movement of slab caused by frost. Provide structural stoop where necessary.

.4 Structural Systems for Car Parking: Design according to CSA S413M, *Parking Structures*. Provide protection against corrosion of reinforcing steel, including a positive slope and drainage system with adequate allowances for construction tolerances and deflections.

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

.6 Design expansion joints, including those between existing and new structures, so that an abrupt change in floor elevation is prevented. Patients, stretchers, and trolleys must be able to pass over these joints with ease.

.7 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 all non-structural components.

.8 Provide drain holes to allow the release of water in all HSS sections subject to freezing.

.9 Design structural floors to prevent transient footstep induced vibration from exceeding the annoyance threshold. Refer to CISC Handbook for Steel Construction – Appendix G, Guide for Floor Vibration, and Commentary A – Serviceability Criteria for Deflections and Vibrations in the National Building Code of Canada.

2.4 Interaction with Other Disciplines

.1 Structurally, design and detail the fastening, support, and back-up systems for exterior walls, brick veneers, cladding, and attachments. Steel connections outside the air barrier shall be galvanized and all welded connections shall be shop welded.

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

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

.4 Provide details that allow for all building movements, including deflections.

.5 For roof slopes, refer to Building Envelope Section, “Roofs”. Structural design must consider the resulting non-uniform loads caused by accumulation of rain water. The removal of rain water at drains can be restricted by hail associated with a major rainfall. Roof structures shall be designed for the effect of a plugged roof drain, and should be designed such that the effect of rain is less stringent than the effect of snow.

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

.7 Structurally design and detail all required guardrails.

.8 Advise the architect of expected movements of the structure, including those caused by deflection, shrinkage, settlement, and volume changes in the soil. Adequate allowances must be provided in all affected elements, including partitions and mechanical systems.

.9 If the expected movements of a grade-supported floor slab cannot justifiably be accommodated or tolerated, use a structural slab. 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. If a slab is constructed over a void form, ensure that the buried plumbing is adequately suspended from the floor slab, and that it is isolated from the soil such that soil movement will not damage the piping or induce loads into the slab.

.10 Specify concrete floor flatness that is consistent with the flooring material to be applied and the architect's aesthetic requirements. Due to the higher cost involved, specify unconventionally stringent flatness only for areas where there is a justifiable benefit.

.11 Ensure adequate stiffness of lightweight roof or other structures that support mechanical equipment with spring isolators. Resonance problems can usually be avoided if the 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.

2.5 Design Parameters to Be Shown on Drawings

(For review, construction, and future reference)

.1 Geotechnical design parameters

.2 Structural design parameters, including:

- design loads
- provisions for future additions
- material properties

.3 Criteria for design to be done by contractors

.4 Existing grade, finished grade, main floor and foundation elevations

.5 Any special construction procedures assumed in design

2.6 Vibration Requirements

.1 Specify a minimum of 130 mm thick concrete for mechanical room floors to minimize structural vibration problems.

.2 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, cafeterias, etc. Typically a peak acceleration of 0.5 %g (4-8 Hz) for office occupancy is acceptable. Refer to reference 5.1.1.2 for further details.

.3 Design normal Operating Rooms and sensitive Patient Rooms to limit floor vibration to the tactile perception threshold; typically 0.05 %g, (4-8 Hz). Less sensitive Patient Rooms may have slightly higher levels of floor vibration; 0.1%g, (4-8 Hz).

.4 Operating rooms and other spaces with sensitive equipment (e.g. microsurgery, neurosurgery, MRI) require much lower levels of floor vibration. Where possible, design floors to the specific criteria provided by equipment manufacturers, assuming the most stringent requirements. Refer to reference 5.1.1.2, Chapter 6, Design for Sensitive Equipment.

.5 Consider supporting vibration sensitive equipment from columns or from a structure spanning between columns to avoid making contact with the floor above. Where vibration sensitive equipment must be supported directly from the floor structure above, the vibration criteria also apply to the floor above the operating room.

.6 Ensure that 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, then additional roof stiffening is recommended.

.7 Allow for a minimum of 100 mm thick concrete housekeeping pad for all mechanical equipment. Refer to mechanical consultant for further requirements.

End of Structural Section

Section Contents

3.1 References

.1 Comply with all applicable codes and standards.

.1 Canadian Standards Association

.1	CSA-B52	Mechanical Refrigeration Code
.2	CAN/CSA-B64.10	Manual for the Maintenance and Field Testing of Backflow Prevention Devices
.3	CAN/CSA-B139	Installation Code for Oil Burning Equipment
.4	CSA-B149.1	Natural Gas and Propane Code
.5	CAN/CSA Z305.1	Nonflammable Medical Gas Piping Systems
.6	CAN/CSA Z305.6	Medical Oxygen Concentrator Central Supply System: For Use with Nonflammable Medical Gas Piping Systems
.7	CSA-Z316.5	Fume Hoods and Associated Exhaust Systems
.8	CAN/CSA-Z317.1	Special Requirements for Plumbing Installation in Health Care Facilities
.9	CAN/CSA-Z317.2	Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities
.10	CAN/CSA-Z317.10	Handling of Waste Materials Within Health Care Facilities
.11	CSA-Z317.13	Infection Control During Construction or Renovation of Health Care Facilities
.12	CSA-Z318.0	Commissioning of Health Care Facilities
.13	CAN/CSA-Z7396-2	Anaesthetic Gas Scavenging Disposal Systems

.2 Alberta Building Code

.3 Alberta Fire Code

.4 National Fire Protection Association Standards

.1	NFPA 10	Portable Fire Extinguishers
.2	NFPA 13	Installation of Sprinkler Systems
.3	NFPA 14	Installation of Standpipe and Hose Systems
.4	NFPA 90A	Installation of Air-Conditioning and Ventilation Systems
.5	NFPA 96	Ventilation Control and Fire Protection of Commercial Cooking Equipment
.6	NFPA 99	Health Care Facilities

.5 National Plumbing Code of Canada

.6 American National Standards Institute

.1	ANSI Z358.1	Emergency Eye Wash and Shower Equipment

.2 Refer to the following references for guidance:

.1 ASHRAE Handbooks

.2 ASHRAE Standards

.1	ASHRAE 12	Minimizing the Risk of Legionellosis Associated with Building Water Systems
.2	ANSI/ASHRAE 52.1	Gravimetric and Dust-spot Methods for Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter
.3	ASHRAE 52.2	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
.4	ANSI/ASHRAE 55	Thermal Environmental Conditions for Human Occupancy
.5	ANSI/ASHRAE 62	Ventilation for Acceptable Indoor Air Quality.
.6	ASHRAE/IESNA 90.1	Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

.3 ASHRAE HVAC Design Manual for Hospitals and Clinics

.4 ACGIH Industrial Ventilation: A Manual of Recommended Practice

.5 SMACNA Standards

.6 Health Canada Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Facilities and Other Institutional Buildings

.7 Model National Energy Code of Canada for Buildings

.8 Alberta Infrastructure EMCS Standard for Logical Point Mnemonics

.9 CSA-Z7396.1 Pipelines for Medical Gases and Vacuum

3.2 Design Conditions

3.2.1 General

.1 Design mechanical systems based on the criteria in Tables 3.2-1 to 3.2-6.

.2 The design parameters specified are minimum requirements and do not preclude the use of higher or more appropriate values..

3 Base design of heating and cooling systems on outdoor ambient temperatures given in the Alberta Building Code.

- Cooling - July, 2.5% value
- Heating - January, 1% value.

4 The design of air supply and exhaust systems shall provide for the control of air movement between spaces and functions to minimize the spread of airborne infection and odour.

.5 Ensure sufficient space and access are provided around mechanical equipment for balancing and commissioning, safety, ease of maintenance and future component replacement.

.6 Use life cycle costing when evaluating system alternatives.

3.2.2 Mechanical System Design Parameters Tables 3.2-1 to 3.2-6

.1 Temperature Range

Where a temperature range is shown (i.e. 22°C - 24°C), select the upper value as the summer design temperature and the lower value as the winter design temperature.

Where a temperature range is shown with an asterisk (*) (i.e. 20° - 24°C*), the mechanical system must be capable of maintaining at any set point within the range.

.2 Relative Humidity Range

Where a humidity range is shown, the humidification system must be capable of maintaining the minimum level in winter and the maximum level in summer.

With the exception of critical care areas, humidity levels may be lowered during extreme weather to prevent condensation on exterior wall and window surfaces.

Where no humidity is shown, space relative humidity is not critical.

.3 Zoning

H denotes individual room heating control

C denotes individual room cooling control
G denotes that the room may be grouped with adjacent rooms having similar heating and cooling requirements

H - G denotes heating only may be grouped

C - G denotes cooling only may be grouped

.4 Outdoor Air

Where outdoor air rates in Tables 3.2-1 to 3.2-6 differ from CAN/CSA Z317.2 or ASHRAE Standards, use the higher value.

.5 Relative Pressurization

E denotes equal or neutral relative pressure to surrounding spaces

\+ denotes positive relative pressure to surrounding spaces

– denotes negative relative pressure to surrounding spaces

± denotes pressure relationship must be reversible. Provide indication of mode of operation

.6 Filter Efficiency

Number indicates Minimum Efficiency Reporting Value (MERV) based on ASHRAE 52.2 except for the designation "HEPA" which means a filter with a 99.97% DOP test efficiency.

.7 Noise Level

Number indicates acceptable range of background noise level in terms of room criteria (RC) assuming a neutral (N) spectrum. Refer also to Section 5.0 - Acoustics.

Table 3.2-1
Patient Care Areas
Acute Care Facilities
Design Parameters

Space	Temperature Range (1) °C	Relative Humidity Range (%)	Zoning	Minimum Total Air Changes Per Hour	Minimum Outdoor Air Changes Per Hour	Relative Pressurization	All Air Exhausted Directly to Outdoors	Filter Efficiency MERV	Noise Level RC(N)	Remarks
Bed Pan Cleaning	22-25	-	G	12	Opt.	-	Yes	13	40-45	
Bone Marrow Transplant Recovery	22-24*	30-50	H,C	15	3	+	Yes	17	30 max	
Burn Unit	24-30	50–70* (7)	H,C	15	5	+	Opt.	14	30 max	
Central Bath	24-27	30-50	H,C	12	Opt.	-	Yes	13	40-45	
Clean Utility	22-25	-	G	6	2	+	Opt.	14	35-40	
Coronary Care Unit	20-24*	30-60	H,C	9	3	+	Opt.	14	35-40	
Corridors	22-24	30-50	G	4	1.3	E	Opt.	13	35-40	
ICU,CCU	22-24*	30-60	H,C	9	3	+	Opt.	14	35-40	
Isolation, Ante Room (5)	22-24	30-50	G	9	3	See Remarks	Opt.	-	35-40	Pressure reversed to isolation room
Isolation, Infectious (2)	22-24*	30-50	H,C	12	3	- (4)	Yes	14	30 max	HEPA filters on exhaust air (3)
Isolation, Protective (2)	22-24*	30-50	H,C	12	3	+ (4)	Yes	17	30 max	
Medication	22-24	30-50	G	6	2	+	Opt.	13	35-40	
Neonatal Intensive Care	24-27*	30-60	H,C	9	3	+	Opt.	14	25 max	
Nourishment	22-25	30-50	G	6	2	-	Opt.	13	35-40	
Nurses Station	22-34	30-50	H,C	6	2	E	Opt.	13	30-35	
Nurseries	24-27*	30-60	H,C	6	2	+	Opt.	14	30-35	
Oncology Recovery	22-24*	30-50	H,C	15	3	+	Yes	17 (6)	25-30	
Patient Lounges	22-24	30-50	H,C	6	2	E	Opt.	13	35-40	
Patient Rooms	22-24	30-50	H-G,C	6	2	E	Opt.	14	30 max	
Patient Washrooms	22-25	30-50	G	12	Opt.	-	Yes	13	35-40	
Pediatrics	22-27*	30-50	H,C	6	2	E	Opt.	14	35-40	
Soiled Utility	22-25	-	G	10	Opt.	-	Yes	13	40-45	

Notes:

(1)
- Where temperature range is shown (eg. 22 - 24) select the upper value as the summer design and the lower value as the winter design temperature.
- Where a temperature range is shown with an asterisk (eg. 20 - 24*) the mechanical system must be capable of maintaining any set point within the range.

(2) Isolation rooms with reversible airflow provisions for the purpose of switching between protective environment and airborne infection isolation function shall not be considered acceptable.

(3) Consult with the user group for the need of HEPA filters on exhaust air.

(4) Maintain a minimum of 50 litres per second air flow differential to achieve effective pressurization control.

(5) Anterooms are recommended for all isolation rooms.

(6) Consult with the user group for the need of HEPA filters on supply air.

(7) Where humidity range is shown with an asterisk (eg. 50-70*) the humidification system must be capable of maintaining any set point within the range.

Table 3.2-2
Diagnostic Treatment Areas
Acute Care Facilities
Design Parameters

Space	Temperature Range (1) °C	Relative Humidity Range (%)	Zoning	Minimum Total Air Changes Per Hour	Minimum Outdoor Air Changes Per Hour	Relative Pressurization	All Air Exhausted Directly to Outdoors	Filter Efficiency MERV	Noise Level RC(N)	Remarks
Anaesthetic Storage	20-24	30-50	G	8	Opt.	-	Yes	14	40-45	
Anaesthetic Workroom	20-24	30-50	H,C	8	2	-	Yes	14	35-40	
Bronchoscopy	22-24*	30-50	H,C	20	6	-	Yes	14	35-40	(3)
Cardiac Catheterization	20-24*	30-50	H,C	20	6	+	Opt.	14	35-40	
Change Area	24-27	30-50	G	6	2	-	Opt.	13	35-40	
Corridor	22-24	30-50	G	4	1.3	E	Opt.	13	35-40	
Dark Room	22-24	30-50	H,C	10	2	-	Yes	13	35-40	
Delivery (Operating Room)	20-24*	50-60	H,C	15 20	15 6	+	Yes Opt.	17	25-35	Scavenge anaesthetic gases.
Diagnostic Imaging (X-ray, CT, MRI)	22-27*	30-50	H,C	9	3	E	Opt.	14	35-40	(2)
Endoscopy	22-24*	30-50	H,C	20	6	-	Yes	14	35-40	
Examination	22-24*	30-50	H,C	6	2	E	Opt.	14	35-40	
Fluoroscopy	22-27*	30-50	H,C	9	3	E	Opt.	14	35-40	(2)
Hydro-Therapy	24-27*	30-50	H,C	9	3	-	Opt.	13	40-45	
Labour/ Delivery/ Recovery/ Postpartum	22-24*	30-50	H,C	9	3	E	Opt.	14	35-40	
Occupational Therapy	22-26*	30-50	H,C	9	3	E	Opt.	13	35-40	
Operating and Cystoscopic Rooms	20-24*	50-60	H,C	20	6	+	Opt.	17	25-35	Scavenge anaesthetic gases.
Physical Therapy	22-24*	30-50	H,C	9	3	E	Opt.	13	35-40	
Radiology Waiting Rooms	22-24	30-50	G	12	2	-	Opt.	13	35-40	
Recovery	22-24*	50-60	H,C	20	6	+	Opt.	14	25-35	
Respiratory Therapy	22-24*	30-50	H,C	9	3	-	Yes	13	35-40	
Scrub Room	21-24*	30-50	H,C	6	2	-	Opt.	14	35-40	
Sterile Corridor	22-24	30-50	G	9	3	+	Opt.	14	35-40	
Therapeutic Pool	26-28*	50-60	H,C	9	3	-	Opt.	13	40-45	Outdoor air to limit RH
Treatment	22-24*	30-50	H,C	6	2	E	Opt.	14	35-40	

Notes:

(1)
- Where temperature range is shown (eg. 22 - 24) select the upper value as the summer design and the lower value as the winter design temperature.
- Where a temperature range is shown with an asterisk (eg. 20 - 24*) the mechanical system must be capable of maintaining any set point within the range.

(2) High equipment heat load, usually 24 hours per day, 365 days per year. Consult radiology equipment supplier for equipment loads, temperature, humidity and lining requirements in ducts at points of entry to the areas.

(3) Consult with the user group for the need of HEPA filters on exhaust air.

Table 3.2-3
Emergency, Ambulatory and Outpatient Areas
Acute Care Facilities
Design Parameters

Space	Temperature Range (1) °C	Relative Humidity Range (%)	Zoning	Minimum Total Air Changes Per Hour	Minimum Outdoor Air Changes Per Hour	Relative Pressurization	All Air Exhausted Directly to Outdoors	Filter Efficiency MERV	Noise Level RC(N)	Remarks
Admitting	22-24	30-50	H,C	6	2	-	Opt.	13	35-40	
Ambulatory Care Clinic Areas	20-24*	30-60	H,C	9	2	-	Opt.	14	35-40	
Cast Room	22-24	30-50	H,C	12	4	-	Yes	13	35-40	Provide filters in exh. grilles (50% efficiency)
Day Beds	22-24	30-50	H-G,C	6	2	E	Opt.	14	30 max	
Day Surgery	22-24*	30-50	H,C	20	6	+	Opt.	14	25-35	
Decontamination	22-24	30-50	H,C	15	Opt.	-	Yes	13	40-50	
Dental Treatment	22-24*	30-50	H,C	9	3	+	Opt.	13	30-35	
Dialysis Unit	22-24	30-50	H,C	9	3	E	Opt.	13	35-40	
Emergency Examination & Treatment	22-24*	30-50	H,C	12	4	-	Opt.	14	35-40	
Emergency Waiting	22-24	30-50	H,C	12	4	-	Opt.	14	35-40	
Observation	22-24*	30-50	H,C	6	2	E	Opt.	14	35-40	
Public Corridor	22-24	30	G	4	1.3	-	Opt.	13	35-40	
Trauma (Emergency)	20-24*	30-50	H,C	15	5	+	Opt.	14	30-35	Scavenge anaesthetic gases.
Trauma (Operating Rooms)	20-24*	50-60	H,C	20	6	+	Opt.	17	25-35	Scavenge anaesthetic gases.
Triage	20-24	30-50	H,C	12	4	-	Opt.	14	35-40	

Notes: (1)
- Where temperature range is shown (eg. 22 - 24) select the upper value as the summer design and the lower value as the winter design temperature.
- Where a temperature range is shown with an asterisk (eg. 20 - 24*) the mechanical system must be capable of maintaining any set point within the range.

Table 3.2-4
Ancillary Areas
Acute Care Facilities
Design Parameters

Space	Temperature Range (1) °C	Relative Humidity Range (%)	Zoning	Minimum Total Air Changes Per Hour	Minimum Outdoor Air Changes Per Hour	Relative Pressurization	All Air Exhausted Directly to Outdoors	Filter Efficiency MERV	Noise Level RC(N)	Remarks
Autopsy	18-20*	30-50	H,C	20	3	-	Yes	13	35-40	
Corridors	22-24	30-50	G	4	1.3	See Remarks	Opt.	13	35-40	Pressure dependent on adjacent rooms
Laboratories										(2)
•Bacteriology	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
•Biochemistry	22-24	30-50	H,C	12	3	+	Opt	13	40-45	
•Cytology	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
•General	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
•Glass-Washing	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
•Histology	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
•Micro-biology	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
Morgue	18-20	30-50	H,C	10	2	–	Yes	13	40-45	
•Nuclear Medicine	22-24	30-50	H,C	12	3	–	Yes	13	40-45	(3)
•Pathology	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
•Serology	22-24	30-50	H,C	12	3	+	Opt	13	40-45	
•Sterilizing	22-24	30-50	H,C	12	3	–	Yes	13	40-45	
Non-Refrigerated Body Hold	18-22*	30-50	H,C	10	2	-	Yes	13	40-45	
Offices	22-24	30-50	G	6	2	E	Opt.	13	30-35	
Pharmacy	22-24	30-50	H,C	9	3	+	Opt	13	30-35	

Notes: (1)
- Where temperature range is shown (eg. 22 - 24) select the upper value as the summer design and the lower value as the winter design temperature.
- Where a temperature range is shown with an asterisk (eg. 20 - 24*) the mechanical system must be capable of maintaining any set point within the range.

(2) Consult with user group for requirements of exhaust air treatment.

(3) Consult user group and equipment supplier for special requirements on radiation precautions and handling of nuclear materials.

Table 3.2-5
Service Areas
Acute Care Facilities
Design Parameters

Space	Temperature Range (1) °C	Relative Humidity Range (%)	Zoning	Minimum Total Air Changes Per Hour	Minimum Outdoor Air Changes Per Hour	Relative Pressurization	All Air Exhausted Directly to Outdoors	Filter Efficiency MERV	Noise Level RC(N)	Remarks
Administrative areas	22-24	30-50	G	6	2	E	Opt.	13	35-40	
Auditoria	22-24*	30-50	H,C	12	See Remarks	E	Opt.	13	20-25	8 l/s per person outdoor air
Bio-Medical Waste Packaged Unit Room	22-25	-	G	12	Opt.	-	Yes	13	40-45	
Cart Wash	22-25	-	G	15	Opt.	-	Yes	13	40-45	
CSR Clean Workroom	22-24*	30-50	H,C	10	3	+	Opt.	13	40-45	
CSR Soiled Decontam Room	22-24	30-50	H,C	10	2	-	Yes	13	40-45	
Classrooms Seminars	22-24*	30-50	H,C	12	See Remarks	E	Opt.	13	25-30	8 l/s per person outdoor air
Clean Linen Folding	21-24	30-50	H,C	10	2	+	Opt.	13	40-45	
Clean Linen Storage	21-24	30-50	G	4	1	+	Opt.	13	40-45	
Conference	22-24*	30-50	H,C	12	See Remarks	E	Opt.	13	25-30	10 l/s per person outdoor air
Corridors	22-24	30-50	G	4	1.3	E	Opt.	13	35-40	
Dining	22-24	30-50	H,C	10	See Remarks	-	Opt.	13	40-45	10 l/s per person outdoor air
Dishwashing	21-27	30-50	G	10	2	-	Yes	13	40-45	(3)
Gift Shop	21-24	30-50	G	6	2	-	Opt.	13	40-45	
House-keeping Closets	21-27	30-50	G	12	Opt.	-	Yes	13	40-45	
Kitchen	21-27	30-50	H,C	10	2	- (2)	Yes	13	40-45	(3)
Laundry	21-27	30-60	H,C	12	3	-	Opt.	13	40-45	(3)
Lockers	22-24	30-50	G	10	Opt.	-	Yes	13	40-45	
Lounges, Staff	22-24	30-50	H,C	6	2	E	Opt.	13	35-40	
Materiel Management	22-24	30-50	H,C	6	2	E	Opt.	13	40-45	

Notes: (1)
- Where temperature range is shown (eg. 22 - 24) select the upper value as the summer design and the lower value as the winter design temperature.
- Where a temperature range is shown with an asterisk (eg. 20 - 24*) the mechanical system must be capable of maintaining any set point within the range.

(2) Reduce air volumes when space is not in use.

(3) Spot cooling may be required for work stations.

Table 3.2-5
Service Areas (Cont'd)
Acute Care Facilities
Design Parameters

Space	Temperature Range (1) °C	Relative Humidity Range (%)	Zoning	Minimum Total Air Changes Per Hour	Minimum Outdoor Air Changes Per Hour	Relative Pressurization	All Air Exhausted Directly to Outdoors	Filter Efficiency MERV	Noise Level RC(N)	Remarks
Mechanical & Electrical Rooms	20-35	-	H	4	Opt.	-	Opt.	8	(2)	(3)
Non. Refrig. Garbage	18-24	-	H,C	12	Opt.	-	Yes	8	40-45	
Offices, Private	22-24	30-50	G	6	2	E	Opt.	13	30-35	
Public Washrooms	22-25	-	G	12	Opt.	-	Yes	13	40-45	
Soiled Linen Sorting	21-24	30-50	H,C	12	2	-	Yes	13	40-45	Supply Air 8 ACH overnight
Soiled Linen Storage	21-24	30-50	G	12	Opt.	-	Yes	13	40-45	Supply Air 8 ACH overnight
Sterilizer Equipment Room	24-27	-	H,C	10	Opt.	-	Yes	13	40-45	(4)
Storage Dietary Day	21-27	30-50	G	4	Opt.	E	Opt.	13	40-45	
Storage - General	21-27	30-50	G	4	Opt.	-	Opt.	13	40-45	
Storage - Medical Gas Cylinders	15-35	-	H	-	-	-	-	-	-	(5)
Storage - Sterile	22-24	30-50	G	4	2	+	Opt.	13	40-45	
Waiting, Reception	22-25	30-50	G	6	2	E	Opt.	13	35-40	

Notes:

(1) Where temperature range is shown (eg. 22 - 24) select the upper value as the summer design and the lower value as the winter design temperature.

Where a temperature range is shown with an asterisk (eg. 20 - 24*) the mechanical system must be capable of maintaining any set point within the range.

(2) Comply with Occupational Health & Safety requirements

(3) Provide adequate volume of combustion air to prevent negative pressure in the space and flue gas downdraft.

(4) Consider heat dissipation from equipment.

(5) Comply with CAN/CSA-Z305.1.

Table 3.2-6
Continuing Care Facilities
Design Parameters

Space	Temperature Range (1) °C	Relative Humidity Range (2) (%)	Zoning	Minimum Total Air Changes Per Hour	Minimum Outdoor Air Changes Per Hour	Relative Pressurization	All Air Exhausted Directly to Outdoors	Minimum Filter Efficiency MERV)	Noise Level RC (N)	Remarks
Activity Rooms	25-28	30-50	H,C	6	2	E	Opt.	13	35-40	
Administrative/Offices	21-24	30-50	G	6	2	E	Opt.	13	30-35	
Barber/Beauty Parlour	25-28	30-50	H,C	12	3	-	Yes	13	35-45	
Central Bath	25-28	30-50	H,C	12	3	-	Yes	13	40-45	
Clean Linen Storage	21-28	30-50	G	2	Opt.	+	Opt.	13	40-45	
Clean Utility	21-28	30-50	G	6	2	+	Opt.	13	35-40	
Dining	25-28	30-50	H,C	6	2	-	Opt.	13	35-40	10 l/s per person outdoor air
Dishwashing	21-28	30-50	G	10	2	-	Yes	-	40-45	
Examination & Treatment	25-28	30-50	H,C	6	2	E	Opt.	13	35-40	
Housekeeping Closets	21-28	30-50	G	12	Opt.	-	Yes	-	-	
Kitchen	21-28	30-50	H,C	10	2	-	Yes	13	40-45	
Laundry	21-28	30-50	H,C	12	3	-	Opt.	13	40-45	
Lounges	25-28	30-50	H,C	6	2	E	Opt.	13	30-35	
Nursing Stations	22-25	30-50	H,C	6	2	E	Opt.	13	30-35	
Physical Therapy	25-28	30-50	H,C	9	3	E	Opt.	13	35-40	
Public Washrooms	21-28	30-50	G	12	Opt.	-	Yes	-	40-45	
Resident Bedrooms	25-28	30-50	H,C-G	4 (3) 4 (3)	2 4 (4)	- (5) - (5)	Opt. Yes	13	30 max	
Resident Room Corridors	25-28	30-50	G	3	1	E	Opt.	13	35-40	
Resident Washrooms	25-28	30-50	G	12	Opt.	-	Yes	-	35-40	
Smoking Room	25-28	30-50	H,C	See Remarks	Opt.	-	Yes	8	35-40	30 l/s per person
Soiled Linen Storage	21-28	30-50	G	10	Opt.	-	Yes	8	-	
Soiled Utility	21-28	30-50	G	10	Opt.	-	Yes	8	40-45	
Storage – General	21-28	30-50	G	2	Opt.	-	Opt.	8	40-45	

Notes:
(1) Where temperature range is shown (eg. 25 - 28) select the upper value as the summer design and the lower value as the winter design temperature.
(2) The optimum relative humidity (RH) range for human comfort and health is 30 to 60% at normal room temperatures. However, the maximum humidity level to which a building may be humidified in winter depends on the ability of the building envelope to prevent condensation. Generally, 30% RH is acceptable down to an outdoor temperature of -10°C. At outdoor temperatures below -10°C reduce the humidity level, at the rate of 3% per 4°C, to a minimum of 15% at -30°C and lower.
(3) Provide ventilation air directly into resident bedrooms.
(4) 100% outside air system with heat recovery.
(5) Maintain resident bedrooms under negative pressure relationship for odour control.

3.3 Energy

3.3.1 Performance Objectives

.1 Design

.1 Design all aspects in accordance with energy standards. Use the Model National Energy Code of Canada for Buildings as a guide.

.2 Design health care facilities with gross area over 10,000 m^2 to operate below target Building Energy Performance Index (BEPI) figures indicated in Table 3.3-1.

.3 Perform energy analysis simulation when designing facilities larger than 10,000 m^2.

.4 Develop energy conservation and heat recovery options for evaluation and approval. Consider energy conservation and energy cost avoidance options that are supported by economic cost analysis. Options which should be considered are:

- free cooling
- heat recovery and reclaim
- reduce air and water flow rates when maximum flow is not required (variable speed drives)
- reduce outside air volumes and ventilation rates during unoccupied hours
- shut down fans during unoccupied hours

.5 Implement energy conservation and energy cost avoidance options with a simple pay back of five years or less.

.6 Specify high efficiency motors in accordance with CSA 390, Energy Efficient Test Methods for Three-Phase Induction Motors.

3.3.2 Target Building Energy Performance Index (BEPI)

.1 The Building Energy Performance Index (BEPI) indicates the amount of energy consumed annually, per unit area, and is defined as:

$$\frac{\text{Building Energy Requirements (kWh)}}{\text{Building Area (m}^2\text{)} \bullet \text{1 year (a)}} = \frac{\text{kWh}}{\text{m}^2 \bullet \text{a}}$$

.2 The target maximum BEPIs are contained in Table 3.3-1. Each facility will be treated on an individual basis with Table 3.3-1 used as a guide only.

.3 Identify all energy consumption resulting from processes in the building that are separate from those required to maintain standard interior temperature, humidity, air quality and lighting conditions.

Table 3.3-1 Target Maximum BEPIs

Target Maximum, BEPIs For Each Building Category (kW•h/m^2•a)		
Building Category	**BEPI** (excluding process load)	**BEPI** (including process load)
Acute Care Facilities	550	750
Continuing Care Facilities	450	550

3.4 Heating

3.4.1 General

.1 Design the heating plant to maintain comfort conditions as outlined in Tables 3.2-1 to 3.2-6.

.2 Select equipment to provide an adequate level of redundancy and reliability taking into account the heating load profile, thermal energy storage, and the availability of spare parts for servicing equipment.

3.4.2 Boilers

.1 Establish the capacities, arrangement and number of boilers such that when any one boiler is out of service, the remaining boilers provide a minimum of 70% of the design load. The remaining boilers shall be sufficient to provide:

- domestic hot water for clinical, dietary and patient care when heated with the boiler systems
- steam for sterilization and dietary use
- building heat for the entire facility
- heating coils of air systems which serve diagnostic, treatment and patient care areas

.2 Select boiler sizes to provide the maximum operating efficiency and cost effectiveness for each facility. Utilize full modulating burner controls in all boiler sizes where available.

.3 Operating pressures for steam boilers greater than 103 kPa are not recommended. Where high pressure steam systems are proposed, analyse all system costs including mandatory supervision requirements.

.4 Use the following as a general guide in determining the use of steam or hot water boilers:

Table 3.4-1 Heating System Guidelines

Number Of Beds		
Acute Care	**Continuing Care**	**Recommendation**
Up to 250	All Sizes	Hot water heating boilers, high pressure steam for sterilizing equipment and low pressure steam for humidification.
More than 250	-	Hot water boilers or low pressure steam boilers with heat exchangers for hot water heating. High pressure steam for sterilizing, kitchen and laundry equipment. Low pressure steam for humidification.

.5 The following may be used as a general guide in determining the type of boiler to be used:

Table 3.4-2 Boiler Type Guidelines

Boiler Size Range	Recommendation
0 - 600 kW (0 - 900 kg/h)	Packaged forced draft water tube, fire tube, or cast iron boilers.
600 - 1500 kW (900 - 2275 kg/h)	Packaged forced draft water tube, fire tube, or cast iron boilers.
1500 - 6000 kW (2275 - 9130 kg/h)	Packaged forced draft fire tube or water tube boilers.
Note: Caution must be applied in the use of hot water boilers. Manufacturer's minimum water circulation rates and temperature differential must be maintained at all times.	

3.4.3 Emergency Stand-by Capability

.1 Provide all primary heating boilers with dual fuel burners. Based on the design load, provide a minimum of 24 hours fuel storage. Local conditions may alter the appropriate amount of fuel storage.

.2 Preference should be given to locate fuel storage tanks inside buildings. Outdoor tanks, where possible, will be located above ground and the installation must meet the requirements of the Alberta Fire Code.

.3 Install heat exchangers, boiler feed pumps, heating circulation pumps, condensate return pumps, fuel oil pumps and other essential accessories such that failure of one accessory will not reduce the plant's capacity to less than 70% of design load.

.4 Connect all primary heating boilers and stand-by equipment, including ancillaries, to both normal and emergency electrical power supply in accordance with CSA-Z32.

3.4.4 Heating Distribution

.1 Preference should be given to the two-pipe reverse return system for heating water piping. Two-pipe direct return system may be used only if the design properly guards against flow imbalance to terminal units, and it is a small part of a reverse return system.

.2 Consider primary-secondary pumping only where it will reduce power consumption and provides better control.

.3 Provide means of isolation, balancing and flow measuring devices at major pieces of equipment and major circuits.

.4 Use separate steam and condensate piping systems. Single pipe steam systems shall not be used.

.5 Provide isolation valves on supply and return mains, and risers.

.6 Where buried steam or hot water mains are used for primary heating, provide at least two such mains, each having a minimum capacity of 70% of design load. A loop system with suitable sectional valving may be used in lieu of two separate mains.

.7 Use variable speed pumps to maintain required system pressures for variable flow distribution systems.

3.4.5 Heating Terminals

.1 Ensure heating terminals are easily accessible for inspection, cleaning and disinfection.

.2 Valve each terminal at the supply and return connections. Balancing valve must be provided at each terminal unit.

3.4.6 Heating Systems

.1 General

.1 Select systems on the basis of sepsis control, maintainability, controllability and life-cycle costs.

.2 Provide thermostatic zoning and design space temperatures as outlined in Tables 3.2-1 to 3.2-6.

.3 Design perimeter heating and air system to prevent cold interior surface temperatures on glazing.

.4 Clean, degrease and chemically treat heating systems prior to start-up.

.2 Finned Radiation

.1 Do not use finned radiation in operating rooms, intensive care units, cardiac care units, recovery rooms, isolation rooms and delivery rooms.

.2 Avoid use of finned elements in patient care areas.

.3 Induction Systems

.1 Do not use induction systems in patient care areas of new facilities.

.4 Radiant Panel Heating

.1 Consider architectural details, window covering and any perimeter air supply outlets in the use of radiant panel heating systems. Limit the panel width to 600 mm and ensure the glazing is completely exposed to the radiant effect.

.2 Use of radiant panels should be considered where;

- a radiant heating effect is required (e.g. burn units, hydrotherapy)
- ease of housekeeping and infection control is a concern
- perimeter furniture and cabinets prevent the use of finned radiation

.3 Use special care in locating radiant panel thermostats. The radiant panel shall be scheduled on before the air system reheat coil.

.4 Radiant panel loop water temperature should not be scheduled so low as to adversely affect the performance of the panel, when combined with another heating system.

.5 Fan Coil Systems

.1 Do not use fan coil systems in patient care areas of new facilities.

.6 Water Source Heat Pumps

.1 Do not use water source heat pumps in patient care areas.

.7 In-Floor Heating Systems

.1 In-Floor heating systems may be considered for physiotherapy and hydrotherapy areas.

3.5 Cooling

3.5.1 General

.1 Design the cooling plant to maintain health and comfort conditions as outlined in Tables 3.2-1 to 3.2-6.

.2 Provide cooling to maintain health and comfort conditions in patient care and treatment areas in all acute care facilities. In continuing care facilities provide means of limiting interior temperatures in summer such as operable windows and air-conditioning.

.3 Use outside air for free cooling when outdoor ambient conditions permit.

3.5.2 Refrigeration Equipment

.1 Limit use of direct expansion (DX) refrigeration in air handling units for cooling capacity up to 105 kW (30 ton). Multiple DX air handling units are acceptable for a total building cooling load not exceeding 280 kW (80 ton). Provide staged compressors for capacity control in DX systems.

.2 Chilled water cooling is preferred when building cooling load is over 280 kW of refrigeration.

.3 Consider provision of multiple refrigeration machines and cooling towers for facilities requiring over 1750 kW (500 ton) of refrigeration.

.4 Do not use condenser water in a chilled water cooling coil.

.5 Design refrigeration systems in conformance with CSA-B52 Mechanical Refrigeration Code. Locate chillers in a machine room separate from combustion equipment (e.g. boilers).

3.5.3 Chiller Sizing

.1 Base the number, type, and capacity of chillers for a cooling plant on the calculated load, diversity factor, and load profile. Do not apply any safety factor for sizing chillers.

.2 Do not size a cooling plant for future expansion unless approved by the Project Manager.

.3 Provide multiple chiller and cooling tower systems such that with the largest system out of service the remaining equipment is capable of providing a minimum of 50% of the design load or 100% of the critical care area design load.

.4 Provide independent dedicated cooling systems for essential 24/7 operations such as data centres, MRI and CT room.

3.5.4 Cooling Towers

.1 Consider fluid coolers only if proximity to air intakes or vapor plume impingement is a problem.

.2 Consider cooling tower effect on neighbourhood ambient noise level. Refer to Section 5.5.5.

.3 Provide basic heaters and interior cooling tower sumps for all cooling towers which operate during low ambient temperatures. Provide interior sumps for all refrigeration systems over 705 kW to reduce chemical make-up requirements during spring and autumn operation.

.4 Ensure adequate net positive suction head on the condenser water pump and suitable piping arrangement to prevent pump impellor cavitation.

.5 Consider sediment separators or sand filters for cooling tower systems. Use non-softened water for sand filter backwash to reduce chemical make-up requirements.

.6 Evaluate both plate type heat exchangers and high performance shell and tube heat exchangers in free cooling applications.

.7 Exercise care in the selection of cooling tower location to ensure that the installed equipment will meet the specified capacity.

3.5.5 Cooling Distribution

.1 Preference should be given to the two-pipe reverse return system for cooling water piping. Two-pipe direct return system may be used only if the design properly guards against flow imbalance to terminal units, and it is a small part of a reverse return system.

.2 Consider primary-secondary pumping for distribution systems over 1750 kW refrigeration or with significantly different pressure requirements to permit saving of operating horsepower.

.3 Provide means of isolating balancing and flow measuring devices at major pieces of equipment and major circuits.

.4 Use variable speed pumps to maintain required system pressures for variable flow distribution systems.

3.5.6 Cooling Systems

.1 Use the following table as a general guide in determining the cooling system to be used:

Table 3.5-1 Cooling System Guidelines

Cooling Load	Cooling Medium	Heat Rejection Equipment	Compressor Type	Additional Information
280 kW (80 ton) or less	Refrigerant (Direct Expansion)	Air cooled condenser	Scroll or reciprocating hermetically sealed	105 kW (30 ton) maximum cooling capacity per air handling unit
280 to 705 kW (80 to 200 ton)	Chilled water	Air cooled condenser or air cooled chiller	Rotary screw	
		Evaporative cooling tower. Free cooling heat exchanger is optional.	Rotary screw	
Greater than 705 kW (200 ton)	Chilled water	Evaporative cooling tower with free cooling heat exchanger	Rotary screw, centrifugal or absorption where cost effective	Refer to 3.5.3.3 for large facilities

3.6 Air Handling Systems

3.6.1 General

.1 Design air handling systems to maintain environmental conditions in accordance with the design requirements as outlined in Tables 3.2-1 to 3.2-6.

.2 Design mechanical air supply to areas of refuge in accordance with the Alberta Building Code.

.3 Design air handling systems to provide free cooling, utilizing outdoor air when ambient conditions permit.

.4 Do not use variable air volume systems where a specific positive or negative pressure relationship is required.

.5 Where constant volume air systems are used, consider reheat requirements for interior zones, especially in spaces used for critical patient care.

.6 Provide parallel air handling units in conformance with CSA Z317.2 on air handling unit redundancy.

.7 Use of 100% outside air should be limited to those cases where heat recovery devices are used or airflows can be reduced during unoccupied periods or a combination of both.

.8 For kitchens provide make-up air and negative pressurization in space during cooking periods. Provide reduced air flows during food preparation periods when exhaust hoods are not in operation.

3.6.2 Air Handling Equipment

.1 Use double wall skin construction without perforation or any exposed insulation in the air stream.

.2 Provide plenums with hinged, sealed access doors to provide access to all components. Provide windows and lighting for inspection of each chamber.

.3 Use a return air fan when recirculating air to air handling units.

.4 Provide an economizer section with outside air, return air and exhaust air dampers arranged to provide good mixing of the air streams.

.5 Use factory manufactured air blenders to prevent air stratification and provide uniform flow across coil.

.6 Do not use mechanical rooms as air plenums.

.7 Use a 50:50 mixture of glycol and water in preheat coils.

.8 Provide summer and winter pre-filters locations where frost may occur. Provide final filters to meet the efficiency requirements of the design guidelines.

.9 Do not use rooftop air handling units unless specifically approved by the Project Manager to meet specific project requirements. Where rooftop units are approved, locate equipment over corridors or other non-critical areas and provide an enclosed heated service corridor with a direct access stair when unit size permits.

.10 Locate fresh air intakes at least 9 m away from ventilation exhausts, medical vacuum exhausts, chimneys, cooling towers, plumbing vents, vehicle exhaust and ground contaminants.

.11 Where spaces are heated with radiant heating panels or radiation, do not use an on-off gas fired heating and ventilating equipment to serve such multiple spaces. Unacceptable temperature swings will result with these systems. Use of high turn down (i.e. 15 to 1) natural gas valves should be considered.

3.6.3 Humidification

.1 Use steam humidifiers in all air handling systems. Steam shall be injected into the supply air with a steam distribution manifold.

.2 Steam generated at a central steam plant may be used for humidification provided the water treatment used in the boiler is non-toxic. Chemical concentrations shall not exceed the levels acceptable under Alberta Occupational Health and Safety Regulations.

.3 Steam for humidification may be generated by a dedicated humidification boiler. Boiler feedwater shall be treated with suitable chemicals and in concentrations acceptable under Alberta Occupational Health and Safety Regulations.

.4 If steam from boilers is unacceptable for humidification then a remote steam to steam heat exchanger should be considered.

.5 Consider softened and demineralized water for make-up to reduce mineral scaling. Facilities have experienced good results in using reverse osmosis water.

.6 Electronic and electrical steam generators for humidification should only be considered when the humidification load is less than 45 kilograms steam per hour. Steam shall be generated outside the supply air stream and injected into the supply air with a dispersion tube.

3.6.4 Zoning

.1 Zone air systems in accordance with space function, occupied hours, and air quality requirements.

.2 Supply air systems may serve areas of different use or occupancy, provided the requirements of the most critical occupancy are satisfied.

.3 Where areas with different operating schedules are served by one air handling unit, provide a means of area isolation to reduce air flow and energy use.

3.6.5 Distribution

.1 Do not circulate air from an area of low level care to an area of high level care, or high humidity area to low humidity area.

.2 Ensure that good air distribution and occupant comfort are achieved through appropriate air outlet application, selection and location. Particular attention should be paid to continuing care facilities where drafts can be a problem.

.3 Provide adequate access for internal inspection and cleaning of all ductwork.

.4 Do not use ceiling space as a return air plenum in any part of a health care facility including continuing care and outpatient clinic facilities.

.5 In operating rooms, use non-aspirating laminar flow air diffusers to provide a downward air flow over the operating table. The exhaust air grilles shall be located at the perimeter of the space 150 mm above the floor.

.6 Use pre-manufactured operating room supply air systems such as non aspirating type diffusers and a ring of linear diffusers to form an air curtain surrounding the surgical team. Ensure air distribution pattern from the linear diffusers do not cause unacceptable drafts.

.7 Consider fully laminar air flow systems only for special use operating theaters such as implant orthopedic procedures.

.8 Provide stainless steel supply and exhaust air outlets and ductwork in operating rooms. To facilitate good housekeeping install access for cleaning ductwork.

.9 Clean all air ducts prior to occupancy. Disinfect air systems serving critical care areas.

3.7 Exhaust Systems

3.7.1 General

.1 Provide exhaust systems to maintain environmental conditions, or to provide requirements and pressure relationships as outlined in Tables 3.2-1 to 3.2-6.

.2 Treat exhaust air from the following areas as required by codes or to ASHRAE standards before discharging to atmosphere:

- isolation rooms
- autopsy rooms
- radioisotope areas
- fume hoods
- special lab areas
- other special areas, deemed necessary

.3 Provide equipment redundancy with emergency power for critical exhaust air systems.

.4 Isolate smoking lounges from adjacent spaces and exhaust directly to outdoors.

3.7.2 Distribution

.1 Locate HEPA filters in an area easily accessible for service and as close as practical to the space served. Ensure access and arrangement of exhaust filter banks permits bagging without direct handling of contaminated filters.

.2 Duct all exhaust air systems. Do not use ceiling space or mechanical rooms as exhaust air plenums.

.3 Use corrosion resistant materials for exhaust ducts conveying corrosive fumes and vapours, or where condensation is likely to occur.

.4 Provide scavenging system for waste anaesthetic gas.

3.7.3 Equipment Discharges

.1 Locate discharges from the following areas and equipment remote from any intake, building opening or occupied space:

- autopsy suite
- isolation room
- hood for radioisotopes
- special laboratory areas
- cooling towers
- boiler stacks
- generators
- emergency smoke exhaust fans
- kitchen exhaust

.2 Consider the effects of winds in selecting the location of all discharges. Wind study testing may be required if equipment discharge locations could possibly contaminate an air intake or adjacent habitable space.

3.8 Fire and Life Safety Systems

3.8.1 General

.1 Design fire and life safety systems in accordance with the requirements of the Alberta Building Code.

3.8.2 Fire Protection

.1 Sprinkler Systems

.1 Design sprinkler systems in accordance with the Alberta Building Code and requirements of NFPA 13, latest edition. Consider preaction type sprinkler systems for critical care areas and diagnostic imaging rooms.

.2 Consider redundancy of water supply for large urban and regional facilities. Review with regional health authority and local authority having jurisdiction.

3.8.3 Standpipe and Hose Systems

.1 Design standpipe and hose systems in accordance with the Alberta Building Code and requirements of NFPA 14, latest edition.

3.8.4 Portable Fire Extinguishers

.1 Provide portable fire extinguishers in accordance with the Alberta Building Code and requirements of NFPA 10, latest edition.

3.8.5 Smoke Control Systems

.1 Fully consider the difficulty in evacuating patients from a facility when designing the smoke control systems.

.2 Design smoke control systems to meet the requirements of the Alberta Building Code, the local authority having jurisdiction, NFPA and ASHRAE guidelines.

.3 Provide separate dedicated smoke removal fans utilizing the building return air ductwork for smoke removal.

.4 Size smoke exhaust fans to handle the zone having the highest exhaust requirement plus 10% of exhaust requirement for each additional zone.

3.9 Plumbing and Drainage Systems

3.9.1 Plumbing Piping Systems

.1 Public Utilities

  .1 In order to provide a reliable water supply, whenever practicable, direct connections shall be made to at least two public water mains such that the interruption of service from one main does not interrupt the service from another main.

  .2 A capped exterior hose connection can also be considered to facilitate temporary supply from an alternative water supply (such as fire hydrant, water truck) in the event of loss of the underground water service.

.2 Domestic Water Service

  .1 Design temperature of hot water supplies in accordance with CAN/CSA-Z317.1 Special Requirements for Plumbing Installations in Health Care Facilities.

  .2 As a minimum provide duplex water heater installation. Use double-wall heat exchangers where there is a risk of contamination.

  .3 Incorporate a means to sanitize the hot water tanks and water distribution system. Each tank shall be capable of attaining a water temperature of 80°C.

  .4 Provide separate systems where dual hot water temperatures are required (e.g. 60°C and 82°C). Do not use mixing valves to provide dual temperatures.

  .5 Provide domestic hot water recirculating piping complete with balancing valves where hot water supply piping exceeds 15 m.

Branch piping from a fixture to a recirculated main shall not exceed 8 m.

.6 Do not exceed 2.0 m/s velocity for cold water piping and 1.2 m/s for hot water supply and recirculating piping to minimize erosion and corrosion.

.7 Provide backflow prevention to plumbing code requirements. On the main water service, install parallel approved backflow prevention devices to ensure water availability during testing and maintenance.

.3 Sanitary Sewer Piping System

.1 Provide sampling manhole in sanitary sewer line in facilities containing laboratories.

.2 Ensure sanitary waste discharge from laboratories and infectious areas complies with local codes, environmental and health regulations.

.3 Provide appropriate traps or interceptors for sinks in areas such as food preparation, cast, photo developing, and hair dressing.

.4 Storm Drainage System

.1 Do not use controlled flow roof drainage.

.2 Provide minimum 100 mm roof drains.

.3 Provide a minimum two roof drains per drainage area.

.4 Direct flow that is discharged at grade so that it does not flow onto areas for pedestrian or vehicle traffic, where it could freeze and become a safety hazard, or onto areas where it could cause erosion damage.

.5 Terminate roof drain exterior discharge outlet with an elbow at least 1.0 m 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.

.5 Laboratory Drainage System

.1 Provide large laboratory areas with acid waste drainage to a neutralizing sump. Sump to be equipped with pH probe and meter.

.2 Provide small laboratories or isolated laboratories with point-of-use dilution or neutralizing traps.

.3 Use chemically and fire resistant piping in drainage systems serving laboratories where acids are used or photo processing is provided.

3.9.2 Plumbing Fixtures

.1 General

.1 Consult with user groups as to appropriate fixture and trim types. Requirements may vary from facility to facility, especially in continuing care facilities.

.2 Provide white fixtures of any one type by the same manufacturer, with chrome-plated fixture trim and accessories.

.3 Where flush valves are used provide low flush and quiet action type.

.4 Provide lavatories in patient rooms with gooseneck spouts, open grid strainers and electronically controlled faucets to permit hands-free operation and open strainer. Lavatories shall not have an overflow, drain stopper or mechanical waste fitting unless specifically approved to meet specific project requirements (eg. flood risk).

.5 Provide nursing station, examination and treatment room lavatories with blade handles or other appropriate means to permit hands-free operation, gooseneck spout and open strainer.

.6 Provide electronic type fixtures in public washrooms.

.7 Provide bathtubs with slip resistant bottom and wide rim seat. Provide hand shower and grab bar.

.8 Water temperature for mixing valves will be set to provide 43°C with limit stops set at 48 °C.

.9 Provide a tempered water supply to emergency eyewash and shower fixtures in accordance with ANSI Z358.1.

.10 Provide vapour vents to atmosphere for steam bedpan washers and sterilizer units.

3.9.3 Water Treatment

.1 Provide a water analysis with recommendations from a water treatment consultant, before determining final water treatment systems.

.2 Use the following table as a guide for water softening requirements. Hardness is expressed as milligrams per litre calcium carbonate equivalent.

Table 3.9-1 Water Softening Guidelines

Hardness mg/l	Recommendation
Less than 60	Water softening not required.
61 - 120	Soften hot water for laundry and ware washing use.
121 - 180	Soften hot water for hygiene, laundry and ware washing. Soften cold water for laundry use.
Over 180	Soften all water except water for human consumption, hose outlets and irrigation services.

.3 Treat and test complete water system prior to occupancy in accordance with CAN/CSA-Z317.1.

3.9.4 High Quality Water System

.1 General

.1 Establish the quantity and quality of water required with the health facility. Where demand is low and a reliable commercial source is available, high quality water should be purchased rather than providing in house equipment.

.2 Consider central systems for high demand requirements only.

.3 Recirculate central systems with a minimum velocity of 1.5 m/s.

.4 Recirculate all branches and minimize dead end piping to less than six times the pipe diameter.

.5 Select suitable equipment, piping and valve materials to ensure maintenance of water quality is not degraded.

.2 Reverse Osmosis Water

.1 Provide prefiltered and softened feed water at 25°C to optimize equipment sizing.

3.9.5 Central Vacuum Cleaning System

.1 General

.1 Consult with user groups as to the use of central vacuum cleaning system. In facilities where extensive floor carpeting is used, consider a dry vacuum system.

.2 Consider a wet vacuum system for the following areas:

- operating rooms
- intensive care
- renal dialysis
- cystoscopy rooms
- obstetrical suite
- emergency area

.3 Locate central vacuum unit such that specified room noise levels in adjacent rooms are not exceeded.

.4 Do not exceed 11 meters hose length.

.5 Use minimum 50 mm diameter piping.

.6 Provide piping that rises to inlets.

.7 Provide heavy brass construction inlets. Provide silent inlets in intensive care units.

.8 Use carbon-steel tubing for dry vacuum system. Wet vacuum system to be stainless-steel tubing gravity drained to separator. Consider remote separators to reduce the amount of stainless steel tubing. Maintain required transport velocities.

.9 Identify wet and dry inlet valves, if both systems are used.

.10 Provide provisions for cleaning and disinfecting of the equipment and piping systems.

.2 Central Disinfection System

.1 Provide central disinfection system in large active treatment facilities where thoracic or orthopedic procedures are undertaken.

.2 Locate outlets adjacent to wet vacuum outlets according to the requirements of the facility user group.

3.10 Medical Gas Systems

3.10.1 General

.1 Provide medical gas systems in accordance with CAN/CSA-305.1 "Nonflammable Medical Gas Piping Systems" and Alberta Building Code. Designers are encouraged to make reference to the new “CSA-Z7396.1-06 Medical gas pipelines systems – Part 1: Pipelines for medical gases and vacuum” Code; however the design should not conflict with the present Code.

.2 Consider capital cost, operating cost, anticipated future expansion and critical nature of the facility e.g. regional disaster centre, in the selection of the type of primary medical gas service for health care facilities.

.3 Do not use hose reel or track type outlet systems in operating rooms because of difficulty of maintaining sterile conditions.

.4 Locate medical gas outlets to allow sufficient space for vacuum bottles, system regulators and adaptors.

.5 On valved and capped connections provided for future use, provide a 15 mm valved and capped connection or other means of test and purge connection downstream of valve. Extend capped connections minimum 450 mm from valves.

.6 Provide 15 mm valved and capped connection or other means of test and purge connection downstream of all riser isolation valves to facilitate future modifications.

.7 Equip multiple-bed intensive care units and neo-natal intensive care units with service valves downstream of zone valves to allow shutdown of a part of the unit for maintenance. Service valves must have handles secured in open position.

.8 Provide medical gas services with line pressure and vacuum gauges at the source and immediately inside the building.

.9 Provide nitrogen service to operating rooms with adjustable pressure regulator and pressure gauges in each room.

.10 Provide an exterior room for storing central medical air, oxygen, nitrogen, carbon dioxide and nitrous oxide cylinders. The room shall be heated and vented with the door opening outwards.

.11 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.

.12 Connect medical gas systems to both normal and emergency power supply.

3.10.2 Outlets and Valves

.1 Medical Gas Outlets

.1 Review the number and type of medical gas outlets with the user groups.

.2 Use Diameter Index Safety System (D.I.S.S.) outlets for new construction. Consult with the users where addition or modification is made to existing Quick Connect outlets.

.3 Provide slide retainer bracket for collection bottle at vacuum outlets.

.2 Shutoff Valves

.1 Provide ball type valves with securable lever handle which are operable from open to closed position in one-quarter turn.

.2 Locate valve boxes in full view of supervisory staff or within the nursing station.

.3 Provide zone valves to isolate medical gas outlets within a specific area.

.4 Provide zone valves immediately outside of each anaesthezing location.

.5 Equip each branch line with a securable service isolation valve at the point of connection to the main.

.6 Provide securable service isolation valves on branches serving more than one zone.

.7 Provide a line pressure gauge on downstream of each zone valve.

3.10.3 Master and Local Alarm Panels

.1 Install alarm panels in locations where continuous responsible surveillance is available.

.2 Building management systems must not be relied on exclusively to monitor medical gas alarms. They can only be considered as a secondary source of monitoring and shall be connected downstream of the Master Alarm Panel.

.3 Equip each zone valve box with a local emergency alarm.

3.10.4 Source of Supply

.1 Medical Air System

.1 The type of central medical air system selected will be based on size of facility, extent of respiratory therapy, projected rate of consumption, remoteness of facility and service from medical gas supplier.

.2 Consideration should be given to cylinder system for small facilities with no mechanical ventilators or anaesthesia 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 On medical air compressor system, provide high moisture and carbon monoxide level alarms downstream of line pressure regulators and upstream of the main service isolation valve.

.5 Equip a reserve high pressure manifold for the medical air compressor system.

.6 Air intake for the medical air compressor will be from a non-contaminated location outside the building complete with insect screen and filter. Refer to CSA-Z7396.1 for alternate intake locations.

.2 Medical Vacuum System

.1 Provide at least three oil-lubricated, oil-less or oil free type vacuum pumps

.2 Where medical vacuum outlets are used for the scavenging of waste anaesthetic gases, ensure vacuum pumps have oxygen compatible components and sufficient capacity.

.3 Provide sufficiently sized vacuum pump exhaust piping to ensure system performance.

.4 Locate exhaust discharge so as not to contaminate air intakes.

.5 Provide vacuum piping with minimum 19 mm diameter.

.3 Central Oxygen System

.1 The type of central oxygen system selected will be based on:

- size of facility
- type of facility (i.e. level of care)
- extent of respiratory therapy (i.e. mechanical ventilators or anaesthesia machines)
- projected rate of consumption
- remoteness of facility
- frequency of service from medical gas supplier

.2 The following tables are recommended guides based on bed rating and on known consumption for acute care facilities.

Table 3.10-1 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.
over 500	A large main bulk storage tank, complete 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 3.10-2 Oxygen Source - Known Consumption

Consumption Cubic Metres per Month	Type of System
Less than 250	High pressure gas cylinder
250 - 750	Mini-bulk
Over 750	Bulk

.3 Oxygen concentrators are an alternative source of oxygen supply. Conduct a full cost benefit analysis when considering the use of oxygen concentrators. Installation shall comply with CAN/CSA-Z305.6 Medical Oxygen Concentrator Supply System.

.4 Central Nitrous Oxide System

.1 Base nitrous oxide storage capacity on one half a cylinder per bank per anaesthetizing location, with a minimum installation of two bottles.

.5 Central Nitrogen System

.1 Base nitrogen storage capacity on one cylinder per bank for each operating room or workroom requiring nitrogen.

.2 Bulk (liquid) nitrogen storage is required only in large facilities. High pressure nitrogen cylinders or mini-bulk liquid cylinders will be used for other facilities.

3.10.5 Anaesthetic Gas Scavenging System

.1 Provide a scavenging system in each space where anaesthetic gases are routinely used. It is preferable to combine the scavenging system with the operating room exhaust air.

.2 Reference CAN/CSA-Z7396-2 Anaesthetic Gas Scavenging Disposal Systems.

.3 Laser plume evacuation system shall be a separate system.

3.10.6 Testing

.1 New or altered medical gas piping systems will be tested according to Part V of CAN/CSA Z305.1 and Alberta Building Code.

3.10.7 Renovating Existing Facilities

.1 When new outlets are added or existing outlets relocated, the sources of gas supplying the new outlets and the alarms protecting them must meet the requirements of the Alberta Building Code and local authorities having jurisdiction.

3.10.8 Suggested Medical Gas Outlets

.1 Use table 3.10-4 as a guide for the number of medical gas outlets recommended for the different functional areas of acute care facilities.

Table 3.10-4 Medical Gas Outlets in Acute Care Facilities

Room	Factor	0_2	Vac	Air	N_20	N_2	Typical Uses
Anaesthesia workroom	1 set of	1	1	1	1	1	
Autopsy			1			1	Suction waste materials from body
Bed holding		1	1				Cardiac arrest, 0_2 therapy
Biomedical/Clinical Engineering		1	1	1			Equipment testing
Blood receiving (blood donors)		1	1				Emergency use
Cardiac catheterization room		1	1	1	1		Cardiac arrest and other emergencies
Cystoscopy and special procedure		1	2	1	1		Emergency use
Deep therapy		1	1	1			Cardiac arrest and other emergencies
Demonstration room (in-service training)		1	1				Demonstrate equipment to new employees and students
Dental Clinic		1	1	1	1	1	
Dispensary (minor surgery, first aid, student health and exams)		2	2	1	1		Emergency use
E.E.G. (electro-encephalogram)		1	1	1			Cardiac arrest and other emergencies
E.C.G. (electro-cardiogram)		1	1	1			Cardiac arrest and other emergencies
E.M.G. (electromyogram)		1	1				Cardiac arrest and other emergencies
Ear-Nose-Throat examination			1	1			Aspiration, topical spray
Emergency rooms	per bed	1	2	1			Cardiac arrest and other emergencies
Endoscopy		1	2	1	1		
Examination room		1	1	1			Cardiac arrest, other emergencies, 0_2 therapy
Fluoroscopy (X-Ray dept)		1	1	1			Cardiac Arrest and other emergencies
Full-term nursery		1	1	1			
General physiology lab		1	1	1			Incubator-Respirators
High level radioisotope (X-Ray dept)		1	1	1			Cardiac arrest and other emergencies
Inhalation therapy	per patient	1	1	1			Cardiac arrest and other emergencies

Table 3.10-4 (cont'd) Medical Gas Outlets in Acute Care Facilities

Room	Factor	0_2	Vac	Air	N_20	N_2	Typical Uses
Intensive care areas		3	3	2			For critically ill, IPPB
Isolation (infectious and contagious diseases)		1	1	1			Patient care
Labour, Delivery, Recovery and Postparturm (LDRP Rooms)		2	3	2	1		Analgesia, anaesthesia, patient care
Nursery and pediatric nursery		1	1	1			Patient care
Nursery, Special care		2	2	1			Patient care
Operating rooms		2	3	2	1	1	Patient care
Orthopedic exam. room		1	1				Cardiac arrest and other emergencies
Pathology (Doctor's office-special lab tests)		1	1	1			Cardiac arrest and other emergencies
Patient room - Private		1	1	1			Patient care
Patient room - Semi-private (2 beds)	per bed	1	1	1			Patient care
Pharmacy room (drug preparation)			1				
Physiotherapy		1	1				Cardiac arrest and other emergencies
Plaster (cast room)		1	1	1			Patient care
Recovery beds		1	1	1			Cardiac arrest and other emergencies
Recovery room		2	3	1			2 vacuum for thoracic, 1 for oral, gastric or wound 0_2 for resp. use
Respiratory treatment room		1	1	1			Patient care
Security nursing (psychiatric or violent patient/use locked boxes)		1	1	1			Patient care
Sterilization (CSR or OR)		1		1			Equipment testing
Stretcher waiting room		1	1	1			Cardiac arrest or other emergencies
Surgical preparation room		1	1	1			Pre-medication for anaesthesia
Teaching lab		1	1	1			
Trauma (Operating Rooms)		2	3	2			Patient care
Treatment room		1	1	1			Special therapy
X-Ray room		1	1	1			Patient Care

3.10.9 Special Gas Systems

.1 Special Gas Systems for Laboratories

.1 Laboratory vacuum and compressed air systems will be separated from medical vacuum and compressed air systems.

.2 Contain special gas systems such as hydrogen, helium, carbon dioxide, argon, methane and various premixed gases within the laboratory using these gases. Restraining brackets must be provided for all gas cylinders.

.3 Duplex manifolds will be equipped with a relief valve located downstream of the two high pressure regulators and vented to the outdoors.

.4 Inflammable and non-flammable relief vent discharge piping must not be combined. Discharge piping must be labeled.

.2 Dental Compressed Air System

.1 Use oil-free duplex air compressors.

.2 System will not be combined with medical compressed air.

.3 Dental Vacuum System

.1 Dental vacuum pumps will be duplex. Design for a vacuum of at least 19 kPa (5.5" of Hg) at the point-of-use.

.2 The pipe sizes will be based on 5 L/s for each outlet with 100% simultaneous use factor.

.3 Pipe connections will rise to inlets with main lines sloped back to separator.

.4 The minimum pipe size will be 50 mm.

.5 Valves will be provided in all risers and branches.

.6 Provide sufficient cleanouts, using TY fittings, in the piping system.

.7 Vacuum discharge piping will be extended through the roof and discharged into the atmosphere.

3.11 Controls

3.11.1 General Requirements

.1 Use BACnet or LonWorks compliant distributed digital control (DDC) energy management control systems (EMCS) to:

- control heating, ventilating and air conditioning systems.
- execute control strategies to minimize energy consumption.
- monitor and record mechanical systems' performance.
- provide dial out of alarm signals.

.2 Approve commercially available field proven systems that will be installed, engineered and commissioned by trained and qualified personnel, employed by companies that can provide an acceptable level of after service.

.3 Provide systems with user friendly interface and control language that allows user reprogramming of the control sequences. Provide program and graphics editing software including all required manuals.

.4 Create dynamic graphics in the Central Control Unit (CCU) for all mechanical systems. Provide a graphics of each floor showing smoke control zones. Include all EMCS controlled space temperatures and smoke dampers.

.5 Use Terminal Equipment Controllers (TEC's) in new construction or in retrofits where majority of terminal equipment will be upgraded.

.6 TEC's should not be used for control of major equipment, i.e. boilers, air handling units, etc.

.7 Provide for offsite support access by including a modem or serial device server for telephone or internet connectivity.

.8 Controls for all essential equipment are to be on emergency power. Central Control Stations are to include a UPS.

3.11.2 EMCS Design Objectives

.1 Develop a plan early in the project to define the requirements for:

- contract documentation,
- vendor acceptance,
- product approval,
- system field inspection,
- customized control software, and
- commissioning the EMCS.

3.11.3 EMCS Operating Objectives

.1 Use custom control sequences and application programs to conserve energy by:

- controlling primary energy consuming equipment.
- deciding optimum start and stop times for equipment and systems that do not operate 24 hours a day.
- resetting air and heating water supply temperatures using feed back from occupied space demand.
- resetting humidity from outside air temperature.
- using air systems to preheat, precool or purge to achieve the objective space temperature at the start of occupancy.
- controlling car plugs.

.2 Use custom control sequences and application programs to provide stable control by resetting heating water supply temperature using feedback from occupied space demand and outside air temperature.

3.11.4 Field Devices

.1 Specify 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 Ensure control valves are selected with 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.

3.11.5 Contract Documents

.1 Provide detailed requirements for:

- O&M Manuals.
- Operator training.
- Central and Portable Control Stations.
- Remote and Terminal Control Units including control language.
- Field Devices, Conduit and Wiring.
- Identification of Points, Devices and Wiring.
- System Start-up and Testing including point verification and calibration.

.2 Provide schematics for each mechanical system showing specified control points.

.3 Provide point sheets listing all points to be installed. Group points on a per system basis. Refer to Alberta Infrastructure Standard for Logical Point Mnemonics when selecting point names.

.4 Provide detailed control sequences identifying the use or purpose of every specified control point

.5 Use the Alberta Infrastructure Basic Master Specification sections as a basis for documents.

3.11.6 Start-up, Testing and Point Verification

.1 Ensure the controls contractor verifies every physical point and submits check sheets showing all calibration values as well as actuator spans for pneumatic actuators.

.2 Ensure contractor submits trend data showing that all control loops have been tuned.

.3 Witness all start-up tests and perform point verifications as outlined under 23 08 95.

3.12 Infection Control

.1 Use CSA-Z317.13 for preventing and controlling construction-related fungal and bacterial infections during the construction, renovation, maintenance and repair work of health care facilities.

3.13 Commissioning

.1 Determine the commissioning requirements for each project based on complexity, size, cost, location, occupancy, new or unique client requirements, and consistent with the risks associated with system performance. Prepare and review commissioning plan with the Project Manager.

.2 Verify the installation and test the performance of each component and system, individually and collectively, to ensure the facility is complete, and functioning efficiently according to the design objectives and approved client requirements.

.3 Provide documentation of verification and performance tests.

.4 Train building operators to operate and maintain systems, through formal seminars and demonstrations of equipment and systems.

.5 Provide appropriate operation and maintenance manuals for use by the building operators. Include, on a system-by-system basis, design criteria, system information, operation procedures, maintenance requirements and shop drawings.

End of Mechanical Section

Section Contents

4.1 References

.1 Meet or exceed guidelines and standards of the following organizations:

.1 Canadian Standards Association

.2 Illuminating Engineering Society

.3 Institute of Electrical and Electronics Engineers

.4 Insulated Cable Engineers Association

.5 NEMA, ULC

.2 Meet requirements of the APEGGA guideline “Responsibilities For Engineering Services For Building Projects V1.0 – April 2001.”

4.2 Services and Power Distribution

4.2.1 General

.1 Provide a comprehensive single line diagram of the power distribution system, as part of the contract documents, complete with the following information:

.1 Configuration, type, voltage and current ratings of all switchgear, switchboards, panelboards and motor control centres.

.2 Type, size and current ratings of all services and feeders.

.3 Type, frame size and trip rating of all overcurrent protective devices.

.4 Available fault current at all switchgear, switchboards, panelboards, and motor control centres.

.5 Connected load and anticipated demand load at all switchgear, switchboards, panelboards and motor control centres (MCC’s).

.6 Service and distribution grounding.

.2 Provide copies of "as-built" single line diagrams as part of the Operating and Maintenance Manuals.

.3 Provide copies of "as-built" single line diagrams framed and hung in each major electrical room with the equipment in the room highlighted.

4.2.2 Electrical Service

.1 Consult with the Owner and the Utility to provide service with the highest level of reliability in a cost effective manner.

.2 Size service for estimated demand plus identified expansion plus 20% spare capacity.

.3 Select service voltage according to the majority of load requirements, 120/208 V or 347/600 V, three-phase, 4-wire. For large facilities (1500 kVA demand or larger), use primary service voltage available from the Utility.

.4 Provide underground service to new facilities.

.5 Provide Transient Voltage Surge Suppression on all 120/208 and 347/600 volt services at the main service.

4.2.3 Power Distribution System Protection and Control

.1 Ensure adequate fault duty ratings of all switchgear, panels, MCC's and overcurrent devices, verified by fault calculation. Perform an Arc Flash Study to determine boundaries, incident energy, warning labels and protective equipment requirements. Ensure lock off devices are provided on appropriate disconnect devices or circuit breakers.

.2 Ensure coordination of overcurrent and ground fault devices:

  .1 Conduct preliminary coordination analysis complete with consolidated time-current characteristic curves and single line diagram showing utility fault level and protection, main incoming and feeder devices.

  .2 Provide final documents of coordination analysis before completion of construction to ensure proper functional coordination of all devices.

.3 Provide all services 1000 A and over, and feeders sized 600 A and over, with ground fault protection. Coordinate ground fault protection of exterior circuits with main distribution detection - this is to prevent a branch circuit fault knocking out the entire system.

.4 Do not provide single phasing or under voltage protection on main service device. If necessary, provide single phase protection for individual motors or group of motors.

4.2.4 Switchgear, Switchboards and Panelboards

.1 Use moulded case circuit breakers for all circuit protective devices except as follows:

  .1 Use industrial duty, drawout type air circuit breakers for services over 800 A.

  .2 Use solid state trip moulded case breakers complete with trip mode indication for services sized 400 to 800 A.

  .3 Use high rupturing capacity fuses where fault duties of equipment require a limitation of the available fault current.

.2 Use metal enclosed switchgear for all high voltage equipment.

.3 Provide microprocessor-based, digital AC metering device for all services with:

  .1 Voltmeter switchable to each phase or line to line

  .2 Power factor

  .3 Kilowatt demand

  .4 Ammeter switchable to each phase

  .5 RS 232 output and interface software for tie to building automation system. Capability for recording, load shed, and alarm set points.

  .6 Relay class circuits and points complete with test blocks in wiring.

  .7 Digital meter to be compatible with LON Work and Back Net and be connected to the Building Management System.

.4 Do not use feed-through panelboards.

.5 Use copper bussing.

.6 Provide lifting equipment for all industrial type drawout air circuit breakers, high voltage switches and stacked high voltage starters.

.7 Provide floor mounted equipment with a housekeeping pad except for roll-out style switchgear.

.8 Working Clearances: Provide a minimum of 1.5 metres clearance in front of all switchgear and MCC's, in addition to the space required for drawout equipment and 1.0 m on the side and back of free standing equipment.

4.2.5 Transformers

.1 Size transformers such that the average demand is at least 60% of rating.

.2 Ensure adequate acoustic ratings, treatment, location and mounting of transformers. Refer to Section 5.0, Acoustics.

.3 Select low temperature rise transformers using high temperature insulating materials to achieve long life and low losses e.g. Class H, 115°C temperature rise.

.4 Provide three-phase transformers with delta-wye connection and accessible voltage taps.

.5 Use flexible conduit for final connection to transformer. Use liquid tight flexible conduit in wet areas.

.6 Make provisions for fan cooling on dry type transformers in excess of 750 kVA. Size transformers for calculated capacity without fan-cooling. Make use of fan-cooled rating of transformer in the design of system redundancy.

.7 Liquid-filled transformers may be used for high voltage applications and vault installation.

  .1 Use 55°-65°C insulation and equip with cooling fan.

  .2 Equip with sudden pressure relays.

4.2.6 Motor Control

.1 Provide motors larger than .37 kW as three phase units.

.2 Provide motors .37 kW and smaller as single phase, 115 V units.

.3 Provide three-phase motor starter with three overload protection elements complete with single phase protection and auxiliary contacts for interlocks.

.4 Provide modular grouped assembly motor control centres for three-phase motor starters. These motor control centres include:

  .1 Standardized central wiring extended to terminal strips in control terminal section.

  .2 Copper bussing.

  .3 Combination magnetic starters, minimum size 1.

  .4 10-15% spare spaces.

  .5 Adjustable time delay relays for start-up on motors 5 kW and larger where this feature is not available through building automation system.

.6 Individual control transformers in each starter cell.

.7 Auxiliary contacts for interlocking controls.

.5 Provide manual motor protection switches for all non-thermally protected single phase motors.

.6 Provide control relays in MCC control terminal section for automated control of single phase motors.

.7 Coordinate motor sequential starting with building automation or controls.

4.2.7 Variable Frequency Drives

.1 Provide drives complete with harmonic distortion line filters which limit total harmonic current distortion to less than 15% to meet requirement of IEEE Standard 519 where the point of common coupling is considered to be the drive terminals.

.2 Use pulse width modulated technology drives, and minimum 12 step wave form.

.3 Provide output dvldt filter to suit motor type and cable length.

.4 Select drives with proven maintenance capabilities.

4.2.8 Feeders

.1 Size feeders for a maximum 2% voltage drop from main distribution to branch circuit panelboard under full load requirements.

.2 Use copper conductors for feeders or aluminium alloy conductors for feeders larger than No. 6 AWG.

.3 Provide full capacity neutral conductors.

4.2.9 Power Factor

.1 Correct power factor to at least 95% where normal loading yields power factor below 90%.

.2 Provide power factor corrections to individual motors 10 kW and larger or groups of motors totaling 50 kW or larger.

.3 Locate capacitors close to motor load, usually downstream of starters.

.4 Where switchable capacitor banks are used, take the following precautions:

  .1 First in, first out switching.

  .2 Provide time delay between switch steps.

  .3 Prevent over correcting and cycling.

  .4 Conduct harmonic analysis and, where necessary, provide harmonic detuning.

4.2.10 Harmonic Distortion and Noise

.1 Identify non-linear loads, including UPS, computers, rectifiers, variable frequency drives, and electronic ballasts, and consider their effects on power distribution system.

.2 Provide harmonic filtration, either with the equipment or separately, to limit total harmonic distortion from each piece of equipment to less than 15%.

.3 Provide transient protection and harmonic filtering in power supply to Data and Communication systems and critical laboratory equipment.

.4 Provide transformer isolation between large harmonic generating loads and the balance of distribution system.

.5 Consider using K-rated transformers when excessive non-linear loads are anticipated.

.6 Use separate neutrals or increase size of neutral of branch circuits where necessary.

4.2.11 Equipment Rooms

.1 Locate panelboards and system cabinets in electrical rooms or equipment closets rather than on public/patient corridor walls.

.2 Locate equipment rooms away from acoustically-sensitive or electromagnetically-sensitive areas.

.3 Provide clear access to equipment rooms at floor level or by means of full stair with hoisting provisions.

.4 Stack electrical rooms and closets vertically in multi-story facilities to facilitate distribution.

4.2.12 Isolated Power Supply

.1 Do not use Isolated Power Supply in new construction.

4.3 Emergency Power Generation and Distribution

4.3.1 General

.1 Provide independent, self-contained emergency power generation in accordance with CAN/CSA C282, Emergency Electrical Power Supply for Buildings and the IEEE Orange Book, Recommended Practice for Energy and Standby Power.

.2 Comply with CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems (3.2.2), with respect to emergency generation.

.3 Provide emergency power to essential loads as outlined in CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

.4 Criteria for generator installation:

  .1 Dedicated indoor, climate-controlled, fire-rated room. Locate generator room away from noise-sensitive areas and at grade level (to facilitate access).

  .2 Exclude unrelated electrical and mechanical equipment from generator room.

  .3 Provide vibration isolation for generator control panel or remote mount from generator set skid.

  .4 Locate transfer equipment and main emergency distribution in close proximity to (but not within) emergency generator room.

  .5 Where feasible, provide wired glass view between switchgear and generator room.

  .6 Skin tight, weatherproof enclosures are NOT acceptable. In certain instances, walk-in enclosures may be considered upon review and approval of the Minister.

4.3.2 Generator Sizing

.1 Size emergency generator for minimum 50% demand loading during regular testing.

.2 Size generator for peak demand load (plus identified expansion, if applicable) with 20% spare.

.3 Size generator to carry the load of one elevator in addition to fire fighters' designated elevator.

4.3.3 Transfer Equipment

.1 Provide drawout type automatic transfer switch complete with bypass isolation feature to allow servicing without the interruption of power.

.2 Drawout air circuit breaker transfer schemes are acceptable in large emergency power systems. Include interlocks.

.3 Provide time delay or in-phase monitoring in transfer scheme to prevent motor damage upon transfer to utility power.

.4 Provide time delay between start-up of each motor over 5 kW on emergency power after transfer to emergency generator, starting largest motor first.

4.3.4 Isolation of Emergency Power Generation and Distribution

.1 Where two or more generator sets are used, provide independent distribution systems with provisions to tie highest priority loads on to one generator in the event of one generator failing. Provide each generator with its own day tank and cooling equipment.

.2 Provide fire rated enclosure for wiring between generator control and transfer equipment.

.3 Separate multiple generators with barriers.

.4 Provide fire rating, using rated cables or enclosures, for emergency power feeders.

4.3.5 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 load or groups of loads in a common area (e.g. laboratories) in preference to a centralized UPS system.

4.3.6 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 Elevator cab lights.

.8 Operating room surgical lights.

.9 Gas shut off solenoid valves.

.2 Provide heavy duty lead-acid batteries. Provide maintenance-free, sealed batteries where discharge of hydrogen is not acceptable.

.3 Maintain battery operating ambient temperature above 20°C.

.4 Provide battery chargers with bulkcharge, overcharge protection and floatcharge features.

4.3.7 Special Considerations

.1 Make provisions for connection to load bank to facilitate annual full load testing; size only for additional required load.

.2 Provide engine with circulating type coolant fluid heater to maintain optimum engine starting temperature.

.3 Classify emergency loads as:

.1 Life support

.2 Life safety

.3 Communications

.4 Patient comfort and prevention of property losses.

.4 Identify load classifications as:

.1 Vital

.2 Delayed Vital

.3 Optional

.5 Acoustics Consideration

.1 Refer to Section 5.0 - Acoustics.

.2 Provide hospital grade exhaust silencers.

.3 Mount generator set on combination steel spring and neoprene vibration isolation.

4.4 Lighting

4.4.1 General

.1 Design lighting system to accommodate a wide range of diversified and often critical tasks while, at the same time, creating a comfortable environment for staff and patients.

.2 Lighting levels to CAN/CSA Z317.5, Illumination Systems in Health Care Facilities and IES RP-29, Lighting for Hospitals and Health Care Facilities.

.3 Design to maximize the energy efficiency of lighting systems.

.4 Design lighting system to facilitate and minimize required maintenance through:

.1 Choice of long-life lamps (10,000 - 20,000 h lamp life)

.2 Choice of lamps and luminaires to minimize different types.

.3 Choice of easy to maintain luminaires.

.4 Choice of accessible luminaire components.

.5 Use efficient optical systems designed for the application, e.g. compact fluorescent luminaires with optical system specifically for the lamp used as opposed to an incandescent luminaire retrofit.

4.4.2 Interior Lighting

.1 Lighting sources for interior spaces:

.1 Limit use of HID sources to indirect lighting systems and high mounting heights.

.2 Generally, use 1220 mm (imperial) fluorescent, F32T8, lamps. Do not use "U" lamps.

.3 Use fluorescent lamps with same colour temperature and colour rendering index in all patient care areas.

.4 Use compact fluorescent luminaires where the 1220 mm linear fluorescent source is not feasible.

.5 Use incandescent sources only in the following applications:

.1 Low ambient lighting.

.2 Where dimming control is required.

.3 For accent or display functions.

.2 Provide intermediate supports on diffusers larger than 1220 x 610 mm.

.3 Use diffuser with minimum 3.3 mm thickness in metal frame for flat lens larger than 1220 x 305 mm.

.4 Do not use styrene material diffusers.

.5 Provide with design report, a schedule, describing for each typical area, luminaire, lighting source, load (W/m^2), and design lighting levels. Upon project completion add measured levels to the table.

4.4.3 Ballasts

.1 Use energy efficient electronic fluorescent ballasts.

.2 Select electronic ballasts with total harmonic distortion current below 12%.

.3 Use high power factor ballasts (including compact fluorescent) with minimum power factor of .95.

.4 Use potted or encapsulated HID ballasts for noise reduction.

.5 For acoustical and infrared interference considerations, refer to the Acoustical Section.

4.4.4 Daylighting

.1 Use daylighting wherever feasible and detail in design development report.

.2 Provide outline of how daylighting is to be integrated into the facility, of automatic controls, and of glare control.

.3 Use photoelectric cell and time clock controls on perimeter lighting where the advantage of daylighting can be taken.

4.4.5 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.

.4 Dimming control:

  .1 For incandescent, provide adequately-rated dimming units with harmonic and radio frequency interference filters and suitable for quartz halogen lamps.

  .2 Use electronic ballasts for fluorescent dimming.

  .3 Do not dim HID sources.

.5 Provide local controls, as a minimum requirement, in individual rooms where lighting is not required on a continuous basis. Where feasible, use occupancy sensors to control lighting in these rooms.

.6 Use low voltage switching for all 347V branch circuits. Do not locate relays in ceiling space.

.7 Limit use of low voltage switching to lighting system in large areas that would require central control or multiple switching. Where it is justified, however, a low voltage switching system may be considered for energy management.

.8 Do not use breaker switching.

4.4.6 Exterior Lighting

.1 Design exterior lighting levels to reflect the 24 h operation of the facility.

.2 Use low maintenance energy-efficient sources, e.g. high pressure sodium.

.3 Employ ultraviolet stable polycarbonate or tempered glass lenses.

.4 Select luminaire types and placement to prevent offensive light spill onto neighbouring properties. Cutoff luminaires are preferred.

4.4.7 Emergency Lighting

.1 Use emergency lighting sources that restrike immediately upon energization.

.2 Provide self-contained emergency lighting battery packs in major electrical rooms and generator room.

4.4.8 Exit Luminaries

.1 Use high brightness LED type exit lights.

4.5 Wiring Materials and Methods

4.5.1 General

.1 Indicate in design documents requirements of various patient care areas in accordance with:

- .1 Canadian Electrical Code, Part 1, Section 24, Patient Care Areas.
- .2 CSA - Z32, *Electrical Safety and Essential Electrical Systems in Health Care Facilities*

.2 Provide a comprehensive colour coding and identification system for all electrical systems.

4.5.2 Conduit and Raceways

.1 Provide underground service entrance in duct bank with steel reinforced concrete encased PVC or FRE duct. Provide transition at foundation wall, manholes etc. with rigid steel conduit. Provide one spare duct.

.2 Provide wiring in conduit. In wood frame construction, use conduit to junction boxes in ceiling space and BX or flexible conduit to wall outlets.

.3 AC 90 (BX) cable is permitted for:

- .1 luminaire drops in ceiling spaces
- .2 wiring between outlets in stud walls

.4 Provide sufficient length of flexible drop to luminaries to enable unit relocation 2 m in any direction. Drops are to occur from junction box on structure to each luminaire.

.5 Record exact routing of conduit runs in floor slabs. Do not loop through to down stream outlets.

.6 Install multiple conduit runs on racks. Provide 25% spare capacity on rack for future additions.

.7 Provide 2 h fire protection through choice of cable (mineral insulated) or through routing of conduit in fire-rated enclosures for emergency power feeders, including services to fire pumps, pressurization fans, and smoke exhaust equipment.

.8 Use steel or aluminum conduit (whichever applies) in proximity of medical equipment susceptible to electromagnetic interference and for cabling associated with systems sensitive to radio frequency interference.

4.5.3 Conductors

.1 Use copper conductors with RW90 X-link, THHN insulation permitted for branch circuits only.

.2 Size branch circuit conductors to avoid excessive voltage drop to criteria as outlined in CSA Z32 (5.4.1). Indicate conductor sizing in construction documents.

4.5.4 Wiring Devices and Equipment

.1 Use hospital grade receptacles for patient care receptacles and specification grade receptacles otherwise.

.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 Control the loading of car block heater outlets by sharing a circuit between two stalls. Provide thermostatic and time clock control, using the facility mechanical control system.

4.5.5 Provisions for Computer Based Equipment

.1 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 to determine the likely incidence of these disturbances.

.2 Identify electronic equipment and systems likely to be affected by these disturbances and the extent of protection necessary for normal operation.

.3 Provide electrical protection and line power conditioning for affected equipment as follows:

  .1 Surge protectors - electronic or varistor surge arrestors for equipment affected by transients.

  .2 Isolation transformers - electrostatically shielded transformers for equipment affected by transients and noise.

.3 Regulated power supplies - for equipment and systems affected by transients, noise, voltage sags and surges.

.4 Electronic filters - for equipment affected by harmonics and noise.

.5 Uninterruptible power supplies - for equipment requiring continuity of service.

.4 Provide surge suppression in the following manners:

.1 If necessary, install surge suppression on utility incoming mains (typically in rural locations).

.2 For areas containing a large group of electrically delicate instruments, provide surge protection on panelboards serving the area.

.3 Provide individual pieces of sensitive equipment, not otherwise protected, with local surge suppression module (computer power bar or wall plug-in style).

.4 Coordinate surge suppression devices within the same power distribution system.

.5 Computer Grade Circuits

.1 Provide computer grade circuits consisting of breakers, raceways, wire, outlets and receptacles designed to provide power to electronic equipment.

.2 Supply only electronic equipment with these circuits. Do not use these circuits to supply convenience receptacles or mechanical equipment.

.3 Review options for circuiting with user. (Normal practice: 2-4 outlets per circuit.)

.4 Do not use common neutrals. Provide a separate, isolated ground for each circuit.

.5 Provide isolated ground receptacles coloured orange and label "computer only".

.6 With sufficient circuits at one location to justify its installation, provide a separate panelboard fed by an electrostatically shielded transformer.

4.5.6 Grounding

.1 Review requirements for an isolated grounding system with User. As a guideline use the following:

  .1 Separate ground conductor from each computer grade outlet to the branch circuit panelboard.

  .2 Isolated ground buss in each branch circuit panelboard supplying electronic loads.

  .3 Bond branch circuit panelboard ground busses to the equipment ground within the panel unless fed directly from a transformer where the ground shall be to the transformer neutral ground point.

  .4 Size all grounding conductors to carry the fault current necessary to trip the overcurrent devices protecting the loads, panelboards and feeders associated with the grounding system.

.2 Use permanent hydraulic compression fittings for all underground terminations and splices in the grounding system.

.3 Provide ground grid test points for future testing requirements.

4.6 Fire Alarm System

4.6.1 General

.1 Install system to CAN/ULC-S524, Installation of Fire Alarm System.

.2 Verify system to CAN/ULC-S537, Verification of Fire Alarm System.

.3 Review design of fire alarm system with local authority.

.4 Select system vendors with local support. Do not use proprietary equipment.

4.6.2 System

.1 Design the most effective fire alarm system to meet the facility's requirements, i.e. the simplest system.

.2 Use of hard wired equipment is encouraged in rural locations where response by factory service personnel is difficult and expensive.

.3 Use addressable technology for large systems and those with complex annunciation requirements.

.4 Provide fire alarm as a stand alone system, independent of building control or security systems.

.5 Provide annunciation at each nursing station with summary information for entire facility as well as the required patient room information.

.6 Coordinate fire alarm zoning with sprinkler system and illustrate zoning graphically.

.7 Annunciate emergency generator - run and trouble modes.

.8 Provide 10% spare fire alarm and detection zones unless the expansion requirements are identified.

.9 Provide details of the coordinated smoke control plan in design report.

.10 Provide fire rated wiring installation for system communications trunks. Wiring to individual zone or device will not require fire rating.

.11 Provide magnetic door hold open devices on circulation doors where smoke or fire separations are required to alleviate need for door "stops" by facility staff.

.12 Provide wiring diagram on inside of each fire alarm panel door. Clearly identify wiring at all panels and junction boxes identifying zones.

4.7 Nurse Call System

4.7.1 General

.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 Do not use proprietary equipment.

4.7.2 System

.1 Provide wiring in conduit or in accessible trays 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.

4.8 Security Systems

4.8.1 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 Provide emergency power supply to security systems and battery backup where warranted.

.3 Review security risks with administration and determine needs for each individual project.

4.8.2 Security System Application

.1 Provide CCTV coverage only as necessary for:

  .1 Access control.

  .2 Monitor of secure areas.

.2 Provide CCTV system with point to point service as opposed to video switching.

.3 Do not use CCTV pan/tilt/zoom cameras, video motion detectors, nor time lapse recording equipment.

.4 Provide staff register and card access control only for facilities with more than 50 staff and only when the need is confirmed.

.5 Provide intrusion alarm in pharmacy and medical records.

.6 Provide perimeter security to detect unauthorized exit or entry.

  .1 Perimeter door monitor system is adequate in most applications.

  .2 Provide electromagnetic locks where confinement is required. Provide interlock with fire alarm System.

4.9 Data and Communication Systems

4.9.1 General

.1 Provide terminal closets and equipment rooms to accommodate data and communications equipment in accordance with CAN/CSA T529, Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.

4.9.2 Data Cabling

.1 Provide data cabling required to meet the users immediate needs as part of the building construction contract.

.2 Provide empty conduit to future work stations. Provide data raceways physically separated from power and other low voltage systems.

.3 Provide patch panels and jacks for a complete Data Cable System.

.4 The Standard for Voice and Data Wiring from Alberta Infrastructure may be used as reference.

4.9.3 Telephone Cabling

.1 Provide telephone system cables and outlets as part of the building construction contract.

.2 The standard for Voice and Data Wiring from Alberta Infrastructure may be used as reference.

.3 The telephone system may be purchased through the construction contract or separately by the Owner.

4.9.4 Public Address System

.1 Provide a public address system to meet the needs of the facility.

.2 Provide zoning to suit facility function, i.e. separate zones in wings of multicare facility.

4.9.5 RFTV System

.1 Provide design for RFTV distribution system for signal strength 6 dBmV to 14 dBmV at each outlet.

.2 Connect cable TV service to RFTV distribution system. If cable TV is not available at present, ensure that it can be connected when service is available.

.3 Provide outlets at each patient bed and in lounge areas.

4.9.6 Intercom Systems

.1 Provide building intercom requirements 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

End of Electrical Section

Section Contents

5.1 References

.1 Refer to the guidelines and standards in the following as a minimum:

.1	ASHRAE	2007 Applications Handbook (SI) Chapter 47 Sound and Vibration Control
.2	AISC/CISC	1997 Steel Design Guide Series 11, Floor Vibrations Due to Human Activity

5.2 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.

5.3 Definitions

.1 The following are definitions of common parameters used to describe the acoustic characteristics of building environments, materials and assemblies:

- Sound Transmission Class (STC): a laboratory measured rating that describes 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.
- Ceiling Attenuation Class (CAC): a laboratory measured rating that describes the sound transmission loss properties of a suspended ceiling system when installed in rooms with a common plenum.
- Noise Reduction Coefficient (NRC): a rating that describes the sound absorptive properties of architectural finishes and building materials. NRC values range from 0.01 (negligible absorption) to 0.99 (very high absorption). Manufacturers of ceiling boards, wall panels and various sound absorptive finishes will list the NRC rating in their product technical information.
- Room Criteria (RC) -a rating for HVAC system noise used as a design goal and for qualifying field installations.

5.4 Architectural

5.4.1 Sound Isolation

.1 Develop the floor plans so that patient rooms and other noise sensitive spaces are not located next to high noise areas (e.g. laundry room, mechanical room). Consider both horizontal and vertical separation of acoustically conflicting occupancies.

.2 Isolate the main circulation routes from patient areas. Do not locate corridors above patient rooms or other noise sensitive spaces.

.3 Use the following table as a general guide for selecting the minimum STC of walls for various room types. Special circumstances may require higher STC requirements than indicated. Large projects with many conflicting adjacent occupancies require an acoustic consultant to define the STC and associated construction requirements.

Table 5.4-1

Wall STC Requirements For Various Room Types

ROOM	STC
Administrative Offices	40
Patient Interview/Treatment/Doctors Offices	45
Senior Administrative Offices/Pastoral	45
Patient Rooms	45
Quiet Counseling Rooms	50
Operating Rooms	50
Meeting/Seminar	50
Intensive Care	50
Labour/Delivery	55
Mechanical Rooms, Kitchens, Laundry	55+

.4 Use full-height wall construction or drywall ceilings in rooms that require STC 50 or greater.

.5 Full height walls or drywall ceilings are also preferred for STC 45 construction. 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.

.6 For administrative offices where speech privacy is less critical, walls may be terminated at the suspended ceiling. In these situations the lay-in ceiling board must have a minimum CAC rating of 35 and a minimum NRC of 0.55.

.7 Prepare large-scale details showing acoustic seals at junctions of building components (eg. interior partitions to building envelope). The objective is to provide a continuous, airtight seal at all junctions.

.8 Provide a complete, airtight sound seal around all piping, duct and conduit that penetrates through partitions and floors. Sealants must comply with the fire separation and waterproofing requirements.

.9 Use massive wall construction (eg. 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.

.10 Critically evaluate the need for a floating concrete floor in mechanical rooms. A floating floor is rarely required for sound isolation except when spaces with low background noise criteria (eg. auditoriums, patient rooms) are located directly below mechanical areas with very loud equipment (e.g. chillers; large open-ended fan units). 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.

.11 Provide a structurally separate, double wall construction between washrooms and occupied spaces to minimize the transfer of plumbing noises.

.12 Locate emergency generators at or below grade level or on an isolated slab to avoid structural vibration problems, wherever possible.

.13 Locate laundry facilities at or below grade to avoid structural vibration problems.

.14 Locate Operating Rooms or Laboratories with sensitive equipment as far away as possible from heavily used corridors, mechanical rooms or other areas that may generate high levels of vibration. At grade locations are preferable to minimize the impact of footfall induced vibration.

5.4.2 Reverberation and Noise Control

.1 Provide a sound absorptive ceiling finish in nurse stations, offices, corridors, cafeterias, large public areas and especially in areas that require voice paging. Ceiling boards or other ceiling finishes should have a minimum NRC of 0.55.

.2 Provide a highly sound absorptive ceiling for open offices where privacy is important (eg. home care, large admitting areas). Ceiling boards or other ceiling finishes should have a minimum NRC of 0.75.

.3 Consider additional sound absorbing wall finishes for nurse stations, recreation rooms and other patient activity areas, especially within continuing care facilities.

.4 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.

5.4.3 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 (Table 3.2-1 to 3.2-6).

5.5 Mechanical Noise and Vibration

5.5.1 Background Noise

.1 Refer to Tables 3.2.-1 to 3.2-6, Mechanical System Design Parameters, within the Mechanical Section 3.0 for acceptable HVAC noise levels.

.2 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.

5.5.2 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 placing rooftop equipment above noise sensitive areas.

.3 Provide details describing acoustic treatment, duct configuration and roof penetrations for any rooftop installations.

.4 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.

.5 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.

.6 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.

.7 Use reactive (packless) or Mylar lined silencers for all clean room applications.

.8 Select diffusers/air outlets so that the combined noise from all diffusers in a room comply with the design criterion. NC noise ratings for diffusers typically need to be specified 6 – 10 points lower than the RC(N) design goal.

.9 Locate balancing dampers at least 2 m away from diffusers to avoid turbulence noise.

.10 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.

.11 Provide smooth air flow conditions near the 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.

5.5.3. 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 a gap around the pipe, and seal with a resilient 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 Divide water supply lines at the riser with each room fed separately. Tee takeoffs serving back-to-back fixtures in separate washrooms are undesirable.

.6 Install water hammer arrester adjacent to any quick-acting solenoid valves.

.7 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.

5.5.4 Vibration Isolation

.1 Use the current ASHRAE Applications Handbook as a general guide for selecting vibration isolators and concrete inertia bases.

.2 Use flexible connectors on pumps requiring vibration isolation from related piping. Twin sphere neoprene rubber flex connectors are the preferred type.

.3 Use flexible connections between fan enclosures and all related ductwork. Provide vibration isolators for all vibrating pipes and ducts in mechanical chases and walls common to noise sensitive areas.

.4 For equipment located on a lightweight roof, 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.

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

5.5.5 Community Noise (Mechanical)

.1 Silence and strategically locate mechanical equipment (eg. cooling towers, exhaust fans, etc.) so as not to exceed the minimum, averaged hourly ambient noise level in the community. This requirement may be more stringent than local municipal noise by-laws.

.2 Silence the outside air intake and discharge openings, and the engine exhaust for emergency generators. 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, but should not exceed 70 dB(A).

.3 Ensure that mechanical noise level in outdoor patient lounge areas and public sidewalks does not exceed 55 dB(A).

5.6 Electrical

5.6.1 General

.1 Do not locate electrical or communication outlets back-to-back in walls. Outlets should be separated by at least one stud space.

.2 Specify light ballasts for all occupied areas with the lowest noise rating available.

5.6.2 Transformer Noise

.1 Avoid locating transformers within ceiling spaces above noise sensitive rooms.

.2 Indoor transformers shall be epoxy encapsulated, dry type wherever feasible.

.3 Provide vibration isolators for transformers located near occupied spaces.

.4 Use flexible conduit to make the connection to the transformer.

End of Acoustics Section

Section Contents

6.1 References

.1 Transportation Association of Canada

- Geometric Design Guide for Canadian Roads
- Manual of Uniform Traffic Control Devices for Canada

.2 Alberta Environmental Protection

- Standards & Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
- Stormwater Management Guidelines
- Alberta Tier 1 Soil and Groundwater Remediation Guidelines.

.3 Alberta Fire Code, by the Alberta Fire Prevention Council

4 Local municipal standards, guidelines and bylaws.

.5 Canadian Standards Association (CSA)

.6 Flood Risk Management Guidelines for Location of New Facilities Funded by Alberta Infrastructure, by Alberta Infrastructure & Transportation

6.2 Site Selection

Prior to acquiring a property:

.1 Confirm site is suitable for proposed development as per the attached Table A in Appendix B. For a copy of the "Flood Risk Management Guidelines for Location of New Facilities Funded by Alberta Infrastructure", contact Alberta Infrastructure.

.2 Complete or review existing Environmental Site Assessments (ESA) to determine environmental liability of site.

.3 Consult with authority having jurisdiction to determine if there are any archeological restrictions for this site.

.4 Confirm that site and development are located at an acceptable distance from high voltage power lines.

.5 Determine if direct or indirect access to a highway is required and if adequate road access is available to the site.

.6 Determine if a Traffic Impact Assessment (TIA) is required and if Public Transportation is available and adequate.

.7 Proposed development must be in compliance with planning/zoning requirements. Confirm need for stormwater management on site.

.8 Confirm that site topography is suitable for the project.

.9 Confirm availability of offsite services such as power, water, sanitary, storm and natural gas.

.10 Fill out the Transportation and Site Requirement checklist in Appendix C.

6.3 Site Survey Plan and Site Plan

.1 Obtain site survey plan from the regional health authority, or prepare a site survey plan if required.

.2 From the information on the site survey plan, include these items on the site plan in the contract documents:

  .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 elevation, and

  .5 All utilities including power and telephone.

6.4 Site Access

.1 Design the location of site access in consideration to driveways and intersections adjacent to and opposite the site.

6.5 Site Signs

.1 Determine the locations of all signs with due consideration to vehicular sight lines.

6.6 Site Grading

.1 Grade site to a minimum of 2% to drain surface water away from buildings.

.2 Address potential ponding and icing problems associated with downspouts. Provide splash pads under downspouts.

6.7 Roads, Walks and Parking

.1 Design driveways and off-site walks to meet local municipal standards.

.2 Maintain minimum grade of 1% for concrete and asphalt surfaces.

.3 Maintain minimum grade of 2% for graveled surfaces.

.4 Provide roadways with a 2% crown or crossfall. Provide sidewalks with 2% crossfall.

.5 Provide barrier free access walkways, entrances and parking spaces, along with appropriate surfaces that do not restrict the mobility of physically disabled people.

.6 Lay out parking lots and parking appurtenances to facilitate snow removal and to prevent damage by snow moving equipment.

.7 Design for snow dumping areas to reduce snow removal requirements.

.8 Do not obstruct parking lot user access to electrical plug-ins.

.9 Provide a pavement structure cross-section for parking and roadways.

.10 For parking lots and roads where heavy trucks are anticipated, design pavement structure based on traffic projections and the California Bearing Ratio.

.11 Provide protective concrete sealers on concrete walks located in prominent areas where de-icing agents will be used.

.12 Provide a concrete pad for garbage bin and recycling bin, and locate bins for ease of access and safety.

.13 In order to address a potential safety concern, efforts should be made to separate main vehicular traffic from main pedestrian traffic.

6.8 Utilities

.1 Provide 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 system, advise the regional health authority and confirm that the existing on-site system can accommodate the additional loads.

.4 Early in the design, confirm with municipalities about any restrictions on stormwater discharge to their stormwater drainage system.

.5 Contact the local municipality to confirm the municipal water pressure available. Determine whether or not an on-site boosting is required for a fire sprinkler system.

.6 On large sites locate utilities in utility corridors keeping in mind any potential for future development.

6.9 Tanks for Petroleum Products

.1 Comply with the requirements of the *Alberta Fire Code*, Alberta Fire Prevention Council

.2 Verify the need for fuel tanks. Where the need is confirmed, provide above ground tanks, wherever feasible.

.3 Consider using day tanks for emergency generators.

.4 Clean up contaminated sites according to Alberta Tier 1 Soil and Groundwater Remediation Guidelines, published by Alberta Environmental Protection.

End of Site Services Section

Section Contents

7.1 References

.1 Alberta Agriculture and Food,

  .1 Alberta Yards & Gardens: What to Grow;

  .2 Backyard Pest Management;

  .3 Pruning in Alberta.

.2 Alberta Infrastructure,

  .1 Manual for Maintenance of Grounds.

.3 Local municipality landscape requirements.

7.2 Exterior Landscape Development

.1 Include municipal boulevards in the landscape design and construction.

.2 Retain as many trees on site as feasible; protect trees and their roots by hoarding. Maintain existing grades to the drip lines of trees, or provide tree wells to compensate for change in grades. Remove existing trees from site that are considered hazardous to property and public safety.

.3 Grade topsoil to drain surface water away from buildings and walkways. Provide positive drainage within tree pits having a tree grate covering.

.4 Design with consideration to maintenance requirements of selected plant and grass varieties, availability of water for maintenance, and soil conditions for plant and grass growth.

.5 In grass areas, provide enough distance between trees and other features to accommodate cost effective mowing equipment. Avoid sharp angles and tight spaces that would make lawn maintenance difficult and unsafe.

.6 Space all plants at no less than 60 per cent of mature spread.

.7 Keep tops of berms free of trees, shrubs and plant beds.

.8 Design slopes, including grassed berms, at less than 3:1 and free from hazardous maintenance requirements.

.9 Design all planters to have minimum planting width of 1.5 m, with minimum 300 mm depth of gravel for drainage and minimum of 600 mm depth of soil mix. Provide weeping holes at planter bases.

.10 Consider the use of plant varieties that are indigenous to the locality.

.11 Subject to budget considerations, sod areas adjacent to the building, areas of high pedestrian traffic and difficult seed establishment areas. Use appropriate grass seed mixtures on other areas.

.12 Provide adequate maintenance in contract for all plants and grass areas until established.

7.3 Planting Near Buildings and Utilities

.1 Provide mulches for dry areas under building overhangs. Do not design these areas for plants.

.2 Locate shrubs at least 750 mm from foundations and edges of sidewalks.

.3 Select small trees or high shrubs with a mature height of 3 m, for areas within 15 m of any overhead utility.

.4 Do not locate trees within the immediate vicinity of underground utility lines.

.5 Do not obscure exterior lighting and building signs with plants.

7.4 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 Provide exterior hose bibs on buildings for every 50 m along building walls.

.3 In municipalities where sewage treatment charges are based on water consumption, provide separate meter if cost efficient.

.4 Where practical, contain all lawn irrigation systems and equipment within the property lines of the project.

.5 Provide pipe sleeves for irrigation systems under roadways and sidewalks. Ensure complete coverage of landscape areas. Design irrigation systems to allow for emptying water from distribution pipes.

.6 Incorporate rain sensors in irrigation systems to prevent overwatering.

.7 Specify low water use systems where appropriate.

.8 Consult with regional health authority before considering irrigation systems for landscape areas other than those adjacent to facilities.

7.5 Interior Landscape Development

.1 Provide gravel for drainage in all planting areas and planters.

.2 In atria, ensure access for maintenance requirements.

.3 Provide adequate lighting conditions to meet growing requirements of selected interior plants.

.4 Provide interior hose bibs every 15 m along building walls in atria.

.5 Use high quality artificial plants in buildings where maintenance of live tropical plants is difficult or poor lighting conditions exist.

7.6 Environmental and Conservation Considerations

.1 Design to minimize maintenance requirements. Consider 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 Minimize the requirement for irrigation through selection and placement of plant material.

.4 Minimize grassed areas. Use low maintenance ground cover plantings, including low maintenance grass mixes, where appropriate.

.5 Use plant material to reduce heating and cooling requirements for buildings.

.6 Use plant material to control snow drifting.

End of Landscape Development

Section Contents

8.1 Site Considerations

.1 Prior to purchasing a property, hire an experienced environmental consultant to complete a Phase I Environmental Site Assessment (ESA), to determine if any site contamination is present. Consult with Alberta Infrastructure, Technical Services Branch, Site and Environmental Services Section.

.2 If the property contains buildings refer to building considerations below.

8.2 Building Considerations

.1 For existing buildings on the property a hazardous materials audit should occur whenever a building will be renovated or demolished, and when suspect materials are in poor condition. The area of the audit should reflect the project scope. The audit can be conducted by an experienced environmental consultant or by Alberta Infrastructure, Technical Services Branch staff.

.2 A hazardous materials audit should include identification, recommendations, and a removal/disposal cost estimate for the following:

  .1 Asbestos containing building materials.

  .2 Chlorofluorocarbons (CFC's) in mechanical equipment used for cooling.

  .3 Chemicals such as water treatment solutions, glycol, cleaning solutions and laboratory chemicals.

  .4 Lead sheeting used in roofing, x-ray rooms and for acoustical privacy.

  .5 Lead used in batteries and paint.

  .6 Mercury used in switches, thermostats and thermometers.

  .7 Polychlorinated Biphenyl's (PCB's) containing oil, used in light fixture ballasts and electrical transformers.

  .8 Radioactive components such as those found in smoke detectors.

  .9 Mould growing on building materials.

.3 All identified hazardous materials that will be disturbed in a renovation/demolition are usually completely removed. Hazardous materials removal/disposal is usually the first component of work in a renovation/demolition. Contact the technical staff in the Building Environment Unit, Alberta Infrastructure, Building Sciences Section if in doubt.

.4 For a list of typical asbestos containing materials refer to Alberta Infrastructure - Technical Bulletin No. 20A (latest edition) available from Alberta Infrastructure - Technical Services Branch.

.5 When there is a concern about whether an existing building material is asbestos or mould containing, it should be considered as potentially harmful, and safe work procedures should be used, unless testing confirms the material to be non-asbestos or non-mould containing. Consult with Alberta Infrastructure technical staff for proper safe work procedures and testing laboratories.

.6 When selecting materials for a new building or an existing building renovation, asbestos containing materials should be avoided. Typical asbestos products manufactured today are considered non-friable materials (i.e. board and pipe products only). Also, mould resistant products are becoming more readily available.

.7 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.

.8 Construction dust control and clean-up procedures should be implemented to assure building occupants are not overexposed to dust. Controls would include dust barriers, negative air pressure within the construction area, and sealing mechanical ventilation ductwork. Clean-up procedures would include HEPA vacuuming, wet wiping techniques and ductwork cleaning.

End of Environmental Section

Section Contents

9.0 Sustainability

9.1 Reference

.1 *LEED Green Building Rating System for New Construction and Major Renovations*, Canada Green Building Council, 2004.

.2 *Commercial Building Incentive Program Technical Guide,* Natural Resources Canada, Ottawa, 2000.

.3 *Green Guide for Healthcare v2.2,* January, 2007.

9.2 General

.1 All new buildings and major renovations shall be certified to a minimum LEED Silver rating. In the absence of sustainable opportunities, where the mandatory credits can't be achieved, or where sufficient optional credits can't be economically achieved, projects with a capital budget less than $2.5 million may be exempted at the discretion of the project team, however, integrated and sustainable design practices should be incorporated.

.2 LEED Green Building Rating System is a voluntary, consensus-based standard for developing healthy and high performance buildings with reduced environmental impacts. The rating system evaluates “greenness” from a whole-building and whole-life perspective in five categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, and Indoor Environmental Quality. LEED promotes integrated and sustainable design practices.

.3 “Integrated design” is a collaborative process between the client group including occupants, operating staff and a multi-disciplinary design team, focusing on the design, construction, operation, and occupancy of a building over its complete life cycle. Functional, environmental, and economic goals are defined and realized by proceeding from whole building system strategies, through increasing levels of specificity, to achieve more optimally integrated solutions.

.4 “Sustainable design” is an integrated approach to building design, construction and operation that focuses on the efficient use and choice of resources, building systems and materials in such a way as to be economical while not compromising the health of the environment or the associated health and well being of the building’s occupants, builders, the general public, or future generations.

.5 All projects should incorporate, as much as possible, sustainable design concepts using the integrated design process. Studies indicate that that the impact of greater occupant satisfaction and comfort resulting from increased individual control over the indoor environment: temperature, air movement, noise, lighting, exterior views and daylight, improves productivity, wellness and retention.

.6 Major renovations must incorporate substantial revisions to building envelope, heating, ventilation and air conditioning, and lighting before LEED silver rating is required.

.7 Should manufactured wood products be used, LEED Canada NC, Version 1, Materials and Resources Credit 7 makes specific reference to wood products certification. The use of forest, wood or engineered wood products locally manufactured under all recognized certification systems is encouraged. For reference purposes and without endorsement, the forest and wood product certification systems available in Alberta include Forest Stewardship Council (FSC), Canadian Standards Association (CSA), Sustainable Forestry Initiative (SFI), and Forest Care.

.8 The goal is to build new health facilities 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.

End of Sustainability Section

AC/H (also ACH) ......air changes per hours

ADA...........................Americans with Disabilities Act

APEGGA ....Association of Professional Engineers, Geologists and Geophysicists of Alberta

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...........................Institute of Electrical and Electronic Engineers

IES.............................see IESNA

IESNA........................Illuminating Engineering Society of North America

LAN ....local area network

LED............................light emitting diode

MCC...........................motor control centre

NC..............................noise criteria

NRC ....noise reduction coefficient (also National Research Council)

Appendix B - Excerpt from "*Flood Risk Management Guidelines for Location of New Facilities Funded by Alberta Infrastructure*"

TABLE A – FACILITY CLASSIFICATION AND PREFERRED DESIGN FLOOD ELEVATION LEVELS FOR ALBERTA INFRASTRUCTURE OWNED AND FUNDED NEW FACILITIES ς

Decreasing consequence assuming adequate warning ↓		CLASS	IMPORTANCE OF AVOIDING MAJOR DAMAGE DURING A FLOOD EMERGENCY	DESIGN FLOOD LEVEL	EXAMPLES OF FACILITIES	COMMENTS
	Lifeline facilities	1	Critical to the ability to save and avoid loss of human life.	1:1000	Legislative buildings Communication centres	Including computing centres
	Lifeline facilities	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
	Lifeline 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
	Lifeline facilities	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.
	Lifeline facilities	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	
	Other facilities	7	Important to retention of documented historical data and artifacts.	1:1000	Museums, archives, cultural centres	
	Other facilities	8	Important to provide threshold level of protection.	1:100	Offices Retail facilities Warehouse Service & maintenance	Other than those associated with facilities in the higher Design Flood Level categories
					Parking Other	See comments under Site Selection for short-term use facilities.

ς Water and Wastewater Facilities are not included in Table A. Contact Alberta Environment for guidelines, related to the location of these facilities, entitled "Standards and Guidelines for Municipal Waterworks , Wastewater and Storm Drainage Systems" published in Dec. 1997 by Alberta Environmental Protection.

Appendix C – Transportation and Site Requirement Checklist for Projects Funded by Alberta Infrastructure

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: