

## **SCHEDULE 1**

### **STATEMENT OF REQUIREMENTS**

# **LAKES DISTRICT HOSPITAL**

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**SCHEDULE 1****STATEMENT OF REQUIREMENTS****PART 1. INTERPRETATION****1.1 Definitions**

In this Schedule:

**“Ambulance Station”** means the existing ambulance station, its grounds and out-buildings

**“Authority”** means the Owner, Northern Health, and its representatives

**“Authority Clinical Representative”** refers to the individual identified by the Authority as being the clinical contact for information and approvals as may be requested by the Design-Builder. The Authority Clinical Representative may delegate any Authority Clinical Representative activities or responsibilities to another specified Authority clinical person

**“Authority IT Representative”** refers to the individual identified by the Owner as being the IT system contact for approvals and information as may be requested by the Design-Builder. The Authority IT Representative may delegate any Authority IT Representative activities or responsibilities to another specified Authority IT person

**“Authority’s Geotechnical Engineer”** means the Geotechnical Engineer hired by the Owner

**“Authority’s Quantity Surveyor”** means the Quantity Surveyor hired by the Owner

**“BC Building Code”** means the 2006 British Columbia Building Code or the version of the BC Building Code current at the time of the issuance of a building permit for the project

**“Building”** means the new hospital building and all related works, as further described in the Statement of Requirements

**“Burns Lake Hospital”** means the existing hospital, its grounds and out-buildings

**“Communication Systems”** has the meaning set out in Section 7.9 of this Schedule

**“Consultant Team”** means the Owner’s existing team of consultants which includes: DGBK Architects (Planning, Interiors and Environmental); Stantec (Mechanical); Stantec (Electrical); CWMM Consulting Engineers Ltd. (Structural); BTY Group (Quantity Surveyors); L+M Engineering Ltd.(Civil); Vertech (Elevator); Lisa Bell and Associates (Food Service Planning); GeoNorth Engineering Ltd. (Geotechnical); GeoTech Drilling Services (Testing)

**“CPTED”** means Crime Prevention Through Environmental Design

**“Equipment”** has the meaning set out in Appendix 1F of this Schedule

**“Existing Building”** means the existing hospital building at the Lakes District Hospital and Health Centre

**“Facility”** means the buildings, related structures, utility connections, landscaping and other improvements to be constructed by the Design-Builder pursuant to the Design-Build agreement

**“Facility Program”** has the meaning set out in section 2.2.2 of this Schedule

**“Indicative Design”** has the meaning set out in Section 2.2 of this Schedule

**“Information Technology (IT) Systems”** refers to the data communication network, telephony, video conferencing, clinical information systems and Vocera wireless staff communication system and all related equipment, printers, fax machines, servers, cabling and other related hardware, software and applications

**“Land”** means the lands located at 741 Centre Street, Burns Lake, British Columbia, legally described as PID 011 768 916 Lot 1, DL 5402, Range 5, Coast District Plan 3710

**“Owner”** means the Authority, Northern Health, and its representatives

**“Project”** means the design, construction, testing and commissioning of the Facility and all other works in accordance with the Design-Build Agreement

**“Program Requirements”** has the meaning set out in the Facility Program section of this Schedule

**“Residence Building”** means the existing residence building located at the Burns Lake Hospital

**“Room Data Sheets”** has the meaning set out in Section 2.2.3 of this Schedule

**“Site”** means the place where the Work is to be performed on the Land and aligns with the area indicated on the Site Plan as provided in Appendix 1E

**“Statement of Requirements”** means the specifications and requirements set out in this Schedule

**“Substantial Completion of the Building”** has the meaning as defined in the Design Build Agreement

**“Substantial Completion of the Project”** has the meaning as defined in the Design Build Agreement

**“TAB”** means testing, adjusting and balancing

## 1.2 Overview

The Statement of Requirements describes key functional requirements for the Design and Construction. They are written in the imperative form and except where otherwise expressly stated within the Statement of Requirements, all work described in or required by the Statement of Requirements will be an obligation of the Design-Builder. All things to be provided, delivered, performed or done by the Design-Builder as prescribed within the Statement of Requirements are deemed to be read and to be interpreted as “Design-Builder will”.

## 1.3 Acronym List

- AAMA – American Architectural Manufacturers Association
- AAS – Aluminum Association Standards
- AASHTO–American Association of State Highway and Transportation Officials
- ACI – American Concrete Institute
- AFUE - Annual Fuel Utilization Efficiency
- AHC – Architectural Hardware Consultant
- ANSI - American National Standards Institute
- ASCC – American Society of Concrete Contractors
- ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
- ASME - American Society of Mechanical Engineers
- ASPE - American Society of Plumbing Engineers
- ASTM - American Society for Testing and Materials
- AWCC – Association of Wall and Ceiling Contractors
- AWMAC – Architectural Woodwork Manufacturer’s Association of Canada
- AWPA – American Wood Protection Association
- BCICA - British Columbia Insulation Contractors Association
- BCLNA - British Columbia Landscape & Nursery Association
- BCSLA - British Columbia Society of Landscape Architects
- BICSI - Building Industry Consulting Service International

- BMS - Building Management System
- CaGBC – Canada Green Building Council
- CCTV – Closed Circuit Television
- CEC – Canadian Electrical Code
- CGA - Compressed Gas Association
- CGSB – Canadian General Standards Board
- CISC – The Canadian Institute of Steel Construction
- Cisca - Ceiling Interior Systems Construction Association
- CMCA – Canadian Masonry Contractors Association
- CPMA – Canadian Paint Manufacturers Association
- CPU – Central Processing Unit
- CPTED - Crime Prevention through Environmental Design
- CRTC – Canadian Radio-television and Telecommunications Commission
- CSA - Canadian Standards Association
- CSDFMA – Canadian Steel Door and Frame Manufacturers Association
- CSSBI – Canadian Sheet Steel Building Institute
- CWB – The Canadian Welding Bureau
- DDC - Direct Digital Controls
- DHI – Door and Hardware Institute
- DISS - Diameter Index Safety System
- EHR - Electronic Health Record
- ENS – Environmental Notation System
- GCA – Glazing Contractors Association of B.C.
- HAZMAT - Hazardous Materials
- HEPA - High Efficiency Particulate Air

- HVAC - Heating, Ventilating and Air-Conditioning
- IEEE - Institute of Electrical and Electronic Engineers
- IGMAC – Insulating Glass Manufacturers Association of Canada
- LDRP – Labour Delivery Recovery and Post-Partum
- MMDC – Master Municipal Construction Documents
- MPI – Master Painters Institute
- NAAMM – National Association of Architectural Metal Manufacturers
- NEMA - National Electrical Standards Association (see CSA)
- NFPA - National Fire Protection Association
- NFCA – National Floor Covering Association
- NLGA – National Lumber Grading Association
- NTSC – National Television Standards Committee
- OPSS – Ontario Provincial Standard Specification
- OS&Y - Open Stem and Yoke
- PACS - Picture Archiving and Communication System
- PBX – Private Branch Exchange
- PoE – Power Over Ethernet
- RCABC – Roofing Contractor’s Association of B.C.
- STC – Sound Transmission Coefficient
- TIA – Telecommunications Industry Association
- TTMAC – Terrazzo and Tile Manufacturers Association of Canada
- TVOC – Total Volatile Organic Compounds
- ULC - Underwriters’ Laboratories of Canada
- UPS – Uninterruptible Power Supply
- VFD - Variable Frequency Drive



- VLAN – Virtual Local Area Network
- VOC – Volatile Organic Compounds
- VoIP – Voice Over Internet Protocol
- WH – Warnock Hersey
- WHMIS – Workplace Hazardous Materials Information System

## PART 2. GENERAL

### 2.1 Standards

#### General Standard of Design and Construction

- 2.1.1 The Design and Construction is to be completed:
- 2.1.1.1 in accordance with the standards set out in this Statement of Requirements;
  - 2.1.1.2 in accordance with the version of the BC Building Code current at the time of the issuance of a building permit for the Project;
  - 2.1.1.3 in accordance with the requirements of all relevant CSA standards including CSA Z317.13-07, and CSA Z318.0-93;
  - 2.1.1.4 in accordance with the requirements of the Owner, document "Section 01550 - Infection Control Measures" during construction;
  - 2.1.1.5 in accordance with applicable laws.
- 2.1.2 If the Design-Builder wishes to make reference to a code or standard from a jurisdiction outside of Canada, then the Design-Builder will demonstrate to the Owner's satisfaction that such code or standard meets or exceeds the requirements of this Schedule and other applicable governing bodies.
- 2.1.3 The Design and Construction is to be performed in compliance with all applicable standards regardless of whether they appear in the document or not, including:
- 2.1.3.1 AIA Guidelines for Design and Construction of Health Care Facilities, 2010.
  - 2.1.3.2 BCICA Quality Standards Manual for Mechanical Insulation, latest edition.
  - 2.1.3.3 ANSI / ASHRAE
    - 2.1.3.3(1) 52.2-1999: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size;
    - 2.1.3.3(2) 55-2004: Thermal Environmental Conditions for Human Occupancy;

- 2.1.3.3(3) 62.1-2004:-Ventilation for Acceptable Air Quality;
- 2.1.3.3(4) 90.1-(2004): Energy Efficient Design for New Buildings;
- 2.1.3.3(5) 111-1988:-Practices for Measurement, Testing, Adjusting & Balancing of Building HVAC Systems;
- 2.1.3.3(6) 129-1997:-Measuring Air Change Effectiveness;
- 2.1.3.3(7) 135-2004:-Data Communication Protocol for Building Automation & Control Networks; and
- 2.1.3.3(8) 0-2005 – The Commissioning Process.

#### 2.1.3.4 ASHRAE:

- 2.1.3.4(1) Handbooks: 2003 HVAC Applications, 2004 HVAC Systems and Equipment, 2005 Fundamentals, 2006 Refrigeration;
- 2.1.3.4(2) Design of Smoke Control Systems;
- 2.1.3.4(3) ASHRAE Guideline 12-2000 - Minimizing the Risk of Legionellosis Associated with Building Water Systems; and
- 2.1.3.4(4) ASHRAE Guideline 1-1996 – The HVAC Commissioning process.

#### 2.1.3.5 ANSI / ASME:

- 2.1.3.5(1) B31.1 Power Piping Code, for steam systems;
- 2.1.3.5(2) Section IX: Welding Qualifications;
- 2.1.3.5(3) Unfired pressure vessels; and

- 2.1.3.5(4) AWS D1.3-98 - Structural Welding Code - Sheet Steel.
- 2.1.3.6 ASPE Plumbing Engineering Design Handbook, Vol. 1-4.
- 2.1.3.7 ASTM:
  - 2.1.3.7(1) ASTM C568-03 - Standard Specification for Limestone Dimension Stone;
  - 2.1.3.7(2) ASTM C615-03 - Standard Specification for Granite Dimension Stone;
  - 2.1.3.7(3) ASTM C503-05 - Standard Specification for Marble Dimension Stone;
  - 2.1.3.7(4) ASTM C616-03 - Standard Specification for Quartz-Based Dimension Stone; and
  - 2.1.3.7(5) BCSLA and BCLNA - BC Landscape Standard – Current Edition.
- 2.1.3.8 CGA -P-2.1:
  - 2.1.3.8(1) Standard for Medical / Surgical Vacuum Systems in Hospitals.
- 2.1.3.9 CSA
  - 2.1.3.9(1) B52HB-05: Mechanical Refrigeration Code;
  - 2.1.3.9(2) B149.1-00: Natural Gas and Propane Installation Code;
  - 2.1.3.9(3) B651-95: Barrier Free Design;
  - 2.1.3.9(4) Z7396.1-06 "Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum;

- 2.1.3.9(5) Z7396.2-06 "Medical Gas Pipeline Systems – Part 2: Anaesthetic Gas Scavenging;
- 2.1.3.9(6) Z317.13-07: Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities;
- 2.1.3.9(7) Z317.2-01: Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities;
- 2.1.3.9(8) Z318.0-93: Commissioning of Health Care Facilities;
- 2.1.3.9(9) Z318.1-95: Commissioning of HVAC Systems in Health Care Facilities;
- 2.1.3.9(10) W186-M1990 (R2002) - Welding of Reinforcing Bars in Reinforced Concrete Construction;
- 2.1.3.9(11) A370-04 - Connectors for Masonry;
- 2.1.3.9(12) A23.1-04/A23.2-04 - Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete; and
- 2.1.3.9(13) S832-06 – Seismic Risk Reduction of Operational and Functional Components (OFCS of buildings).
- 2.1.3.9(14) A23.3-04 – Design of Concrete Structures
- 2.1.3.9(15) S16-09 – Design of Steel Structures
- 2.1.3.9(16) O86-09 – Engineering Design in Wood
- 2.1.3.9(17) S136-07 – North American Specification for the Design of Cold-Formed Steel Structural Members

- 2.1.3.9(18) S157-05 – Strength Design in Aluminum
- 2.1.3.9(19) S304.1-04 – Design of Masonry Structures
- 2.1.3.9(20) CSA B44-2010 – Elevator Code

#### 2.1.3.10 MPI

- 2.1.3.10(1) Master Painters Institute (MPI) Architectural Specification Standards Manual.

#### 2.1.3.11 NFPA

- 2.1.3.11(1) 10-2002: Standard for Portable Fire Extinguishers;
- 2.1.3.11(2) 13: Standard for the Installation of Sprinkler Systems;
- 2.1.3.11(3) 56F: Non-flammable Medical Gas System;
- 2.1.3.11(4) 90A - Current Edition: Standard for Installation of Air Conditioning and Ventilation Systems;
- 2.1.3.11(5) 92A - Current Edition: Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences; and
- 2.1.3.11(6) 101 - Current Edition: Life Safety Code.

2.1.3.12 Master Municipal Construction Document (MMCD) latest edition; and

2.1.3.13 BC Supplement to TAC Geometric Design Guide latest edition

## 2.2 Indicative Design and Design Requirements

- 2.2.1 In support of its approval request to Government for the building, the Owner and its Consultant Team developed an indicative design.

- 2.2.2 The Owner and its Consultants prepared a Facility Program (Appendix 1I) for the building. The Facility Program specifies all required spaces, areas, and departments.
- 2.2.3 The Owner and its Consultants prepared the Room Data Sheets for the clinical components of the project. The Room Data Sheets are included as Appendix 1J. The Room Data Sheets describe the critical adjacencies, technical requirements, spatial needs, furnishings, and primary equipment which needs to be addressed in order for the Project to successfully serve the needs of the Owner today and in the future.
- 2.2.4 The Indicative Design has been drawn to reflect program areas and significant design features as required by the Facility Program and the Room Data Sheets. Department layouts and their functional relationships have been tested with, and approved by, the Owner and its user and technical groups.
- 2.2.5 During various public sessions site and floor plans, together with the Architect's renderings and scale model showing the building's Indicative Design were presented to the Village of Burns Lake. The Indicative Design has been favourably received.
- 2.2.6 The Design-Builder shall use the Indicative Design as both a reference and a minimum standard of acceptance baseline solution for its design, but the Owner makes no representation as to the accuracy or completeness of any aspect of the Indicative Design. The Design-Builder may consider designs which differ from the Indicative Design, provided that the Design-Builder meets the general intent of functionality and quality implicit in the Indicative Design.
- 2.2.7 The Site must be accessed from Centre Street. The Design-Builder is required to work with the Owner and the Village of Burns Lake to develop a mutually satisfactory solution for the exact locations along Centre Street for access to, and egress from, the Site. All meetings with the Village of Burns Lake must be arranged through the Owner and will be held with a representative of the Owner in attendance.
- 2.2.8 The Design-Builder is expected to work with the Village of Burns Lake Planning and Building Departments regarding the design of the building, and ensuring the building's conformance with applicable laws.
- 2.2.9 The Design-Builder will provide a proposed design and construction schedule in the form of a Gantt Chart which clearly stipulates the Owner review process:
  - 2.2.9.1 Provide the proposed timing and number of meetings required with the Owner and its user groups, including review and sign-off of the design at submission milestones;
  - 2.2.9.2 Identify all activities on the critical path, milestone dates, review activities, and requirements for the Owner's review and signoff.

- 2.2.10 The Design-Builder will be completely responsible for all aspects of the Design and Construction of the building whether or not it uses all or any part of the Indicative Design, and the Design-Builder will be responsible to independently verify the accuracy of any information contained in or inferred from the Indicative Design or the Facility Program.



## **PART 3. DESIGN PRINCIPLES**

### **3.1 The Site**

3.1.1 A Topographical Survey is available.

3.1.1.1. The Design-Builder shall interpret the survey information in the Topographical Survey by McElhanney titled "Site Plan – Existing Condition" (dated November 2007) for its own use in evaluating the effect on site access and construction operations. The Design-Builder shall visit the project site, and may, at its option prior to the execution of the Project Agreement, perform further investigations at its own expense after receiving written permission from the Owner.

3.1.1.2 The Site borders on the Lake Babine Nation, bounded by 10<sup>th</sup> Avenue and a public walkway. There will be no site access from 10<sup>th</sup> Avenue.

3.1.1.3 The Design-Builder must maintain vehicle access to the B.C. Ambulance Station and existing building Loading Dock at all times.

3.1.2 A Geotechnical Report is available.

3.1.2.1 The "Geotechnical Report – Proposed Hospital" dated October 5, 2012, is included for information only and will not form a part of the Project Agreement. The Design-Builder shall interpret the information for its own use in evaluating the affect of sub-surface conditions on construction operations. The interpolation of conditions between said test borings is not guaranteed by the Owner. The Design-Builder shall visit the project site, and may at its option and prior to the execution of the Project Agreement, perform further sub-surface investigation at its own expense, after receiving written permission from the Owner.

3.1.3 Existing trees will be retained wherever possible.

3.1.4 Attenuate any noise from the Building to acceptable levels at neighbouring properties; particularly from the new standby generator set and mechanical equipment.

3.1.5 Rooftop mechanical equipment is not allowed. Refer to Section 3.8.1.14.

3.1.6 Visually shield any mechanical and electrical equipment at grade installed as part of this project and located on the hospital campus.

3.1.7 Address the following within and on the Building site and immediately adjacent areas impacted by this project:

3.1.7.1 Physical safety and after-hours security of workers and patients is paramount. The site design should permit safe access and egress and secure pathways to and from parking.

3.1.7.2 Way-finding and legible connections between the Building and the Village of Burns Lake, and between the Building and the Lake Babine Nation.

3.1.7.3 Sheltering of building walkways and building entrances; building users should be reasonably shielded at building entrances from wind carrying dust and precipitation.

3.1.7.4 The Village of Burns Lake receives large quantities of snow. The site design must facilitate safe and cost effective snow removal with a goal of minimizing service disruption.

3.1.7.5 Security will follow modern principles of CPTED, which includes the development of welcoming environments that establish a sense of ownership among building users and the community at large, as well as patients and visitors.

3.1.7.6 Access to and from the Site to meet the needs of physician, staff and visitor traffic, ambulances for emergencies as well as service and delivery vehicles; Delivery zones around and within the building shall be provided such that service and delivery vehicles will not need to back-up and disrupt neighbouring residents.

3.1.7.7 Safe, well lit spaces for non-ambulatory individuals planned in conjunction with walkways and other outdoor areas.

3.1.7.8 DELETED

## **3.2 Architecture**

### **3.2.1 Building Configuration**

3.2.1.1 The site and its functional relationships require a two storey building. The Design-Builder is encouraged to review the Burns Lake Hospital site, and its existing building layout.

3.2.1.2 The existing building must remain in operation at all times during the period of construction, commissioning, fit-up, and occupation of the Building.

3.2.1.3 The Owner shall have up to 45 days to reach Total Completion following achievement of Substantial Completion of the Building.

3.2.1.4 When the Owner has obtained Total Completion the existing building may be demolished for completion of site works.

### 3.2.2 Qualitative Aspects

3.2.2.1 Access to visible daylight to staff work areas is desired;

3.2.2.2 Equitable and respectful - with all Building Users and patient confidentiality and dignity maintained;

3.2.2.3 Restorative – with staff workspaces that are comfortable, peaceful, attractive, and that feel connected to the day and the seasons;

3.2.2.4 Efficient - reducing Building Users' distances to travel within the functional departments;

3.2.2.5 Flexible - to accommodate continuous programmatic change and growth through the use of modular laboratory, office and exam room furniture and the provision of unassigned spaces;

3.2.2.6 The Design is to consider the safety and the well-being of staff, visitors and patients. The Design and Construction approach to sustainability will therefore include the following characteristics:

3.2.2.6(1) Ease of access – both to and within the Building for all staff, visitors, patients and delivery of materials and equipment;

3.2.2.6(2) Benign – the building will be energy efficient, water balanced, toxin free, with minimal and well-managed waste consistent with the spirit and intent of LEED and the Green Guide for Healthcare version 2.2; and

3.2.2.6(3) Secure – ensure security for staff who will occupy parts of the Building 24 hours per day while permitting the public to access the outpatient collection area and clinical offices during working hours.

### 3.2.3 Entrance vestibules

- 3.2.3.1 Will be protected from snow and rain by canopies designed for that purpose;
- 3.2.3.2 Will deal effectively with water, mud, sand and dirt;
- 3.2.3.3 Will be used for after-hours access and control of the building and be of barrier free design; and
- 3.2.3.4 Will facilitate ease of deliveries and be able to accommodate movement of large equipment.

### 3.2.4 Elder Friendly

- 3.2.4.1 The Design will incorporate Elder Friendly design principles. in accordance with the design recommendations for an elderly friendly hospital that are set out in “Code Plus: Physical Design for an Elderly Friendly Hospital” published by Fraser Health as applicable to this healthcare building; and
- 3.2.4.2 Building should address elder friendly design in all public and clinical spaces within the building.

## 3.3 Sustainable Design

- 3.3.1 The Project will be designed and certified to achieve LEED Gold, either through the Canadian Green Building council (LEED 2009) or through the U.S. Green Building Council (LEED for Healthcare).
- 3.3.2 Where proven feasible, design the Building to utilize alternate energy sources such as passive solar water heating and alternate heating and cooling sources such as heat pumps. Geothermal thermo conductivity tests have been undertaken.
- 3.3.3 An energy model shall be completed to demonstrate anticipated building energy performance in compliance with LEED EA Credit requirements (or equivalent). Meet the requirements stated in Appendix 1A: Energy Model.

## 3.4 Disaster Preparedness

- 3.4.1 The Building is to be designed and built as a Post Disaster Building as defined by the British Columbia Building Code. Design the Building so that:
  - 3.4.1.1 The Hospital and outbuildings will function to a reduced level (not less than 65%) without disruption throughout instances of extended power interruption, and permit staff to respond

to disasters and emergency situations including but not limited to fire, contamination of water supply, earthquake, flood, chemical spill and other regional disaster conditions.

#### 3.4.2 Post-disaster structural design

3.4.2.1 See section 3.11.4

#### 3.4.3 Post-disaster mechanical design

3.4.3.1 Design the mechanical piping and equipment seismically to post disaster standards as outlined in the BC Building Code;

3.4.3.2 Provide a water inlet connection on the exterior of the building to allow for supply of potable water from a tanker truck;

3.4.3.3 Provide a sanitary sewer sump and pump out connection exterior to the building for connection to a sewage pump truck.

#### 3.4.4 Post-disaster electrical design

3.4.4.1 See section 7.8.1.2 (1)

### 3.5 Safety and Security

#### 3.5.1 Incorporate the following into the Designs:

3.5.1.1 CPTED principles in Site layout, Building design, landscape development and lighting; and

3.5.1.2 Guidelines for the physical security of chemicals, drugs and needles and syringes stored in healthcare facilities, as produced by the College of Pharmacists of British Columbia.

#### 3.5.2 Incorporate the following in the exterior Design:

3.5.2.1 Provide exterior lighting near building entrances, exits, walkways, public areas, and parking areas. Lighting will not cause glare, shadow, or high contrast with surrounding areas and will not flood onto neighbouring property;

3.5.2.2 Shrubbery within 2m of walkways will not exceed 50cm in height;

- 3.5.2.3 Provide video surveillance of all exterior areas including parking lot, entrances and exits, loading zones, sidewalks and west walking path to Lake Babine Nation land. Arrange camera locations to facilitate viewing of the entire lot. Avoid dead spots and corners
- 3.5.2.4 Provide one (1) panic station centrally located in parking lot.
- 3.5.3 Incorporate the following in the interior Design:
  - 3.5.3.1 Video surveillance at all main entrances to the Building so surveillance equipment is visible to people entering the area. Cameras shall be positioned to provide surveillance sufficient for facial identification of persons entering the building;
  - 3.5.3.2 Card access control of all entrances and other areas of the Building. The Card Access System will have the capability of having multiple zones.
  - 3.5.3.3 Two pay phones will be located in the Outpatient reception lobby and two pay phones will be located in the Emergency Waiting area.

### **3.6 Flexibility**

- 3.6.1 Plan the Building to Village of Burns Lake site planning standards recognizing that the building could be expanded in the future. Site limits are shown on the Site Plan but must be verified with the Village of Burns Lake.
- 3.6.2 All plans for future expansion of the Building should maintain or improve the level of daylight penetration into the Building.
- 3.6.3 It is important that the Design permit future renovations and horizontal expansion, and that such accommodation be clearly articulated and illustrated in the Design submission as follows:
  - 3.6.3.1 Allow for future renovation of the Major Procedures area of Emergency into a full-functioning operating room. This includes all roughed-in mechanical, electrical and plumbing for the future operating room;
  - 3.6.3.2 Provide all electrical infrastructure and data drops as required for fully operational RFID systems in supply rooms:

- 3.6.3.3 Locate permanent building elements such as corridors, stairs, elevator and duct shafts to minimize constraints on configurational change;
- 3.6.3.4 Provide a floor to floor height that permits horizontal zoning of services; minimum floor to floor height is 4.5M. Provide a minimum interior room ceiling height of 2.7M;
- 3.6.3.5 In areas of the Building where demountable partitions or systems walls and furnishings are possible, provide a fenestration pattern that is non-restrictive;
- 3.6.3.6 Minimize interior columns for ease of planning and re-planning of the Building;
- 3.6.3.7 Locate interior shear walls and structural bracing to minimize constraints on future configurational change;
- 3.6.3.8 Provide internal departmental corridors that link the fronts and backs of adjacent departments to allow border zone spaces to ebb and flow between departments and to increase inter-departmental communication and LEAN work flows;
- 3.6.3.9 Design-Builder is to identify logical and accessible locations of future floor penetrations throughout changeable areas of the building for future installation of service lines, plumbing, duct chases, electrical conduit etc.,
- 3.6.3.10 Facilitating future flexibility by providing the ability to reconfigure departments, offices and exam rooms is desired. The Design-Builder may use movable/demountable walls in administrative and clinical office areas.

### 3.7 Use of Wood

- 3.7.1 As contemplated by the *Wood First Act* (British Columbia), The Design-Builder will incorporate wood products into the design of the building to the extent that the use of wood products is consistent with the requirements of this Schedule.
- 3.7.2 Use wood as a featured material in both the interior and exterior of the Building. Wood will be used where indicated as "Appropriate" in Table 1. Wood will not be used where indicated as "Inappropriate". Wood studs shall be used where Design-Builders determine that they are appropriate at the Design-Builder's discretion.
- 3.7.3 **Table 1. Wood First - Appropriate Use**

Area of Usage	Appropriateness	Justification
<b>Substructure</b>		
Forming (temporary)	Appropriate	The use of wood in this process is a traditional method within the construction process
<b>Structure</b>		
Main Floor Deck	Inappropriate	Loads required for the main floor deck are in excess of wood's capabilities. Furthermore wood is subject to deterioration when exposed to moisture and would require a heated and insulated crawlspace outfitted with automatic fire sprinklers. As a non-combustible structure, the use of a wood main floor deck would require fire protection.
Beams	Inappropriate	As a non-combustible structure, the use of wood structural beams would require fire protection. Long spans used to minimize permanent vertical support are beyond the practical structural capability of wooden beams.
Columns	Inappropriate	Wooden structural columns would require fire protection. Wooden columns encased in fire protective materials would be large in dimension and would restrict future flexibility.
Upper Floor Deck	Inappropriate	Point and live loads required for the upper floor deck are in excess of wood's capabilities. Wood is subject to rapid deterioration when exposed to moisture. Also vibration and long spans on the structural grid would create an overly complicated structure
Roof Deck	Inappropriate	Burns Lake experiences heavy snow loads. As a non-combustible structure, the use of structural wood beams would require fire protection. Long spans used to minimize permanent vertical support are beyond their practical structural capability.
<b>Exterior Cladding</b>		
Roof Deck (Flat Roof)	Inappropriate	There is no known wood product for this application
Cladding and strapping	Appropriate	Wood can be used in limited quantities as part of a rain screen envelope assembly. Wooden strapping is also permitted.
Windows	Inappropriate	Wooden window frames cannot be used in a non-combustible structure as they lack the durability of metal frames and are difficult to clean.
Curtain Wall	Inappropriate	There is no known wood product for this application
Doors	Appropriate	Metal clad wooden doors can be used.



Area of Usage	Appropriateness	Justification
<b>Interior Partitions and Doors</b>		
Partition Studding	Appropriate	Support studs used for the framing of the walls
Interior Doors	Appropriate for offices	Framing, core and facing of door can be wood for locations not requiring greater than a 90 minute fire resistance rating. Wood doors in high metal cart and material transport traffic areas like the laboratory would need protection
<b>Vertical Movement</b>		
Stairs (Structural)	Inappropriate	The performance of wood in these locations will be challenged due to the load capacities and precluded by the BC Building Code due to fire resistance rating limitations.
Handrail	Appropriate for non-exit stairs	Use of wood can be utilised in the aesthetic completion of the staircase
Guardrails	Appropriate for non-exit stairs	Wood can be used in these locations where there is a low to medium risk of impact
<b>Fittings and Equipment</b>		
Hardwood Floor	Appropriate	Wood could be used in certain, non-laboratory locations as a floor finish; this would be limited to high end finished areas which are not subject to low acoustic or high usage requirements
Ceiling Tiles	Appropriate	Wood could be used in ceiling tiles for aesthetic requirements in certain, non-laboratory areas within the building. This would be limited to high end finished areas which are not subject to low acoustic or high usage requirements
Wall Finish	Appropriate	Wood could be used as a wall finish for aesthetic and acoustic requirements in certain, non-laboratory areas within the building. This would be limited to high end finished areas which are not impaired by acoustic requirements and high usage. Handrails and bumper guards can be made of wood.
Toilet Partitions	Appropriate	The core material for the partitions can be made from wood particles
Signs	Appropriate	The base material on which the sign is mounted can be of wood
Loose Equipment (Desks, chairs, etc)	Appropriate	The core material for the desks, chairs, etc can be made from particles and complete wood substrate

Area of Usage	Appropriateness	Justification
Fixed Equipment (Millwork)	Appropriate	The carcass, core material and substrate for millwork can be constructed with wood
Modular Lab Benches	Appropriate	The carcass, core material and substrate for modular lab benches can be constructed with wood
Specialized Equipment	Inappropriate	Clinical equipment and associated environment cannot utilise wood as these environments need to be inert
<b>Mechanical</b>		
None Known		
<b>Electrical</b>		
None Known		
<b>Site Development</b>		
Landscaping (Architectural, decorative, site furnishings, etc)	Appropriate	Wood could be used in Landscaped areas for the Arts, Architectural features/site furnishings; seats, pagodas, etc.
<b>Contractor</b>		
Site establishment		Where appropriate the Design Builder is to endeavour to utilise materials of wood and wood derivative for their site establishment

3.7.4 Provide rough carpentry, wood backing materials, backing boards for mechanical rooms and electrical/communication rooms, roof sheathing, copings, cant strips, finish carpentry and architectural woodwork, including but not limited to exterior fascia's, cabinets, casework (excluding laboratory casework, which is included in Division 12), frames, panelling, ceiling battens, trim, installation of doors and hardware, and other wood-related products and applications as required for wood products exposed to view in finished interior and exterior installations.

### 3.8 Mechanical Engineering

3.8.1 General standard of design principles:

- 3.8.1.1 This section is accompanied by and should be read in with conjunction with the Equipment List.
- 3.8.1.2 The HVAC, plumbing, fire protection, speciality systems and medical gas systems will be designed to provide a healing,

comfortable and productive environment for the Building Users.

- 3.8.1.3 It is essential that all mechanical systems, equipment, material and installation conform to the latest version of all the applicable codes, standards, regulations and guidelines. The codes, standards and regulations shall include, but not be limited to the following:

3.8.1.3(1) Codes:

- 3.8.1.3(1)(a) B.C. Building Code (BCBC);
- 3.8.1.3(1)(b) National Building Code (NBC);
- 3.8.1.3(1)(c) Model National Energy Code (MNECB);
- 3.8.1.3(1)(d) Canadian Electrical Safety Code (2006);
- 3.8.1.3(1)(e) B.C. Fire Code;
- 3.8.1.3(1)(f) National Fire Code (NFC);
- 3.8.1.3(1)(g) B.C. Plumbing Code;
- 3.8.1.3(1)(h) Village of Burns Lake Bylaws;
- 3.8.1.3(1)(i) Other Municipality Bylaws;
- 3.8.1.3(1)(j) Ministry of Environment – Environment Protection Act – Regulation 346 (MOE);
- 3.8.1.3(1)(k) Natural Gas Utilization Code; and
- 3.8.1.3(1)(l) Installation Code for Oil Burning Equipment.

3.8.1.3(2) Standards:

- 3.8.1.3(2)(a) Canadian Standards Association (CSA);
- 3.8.1.3(2)(b) National Fire Protection Agency (NFPA);
- 3.8.1.3(2)(c) American Standards for Testing and Materials (ASTM);
- 3.8.1.3(2)(d) American National Standards Institute (ANSI);

- 3.8.1.3(2)(e) American Water Works Association (AWWA);
  - 3.8.1.3(2)(f) Underwriters Laboratories of Canada (ULC);
  - 3.8.1.3(2)(g) Institute of Electrical and Electronic Engineers (IEEE) Inc. Standards; ASHRAE/IES 90.1 “Energy Standards for Buildings Except Low-Rise Residential Buildings”;
  - 3.8.1.3(2)(h) 2001 revision of CAN/CSA-Z317.2-01 “Special Requirements for HVAC Systems in Health Care Facilities;
  - 3.8.1.3(2)(i) Latest revision of CAN/CSA-Z317.1 “Special Requirements for Plumbing Installations in Health Care Systems”;
  - 3.8.1.3(2)(j) Latest revision of CAN/CSA-Z305.1 “Non-Flammable Medical Gas Piping Systems”.
  - 3.8.1.3(2)(k) Latest revision of CAN/CSA – Z317.13-031 Infection Control During Construction or Renovation of Health Care Facilities;
  - 3.8.1.3(2)(l) Latest revision of Z316.5 Fume Hoods and Associated Exhaust System; and
  - 3.8.1.3(2)(m) Latest revision of Z77396 Medical Gas Pipeline Systems.
- 3.8.1.3(3) Guidelines:
- 3.8.1.3(3)(a) American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbooks;
  - 3.8.1.3(3)(b) American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) System Design Manual for Hospitals and Clinics;
  - 3.8.1.3(3)(c) Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA) Manuals;
  - 3.8.1.3(3)(d) Industrials Ventilation Manual;

- 3.8.1.3(3)(e) Hydronics Institute Manuals;
  - 3.8.1.3(3)(f) Factory Mutual (FM);
  - 3.8.1.3(3)(g) Associated Air Balance Council (AABC);
  - 3.8.1.3(3)(h) National Environmental Balancing Bureau (NEBB); and
  - 3.8.1.3(3)(i) Institute of Electrical and Electronic Engineers (IEEE) Inc. publications; Leadership in Energy and Environmental Design (LEED) Program.
- 3.8.1.4 The mechanical, plumbing, fire protection, speciality systems and medical gas systems will minimize impact on the natural and physical environment, through energy efficiency, optimization of resource use, and simplification of the systems.
- 3.8.1.5 For Class I and II areas and laboratory rooms as defined by CSA, mechanical and plumbing equipment will be configured and located in such a way that maintenance and repair can be performed without entering these areas.
- 3.8.1.6 The mechanical, plumbing, fire protection, speciality systems and medical gas systems component selection, system design, and installation will incorporate the flexibility and adaptability for future expansion without major disruption or alteration to the facilities infrastructure.
- 3.8.1.7 The mechanical, plumbing, fire protection, speciality systems and medical gas systems will be developed to provide reliability of continual operation. Make accommodation for 20% additional capacity and growth in system design, including shafts and chases for horizontal and vertical distribution. Include standby capacity and redundancy in system design.
- 3.8.1.8 Provide water, sanitary, storm and gas utilities as required and sized to suit the consumption and discharge needs of the Building. Water, glycol and other fluids used within mechanical systems will be treated to prevent corrosion, algae growth, build up of deposits, disease, bacteria and will prolong the equipment life.

- 3.8.1.9 All mechanical, HVAC, plumbing, fire protection, and speciality systems and medical gas systems will be vibration isolated to minimize noise and vibration through the structure or other components of the Building.
- 3.8.1.10 All mechanical, HVAC, plumbing, fire protection, speciality systems and medical gas systems will comply with standard acoustic requirements as per CSA.
- 3.8.1.11 All pipes, ducts and fittings will be insulated to conserve energy, prevent condensation, attenuate noise and prevent accidental burns.
- 3.8.1.12 Speciality systems will include acid waste and vent.
- 3.8.1.13 All entrances to the Building will be protected by vestibules and forced air heaters.
- 3.8.1.14 All mechanical equipment will be contained inside the building, e.g. no rooftop equipment.
- 3.8.1.15 All louvers, fresh air intakes, and exhaust openings will be designed to operate in high snow conditions.

### 3.8.2 List of Manufacturers:

The following listed manufacturers are acceptable for their ability to meet the general design intent, quality and performance characteristics of the specified product. The list does not endorse the acceptability of all products available from the listed manufacturers/suppliers. It remains the responsibility of the contractor to ensure the products supplied are equal to the specified products in every respect, operate as intended, and meet the performance specifications and physical dimensions of the specified product.

#### 3.8.2.1 Manufacturer's List

- Access Doors Maxam, Acudor, Milcor, Can.Aqua, Mifab
- Air Flow Measuring Air Monitor, Air Stations Cambridge, Sentinel, Ebtron
- Air Handling Units Racan, Pace, Haakon, Scott Springfield, Huntair, Venmar, York
- Air Separators, Relief Valves Armstrong, Bell & Gossett, Taco
- Air Terminals - Grilles Registers, Diffusers E.H. Price, Titus, Halton
- Air Valves - Mixing, Constant E.H. Price, Titus, Trane

Volume and VAV	
• Air Vents	Hoffman, Maid-O-Mist, Taco
• Backdraft Dampers	Airolite, Vent-Aire, Penn, T.A. Morrison
• Backflow Preventers	Febco, Watts, Hersey, Singer, Ames
• Balancing Dampers	Maxam, Ruskin
• Boilers - Condensing	Viessmann, Cleaver Brooks, Budarus, Dedietrich
• Bypass Filter (HW)	Sumco, GESL, Pace Chemicals
• Chillers – Centrifugal, Scroll	York, Trane, McQuay, Multistuck
• Chimney and Breeching	Metalbestos P/S, Van Packer P/S, Metal Fab PIL
• CO and Combustible Gas Detector	MSA, ACME, Armstrong, Critical Environment Technology
• Coils - Heating and Cooling	Trane, Aerofin, Colmac
• Condensing Units and Fan Coil Units	Trane, Dunham Bush, York
• Condensers - Air Cooled Refrigerant	Trane, Carrier, Engineered Air, Keeprite
• Controls Contractors	Siemens, Delta, Johnson Controls, Reliable Controls
• Convectors - Electric	Chromalox, Q-Mark
• Convectors - HW	Engineered Air, Trane, Rosemex, McQuay, Dunham Bush
• Cooling Tower Water Filter	Baltimore Air Coil, PEP
• Cooling Towers - Blow Through and Fluid Coolers	Baltimore Air Coil, Evapco, Marley/ Recold
• Cooling Towers - Induced Draft	Baltimore Air Coil, Marley
• Dampers - Control, Backdraft	Ruskin, Tamco
• Dampers - Smoke-Fire Combination	Ruskin, Controlled Air, Prefco
• Domestic Water Heaters - Gas	Aerco, AO Smith, Ruud-Rheem, State, PVI, Armstrong
• Drains - Floor, Roof, Cleanouts Trap Primers, Water Hammer Arrestors	Zurn, Ancon, PPP, J.R. Smith
• Drinking Fountains - Refrigerated	Western, Haws, Cordley, Elkay
• Expansion Compensators	Flexonics, Tube Turn, Hyspan, Hydroflex, Metraflex, United Flexible, Mason
• Expansion Joints	Flexonics, Hyspan, Hydroflex, Metraflex, United Flexible, Mason
• Eye Wash Fountains	Western, Haws

- Fan Coil Units Trane, Engineered Air, Williams, First Co.
- Fans - Axial (Belted-Adjustable Pitch) Woods, Joy
- Fans - Axial (Belted-Fixed Pitch, Direct Drive-Adjustable Pitch) Northern, Chicago, Woods, Joy, CB&F
- Fans - Axial (Variable Pitch in Motion) Woods, Joy
- Fans - Bathroom Exhaust ACME, Broan, Penn Zephyr, Reversomatic, Nutone, Broan
- Fans - Centrifugal Buffalo, Twin City, Trane, Chicago, Barry Blower, Northern, Haakon
- Fans - Grease Exhaust Cook, Greenheck, ACME, Carnes, Garland
- Fans - In-Line Centrifugal Greenheck, Jenn Air, Ammerman, ILG, Cook, Penn, Twin-City, Carnes
- Fans - In-Line Centrifugal (Tubular) Chicago, Greenheck, Twin-City, Barry/CML, Northern Blower
- Fans - Kitchen Range Hoods Nutone, Lau, Broan
- Fans - Propeller Greenheck, Cook, Penn, Jenn Air, ACME, Powerline, Joy
- Fans - Roof and Wall Mounted Greenheck, Ammerman, Powerline, ACME, Loren Cook, Penn, Jenn Fan, ILG, Carnes, Twin City
- Filters Cambridge, AAF, Pacific, FARR
- Fire Dampers Controlled Air, Ruskin, Canadian Advanced Air, Maxam, Nailor
- Fire Hose Cabinets, Valves and Extinguishers NFE, Grigor, Wilson & Cousins, Flag
- Flexible Connectors - Ducting Thermaflex, G.I. Industries Type IHP
- Flexible Connectors - Piping Flexonics, Tube Turn, Atlantic, Hyspan, Hydroflex, Metraflex, United Flexible, Mason
- Flexible Duct Thermaflex, Wiremold, GI Industries Type H.P.
- Flow Meter - Orifice Plate Gerand
- Flow Meter - Pitot Tube Presco, Annubar
- Flow Meter - Venturi Gerand, Presco
- Gauges - Air Dwyer, Magnehelic
- Gauges - OWG Pressure Trelice, Marsh, Ashcroft, Weiss
- Grease Interceptors Zurn, Ancon, J.R. Smith
- Grooved Mechanical Pipe Joints Victaulic



- Heat Exchangers - Plate Alpha Laval, Tranter, Armstrong, APV
- Heat Exchangers - Shell and Tube Armstrong, Taco, Leitch, Bell & Gossett
- Heat Pumps AAF-Enercon, McQuay, Trane, Friedrich, Multisack, York, Florida Heat Pump, ClimaCool Corp
- Hose Bibbs Jenkins, Dahl, Crane, Toyo, Kitz, Mifab
- Humidifiers - Electric Armstrong, Vapac, Nortec, Dri-Steam
- Humidifiers - Steam Armstrong, Sarco, Dri-Steam, Pure Humidifier
- Immersion Heaters Armstrong, Taco, B&G
- Insulation - Piping and Duct Fibreglass Canada, Manson, Knauf Fibreglass, Plasti-Fab, Manville
- Kitchen Exhaust Filtration and Recirculation Unit Garland
- Louvres Airolite, Penn, Airstream, West Vent, Nailor, Ruskin
- Makeup Air Units - Packaged Indirect or Direct Fired Engineered Air, I.C.E., Reznor
- Meters Positive Displacement Neptune, Rockwell
- Pipe Restraints Trelleborg
- Piping Hangers and Saddles Grinnell, Myatt
- Plug Cocks DeZurik, Newman-Milliken
- Plumbing Brass Crane, American Standard, Cambridge Brass, Waltec, Kohler, Symmons
- Plumbing Fixtures Crane, American Standard, Kohler
- Plumbing fixtures - Prefab FRP Aquarius, Acrylic Tubs
- Pump - Condensate Packages Paco, Leitch
- Pumps - Deaerators and Boiler Feed York Shipley, Cleaver Brooks, Duro
- Pumps - Fire Booster Aurora, Peerless, Leitch, Armstrong
- Pumps - In-Line Circulators Armstrong, B & G, Taco, Grundfos
- Pumps - Manual Crane
- Pumps - Positive Displacement Viking, Fairbanks, Morse, Ebara
- Pumps - Submersible Bilge or Sewage Monarch, Barnes, Hydromatic or Sewage, Myers, Zoeller
- Pumps - Sump Monarch, Barnes, Hydromatic, Myers, Zoeller
- Pumps - Turbine Aurora

- Pumps - Vertical In-Line and Base Mounted    Armstrong, B & G, Taco, Leitch, Grundfos
- Radiant Ceiling Panels    Airtex, Frenger, Eng Air, TWA
- Radiation - Wall Fin    Engineered Air, Trane, Slant/Fin, Rosemex, Dunham Bush
- Roof Top Heating/Cooling Units    Lennox, Carrier, Trane, Scott Springfield
- Showers - Institutional    Symmons
- Silencers - Fan and Duct    Vibro Acoustics, Vibron, Korfund, I.A.C, Koopers
- Sinks - Mop    Fiat, Crane, American Standard
- Sinks - Stainless Steel    KIL, American Standard, Elkay
- Steam Fittings - High Pressure    Grinnel
- Steam Pressure Reducing Station    Spirax/Sarco, Fisher
- Steam Relief Valves    Spirax/Sarco
- Steam Traps    Spirax/Sarco, Armstrong, Erwal
- Strainers    Armstrong, Sarco, Mueller, Toyo, Anderson, Metraflex, Yarway
- Tank - Diaphragm Type Expansion    Amtrol, Hamlet and Garneau Inc.
- Tanks - Boiler Feed and Blowdown    York Shipley, Cleaver Brooks
- Tanks - Domestic Hot Water Storage    Clemmer, Everdur, Westeel-Rosco, Ruud/Rheem, State
- Tanks - Expansion    Bell & Gossett, AS Leitch, Sanford, Westeel-Rosco Steelweld, Clemmer, Wheatley
- Tanks - Fibreglass Fuel Oil Storage    CAE, ZCL Manufacturing, Owens, Corning
- Tanks - Steel Fuel Oil Storage    Clemmer, Westeel-Rosco, Tidy, Regal
- Thermometers    Terrice, Marsh, Ashcroft, Winters
- Unit Heaters - Cabinet    Trane, Engineered Air, Rosemex, McQuay
- Unit Heaters - Electric    Chromalox, Q-Mark
- Unit Heaters - Gas Fired    Lennox, Modine, Reznor
- Unit Heaters - HW    Engineered Air, Trane, Rosemex, McQuay, Dunham Bush
- Valves - Butterfly    Jenkins, Keystone, DeZurik, Centreline, Monotight, Dresser, Lunkenheimer, Crane, Bray, Toyo, Grinnell
- Valves - Circuit Balancing    Armstrong, B & G, Wheatley, Tour & Anderson
- Valves - Drain, Radiator    Jenkins, Dahl, Crane, Toyo, Kitz

• Valves - Eccentric Plug	DeZurik, Homestead
• Valves - Gate, Globe, Swing, Check, Ball	Jenkins, Toyo, Crane, Kitz, Milwaukee
• Valves - Plumbing Flush	Crane, Sloan, Teck
• Valves - Pressure Balanced Mixing	Symmons
• Valves - Pressure Reducing	Armstrong, Bell & Gossett, Taco
• Valves - Relief	Armstrong, Bell & Gossett, Taco, Wheatley
• Valves - Shower	Symmons, Powers
• Valves - Silent Check	Val-matic, APCO, StreamFlo
• Valves - Suction Diffusers Combination Check and Balance	Armstrong, B&G, Taco
• Valves - Thermostatic Mixing	Symmons, Powers, Lawler
• Valves - Water Pressure Reducing	Watts, Clayton, Singer, Zurn. Wilkins, BCA, Cash Acme, Braukman
• Vent Caps	Jenn-Air, Penn Ventilator
• Vent Sets	Greenheck, Trane, Sheldons, Buffalo, New York, Brundage, Loren Cook, Lau
• Vibration Isolation	Mason, Vibro Acoustic
• Wash Fountains	Bradley
• Wash Fountains	Bradley
• Water Closet Seats	Moldex, Beneke, Bemis
• Water Softening	Duro, Petwa, Gladwell, Water Conditioning Canada
• Water Filter	Judo, Amiad

### **3.9 Electrical Engineering**

General standard of design principles:

- 3.9.1 Provide lighting that is energy efficient and environmentally friendly.
- 3.9.2 Provide electrical systems which promote energy efficiency and adhere to LEED for New Construction principles.
- 3.9.3 Integrate communications systems where this integration provides an efficiency advantage, operational advantage, and cost advantage.
- 3.9.4 Ensure a safe environment for staff, visitors and Patients by proper utilization of access control, video monitoring, and lighting.
- 3.9.5 All systems shall integrate and be compatible with existing B.C. Ambulance Services (BCAS) and Northern Health (NH) systems.

### **3.10 Civil Engineering**

General standard of design principles:

- 3.10.1 All onsite water, sanitary sewer, and drainage systems shall be designed to fully accommodate the requirements of the new hospital, the relocated nurses residence, the existing ambulance station, and all parking areas and roadways.
- 3.10.2 All onsite water, sanitary sewer, and drainage systems shall be designed to connect with the existing Village of Burns Lake municipal infrastructure.

### **3.11 Structural Engineering**

#### 3.11.1 Structural Design Principles

- 3.11.1.1 The Structural Engineer of Record will be a professional engineer registered in the Province of B.C. experienced in the design of institutional and commercial building of similar size and shall have designated structural engineer 'StructEng' standing with APEGBC.
- 3.11.1.2 The structural design shall meet the minimum requirements of the B.C. Building Code (BCBC) and all other applicable codes, material standards, and local by-laws and the loading and performance requirements detailed in this section.
- 3.11.1.3 Prior to construction, the Engineer of Record will have a qualified independent professional engineer carry out a

concept review in accordance with the requirements of APEGBC quality management by-law.

- 3.11.1.4 The structural engineer of record will perform field review of the construction at sufficient frequency and review shop drawings and reports of inspection and testing agencies to verify that the building structure has been built in substantial conformance with the approved issued for construction drawings and specifications.
- 3.11.1.5 The use of B.C. wood and wood products shall be considered in the design of the building.
- 3.11.1.6 A geotechnical consultant will be part of the Design Build project team to provide recommendations for the design of foundations, slabs on grade, and superstructure, including seismic design parameters. A supplementary geotechnical investigation may be required.

### 3.11.2 Structural Systems

- 3.11.2.1 The preferred structural systems for the suspended floor and main roof consist of cast-in-place concrete flat slab construction and steel framing respectively. Any other proposed system is to provide similar performance for flexibility for change, vibration resistance, fire rating, acoustic separation, ceiling space available for services, and overall building height.
- 3.11.2.2 Reinforced cast-in-place concrete construction will be used for the lower storey of the structure.
- 3.11.2.3 Building lateral seismic and wind loads will be resisted by reinforced concrete shear walls or structural steel bracing located at stair and elevator cores and at exterior walls. Shear walls and bracing should be avoided within interior spaces in order to leave flexibility for future changes.
- 3.11.2.4 Post tensioned or precast concrete structural systems shall not be used.
- 3.11.2.5 Roofs may be concrete slab or structural steel construction. Structural steel open web joists shall not be used for the design of floors.

### 3.11.3 Design loads

### 3.11.3.1 Performance criteria:

3.11.3.1(1) unless required by the specific use and occupancy, and equipment loads, the following minimum floor design live loads will apply:

3.11.3.1(1)(a) Lower floor and Upper Floor: 4.8 kPa;

3.11.3.1(1)(b) mechanical/electrical service rooms and floors: 4.8 kPa minimum but to accommodate actual equipment in place;

3.11.3.1(2) upper floor will be designed to accommodate concentrated loads from equipment, fixtures, and machinery, whether floor, wall, or ceiling-mounted;

3.11.3.1(3) floors will be designed for a minimum superimposed dead load allowance of 1.5 kPa to allow for partitions, ceilings and suspended mechanical equipment. The roof shall be designed for a superimposed dead load of 0.5 kPa plus all related roofing membrane weights;

3.11.3.1(4) roofs will be designed for the minimum wind, snow and rain loads as required by the BC Building Code. Notwithstanding other requirements, the minimum live load for design of roofs will be 1.0 kPa and roofs will be designed to accommodate concentrated loads from roofing materials, ceilings, equipment, machinery and features, whether roof or ceiling-mounted;

3.11.3.1(5) floors and roofs above mechanical and electrical service rooms and penthouses will be designed for a superimposed suspended equipment dead load in addition to the minimum dead load allowances specified above

### 3.11.4 Post – disaster

3.11.4.1 The Building's structures, structural components, and non-structural components and equipment restraint, will be designed as post-disaster in accordance with the BC Building Code (BCBC).

### 3.11.5 Flexibility for future change

3.11.5.1 The Building will be designed to accommodate renovations for change including equipment, medical and laboratory techniques, and building services.

3.11.5.2 Performance criteria:

3.11.5.2(1) the selection of a structural system that will readily accommodate future changes for similar design load parameters without the addition of structural members, welding, noise, dust, or demolition should be a primary structural design criteria; and

3.11.5.2(2) electrical and communication conduits will not be embedded into concrete slabs and toppings.

3.11.6 Deflection limitations

3.11.6.1 The structure will be designed to minimize the effects of deflection and long-term creep.

3.11.6.2 The design of the structure is to meet the deflection limits of the BC Building Code, and applicable CSA standards as a minimum and as required for the non-structural components of the Building. Notwithstanding the above, the deflection limit will not exceed the levels specified in this section.

3.11.6.3 Performance criteria:

3.11.6.3(1) for concrete floor or roof construction, the maximum deflection occurring after the installation of non-structural elements due to all sustained loads, including long-term creep deflection, plus immediate deflection due to additional live load, will not exceed span/480;

3.11.6.3(2) for steel roof construction, the maximum live load deflection will not exceed span/ 360;

3.11.6.3(3) for steel floor construction, the maximum live load deflection will not exceed span/480 and the total load deflection will not exceed span/360. The total load deflection will include effects of shrinkage of concrete topping slabs; and

3.11.6.3(4) the floor and roof perimeter edge will be designed to limit short and long term deflection occurring after the

installation of exterior wall components, including effects of creep, to a maximum of 25mm.

### 3.11.7 Vibration limitations

- 3.11.7.1 The Design-Builder acknowledges that there are numerous pieces of Equipment used in the project which may be sensitive to even low levels of vibration including microscopes and spectrometers.
- 3.11.7.2 An acoustic and vibration consultant will be retained by the Design-Builder. The consultant will be a professional engineer licensed to practice in the Province of British Columbia with demonstrated experience in providing recommendations and analysis for acoustic and vibration performance for buildings similar in function, size and complexity to the building.
- 3.11.7.3 Ensure that the design of the structural, mechanical and electrical systems of the project complies with the more stringent requirements of Table 3.11.7 Serviceability Criteria for Deflections and Vibrations. The requirements of equipment manufacturers and the principles detailed in this Section to result in control of the vibration of structure of the building and such that performance of the Equipment is not adversely affected.
- 3.11.7.4 Undertake space planning to maximize the separation between vibration sensitive Equipment and sources of vibration, particularly mechanical rooms, electrical rooms, communications closets and server rooms.
- 3.11.7.5 Table 3.11.7 lists the requirements for various typical areas of the Building and the maximum vibration velocity allowed – note that the corresponding floor stiffness applies only to footfalls within the floor space in consideration.
- 3.11.7.6 Demonstrate using numerical analysis carried out by the structural engineer and vibration consultant that the vibration responses of the proposed building structure at the location of the space or Equipment in question will not exceed the values specified in Table 3.11.7.
- 3.11.7.7 Select the damping ratio, based on generally accepted practice, to reflect appropriately the structural system, the



influence of non-structural elements and the effect of building occupants.

- 3.11.7.8 Undertake field testing of the vibration response of the structure at the location of critical Equipment or spaces to demonstrate that the as-constructed condition will satisfy the required maximum vibration response noted in table 3.11.7.

**Table 3.11.7: Acceptable Vibration Levels for Various Typical Facility Spaces**

Occupancy or Equipment Requirements	Vibrational Velocity (1)		Floor Stiffness $KF_n$ <sup>(2)</sup>
	$\mu\text{in/s}$	$\mu\text{m/s}$	kip/in-sec
Mechanical rooms on an unoccupied floor above of below an occupied floor	4000	1000	Not Applicable
Office areas, waiting rooms and corridors	1600	400	250-1500
Mechanical Rooms on the same floor as an occupied area	1200	300	Not Applicable
Computer areas; patient areas (daytime) - threshold of human perception	8000	200	500-3000
Laboratories and critical work areas; bench microscopes up to 100 x magnification	4000	100	1000-6000
Bench microscopes up to 400 x magnification; optical and other precision	2000	50	2000-12000

- 3.11.7.9 Where space utilization dictates otherwise, place such vibration sensitive equipment on a massive, stiff structure such as a thick reinforced concrete slab.
- 3.11.7.10 Avoid locating vibration sensitive equipment or spaces on spans greater than 9m unless significant structures can be accommodated.
- 3.11.7.11 Avoid placing vibration sensitive equipment on light-weight, or long-span floor structures.
- 3.11.7.12 Whenever possible, isolate the major sources of vibration at the source as opposed to isolation of the vibration sensitive equipment itself. Machinery that could be a source of vibration will be mounted using vibration isolation techniques.
- 3.11.7.13 Be aware that additional mass may be required to provide an inertial base for adequate isolation of building services or equipment and the structure must account for this additional dead load.

### 3.11.8 Durability

- 3.11.8.1 The building structure and structural components will be designed for a minimum 100-year life span.
- 3.11.8.2 Design of the Building structure will be in accordance with the BC Building Code and the applicable material and CSA standards including CSA S478 Guideline on Durability of Buildings.
- 3.11.8.3 Design of the building structure and structural components will minimize effects of corrosion and deterioration due to environment and use in accordance with the following:
  - 3.11.8.3(1)(a) adequate concrete crack control joints and expansion/contraction joints. Caulk exposed joints;
  - 3.11.8.3(1)(b) high strength concrete mixes proportioned to CSA durability requirements for exposure class;
  - 3.11.8.3(1)(c) reinforce concrete for crack control and repair exposed cracks;

- 3.11.8.3(1)(d) chamfer corners of exposed concrete where possible;
- 3.11.8.3(1)(e) hot-dip galvanize exterior exposed steel;
- 3.11.8.3(1)(f) reinforcement and required curing for concrete toppings;
- 3.11.8.3(1)(g) corrosion protection measures for concrete exposed to moisture in the parking area in accordance with CSA S413, including application of sealers to vertical concrete surfaces in splash zones and slopes for drainage; and
- 3.11.8.3(1)(h) Wood structural elements will not be directly exposed to the weather. Provide protective cap flashings and drips, sealers, raised concrete pedestals at grade supports, and roof overhangs. Protection shall account for wind driven rain exposure. Exposure to direct sunlight should also be avoided.

### 3.11.9 Equipment supports

- 3.11.9.1 Design will provide for support/anchorage of equipment. Equipment will be supported, anchored, and braced to resist gravity, operational, and seismic loads, as advised by the relevant manufacturers, in a manner required for the functional and service requirements for the specific equipment.
- 3.11.9.2 The Design for medical and laboratory equipment supports, anchorage, and bracing will be carried out by a qualified professional engineer registered in the Province of British Columbia. Installations will be field reviewed by the design engineer.
- 3.11.9.3 Performance criteria:
  - 3.11.9.3(1) floor and roof assemblies will be designed to support the gravity and seismic loads for floor, wall, or ceiling-mounted equipment;
  - 3.11.9.3(2) the structure will be designed for the vibration limitations specified by the manufacturer of the

specified equipment. Carry out in-situ vibration testing when specified by the equipment manufacturer;

- 3.11.9.3(3) drilled insert-type anchors for equipment supports and anchorage will be rated by the insert manufacturer for seismic and cyclic loading applications and drop-in sleeve anchors will not be used.

## **PART 4. SITE DEVELOPMENT REQUIREMENTS**

### **4.1 Exterior Spaces**

4.1.1 Provide exterior public spaces including areas that:

- 4.1.1.1 Welcome and engage visitors, patients, and staff;
- 4.1.1.2 Provide protection from sun, wind, rain and polluted air produced by roadways and parking areas at main and emergency and loading entries;
- 4.1.1.3 Have visual appeal throughout the year;
- 4.1.1.4 Are low maintenance;
- 4.1.1.5 Provide physical separation between site and residential neighbours;
- 4.1.1.6 Provide visual privacy for residential neighbours both in their houses and their outdoor spaces;
- 4.1.1.7 Ensure minimal intrusion of Building activities on neighbours. Particular attention should be given to the routes of late night and early morning staff around the site.
- 4.1.1.8 Are safe, with visible areas with adequate lighting and seating for visitors waiting for transportation;
- 4.1.1.9 Locate lighting and other elements to support way-finding with particular emphasis on building entrances; and
- 4.1.1.10 Incorporate principles of Crime Prevention through Environmental Design (CPTED).

4.1.2 Provide Building staff with sheltered outdoor spaces that:

- 4.1.2.1 Provide shelter from sun, rain and wind;
- 4.1.2.2 Offer views of trees and plants that reflect seasonal change; and
- 4.1.2.3 Are located to minimize noise which could disturb neighbours.

### **4.2 Circulation and Adjacencies (Pedestrian and Vehicular)**

4.2.1 General

Circulation will co-ordinate the movements of vehicles, bicycles, pedestrian and wheelchairs. The design will emphasize safety, while providing opportunities for interaction and social contact.

#### 4.2.2 Pedestrian Walkways

4.2.2.1 Integrate pedestrian circulation throughout the Site that minimizes conflict with vehicles and bicycle zones between the following areas:

4.2.2.1(1) the surrounding roads and major entrances;

4.2.2.1(2) The relocated Nurses Residence and the main hospital;

4.2.2.1(3) The Ambulance station and Centre Street;

4.2.2.1(4) The Emergency entrance and Centre Street

4.2.2.1(5) the Building campus

4.2.2.2 Design pathways to provide universal access to all entrances and exits;

4.2.2.3 Pathways and sidewalks will be configured to provide maximum amount of natural visual surveillance; and

4.2.2.4 All sidewalks shall be concrete with a minimum width of 1.5 meters

4.2.2.5 All sidewalks shall have a maximum grade of 5.0%,

4.2.2.6 Where sidewalk grades exceed 2.0%, handrails shall be provided in accordance to the BC Building Code.

#### 4.2.3 Vehicular access & parking

4.2.3.1 Integrate vehicular circulation with layout of pedestrian and bicycle zones to provide visible connections, to promote safe travel, and to minimize conflict between vehicles and other modes of travel.

4.2.3.2 Maintain continuous access to the existing Ambulance Station.

4.2.3.3 Provide a drop off area for NH buses, and ensure the road way and parking lot design permits all required bus turning movements.

- 4.2.3.4 Provide all required turning movements for a 5 tonne cube truck and semi-trailer truck (WB 20), in order to permit full access to the loading dock.
- 4.2.3.5 Provide Ambulance access to and from Centre Street
- 4.2.3.6 Provide the following number of parking facilities (total 65): 8 handicap stalls; 4 ambulance stalls; 4 car pool stalls; 6 NH fleet vehicle stalls; 43 public parking.
- 4.2.3.7 Parking spaces to be delineated by double line paint markings, and parking spaces to reflect the high percentage of pick-up trucks.

#### 4.2.4 Exterior Signage

- 4.2.4.1 Signage will be designed and located to satisfy the Owner's requirements for Site identification. There will be three (3) large signs identifying the Building located at the main entrances and at the corner of 10th avenue and Centre Street. Signage will be designed and constructed to withstand typical weather conditions experienced in Burns Lake. Signage will be provided with lighting after dark so that major signs are legible at all times. Ensure that views to important signs, site and building entrance are not obstructed by trees or shrubs. Wayfinding design must assist staff, visitors and patients to:

- 4.2.4.1(1) Know the building name;
- 4.2.4.1(2) Know where to park;
- 4.2.4.1(3) Know how to find the correct entrance;
- 4.2.4.1(4) Know how to find the correct destination;
- 4.2.4.1(5) Know where adjacent streets are relative to each exit;
- 4.2.4.1(6) Know where the Emergency Department Entry is located;
- 4.2.4.1(7) Know where the Main Entry is;
- 4.2.4.1(8) Know how to exit the parking lot;

- 4.2.4.1(9) Know where the delivery entrance is;
- 4.2.4.1(10) Understand where not to park throughout the site and
- 4.2.4.1(11) Understand that exit doors are not to be used for entry.

### 4.3 Site Infrastructure

4.3.1 All municipal services shall conform to the Village of Burns Lake Subdivision and Development Servicing Bylaw.

#### 4.3.2 On-Site Services Infrastructure

4.3.2.1 All on-site servicing shall meet the quality requirements for the corresponding municipal off-site services. On-site services shall be designed and constructed to meet proposed development requirements.

4.3.2.2 All existing site services to the existing hospital shall be maintained until the new hospital is fully commissioned and operational. A Construction Period Joint Committee will be formed by Owner and Design-Builder to ensure ongoing communication and coordination during substantial completion, handover, and occupancy of new hospital, as well as closure and demolition of existing hospital.

#### 4.3.3 Off-Site Services Infrastructure

4.3.3.1 All off-site services necessary for a functional Building and as described in Section 4.3 are included in the Design-Builder scope of work.

4.3.3.2 All off-site servicing shall meet the quality requirements as per the Village of Burns Lake Subdivision and Development Servicing Bylaw and the MMCD Details. Road and utility construction design, construction supervision, and quality control supervision of all off-site and site services including on-site ground recharge drainage collection and disposal systems, must be performed by an approved consulting civil engineer. Off Site designs must be submitted by the Design-Builder to the Village of Burns Lake Engineering Department for review and marked "issued for construction" by the Village Engineer before any off-site construction may begin.



#### 4.3.4 Sanitary Sewers

- 4.3.4.1 The Design-Builder's Civil Engineer will confirm the development requirements of this proposed development and establish the service needs;
- 4.3.4.2 The sanitary sewers shall be of a diameter, grade and depth to safely convey all effluent from the site. The sanitary sewer system includes the pipes, manholes, and all other required appurtenances to comply with applicable municipal and provincial standards.
- 4.3.4.3 All Sanitary Sewers shall discharge effluent from the site towards the existing Sanitary Sewer located on 9<sup>th</sup> Avenue.

#### 4.3.5 Storm Sewers and Drainage

- 4.3.5.1 The storm sewers and drainage network shall be of a size, grade and depth to safely convey all storm water;
- 4.3.5.2 Site storm water storage and attenuation shall be provided as required to insure no net increase in downstream flows for the 10 year return period;
- 4.3.5.3 The Design-Builder must engage a consulting Civil Engineer to provide a storm water management plan for the site, which meets the requirements of the Village of Burns Lake. The storm water management plan must also include provision of lot grading plan, minimum basement elevation (MBE), if applicable, and provision of a storm drainage service for the development and /or recommendations for onsite drainage containment and disposal systems; and
- 4.3.5.4 All Storm Sewer discharge shall be directed to the existing municipal ditch on 9<sup>th</sup> Avenue.

#### 4.3.6 Watermain and Appurtenances

- 4.3.6.1 The watermain system (watermain and appurtenances) shall be capable of providing domestic and fire fighting capacity for the Building.
- 4.3.6.2 The watermain system shall provide redundancy;
- 4.3.6.3 The watermain system shall include backflow preventers, as per Village of Burns Lake Bylaw requirements, to protect the municipal system and on site facilities from contaminants;

- 4.3.6.4 The watermain system shall include a flow meter as per the Village of Burns Lake requirements; and
- 4.3.6.5 The Design-Builder's mechanical engineer will determine the domestic and fire protection requirements of this proposed development and establish hydrant requirements and service needs.
- 4.3.6.6 Separate water services shall be provided for the new hospital and the relocated Nurses Residence.

4.3.7 Electrical, Telecommunications, Gas Services

- 4.3.7.1 Electrical, telecommunications, and gas services to support the Building shall be provided; and
- 4.3.7.2 It is the Design-Builder's responsibility to make a servicing application with the respective electric power, telephone and cable transmission companies to arrange for these services, which would be at the Design-Builder's cost.

## **PART 5. ARCHITECTURAL**

### **5.1 Location and Siting**

- 5.1.1 Site the Building as per Appendix 1E Site Diagram. Design will satisfy all Village of Burns Lake zoning requirements.

### **5.2 Building Configuration and Global Circulation**

- 5.2.1 Separate back of house / service circulation from public circulation, including elevators.

### **5.3 Quality of Space/Interior Design**

- 5.3.1 Incorporate the principles of evidence-based design.
- 5.3.2 Maximize opportunities for access to natural light and views.
- 5.3.3 Employ materials and detail surfaces to absorb and minimize sound transmission throughout clinical and staff work areas.
- 5.3.4 Conceal and make discreet from view of visitors and patients the clinical infrastructure wherever possible in clinical areas.
- 5.3.5 Create visual interest within public areas by varying colours, textures, lighting and by employing wood finishes wherever reasonable.
- 5.3.6 Avoid 'blank' hallways with solid-coloured end walls wherever possible: provide views and/or direct or borrowed natural light at ends of hallways.
- 5.3.7 Design building access and interior circulation systems which support the confidentiality of patient information and the security needs of staff at all hours of the day.
- 5.3.8 Design workplaces so that they are flexible and adaptable to change in program or personnel and promote staff and patient safety.
- 5.3.9 Design of workspaces and millwork will be ergonomic and conducive to workflow and processes, and based on program requirements.
- 5.3.10 Include and identify suitable spaces in public areas of the Building for the display of two- and three-dimensional art complete with wall backing for mounting and donor recognition systems complete with required lighting, power, and data connectivity.
- 5.3.11 Design the Building with respect for the economy and culture of the Province by using wood panelling, exposed wood structure and wood feature strips where consistent with the overall project objectives.

### **5.4 Interior Wayfinding and Signage**

#### 5.4.1 Overriding Principles

- 5.4.1.1 Provide simple circulation systems and functions so that way finding is inherently easy;
- 5.4.1.2 Locate major destinations, such as department entrances, along primary circulation paths for easy access. Make waiting areas as open as possible to build confidence in way finding. Design waiting areas to be distinct from circulation;
- 5.4.1.3 Design public elevator and stair lobbies and public circulation routes to be distinct from service and from other non-public routes;
- 5.4.1.4 Provide all signage required for building operations;
- 5.4.1.5 Design signage such that the materials, colours, letter fonts, sizes and other aesthetic and functional considerations, such as Braille, conform to a conceptually coherent overall way finding design system and respect the wall finish modules;
- 5.4.1.6 Provide signage that is resistant to graffiti and physical damage;
- 5.4.1.7 Provide signage that is easy to replace when necessary;
- 5.4.1.8 Use international symbols where required;
- 5.4.1.9 Orient all building plan directories to reflect the direction from which they are viewed;
- 5.4.1.10 Provide signage that directs visitors to departments and rooms within;
- 5.4.1.11 Provide signage that is clearly visible day or night; and
- 5.4.1.12 Avoid multi-layered naming hierarchies and complex numbering systems.

#### 5.4.2 Design Requirements

- 5.4.2.1 Design the internal directional signs to include:
  - 5.4.2.1(1) a main directory, installed at the main public entrances to the Building, that indicates the Building

- in relation to the overall Building Campus Site and the location of every area and department within the Building that is accessible to the public;
- 5.4.2.1(2) a continuous 'trail' of signage from the entrances to each of the reception/information points listed on the directories; this can be unique floor designs, colour, painted lines on walls, or other approved method.
  - 5.4.2.1(3) installation of signage at each point at which a directional decision is required;
  - 5.4.2.1(4) consistent terminology;
  - 5.4.2.1(5) door signage to indicate restrictions on entry and warn of hazards;
  - 5.4.2.1(6) door signage will not be obscured by emergency systems or other functional elements of the building;
  - 5.4.2.1(7) door signage that will identify every space (e.g. rooms, alcoves, corridors and stairwells) in the Building.
  - 5.4.2.1(8) door signage that will be located in a consistent location for every room in the Building.
  - 5.4.2.1(9) door signage that is consistent with the following room numbering protocol:
    - 5.4.2.1(9)(a) each room has a unique identifier number;
    - 5.4.2.1(9)(b) rooms are numbered in a manner that reflects normal movement through the facilities;

- 5.4.2.1(9)(c)      labelling anticipates a person attempting to follow numbering along corridors in sequence;
- 5.4.2.1(9)(d)      blocks of numbers are periodically skipped to allow for future expansion of the numbering system if rooms are added through renovations;
- 5.4.2.1(9)(e)      the Design-Builder will review with, and obtain approval from, the Owner for the door/room/parking stall numbering system prior to placing.
- 5.4.2.1(10)      corridors require unique numbers which are two digits;
- 5.4.2.1(11)      stair wells utilize a single digit; and
- 5.4.2.1(12)      each room requires a number for service reasons and since many rooms will not have formal wall numbering panels, each door frame will be equipped with a lamacoid number plate approximately 25 mm high by 50 mm long, attached to the head of the door frame on the hinge side; and as this numbering system is used for deliveries, repairs, fire alarm notifications, etc., it is important that room numbers be determined early in design and maintained following occupancy. Follow the same numbering system on design and construction documentation for all disciplines (architectural, mechanical, electrical, etc.).

5.4.2.2      External directional signage will:

- 5.4.2.2(1)      clearly indicate access for the public;
- 5.4.2.2(2)      clearly indicate restrictions to 'after-hours' access and closest accessible entrance; and

5.4.2.2(3) be well illuminated, backlit, reflective or high contrast and easily visible at night; and

5.4.2.2(4) ensure that illuminated external Building signage:

5.4.2.2(4)(a) clearly identifies the Building;

5.4.2.2(4)(b) minimizes light spillage; and

5.4.2.2(4)(c) indicates the accesses, parking and restrictions for various vehicle types, as required.

## **5.5 Building Envelope**

5.5.1 Complete all Design and Construction so as to prevent the accumulation and stagnation of rain, snow, ice and dirt on the sloped horizontal and vertical surfaces of the envelope for the climate the building is situated in. This includes but is not limited to the installation of snow retention bars, drains with cleanouts, access panels and /or heat tracing to keep passageways flowing continuously.

5.5.2 Design exterior walls in accordance with rain-screen principles. Include a continuous air space of minimum 25 mm clear width located within the exterior wall assembly.

5.5.3 Ensure that materials and systems employed in wall and roof assemblies contribute to reducing heat gain and loss with minimal decline in performance over their expected 50 year lifespan.

5.5.4 Ensure continuation of the air barrier, vapour barrier, thermal barrier and rain barrier across the entire envelope including foundations, walls and roofs.

5.5.5 Design Building Envelope details to avoid thermal bridging.

5.5.6 Utilize a building envelope consultant through design and construction.

## **5.6 Exterior Building Components – not used**

## **5.7 Interior Building Components**

5.7.1 Design and build the building interior building components in accordance with the following:

5.7.1.1 Interior Walls and Partitions

- 5.7.1.1(1) The interior walls and partition systems will:
- 5.7.1.1(2) provide acoustic separations as required for the specific functions to be carried out in the spaces affected. Refer to Appendix 1D; and
- 5.7.1.1(3) provide all separations required for fire safety and protection.

5.7.1.2 Seismic resistance capabilities will conform to the requirements of CSA S832-06 Guidelines for Seismic Risk Reduction of Operational and Functional Components of Buildings.

5.7.1.3 Design and select interior walls and partitions, partition systems and interior finishes to comply and optimize the following criteria as may be relevant for the particular or specific functions enclosed:

- 5.7.1.3(1) easily cleanable and maintained systems and finishes which contribute to infection control;
- 5.7.1.3(2) permanence and durability including impact resistance;
- 5.7.1.3(3) flexibility and adaptability of services;
- 5.7.1.3(4) low VOC emissions so as to minimize adverse impact on indoor air quality and indoor environmental quality; and
- 5.7.1.3(5) aesthetic and design qualities to provide a positive environment for staff and visitors.

## 5.7.2 Ceilings

- 5.7.2.1 The ceiling system will be part of the definition of interior spaces and may be accessible or inaccessible in total or in part as required to service each room's requirements.
- 5.7.2.2 Accessible ceiling systems must provide access to the ceiling spaces throughout the system.



- 5.7.2.3 Ceiling systems will comprise a major component of the acoustic or sound attenuation function as required in the spaces in which they are installed and will conform to the Sound Transmission ratings specified in Appendix 1D.
- 5.7.2.4 Ceiling height will not be less than 2.7 metres above the finished floor in all areas except for the following:
- 5.7.2.5 Ceiling heights in storage rooms and toilet rooms will not be less than 2.4 metres
- 5.7.2.6 Ceiling finishes to comply with and optimize the following criteria as may be relevant to the particular or specific functions of the space:
  - 5.7.2.6(1) easily cleanable and maintained systems and finishes which facilitate infection control;
  - 5.7.2.6(2) flexibility and access to the spaces above;
  - 5.7.2.6(3) compatibility with mechanical, plumbing, electrical, communications services and fixtures;
  - 5.7.2.6(4) low VOC emissions so as to minimize adverse impact on indoor air quality and indoor environmental quality; and
  - 5.7.2.6(5) Aesthetic and design qualities to provide a positive environment for staff and visitors.

### 5.7.3 Floor Finishes

- 5.7.3.1 The floor and floor systems will be a component of the definition of interior space and will be finished to be complementary and integral to the functional and aesthetic requirements of the interior space.
- 5.7.3.2 Floor finishes will be selected to suit types and concentration of pedestrian and/or vehicular/wheel traffic to be anticipated.
- 5.7.3.3 The following criteria will govern and be integral to the selection of floor finishes:

- 5.7.3.3(1) easily cleanable and maintained finishes which contribute to infection control;
- 5.7.3.3(2) the frequency and quality of joints and ease of replacement if and when required; butterfly joints at outside corners of cove base;
- 5.7.3.3(3) imperviousness to concentrations of moisture anticipated to be existing on the floors and duration of that moisture;
- 5.7.3.3(4) permanence, durability and resistance to concentrated service traffic both pedestrian and vehicular;
- 5.7.3.3(5) aesthetic and design qualities to provide a positive environment for staff and visitors;
- 5.7.3.3(6) Low VOC emissions so as to minimize adverse impact on indoor air quality and indoor environmental quality; and
- 5.7.3.3(7) patterns and textures compatible with the requirements for pedestrian safety and elder friendly design. Refer to Part 3.2 and Part 3.5. Non-skid flooring will be used in wet areas, wash and change rooms.
- 5.7.3.3(8) Must Use Northern Health Acceptable Products.

#### 5.7.4 Infection Control

- 5.7.4.1 Design the Building to mitigate and prevent where possible, the spread of infection including via contaminated surfaces and airborne pathogens.
- 5.7.4.2 Select materials and use simple detailing leading to quality workmanship and ease of accessibility for routine cleaning and maintenance.

- 5.7.4.3 Design the Building to consider ease of infection control in future alterations, modifications and additions.

## **PART 6. FACILITIES CONSTRUCTION SUBGROUP SPECIFICATIONS**

### **6.1 Procurement and Contracting Requirements (Division 01) – not used**

### **6.2 Existing Conditions (Division 02)**

#### 6.2.1 Basic requirements

6.2.1.1 Refer to 3.1.2 for available survey information.

6.2.1.2 Further site specific geotechnical investigations including subsurface drilling and sampling, material testing, exploratory excavations, and pre-construction monitoring may be performed prior to construction at the Design-Builder's expense.

### **6.3 Concrete (Division 03)**

#### 6.3.1 Basic Requirements

6.3.1.1 See Section 2.1.3 Technical References. The list of technical references is not intended to be a complete list of applicable standards. Design and construction will comply with applicable standards and practices whether listed in this section or not.

6.3.1.2 Exposed concrete, with no finish materials, to be sealed:

6.3.1.2(1) Silicate-based sealers: At parking lot, and areas of exposed concrete, provide sodium or potassium silicate products that react chemically with the calcium in the concrete to densify, seal, and dustproof the concrete at the end of the 3 day wet cure period. Installer shall certify compliance with manufacturer's printed installation instructions for use as curing agent or as concrete sealer, as applicable.

#### 6.3.2 Overriding Principles

6.3.2.1 Design and construct cast in place concrete of required properties for the intended use in accordance with the requirements of all applicable codes and specifications.

#### 6.3.3 Quality Requirements

- 6.3.3.1 Inspection and testing of cast in place concrete and concrete materials will be carried out by a testing laboratory in accordance with CAN/CSA A23.1-04. Non-destructive Methods for Testing Concrete will comply with CAN/CSA A23.2-04.
- 6.3.3.2 Performance Criteria:
  - 6.3.3.2(1) concrete floors will be finished with a smooth, dense, steel trowel finish with a Class A Flatness Classification in accordance with CSA A23.1. Overlay toppings to level floors will not be used;
  - 6.3.3.2(2) cracks in concrete floors and walls will be repaired to suit the floor finish and long-term serviceability requirements of the floor;
  - 6.3.3.2(3) foundation walls for below-grade occupied spaces will be water-proofed to prevent groundwater ingress. Construction joints will have purpose-made water stops. A perimeter draining system will be installed around the exterior of the earth-retained building foundation; and
  - 6.3.3.2(4) exposed Architectural concrete will comply with CAN/CSA A23.1-04 Section 8.3.

## **6.4 Masonry (Division 04)**

### **6.4.1 Basic Requirements**

- 6.4.1.1 Masonry design and construction that meets or exceeds current Canadian standards and practices as set out in this section, may be considered for building elements and systems.
- 6.4.1.2 Masonry construction may be considered for exterior walls and walls systems where permanence of finishes, both visually and functionally, and ease of maintenance are primary considerations in the exterior fabric of the building.
- 6.4.1.3 Masonry construction may be considered for interior walls and wall systems when priorities include, permanence and maintenance, sound transmission control, fire resistance and separation requirements and security.

- 6.4.1.4 See Section 2.1.3 Technical References. The list of technical references is not intended to be a complete list of applicable standards. Design and construction will comply with applicable standards and practices whether listed in this section or not.

## 6.4.2 Concrete Masonry Units

### 6.4.2.1 Overriding Principles:

- 6.4.2.1(1) Concrete unit masonry may be considered for both independent exterior walls and in exterior wall systems as a structural backing to other finish materials or systems; and
- 6.4.2.1(2) Concrete unit masonry for interior applications may be considered as an integrally finished material, as a base for applied finish and as a structural backing to other finish systems:
- 6.4.2.1(2)(a) unpainted concrete unit masonry will not be considered an acceptable exposed finish.

### 6.4.2.2 Quality Requirements:

- 6.4.2.2(1) Masonry design and construction will comply with all applicable codes and standards including, but not limited to, CSA S304.1-04, the BC Building Code, and the standards listed in Section 2.1.3 for Technical References; and
- 6.4.2.2(2) Concrete unit masonry practices and work standards will comply with Canadian Masonry Contractors Association (CMCA) Masonry Practices Manual, CSA-S304.1-04, and CSA-A371-04 ( R2009 ).

## 6.4.3 Brick Masonry

### 6.4.3.1 Overriding Principles:

- 6.4.3.1(1) Exterior wall systems comprising brick masonry as a finish veneer to concrete, concrete masonry or metal framing will be a rain screen or cavity wall system;
- 6.4.3.1(2) No brick masonry below grade for exterior applications; and

- 6.4.3.1(3) Brick masonry in interior applications will have integral finish and construction compatible to the maintenance and infection control requirements of the Owner.

#### 6.4.4 Stone Masonry

##### 6.4.4.1 Overriding Principles:

- 6.4.4.1(1) Stone masonry may be considered as a finish veneer to concrete walls or concrete masonry walls. Exterior wall systems in such applications will be a rain screen or cavity wall system.

##### 6.4.4.2 Quality Requirements:

- 6.4.4.2(1) Stone will be sound, hard and durable, well-seasoned and of uniform strength, colour and texture, and free of quarry sap, flaws, seams, sand holes, iron pyrites or other mineral or organic defects.

### 6.5 Metals (Division 05)

#### 6.5.1 Basic Requirements

- 6.5.1.1 Structural steel, steel deck, and cold-formed steel stud design and construction that meets or exceeds current Canadian standards and practices as set out in this section, may be considered for building elements and systems.
- 6.5.1.2 See Section 2.1.3 Technical References. Additional below list of technical references is not intended to be a complete list of applicable standards. Design and construction will comply with applicable standards and practices whether listed in this section or not.

#### 6.5.2 Performance Criteria:

- 6.5.2.1 Structural steel, steel deck, and cold-formed steel stud systems will be designed to comply with the deflection and vibration criteria outlined in Structural Sections 3.10.6 and 3.10.7.
- 6.5.2.2 Erection tolerances for steel construction will be in accordance with CSA S16-01 Clause 29.7 except the

maximum out-of-plumb acceptable for exterior columns will be +/- 20mm over the full height of the building.

- 6.5.2.3 For steel floor and roof construction, the deflection of steel beams, joists, and girders due to the wet weight of concrete topping slabs will be considered. Topping slab thickness may have to vary to maintain floor levelness tolerances. The additional concrete ponding weight will be considered in the design of the structure.
- 6.5.2.4 Concrete topping slabs will be finished with a smooth, dense, steel trowel finish with a Class A Flatness Classification in accordance with CSA A23.1. Thin overlay toppings to level floors will not be used.
- 6.5.2.5 Special attention will be paid to crack control of concrete topping slabs on steel deck. As a minimum, the following details and procedures will be implemented:
- 6.5.2.5(1) minimize wet weight deflections of steel decking and supporting structure;
  - 6.5.2.5(2) where practical, place concrete in alternate bays. Avoid placing large areas at one time;
  - 6.5.2.5(3) use concrete topping with a low design slump. Add superplasticizer to increase slump for placing and finishing;
  - 6.5.2.5(4) use 14mm or larger aggregate topping mix;
  - 6.5.2.5(5) avoid placing topping slabs on hot or windy days;
  - 6.5.2.5(6) reinforce topping slabs with a minimum 10M at 300mm centers each way chaired a minimum 20mm above steel deck;
  - 6.5.2.5(7) Provide extra topping slab reinforcement around openings,



- columns, and at corners; over beams and
- 6.5.2.5(8) wet cure topping slabs for a minimum of three days using soaked burlap covered with polyethylene or similar methods.
- 6.5.2.6 Cracks in concrete topping slabs will be repaired to suit the floor finish and long-term serviceability requirements of the floor.
- 6.5.2.7 Steel floor/roof decking will be wide rib profile for ease of attachment of current and future services, equipment, and fixtures using drilled insert expansion anchors into the bottom of the deck ribs.
- 6.5.2.8 Steel floor/roof decking plus the concrete topping slab thickness will satisfy the requirements of a ULC-rated assembly meeting the BC Building Code fire rating requirements. Spray on or applied fireproofing material will not be used to achieve required floor deck fire rating.
- 6.5.2.9 Structural steel floor/roof framing and supporting members will be fire-proofed to meet the BC Building Code fire rating requirement.
- 6.5.3 Preference will be given to spray-on fire proof applications to floor/roof beams, joists, and girders for ease of attachment of future services, equipment, and fixtures. Spray on fireproofing will have an applied sealer creating a dense non-friable surface.
- 6.5.4 Structural Steel
- 6.5.4.1 Quality Requirements:
- 6.5.4.1(1) quality of workmanship will be inspected by an approved testing laboratory. Testing procedures as specified in CSA S16-09 to verify soundness of representative shop and field welds will be used. All full strength welds shall be tested;
- 6.5.4.1(2) material quality including sourcing and welding quality to be monitored by independent testing agency; and

- 6.5.4.1(3) preparation and painting of Structural Steel Components will conform to the Master Painters' Institute (MPI) Standards.

## 6.5.5 Load Bearing Steel Studs

### 6.5.5.1 Overriding Principle:

- 6.5.5.1(1) load bearing steel studs may be considered as a component of the exterior wall systems to support exterior wall finishes and form an integral part of the building envelope; and
- 6.5.5.1(2) load bearing steel studs may be part of the building structure or may be independent of the principle building structural system.

### 6.5.5.2 Quality Requirements

- 6.5.5.2(1) load bearing steel stud design will be carried out by a Professional Engineer registered in the Province of British Columbia and construction will comply with CSA-S136-07;
- 6.5.5.2(2) manufacturer will be certified in accordance with CSSBI Standard 30M-06 and CSA-A660-04;
- 6.5.5.2(3) fabricator and erector will be experienced in the type of work undertaken. Erection will be reviewed by the design engineer; and
- 6.5.5.2(4) conform to the Association of Wall and Ceiling Contractor's Specification Standards Manual (AWCC).

### 6.5.5.3 Performance Requirements:

- 6.5.5.3(1) limit maximum deflection under specified wind loads to L/360, unless a smaller maximum deflection is specifically required due to wall finishes. For brick masonry used as an exterior finish over steel stud back-up, provide steel stud deflection of L/600 maximum;
- 6.5.5.3(2) design components to accommodate erection tolerances of the structure;

- 6.5.5.3(3) design wind bearing stud end connections to accommodate floor/roof deflections and to ensure that studs are not loaded axially; and
- 6.5.5.3(4) design steel studs to take into account the anchorage of other materials being supported including but not limited to: sub-girts supporting metal cladding and composite panels, soffit finishes and the provision of lateral support at window heads.

#### 6.5.6 Miscellaneous Metals

##### 6.5.6.1 Quality Requirements:

- 6.5.6.1(1) Primers and paints of miscellaneous metals will conform to Master Painters Institute (MPI) Architectural Specification Standards Manual.

### 6.6 Wood Plastics and Composites (Division 06)

#### 6.6.1 Basic requirements

- 6.6.1.1 Wood and plastic products and procedures required in the construction process and as integral components of the building fabric, including but not limited to fabrication, assemblies, surfaces, and finishes, will conform to requirements outlined in Output Specifications Section 2.1. Standards and to those set out in this division.
- 6.6.1.2 Added Urea formaldehyde will not be permitted.
- 6.6.1.3 Finish carpentry and architectural woodwork, including but not limited to cabinets, casework (excluding laboratory casework, which is included in Division 12), frames, panelling, trim, installation of doors and hardware, and other wood-related products and applications will be provided as required for wood products exposed to view in finished interior and exterior installations.
- 6.6.1.4 Plastic laminate surfacing and/or solid polymer fabricated surfacing will be provided as required to create surfaces that require antiseptic or clean characteristics, special or regular maintenance, and resistance to caustic action of chemicals or agents used by the Owner.

- 6.6.1.5 Acrylic plastic products will be provided as required for wall cladding, wall protection, corner protection, casework finishing, trims, ornamental elements, door protection and other applications to achieve a quality of interior finish suitable for use by patients and staff.
- 6.6.1.6 Timber structural elements will be glued-laminated structural units meeting the requirements of CAN/CSA-0122 and CAN/CSA-0177. Timber connector hardware will be hot dipped galvanized where exterior exposure. All nuts, washers and bolts will be galvanized.

## 6.6.2 Performance Criteria

- 6.6.2.1 Finish carpentry and architectural woodwork:
  - 6.6.2.1(1) design, fabrication, materials, installation, and workmanship of finish carpentry and architectural woodwork will conform to quality standards outlined in 6.6.1.1, the Architectural Woodwork Manufacturer's Association of Canada (AWMAC) Architectural Woodwork Standards (AQS) (First Edition) for minimum "Custom Grade," and Door and Hardware Institute (DHI) standards;
  - 6.6.2.1(2) VOC emission levels will be in accordance with CaGBC (Canada Green Building Council) to minimize adverse impact on indoor environmental and air quality;
  - 6.6.2.1(3) adhesives will be non-toxic, non-solvent glue to comply with AWMAC Architectural Woodwork Standards, Canadian 'Eco-Logo' program, and CaGBC (Canada Green Building Council); and
  - 6.6.2.1(4) marine-grade plywood substrate will be used for countertops at wood bases at cabinets.

## 6.7 Thermal and Moisture Protection (Division 07)

### 6.7.1 Basic requirements

- 6.7.1.1 Construction assemblies will be designed according to the building envelope principles outlined in Section 5.5 Building Envelope.
- 6.7.1.2 Construction assemblies will prevent the ingress of moisture or water vapour from the exterior into the building and the

passage of air through the building envelope from the interior spaces to the exterior and vice versa.

- 6.7.1.3 Construction assemblies will prevent the ingress of moisture through foundation walls below grade, both subject and not subject to hydrostatic pressure.
- 6.7.1.4 Comfortable, liveable interior environments will be created by providing protection such as insulation to resist the transfer of heat through exterior walls and roofs.
- 6.7.1.5 Resistance to the propagation and spread of fire will be provided for exterior walls and interior walls designated as fire-resistance rated separations.

## 6.7.2 Performance criteria

### 6.7.2.1 Damp proofing

6.1.2.1(1) foundation wall surfaces will have sufficient damp proofing coverage that is sufficient to repel and prevent moisture ingress in accordance with BC Building Code 5.8.2.

### 6.7.2.2 Waterproofing

6.7.2.2(1) waterproofing will be provided to prevent water ingress to occupied spaces below grade at below-grade vertical concrete walls where hydrostatic head is indicated on geotechnical report;

6.7.2.2(2) sheet or fluid-applied membrane waterproofing will be used to prevent water ingress over suspended slabs and decks and associated walls over habitable spaces where water collection is anticipated; and

6.7.2.2(3) waterproof membranes in the form of air barriers will be provided in exterior walls as part of the building envelope and integral with rain screen or cavity wall assemblies.

### 6.7.2.3 Vapour Barriers

6.7.2.3(1) a continuous vapour barrier membrane will be provided to prevent water vapour transmission and condensation in wall assemblies, roofing assemblies, and under concrete slabs-on-grade within the building perimeter.

#### 6.7.2.4 Air Barriers

6.7.2.4(1) air barrier assemblies will be designed to limit air ex-filtration and infiltration through materials of the assembly, joints in the assembly, joints in components of the wall assembly, and junctions with other building elements including the roof; and

6.7.2.4(2) air barrier assemblies will prevent air leakage caused by air pressure across the wall and roof assembly, including interruptions to the integrity of wall and roof systems such as junctions with dissimilar constructions to the standards as listed above. Provide air barriers to prevent water intrusion in accordance with Paragraph 6.7.2.2 (3) above. Air barriers may be sheet or fluid-applied.

#### 6.7.2.5 Thermal Protection

6.7.2.5(1) thermal insulation will be provided as part of the building envelope to prevent the transfer of heat both from the interior to the exterior and vice versa, dependent on seasonal conditions, and to resist the absorption of water;

6.7.2.5(2) thermal protection materials will be of a type and quality that will provide consistent environmental quality to enclosed spaces;

6.7.2.5(3) Foamed plastic insulation will be CFC and HCFC free and in compliance with the Province of British Columbia Ozone Depleting Substances Regulations.

6.7.2.5(4) Minimum insulation values will be as required to meet or exceed the BC Building Code, ASHRAE 90.1-2004, building Energy Model, and LEED requirements.

#### 6.7.2.6 Roofing

6.7.2.6(1) Materials and workmanship for roofing will conform to the Roofing Contractors Association of British Columbia Guarantee Corp (RGC) latest Standards and ten (10) year Guarantee, as published in the RGC Roofing Practices Manual.

- 6.7.2.6(2) Roof materials will comply with RGC Roofing Practices Manual “Acceptable Materials List,” including:
  - 6.7.2.6(2)(a) Flexible membrane – SBS modified (two-ply system)
  - 6.7.2.6(2)(b) Flexible membrane – Elastomeric or Thermoplastic (single-ply system)
- 6.7.2.6(3) Roof assembly design including deck, vapour barrier, insulation, board stock, and membranes shall comply with British Columbia Building Code for fire classifications and with RGC requirements with wind uplift requirements, as well as requirements of Paragraph 3.10.1.1 for live loads, dead loads, snow loads, and wind uplift. Comply with ULC Class 60 wind uplift classification.
- 6.7.2.6(4) Quality of roofing will undergo inspections as required by the RCABC.
- 6.7.2.6(5) Foamed plastic insulation will be CFC- and HCFC-free and in compliance with the Province of British Columbia Ozone Depleting Substances Regulations.
- 6.7.2.6(6) A complete horizontal barrier to weather and climate will be provided, using one of the following construction systems as applicable to the installation required:
  - 6.7.2.6(6)(a) 2 ply SBS
  - 6.7.2.6(6)(b) Other roofing systems including but not limited to sheet metal, shingles, and roof tiles.
- 6.7.2.6(7) Roofing systems will include:

- 6.7.2.6(7)(a) Flashings and sheet metal;
- 6.7.2.6(7)(b) Thermal insulation;
- 6.7.2.6(7)(c) Roofing specialties and accessories required for completion;
- 6.7.2.6(7)(d) Interior access systems to roof areas;
- 6.7.2.6(7)(e) Wear protection from roof maintenance staff use, per RCABC;
- 6.7.2.6(7)(f) Roof drainage, including overflow scuppers.

6.7.2.6(8) Sheet metal flashings will be designed to divert water away from membrane flashing termination and protect the membrane from deterioration due to the elements and mechanical damage. The roofing membrane will be continuous under the metal. Ensure that sheet metal components comply with wind uplift requirements established for roofing system

6.7.2.6(9) Metal roofing systems, if used, will provide clear internal paths of drainage to allow any trapped moisture to drain to the exterior and avoid the staining of architectural finishes, forming of puddles, forming of icicles, and dripping on pedestrians. Building design and roof systems will ensure that entrance ways are protected from sliding snow and ice and will ensure that there are no accumulations of snow and ice in roof valleys.

#### 6.7.2.7 Fire and Smoke Protection

- 6.7.2.7(1) Spray-applied cementitious fire proofing will conform to standards of Warnock-Hersey (WH) Certification Listings. Typically, cementitious fireproofing will be nominal 240 kg/m<sup>3</sup> density unless otherwise required



by BC Building Code. Provide Portland cement based, wet mix, exterior exposed fireproofing for underside of floor deck above parking. Paint white for added reflectivity per Section 6.9.

- 6.7.2.7(2) Barriers will be integrated into vertical and horizontal space separations to protect against the spread of fire and smoke, and protection will be applied to exposed building elements (structural and non-structural) susceptible to fire and subsequent damage.
- 6.7.2.7(3) Penetrations of vertical and horizontal fire-resistance rated separations will be protected.
- 6.7.2.7(4) Fire-stopping and smoke seal systems will consist of asbestos-free materials and systems, capable of maintaining an effective barrier against flame, smoke, and gases.
- 6.7.2.7(5) Fire-stopping materials will:
  - 6.7.2.7(5)(a) Be compatible with substrates;
  - 6.7.2.7(5)(b) Allow for movement caused by thermal cycles;
  - 6.7.2.7(5)(c) Prevent the transmission of vibrations from pipe, conduit or duct to structure and structure to pipe, conduit or duct.
- 6.7.2.7(6) When more than one product is required for an assembly, all products will be compatible and from the same manufacturer and shall comply with requirements established by ULC tested assemblies. Note that damming materials, such as mineral fibre insulation, is usually not manufactured by the firestopping product manufacturer.
- 6.7.2.7(7) Fire stopping sealants and coatings will be silicone-based or urethane-based and guaranteed not to re-emulsify if subject to wetting or standing water; acrylic-based coatings and sealants are not acceptable.

#### 6.7.2.8 Sealants

- 6.7.2.8(1) Sealant materials will be applied to achieve:
- 6.7.2.8(1)(a) Seals to the building envelope systems or around openings in the building envelope systems as required to prevent water ingress;
  - 6.7.2.8(1)(b) Seals around and over cavities in or behind surface elements to allow effective infection control;
  - 6.7.2.8(1)(c) Sealed joints between dissimilar or similar materials to allow a smooth or even transitions;
  - 6.7.2.8(1)(d) Sealed expansion or controls joints in the building envelope systems or structural systems to allow movement.
  - 6.7.2.8(1)(e) No cracks will be allowed in clinical areas.
- 6.7.2.8(2) Exterior sealants will completely and continuously fill joints between dissimilar and/or similar materials.
- 6.7.2.8(3) Interior sealant (at frames such as those at doors, windows and skylights) will completely fill joints between dissimilar materials and will be one component, acrylic emulsion type.
- 6.7.2.8(4) Silicone caulking to washroom plumbing fixtures will be mildew-resistant and impervious to water.
- 6.7.2.8(5) Sealants applied to expansion and control joints in concrete floors requiring self-levelling properties will be two-component, traffic-grade urethane sealants for horizontal surfaces.
- 6.7.2.8(6) Sealants for exterior vertical expansion and control joints in masonry or wall cladding will be non-sag sealant.
- 6.7.2.8(7) Sealants will allow for minimum 25% movement in joint width.
- 6.7.2.8(7)(a) In corridors and other traffic areas used by laundry carts, supply carts, material handling equipment etc., sealant will be traffic bearing

type and suitable to support imposed load without deformation or failure.

## 6.8 Openings (Division 08)

### 6.8.1 Basic requirements

- 6.8.1.1 Except where wire glass is required in accordance with the BC Building Code, interior windows and sidelights will be constructed of tempered glass. Exterior glazing at doors and sidelights will be laminated. Where required by Code, label as safety glass.
- 6.8.1.2 Installation methods and locations for doors, frames, and hardware will conform to Door and Hardware Institute (DHI) standards.
- 6.8.1.3 Doors
  - 6.8.1.3(1) Doors will be sized, fabricated, and installed to suit the intended function of spaces or rooms requiring acoustic or visual privacy, security, special HVAC requirements, fire-resistance rated separations or other closures.
  - 6.8.1.3(2) Size Requirements for Doors
    - 6.8.1.3(2)(a) Door openings will be of adequate width to suit the intended purpose of rooms on either side of the doors and allow the movement of people and equipment associated with those rooms.
    - 6.8.1.3(2)(b) Double doors will be provided into rooms where large pieces of equipment will be moved in or out during the lifetime of the building, and where such equipment cannot pass through 1200 mm single door openings.
    - 6.8.1.3(2)(c) Door openings must accommodate movement of equipment.
    - 6.8.1.3(2)(d) Double doors will be provided into corridors and major laboratory areas.
    - 6.8.1.3(2)(e) Unless required otherwise, doors to outpatient areas, including doors to water

closets and change room cubicles, will have a minimum width of 950 mm.

- 6.8.1.3(2)(f) No single door will be less than 750 mm wide.
- 6.8.1.3(2)(g) No door or door leaf will be less than 2135 mm high, unless specifically required for access to services or other purposes where height is restricted.
- 6.8.1.3(3) Acoustic Requirements for doors:
  - 6.8.1.3(3)(a) Doors will have an STC rating corresponding to that of the wall or partition in which the door is located.
  - 6.8.1.3(4) Doors into or between major departments or activity areas through which cart, stretcher, or bed traffic is anticipated on a routine basis will be automatically activated by an electronic device or manual push button, located to allow emergency access without the necessity to stop movement. All other doors through which cart, equipment or frequent staff traffic is anticipated on a routine basis will have hardware or automatic activation that allows the doors to stay in an open position.
  - 6.8.1.3(5) Door sizes and designs will be applied consistently to rooms of similar use, location, and configuration.
  - 6.8.1.3(6) Doors will not swing into corridors in a manner that may obstruct traffic flow or reduce the corridor width, except doors to spaces that are used infrequently and not subject to occupancy such as small closets.
  - 6.8.1.3(7) Doors may swing into washrooms, provided they allow for ease of use. Such doors will be equipped with required hardware to allow the door to be opened out into the corridor in an emergency situation.
  - 6.8.1.3(8) Doors will have required hinges, edge protection, and face protection to minimize damage and resultant disruptive maintenance.

- 6.8.1.3(9) Doors and frames will have a suitable finish that prevents dirt and fingerprint accumulation, and can be easily cleaned and disinfected.
  - 6.8.1.3(10) Where possible, the preference is to provide glazing in an adjacent sidelight rather than within the door itself.
  - 6.8.1.3(11) Blinds or window coverings suitable for the level of functional and operational requirements will be provided where privacy might be a concern. Blinds may be integral with the window air space, or surface applied in accordance with Section 6.12.2.1.
  - 6.8.1.3(12) Doors and door frames will have the capability to withstand the varying and high levels of humidity and impact that occur typically within a laboratory and maintain their inherent aesthetic and functional capacities. Frames and anchors for doors, sidelights, and interior and exterior windows for special areas will be designed to withstand the heavy degree of impact anticipated and maintain their aesthetic and functional capacities.
  - 6.8.1.3(13) In areas where security is considered paramount such as secure entrances, safety and security will be achieved with the required location, configuration, materials, construction, and detailing of doors and hardware in accordance with British Columbia Ministry of Health Standards.
  - 6.8.1.3(14) Secure room / Seclusion room will be designed and constructed to comply with requirements of the BC Ministry of Health document "Standards – Hospital-Based Psychiatric Emergency Services: Observation Units" (latest edition).
- 6.8.1.4 Windows
- 6.8.1.4(1) Windows will be sized, configured, and adequately constructed to suit rooms that require daylight, views and/or natural ventilation.
  - 6.8.1.4(2) Consideration will be given to providing 'borrowed light' through interior windows to occupied rooms that do not have exterior windows. The intent is to borrow

light from areas that have windows and consequently create a more comfortable and less closed-in atmosphere.

- 6.8.1.4(3) Glazing heights will be coordinated with adjacent wall protection, handrails, door hardware, and other accessories to achieve functional and aesthetic cohesiveness.

## 6.8.2 Performance Criteria

### 6.8.2.1 Hollow Metal Doors and Frames

- 6.8.2.1(1) Materials and manufacture of metal doors and frames will conform to the requirements of the Canadian Steel Door and Frame Manufacturer's Association (CSDFMA).
- 6.8.2.1(2) Interior metal doors will have flush faced construction. Provide continuously welded, seamless edge construction using steel sheet; 16 gauge (1.6 mm) typically
- 6.8.2.1(3) Exterior Metal Doors will have
  - 6.8.2.1(3)(a) Flush faced construction Provide steel sheet; minimum 16 gauge (1.6 mm).
  - 6.8.2.1(3)(b) Edge seams to correspond with door function and minimize maintenance needed. Provide with continuously welded, seamless edge construction.
  - 6.8.2.1(3)(c) Prepared surfaces to receive finishes that resist corrosion from exposure to weather. Provide with ZF180 coating.
- 6.8.2.1(4) Pressed Metal Frames will have
  - 6.8.2.1(4)(a) Fully welded construction Provide same gauge at frames as at doors to improve performance of assembly, including hardware.
  - 6.8.2.1(4)(b) Thermally-broken door frames at exterior, non-fire-rated openings.

6.8.2.1(4)(c) Anchors to each jamb to suit wall type and receive the frame.

6.8.2.1(5) Door Glazing

6.8.2.1(5)(a) Exterior glazing will be sealed units in thermally-broken frames to prevent heat loss.

6.8.2.2 Wood Doors

6.8.2.2(1) Wood doors will conform to the Architectural Woodwork Standards (First Edition) published by the Architectural Woodwork Manufacturer's Association of Canada (AWMAC).

6.8.2.2(2) Wood doors will be sized, constructed and hardware, and be provided with hardware and finishes to suit the intended function and aesthetics of the building and its program.

6.8.2.2(3) Construction, finish, and installation will attempt to minimize the requirement for maintenance and resulting disruption to hospital operations.

6.8.2.2(4) Wood doors will be flush Custom Grade quality, solid particleboard core.

6.8.2.2(5) Fire-resistance rated doors will be constructed with a homogeneous incombustible mineral core and AWMAC Quality Standards Option 5 blocking.

6.8.2.2(6) Finish hardware will be installed securely to resist loosening over time and fastened to solid wood backing, except where hardware is designed to be through-bolted.

6.8.2.2(7) Stiles, rails and faces will be glued to the core with Type II water-resistant adhesive to minimize delamination or disassembly as a result of moisture ingress.

6.8.2.2(8) For wood finished doors, face veneer will be A-Grade hardwood veneer with AWMAC No. 3 edge and finished to suit the intended use. Clear urethane factory finish. For paint finished doors finish with

primer and minimum two coats of paint as per Section 6.9.2.7.

#### 6.8.2.3 Aluminum Entrances and Storefronts

- 6.8.2.3(1) Aluminum entrances and storefront framing and doors may form part of the exterior envelope of the building(s) or provide glazed interior partitions as required to comply with functional program requirements.
- 6.8.2.3(2) Aluminum doors will be used within aluminum entrances and storefront. Provide with offset pivots or with heavy duty butt hinges to accommodate expected traffic.
- 6.8.2.3(3) Frames will be thermally-broken, flush glazed, aluminum sections, to accept insulating glass units at exterior openings.
- 6.8.2.3(4) Frames will incorporate drained and vented system (rain screen) with a complete air and vapour seal, allowing any moisture entering the frame to drain to the exterior and allowing air into the pressuring chamber.
- 6.8.2.3(5) Aluminum swing entrance doors will be heavy-duty commercial or institutional grade and may be automatically operated, motion-detector controlled, with longer opening times for the elderly.
- 6.8.2.3(6) Aluminum finish for exposed aluminum surfaces will be applied in the manufacturing process and be permanent and resistant to corrosion caused by weather exposure and climate.

#### 6.8.2.4 Specialty Doors

##### 6.8.2.4(1) Overhead Rolling Service Doors

- 6.8.2.4(1)(a) Lateral movement of door curtain slats will be restrained. Windlocks will be provided as required by door size or wind load requirements.



6.8.2.4(1)(b) Curtain slats will be interlocking flat slats, complete with bottom bar and contact type bottom astragal.

6.8.2.4(1)(c) Manual operation will be provided with inside lift handle and locking bar or chain hoist. Motor operation will be provided on doors requiring constant usage. Chain operation will be by means of reduction gears and galvanized hand chain.

6.8.2.4(1)(d) For fire doors, automatic closing device will be operated by fire door release device connected to fire alarm system.

#### 6.8.2.4(2) Overhead Rolling Grilles

6.8.2.4(2)(a) Overhead rolling grilles will be fabricated with metal components, and assembled to allow visual access to secure areas.

6.8.2.4(2)(b) Grille guides will be complete with aluminum or steel guides, fabricated to withstand vertical and lateral loads, counterbalanced by helical torsion springs, and sound-deadened.

6.8.2.4(2)(c) Manual operation will be provided with inside lift handle and locking bar or chain hoist. Motor operation may be provided on grilles requiring constant usage. Chain operation will be by means of reduction gears and galvanized hand chain.

#### 6.8.2.4(3) Overhead Rolling Counter Shutters

6.8.2.4(3)(a) Shutter curtains will be fabricated with extruded aluminum, galvanized steel, or stainless steel interlocking flat slats, complete with guides of similar materials.

6.8.2.4(3)(b) Shutters will have manual operation and locking capability.

#### 6.8.2.4(4) Sliding Doors and Panels

- 6.8.2.4(4)(a) Door and track materials and assembly will operate smoothly and resist door derailment.
  - 6.8.2.4(4)(b) Systems with a swing-type door(s) will attach to the slide door carrier(s) by means of top pivot bar and bottom pin guide, and contain a breakaway release latch for holding the door in the closed position during normal operation. Swing-out sidelights will allow the active sliding door to swing at 90° from any position in the sliding mode.
  - 6.8.2.4(4)(c) Glass will be of safety type, capable of withstanding the impact of manually-wheeled vehicles in emergency situations.
- 6.8.2.4(5) Interior Aluminum Sliding Doors and Sidelights
- 6.8.2.4(5)(a) Interior sliding doors and sidelights will be top hung, with no recessed floor track per infection control requirements, with sliding and fixed panel(s), and suitable for single glazing with 6 mm clear fully tempered float glass.
- 6.8.2.4(6) Automatic Sliding Doors
- 6.8.2.4(6)(a) Automatic sliding doors will be installed at main and emergency entrances.
  - 6.8.2.4(6)(b) Doors equipment will accommodate medium to heavy pedestrian traffic and up to the following weights for active leaf doors: 100 kg for locations as designated bi-part, 200 kg for single slide.
  - 6.8.2.4(6)(c) Door operator, including the motion and presence detection system, will be capable of operating within the temperature ranges existing at the building and be unaffected by ambient light or ultrasonic interference.
  - 6.8.2.4(6)(d) Doors will be on motion sensors and securable after hours.
- 6.8.2.4(7) Automatic Swing Doors

- 6.8.2.4(7)(a) Automatic swing doors may be installed at main and emergency entrances and may be used for other interior and exterior locations.
- 6.8.2.4(7)(b) Door equipment will accommodate medium to heavy pedestrian traffic and up to 98 kg weight of doors.
- 6.8.2.4(7)(c) Directional motion sensor control device, if used, will be unaffected by ambient light or ultrasonic frequencies.
- 6.8.2.4(7)(d) All in-swing doors that are required exits will be equipped with an emergency breakaway switch that internally cuts power to the operator. No external power switch will be allowed
- 6.8.2.4(7)(e) Longer hold-open times will be implemented to accommodate the elderly and frail.
- 6.8.2.4(7)(f) Use of delayed panic hardware to meet exit route requirements is discouraged.

#### 6.8.2.4(8) Aluminum Curtain Wall and Windows

- 6.8.2.4(8)(a) Aluminum curtain walls will conform to the Aluminum Association Standards (AAS), and the American Architectural Manufacturers Association (AAMA) field testing specifications.
- 6.8.2.4(8)(b) Curtain wall framing will incorporate a drained and vented system with a complete air and vapour seal, allowing any water entering the framing/system and the glazing detail cavities to drain to the exterior and also allow air into the pressuring chamber.
- 6.8.2.4(8)(c) The design of the curtain wall framing will incorporate a thermal-break system.
- 6.8.2.4(8)(d) Aluminum finish for exposed aluminum surfaces will be permanent and resistant to corrosion resulting from weather exposure and climate.

6.8.2.4(8)(e) The assembly will be designed to resist local seismic conditions (post-disaster building).

6.8.2.4(8)(f) The assembly will resist 1-in-100 year climatic events (with a safety factor).

#### 6.8.2.5 Glass and Glazing

6.8.2.5(1) Glass and glazing materials and workmanship will conform to the Insulating Glass Manufacturers Association of Canada (IGMAC) Guidelines, and the Glazing Contractors Association of B.C. (GCA) Glazing Systems Specifications Manual.

6.8.2.5(2) Exterior and/or interior glass and glazing may be provided as integral components of the exterior building envelope, interior partitions and screens, exterior and interior doors, handrail balustrades, skylights and decorative and ornamental glazing.

6.8.2.5(3) The assembly will be designed to resist local seismic conditions as a post-disaster building.

6.8.2.5(4) The assembly will resist 1-in-100 year climatic events (with a safety factor).

6.8.2.5(5) Laminated safety glass will be used in single-glazed skylights, entry doors and sidelights, or as the inboard light of a double-glazed skylight.

#### 6.8.2.5(6) Mirrors

6.8.2.5(6)(a) Full wall unframed mirrors will be 6 mm thick minimum float glass backed with electrolytically-applied copper plating. All edges will be ground smooth and polished.

6.8.2.5(6)(b) Wall mounted posture mirrors will be framed type; one piece, stainless steel channel frame with a No. 1 quality, 6 mm thick float glass mirror backed with electrolytically applied copper plating. Back will be galvanized steel.

6.8.2.5(6)(c)

#### 6.8.2.6 Finish Hardware

- 6.8.2.6(1) Finish hardware materials and workmanship will conform to quality standards of the Door and Hardware Institute (DHI).
- 6.8.2.6(2) Finish hardware supplier will be an established contract builders hardware firm who will have in its employ one or more AHC (Architectural Hardware Consultant) who are members in good standing of the Door and Hardware Institute (DHI) and who will be responsible for the complete hardware contract.
- 6.8.2.6(3) Finishes will be selected to provide maximum longevity and preservation of the finish.
- 6.8.2.6(4) Hardware, where applicable, will be ULC-listed for fire rating for all functions up to 2-hour doors.
- 6.8.2.6(5) Hardware will be heavy-duty commercial quality. Locksets and latchsets will be fully mortised type and lever handles will be solid material.
- 6.8.2.6(6) Keying
  - 6.8.2.6(6)(a) Primus EF Level 2 Cylinders will be supplied.
  - 6.8.2.6(6)(b) A minimum 4-level keying system will be implemented.
  - 6.8.2.6(6)(c) Locking and Cylinders shall all be keyed to a new grand master key in system and keyed to the Owner's requirements.
  - 6.8.2.6(6)(d) New key fittings will be given to and controlled by the Owner.
  - 6.8.2.6(6)(e) Keys from factory will be given to the Owner.
  - 6.8.2.6(6)(f) Four (4) keys will be supplied for each lock cylinder.

## 6.9 Finishes (Division 09)

### 6.9.1 Basic Requirements

- 6.9.1.1 In areas where finishes and systems of installation will occur and water is anticipated to be present as part of cleaning or

other procedures, water will be allowed to collect and exist without causing damage to the finishes or substrate.

- 6.9.1.2 For areas in which wear is a concern, such as areas with anticipated pedestrian or wheeled traffic, finish materials will be durable to withstand damage and easily replaceable in sections if damage does occur.
- 6.9.1.3 Infection prevention and control will be a priority in the selection of finishes for all laboratory and clinical areas in addition to circulation / facilities.
- 6.9.1.4 Acoustic characteristics of finish materials will be a priority consideration.
- 6.9.1.5 The appearance of finishes and colours will create and promote a natural healing environment, prevent glare, and minimize artificial lighting requirements.
- 6.9.1.6 Selection of materials will promote sustainability by, for instance, having low-emissivity or comprising of renewable resources.

## 6.9.2 Performance Criteria

- 6.9.2.1 Interior Wall Framing
  - 6.9.2.1(1) Materials and workmanship for interior walls, including steel studs and furring and gypsum board ceiling suspension systems, will conform to the Canadian Sheet Steel Building Institute Standards (CSSB1), and the Association of Wall and Ceiling Contractors of B.C. (AWCC) Wall & Ceiling Specification Standards Manual (latest edition).
  - 6.9.2.1(2) System design and components will meet seismic restraint requirements for a post-disaster building.
  - 6.9.2.1(3) Prefabricated steel studs for interior partitions and furring will be non-load bearing, with no axial load other than its own weight, the weight of attached finishes, and lateral loads of interior pressure differences and seismic loads.
  - 6.9.2.1(4) Steel stud framing construction will accommodate electrical, plumbing and other services in the partition

cavity, and support fixtures, wall cabinets and other such wall-mounted items with reinforcement and backing.

- 6.9.2.1(5) Design will consider the differences in air pressure that may result on opposite sides of the wall or partition due to factors such as wind and other lateral pressures, stack effects, or mechanically-induced air pressurization.

#### 6.9.2.2 Gypsum Board

- 6.9.2.2(1) Materials and workmanship for gypsum board and accessories will conform to the Association of Wall and Ceiling Contractors of B.C. (AWCC) Wall & Ceiling Specification Standards Manual (latest edition). Note that the British Columbia Wall and Ceiling Association - <http://bcwca.org/> also provides a link to the AWCC website, but the Standard is by AWCC. The Association of Wall and Ceiling Contractors (AWCC) of BC - <http://awccbc.org/> issues the Standards Manual. There is also a Northwest Walls & Ceilings Bureau (NWCB) - <http://www.nwcb.org/>, that spans the US and Canadian Northwest and who publishes a standard "Recommended Levels for Finishing of Gypsum Board". Typically, finish exposed gypsum board surfaces to Level 4 finish.

- 6.9.2.2(2) Thickness of gypsum board will be not less than 16 mm.

- 6.9.2.2(3) Except for 6.9.2.2(4), glass mat water-resistant gypsum backing panels (tile backer board) will be used behind wall covering in showers, behind sinks, or other wet areas. Plywood backing will be used in Clean and Soiled Supply rooms, and wherever millwork or equipment is to be wall mounted.

- 6.9.2.2(4) Reinforced cementitious board or cementitious backer unit (CBU) may be used as an alternative to glass mat water-resistant gypsum backing panels in 6.9.2.2(3).

- 6.9.2.2(5) Abuse-resistant gypsum board will be provided where required for increased resistance to abrasion,

indentation, and penetration of interior walls and ceilings.

- 6.9.2.2(6) Glass mat surfaced gypsum sheathing board will be used wherever exterior gypsum sheathing is required at exterior walls.
- 6.9.2.2(7) Airborne sound insulation will be provided for gypsum board/steel stud assembly to close off air leaks and flanking paths by which noise can go around the assembly. Assemblies will be airtight. Recessed wall fixtures such as cabinets or electrical, telephone and television outlets and medical gas outlets, which perforate the gypsum board surface, will not be located back-to-back. In addition, any opening for fixtures will be carefully cut to the proper size and piping penetrations will be sealed. Conduit/duct/piping penetrations will be sealed with tape and filled at the plenum barrier. The entire perimeter of a sound insulating assembly will be made airtight to prevent sound flanking. An acoustic caulking compound or acoustical sealant as recommended by the acoustic consultant will be used to seal between the assembly and all dissimilar surfaces (including at window mullions) in accordance with the recommendations of the acoustic consultant.

#### 6.9.2.3 Ceramic Tilework

- 6.9.2.3(1) Materials and workmanship for ceramic tilework will conform to the Terrazzo Tile and Marble Association of Canada (TTMAC) Tile Guide Specification Section 09 30 00 Tile (latest edition).
- 6.9.2.3(2) In order to reduce opportunities for the spread of infection, use of ceramic tile will be minimized in patient care, emergency, and diagnostic areas.
- 6.9.2.3(3) Floor tile installed on wet and exterior surfaces will have the following static coefficients of friction as per the American Society for Testing and Materials International (ASTM):
  - 6.9.2.3(3)(a) Level Surfaces: Not less than 0.50 for wet and dry conditions.



- 6.9.2.3(3)(b) Stair Treads: Not less than 0.60 for wet and dry conditions.
  - 6.9.2.3(3)(c) Ramp Surfaces: Not less than 0.60 for wet and dry conditions.
  - 6.9.2.3(4) Exterior tiles will be frost-resistant and have a moisture absorption rating of 3.0% or less.
  - 6.9.2.3(5) Control joints and expansion joints will be provided in conformance with the recommendations of the TTMAC Tile Installation Manual.
  - 6.9.2.3(6) A waterproof membrane will be provided under ceramic floor tile in showers and other wet areas. The membrane may be trowel-applied, built-up, liquid-applied or sheet-applied.
  - 6.9.2.3(7) Crack isolation membranes will be provided to resist crack transmission from the substrate due to lateral movement and designed for use in thin-set applications of tile over a cracked substrate. Materials used will be elastomeric sheets or trowel-applied materials suitable for subsequent bonding of ceramic tile.
  - 6.9.2.3(8) Ceramic tile will be set and grouted with epoxy setting and grouting materials.
- 6.9.2.4 Acoustic Ceilings
- 6.9.2.4(1) Interior sound levels will be controlled to facilitate a safe working environment for building staff.
  - 6.9.2.4(2) Acoustic ceiling tiles in a suspension system will be installed to provide a level of sound attenuation to suit the intended function of the room.
  - 6.9.2.4(3) Ceiling tiles in a suspension system will provide accessibility to the ceiling spaces where access is required to mechanical, electrical or other service systems.
  - 6.9.2.4(4) Special surface-treated ceiling tiles and panels, such as wood, mylar or metal-faced tiles, may be utilized.

- 6.9.2.4(5) System design and components will meet seismic restraint requirements for a post-disaster building.
- 6.9.2.4(6) Standard acoustical panels and tiles will be designed for installation within the normal occupancy condition range of 15°C - 29°C and maximum 70% relative humidity (RH). When the service use temperature and RH are expected to exceed these ranges, use of acoustical units specifically designed for such applications will be considered.
- 6.9.2.4(7) In any area where lay-in ceiling panels frequently need to be removed for plenum access, tiles will be provided with scratch-resistant surfaces and sealed edges.

#### 6.9.2.5 Flooring

##### 6.9.2.5(1) Flooring Types

###### 6.9.2.5(1)(a) All rooms except wet rooms

- The accepted product for the Owner will be Tarkett Granitt or approved equal.
- All joins will be hot welded seam.
- All installs will have a 150 mm Tarkett coved base or approved equal.
- Cove will not be capped, but will be straight cut, finished with clear silicone caulking.
- Flooring adhesive to be water soluble, low odour product.
- Edging will be finished with vinyl finishing strip as per manufacturers recommendations.
- Flooring will not be finished with sealer and/or wax, but must be finished with high speed buffing as per manufacturers recommendations.

###### 6.9.2.5(1)(b) Wet Rooms

- The accepted product for the Owner will be Tarkett Eminent Safe T or approved equal.
- All joins will be hot welded seam.
- All installs will have a 150 mm Tarkett eminent coved base or approved equal.
- Cove will not be capped, but will be straight cut, finished with clear silicone Caulking

- Flooring adhesive to be solvent based, low odour product.
- Edging will be finished with vinyl finishing strip.

#### 6.9.2.5(1)(c) Stair Covering, Where Applicable

- Stair treads will be one piece solid vinyl Johnsonite VIRTR (visually impaired roundel tread riser) with carborundum strip.
- Adhesive to be water soluble, low odour product.

#### 6.9.2.5(1)(d) Other Flooring

There may be floor surfaces that require specialized application such as Stonehard, poured epoxy, painted concrete, rubber, or special vinyl. These applications will be reviewed on a per application basis.

6.9.2.5(2) Materials and workmanship for flooring will conform to the National Floor Covering Association (NFCA) (<http://www.nfcaonline.ca/>) Specification Standards Manual. US Federal Specification RR-T-650e. <http://www.wbdg.org/ccb/FEDMIL/rrt650e.pdf>

6.9.2.5(3) The selection process for flooring materials will include considerations of cleaning and maintenance, pedestrian and rolling traffic, acoustics, infection control, and aesthetics.

6.9.2.5(4) Epoxy flooring in all wet areas will be water and slip-resistant and prevent water or moisture transmission to the substrate. Flooring will terminate at the walls in the form of 150mm high flash covers in these areas.

6.9.2.5(5) Flooring on which wheeled or service vehicle traffic is anticipated and wear and damage may result will comprise of suitably heavy-duty materials.

6.9.2.5(6) Flooring in areas where cart or stretcher traffic is expected or where cleaning on a regular or emergency basis is necessary will be of a quality suitable for those purposes, and with barrier free or smooth finishes.

- 6.9.2.5(7) Flooring in washrooms will be impervious to water and have a slip-resistant finish.
- 6.9.2.5(8) Resilient tile products will be considered for flooring in service corridors and service areas.
- 6.9.2.5(9) Resilient Flooring
  - 6.9.2.5(9)(a) Slip-resistant sheet vinyl will have a static coefficient of friction of 0.6 on level surfaces and 0.8 on ramps.
  - 6.9.2.5(9)(b) Exposed surface will provide anti-bacterial activity against gram-positive and gram-negative micro-organisms. All seams will be welded. Areas surfaced in sheet flooring will have integral cove bases.
  - 6.9.2.5(9)(c) Linoleum flooring is not an acceptable product.
  - 6.9.2.5(9)(d) Rubber flooring tile where approved by Owner will be formulated with 100% virgin elastomers, reinforcing agents, soil-resisting agents, and migrating waxes compounded to create durability, excellent cleaning characteristics, and exceptional slip resistance. Stud designs will have chamfered edges with a sharply-defined edge at the top for higher slip resistance, easier cleaning, superior maintenance and low vibration design to minimize vibration and noise. Areas surfaced with resilient tile flooring will have rubber bases.
  - 6.9.2.5(9)(e) Tactile warning strips and stair nosings will be provided to assist the visually impaired.
  - 6.9.2.5(9)(f) Adhesive for resilient flooring will meet or exceed EPA Standards for acceptable VOC concentration and emission rates.
- 6.9.2.5(10) Seamless Quartz Epoxy Flooring
  - 6.9.2.5(10)(a) Seamless epoxy flooring will be a 100% solids, zero VOC, solvent-free system

comprised of a two-component epoxy primer, a two-component epoxy resin and curing agent, coloured quartz aggregate broadcast into both primer and undercoat, and a high performance, UV-resistant two-component, clear epoxy sealer. Bases will be integral cove bases.

#### 6.9.2.6 Acoustic Treatment

- 6.9.2.6(1) Acoustic treatment will be provided where sound attenuation, soundproofing or other sound control measures are necessary to create a safe and comfortable environment for staff and where confidentiality is paramount.
- 6.9.2.6(2) For STC ratings, refer to Appendix 1D.
- 6.9.2.6(3) Sound control will include:
  - 6.9.2.6(3)(a) Attenuation of sound throughout the building;
  - 6.9.2.6(3)(b) Sound isolation between the exterior and interior spaces;
  - 6.9.2.6(3)(c) Sound isolation between interior spaces within the building at both horizontal and vertical separations;
  - 6.9.2.6(3)(d) Sound and vibration isolation of building service noises and sound isolation of building service rooms.
- 6.9.2.6(4) Partition and ceiling construction will provide approximately the same degree of sound control through each assembly. When a partition is used for sound isolation, the sound control construction will extend from slab to slab.
- 6.9.2.6(5) Optimum sound isolation requires that the integrity of gypsum board partitions and ceilings (mass) never be violated by vent or grille cut-outs or by recessed cabinets, light fixtures, etc.

- 6.9.2.6(6) Mineral fibre insulation will be used to seal joints around all cut-outs such TV, data, plumbing, recessed cabinets and bathtub cavities.
- 6.9.2.6(7) Constructions such as ducts, rigid conduits, or corridors that act as speaking tubes to transmit sound from one area to another will be minimized. Common supply and return ducts will have sound attenuation liners at the diffuser and/or grill to maintain assemblies' STC. Conduit will be sealed.
- 6.9.2.6(8) To isolate structure-borne vibrations and sound, vibrating equipment will have resilient mountings to minimize sound transfer to structural materials. Ducts, pipes, and conduits will have resilient, non-rigid boots or flexible couplings where they leave vibrating equipment; and they will be isolated from the structure with resilient gaskets and sealant where they pass through walls, floors, or other building surfaces.
- 6.9.2.6(9) Acoustic screens, vibration isolators, and carefully selected exterior equipment will be used to prevent exterior noise that neighbours may find offensive.

#### 6.9.2.7 Painting and Protective Coatings

##### 6.9.2.7(1) Paints

###### 6.9.2.7(1)(a) Walls, doors and shelving

- The accepted product for the Owner will be eggshell or semi gloss.
- Application: brush, roller or spray
- Clean up: warm water
- Thinner if needed: water
- Colour selection / patterning will be at the discretion of the Owner
- Ensure bottoms and tops of doors are painted for ease of cleaning.

###### 6.9.2.7(1)(b) Door frames and metal doors

- The accepted product for the Owner will be semi gloss
- Application: brush, roller or spray
- Clean up: warm water

- Thinner: water
- Colour selection / patterning will be at the discretion of the Owner

#### 6.9.2.7(1)(c) Wood finish doors

- The accepted product for the Owner will be Clear Coat Interior Varnish
- Application: brush, roller or spray
- Clean up: mineral spirits
- Thinner: mineral spirits

#### 6.9.2.7(1)(d) Paint Grade Doors

- The accepted product for the Owner will be semi gloss
- Application: brush, roller or spray
- Clean up: warm water
- Thinner if needed: water
- Colour selection / patterning will be at the discretion of the Owner

#### 6.9.2.7(1)(e) Ceilings

- The accepted product for the Owner will be flat
- Application: brush, roller or spray
- Clean up: warm water
- Thinner: water
- White will be the preferred colour for all painted ceilings

#### 6.9.2.7(1)(f) New wall / product finish

- The accepted product for the Owner will be latex sealer
- Application: brush, roller or spray
- Clean up: warm water
- White will be the preferred colour

#### 6.9.2.7(1)(g) Exterior walls

- The accepted product for the Owner will be exterior semi gloss latex
- Application: brush, roller or spray
- Clean up: warm water
- Thinner: up to 10% water for spraying applications
- Colour selection will be at the discretion of the Owner

#### 6.9.2.7(1)(h) Interior Floors, concrete

- The accepted product for the Owner will be 2 part finish equal to Cloverdale Paints ClovaCoat 300, base component A, curing agent B
  - Primer if needed will be equal to Preptech 83020, base component A, curing agent B
  - Application: brush, roller, spray (preferred)
  - Thinner: C70 or C25
  - Colour selection will be at the discretion of the Owner
- 6.9.2.7(2) Materials and workmanship will conform to Master Painters Institute (MPI) Architectural Painting Specification Manual (latest edition).
- 6.9.2.7(3) Exterior paints and painting will be of a quality to protect the substrate materials from weather and climate conditions.
- 6.9.2.7(4) A visually harmonious and aesthetically coordinated appearance will be achieved across all areas of the building.
- 6.9.2.7(5) Exterior and interior finish materials will have surface finishes either as manufactured and integral to the finish material or as applied to the surface of the finish material by paint or special coating.
- 6.9.2.7(6) Exterior and interior materials subject to corrosion from exposure to moisture or other corrosive agents and where painting is deemed to be insufficient protection will receive a special protective coating. Such materials include exterior and interior structural, galvanized, and miscellaneous steel.
- 6.9.2.7(7) In interior areas, indoor air quality will be a priority, and paints and paint materials will have a minimal volatile organic compound level.
- 6.9.2.7(8) Interior paint materials will be of a quality to withstand regular or repeated cleaning as the function of the area dictates.
- 6.9.2.7(9) Handrails, doors, and frames will be painted a contrasting colour from walls in consideration of the visually impaired.



- 6.9.2.7(10) Parking area, stair wells walls and ceilings shall be painted white.
- 6.9.2.7(11) Materials used will be lead and mercury-free.
- 6.9.2.7(12) Seamless epoxy wall coatings will be a two-component, high solids, Zero or low VOC, solvent-free, epoxy glaze wall coating, and will be seamless and abrasion, chemical, and UV-resistant.
- 6.9.2.7(13) Paint materials will be rated under Environmental Notation System (ENS) with acceptable VOC ranges as listed in the MPI Approved Product List under "E" ranges.
- 6.9.2.7(14) Only materials having a minimum MPI "Environmentally Friendly" E2 rating based on VOC (EPA Method 24) content levels will be used.

#### 6.9.2.8 Special Wall Coverings

- 6.9.2.8(1) Materials and workmanship will conform to the Master Painters Institute (MPI) Architectural Painting Specification Manual (latest edition).
- 6.9.2.8(2) Wall coverings may be required on interior walls to satisfy aesthetic considerations beyond the application of paint and create a comfortable working environment in staff work areas, and a safe and inviting environment in public areas.
- 6.9.2.8(3) Wall coverings will not be used in areas that may have excessive moisture present or require high and frequent maintenance.
- 6.9.2.8(4) Sealers and adhesives will be non-toxic, water-based type and meet requirements of Canadian "Eco Logo" program or equivalent. TVOC emissive content will not be more than 20 grams per litre.

## 6.10 Specialties (Division 10)

### 6.10.1 Basic Requirements

- 6.10.1.1 Specialty products will be manufactured for the specific purposes intended, installed in strict accordance with the manufacturer's directions.

## 6.10.2 Performance Criteria

### 6.10.2.1 Tackboards and Whiteboards

- 6.10.2.1(1) Tackboard surfaces will be of a type and quality to allow pin penetration of the surface materials and have reasonable resistance to deterioration.
- 6.10.2.1(2) Whiteboard surfaces will be of a type to allow use of felt-type writing instruments and allow erasing and cleaning with minimal effort.
- 6.10.2.1(3) Tackboards and whiteboards will be complete with manufactured frames and accessory trays.
- 6.10.2.1(4) Whiteboard writing surfaces will be porcelain ceramic on steel surface, magnetic, scratch and abrasion-resistant and have maximum contrast, glare control, and reflectivity, and be scratch and abrasion-resistant.
- 6.10.2.1(5) Lamination adhesive used for tackboards and whiteboards will be non-toxic, water-based adhesive.

### 6.10.2.2 Compartments and Cubicles

- 6.10.2.2(1) Compartments and cubicles will include toilet partitions, change cubicles, shower partitions, and other compartments and cubicles requiring privacy and security.
- 6.10.2.2(2) Exposed surfaces will be permanent, water-resistant, corrosion-proof, and readily cleaned and maintained.
- 6.10.2.2(3) Partitions and standards will be secured to the floor or ceiling structure, and resistant to lateral loading and impact.
- 6.10.2.2(4) Compartment/cubicle doors will be of material matching the partitions and include permanent, purpose-made hardware. Doors and hardware will provide privacy and security and be handicap accessible where required.
- 6.10.2.2(5) Change compartments will be complete with a mirror.
- 6.10.2.2(6) Toilet Partitions

6.10.2.2(6)(a) Sheet metal will be galvanized steel conforming to ASTM A653 with minimum ZF001 (A01) zinc coating. Finish for steel surfaces will be polyester, baked enamel.

6.10.2.2(6)(b) Stainless steel will be Type 304 conforming to ASTM A240 with No. 4 finish.

6.10.2.2(6)(c) Fibre-reinforced plastic (fibreglass) will be moisture resistant.

#### 6.10.2.2(7) Change Cubicle Partitions

6.10.2.2(7)(a) Where not adjacent to showers, partitions will conform to quality assurance requirements specified for toilet partitions.

#### 6.10.2.2(8) Shower Partitions

6.10.2.2(8)(a) Partitions will be solid phenolic laminated thick stock, factory-laminated with decorative finish both faces of core and conforming to CAN3-A172 or CSA LD3.

#### 6.10.2.3 Wall Guards and Corner Guards, Handrails, Wall Protection, Door Edge and Door Frame Protection

##### 6.10.2.3(1) Wall and corner guards

6.10.2.3(1)(a) Protection of walls and exposed wall corners at service areas and other areas will be provided as required by the Owner to prevent damage due to impact from traffic such as equipment and service carts.

6.10.2.3(1)(b) Materials selected will be determined by the amount and degree of impact anticipated. Corner guards shall be stainless steel or better.

6.10.2.3(1)(c) Wall and corner guards will be secured to reinforcing and backing in the walls, which will be sufficient to withstand expected impact loads.

##### 6.10.2.3(2) Handrails

6.10.2.3(2)(a) Handrails will be provided in clinical office corridors and other ambulatory patient areas and as required by the Owner.

6.10.2.3(2)(b) Handrails are to be made of durable, non-porous materials that can stand up to repeated use of cleaning materials.

#### 6.10.2.3(3) Wall protection

6.10.2.3(3)(a) Sheet wall protection will be applied to wall areas where the impact damage anticipated is of a larger area of wall than would be protected by bumper guards.

6.10.2.3(3)(b) Sheet wall protection to faces of doors will be applied where impact damage is anticipated and may complement the installation of door edge and frame protection.

6.10.2.3(3)(c) Wall protection will be secured to reinforcing and backing in the walls, which will be sufficient to withstand expected impact loads.

6.10.2.3(3)(d) Wall protection handrails and corner guard products will be stain-resistant to pen marks, paint, and graffiti, and will withstand commercial cleaners without fading or staining. These products will also contain anti-microbial additives to retard mildew and bacterial growth.

#### 6.10.2.3(4) Door Edge and Door Frame Protection

6.10.2.3(4)(a) Door edges and door frames in clinical and service areas will be protected from damage such as impact caused by the regular movement of carts and other wheeled vehicles.

#### 6.10.2.4 Building Signage

6.10.2.4(1) Refer to Sections 4.2.4 Exterior Signage and 5.4 Interior Wayfinding and Signage.

#### 6.10.2.5 Metal Lockers

- 6.10.2.5(1) Individual and shared storage facilities will be provided in designated staff areas for building staff and in accessible secure areas suitable for staff to secure personal effects.
  - 6.10.2.5(2) Such storage facilities may be metal lockers and metal locker systems of appropriate sizes, quantities, and groupings.
  - 6.10.2.5(3) Sheet metal will be galvanized steel conforming to ASTM A653 with ZF001 (A01) zinc coating.
  - 6.10.2.5(4) Finish for steel surfaces will be polyester baked enamel.
  - 6.10.2.5(5) Single, double, or multiple-tier metal lockers for staff use will be complete with provision for locking with padlock, number plates, and hanging hooks.
- 6.10.2.6 Storage Shelving Systems
- 6.10.2.6(1) Storage systems for materials will be provided in designated storage areas.
  - 6.10.2.6(2) Adjustable shelving systems may be specifically manufactured for storage purposes, such as plywood or steel-slotted angle industrial shelving for bulk materials or plastic laminate-faced plywood for clean storage.
  - 6.10.2.6(3) Mobile storage systems for files will be a high-density system designed to make maximum use of available space by eliminating need for access aisle for each run of shelving. System must be installed and braced to resist seismic loads.
- 6.10.2.7 Washroom, Shower and Hand Wash Sink Accessories
- 6.10.2.7(1) Accessories in washrooms, showers and at hand wash sinks will be supplied and installed by the Design-Builder unless otherwise noted. Type, size, and number of accessories will be determined by the numbers and categories of users.
  - 6.10.2.7(2) Washroom accessories will include but are not limited to the following:

- 6.10.2.7(2)(a) Soap dispensers (Owner provided, Design-Builder installed)
  - 6.10.2.7(2)(b) Toilet paper dispensers (Owner provided, Design-Builder installed)
  - 6.10.2.7(2)(c) Paper towel dispensers (Owner provided, Design-Builder installed)
  - 6.10.2.7(2)(d) Paper towel waste bin
  - 6.10.2.7(2)(e) Mirrors
  - 6.10.2.7(2)(f) Angled mirrors as required
  - 6.10.2.7(2)(g) Handicap grab bars (with integral tactile grip finish)
  - 6.10.2.7(2)(h) Coat hooks
  - 6.10.2.7(2)(i) Sanitary napkin disposal receptacles
  - 6.10.2.7(2)(j) Baby change tables
  - 6.10.2.7(2)(k) 'In-Use' indicators
- 6.10.2.7(3) Shower rooms or showers in washrooms will include but are not limited to the following accessories (Design-Builder supply and install):
- 6.10.2.7(3)(a) Shower curtain track or rod, curtains
  - 6.10.2.7(3)(b) Handicap grab bars
  - 6.10.2.7(3)(c) Coat hooks (minimum 1 per washroom)
- 6.10.2.7(4) Hand wash sink accessories will include but are not limited to the following:
- 6.10.2.7(4)(a) Soap dispensers (Owner provided, Design-Builder installed)
  - 6.10.2.7(4)(b) Paper towel dispensers (Owner provided, Design-Builder installed)
  - 6.10.2.7(4)(c) Paper towel disposals

- 6.10.2.7(5) Accessories with safety features will be selected for areas where there is increased risk of patient injury, and be in accordance with British Columbia Ministry of Health Standards.
- 6.10.2.7(6) Recessed dispensers (such as those for paper towels, soap, and waste receptacles) will not be used.
- 6.10.2.7(7) Accessories will be commercial grade and free from imperfections in manufacture and finish.
- 6.10.2.7(8) Washroom accessory and installation will allow cleaning and maintenance of the accessory and surrounding wall area.
- 6.10.2.7(9) Fittings will have concealed fastening for security and discouragement of tampering.

## **6.11 Equipment (Division 11)**

- 6.11.1 The obligations and responsibilities of the parties related to Equipment are set out in Appendix 1F, Section 1 Equipment Responsibility. Equipment Lists as defined in Appendix 1F, Section 1 are provided in Appendices 1F, 1G and 1H. The Design-Builder will complete the Design and Construction to accommodate the Equipment in the Facility, including all required electrical and plumbing connections, structural support, seismic restraints and space for efficient access, all to the tolerances and specifications as may be specified and required by the manufacturers or vendors of the Equipment (which may be of a higher standard than specified in the Statement of Requirements).

## **6.12 Furnishings (Division 12)**

### **6.12.1 Basic Requirements**

- 6.12.1.1 Window coverings will allow control of exterior light entering the room during daylight hours and provide privacy during daylight and non-daylight hours.
- 6.12.1.2 Window coverings will be designed to minimize light spillage into residential areas.
- 6.12.1.3 Window coverings in Inpatient Units will be required to provide black-out functions. Materials, tracks, seals, and operation will be suited to the purpose.

6.12.1.4 Window coverings will be designed and manufactured using materials and mechanisms that would minimize cleaning and maintenance operations and maximize infection control.

6.12.1.5 Provide window coverings as follows:

6.12.1.5(1) to all exterior windows, preferably vertical blinds but other products will be considered providing they provide privacy, sun and heat control consistent with the energy management plan, are easy to clean and do not support or provide a surface that encourages spread of infectious disease (i.e. do not become electrostatically charged);

6.12.1.5(2) to all interior windows including windows in doors, where privacy may be a concern; and

6.12.1.5(3) all window coverings must be easy to remove and clean.

## 6.12.2 Performance Criteria

### 6.12.2.1 Window Shade Systems

6.12.2.1(1) Will be PVC or vinyl-coated polyester or fibreglass yarn.

6.12.2.1(2) Will be waterproof, washable, rot-proof, flame-resistant, fungal and bacteria-resistant, colourfast to light, glare-reducing, and able to control heat gain and provide external visibility.

6.12.2.1(3) Will pass Small Scale Vertical Burn requirements in accordance with CAN/ULC-S109 or NFPA-701.

6.12.2.1(4) Will be tested in accordance with ASHRAE Standard 74073 for shading coefficient, fungal resistance in accordance with ASTM G21, and bacterial resistance.

6.12.2.1(5) Will meet infection control requirements for window shade systems.

## 6.12.3 Laboratory Casework and Countertops

6.12.3.1 Laboratory Grade Plastic Laminate Casework and Countertops: Chemical-resistant plastic laminate, CSA LD-3,



with backing sheet over 45 pound density MDF or particleboard core; Core shall have no added urea formaldehyde. Provide with 3 mm PVC edge band at countertops and casework edges; color to match plastic laminate. Minimum thickness at countertops: 25 mm. Minimum core thickness at typical casework: 19 mm except provide 6 mm thick hardboard at fully-concealed unit backs. Core at toe space shall be marine grade plywood.

- 6.12.3.2 Epoxy Countertops and Sinks: At sinks in typical casework, provide epoxy sinks with epoxy countertop surround minimum 600 mm wide on both sides of sink by full depth of countertop. Epoxy thickness: 25 mm. Color: As selected by the Owner; ensure match with available laboratory grade plastic laminate at adjacent casework and countertop surfaces. Provide minimum 25 mm by 25 mm by 3 mm epoxy coated steel rail bracing for full width of base unit at underside of sink.
- 6.12.3.3 Countertop Brackets: Where no base cabinets are indicated, provide countertop brackets similar to Rakks EH-1818 or EH-1824 brackets by Rangine spaced at maximum 1200 mm.
- 6.12.3.4 Provide one full size mock-up of each of the following for Owner's review and approval: Inpatient Unit – single, Inpatient Unit – double, Emergency bay, and Pharmacy room. All mechanical, electrical, equipment, and furniture to be located (physically installed or location taped on floor / wall). Provide complete samples of finished casework for Lab and Pharmacy including typical upper and lower units. Provide a single A1 and B4 unit with countertop as mock-ups for each space requiring mock-ups.

## **6.13 Special Construction (Division 13)**

### 6.13.1 Performance Criteria

#### 6.13.1.1 Kitchen Cold Rooms

- 6.13.1.1(1) Short-term or long-term refrigerated storage for food stuffs and other goods and materials will be accommodated in engineered and manufactured insulated "walk-in" rooms.

- 6.13.1.1(2) Kitchen cooler and freezer will be sized and the refrigeration level calibrated for the specific and particular goods or materials to be stored.
- 6.13.1.1(3) Drygoods and material storage, freezers, and coolers will have remote monitoring and egress controls.
- 6.13.1.1(4) Cold room panel joints, when tested in accordance with ASTM E283 – Air Leakage Rate Testing and ASTM E96 – Water Vapour Permeance Rate Testing, will have an air leakage rate of 75 Pa OF 0.00m<sup>3</sup>/h-m<sup>2</sup> and a water vapour permeance rate of 0.00 perms.
- 6.13.1.1(5) Cold room wall and ceiling panels will be listed with Underwriters Laboratories of Canada (ULC) in accordance with ULC/ORD-C376-1995 – Fire Growth of Foamed Plastic Insulated Building Panels in a Full-Scale Room Configuration.
- 6.13.1.1(6) Positive drainage of condensation occurring within wall construction and water entering at joints will be provided to exterior face of wall in accordance with NRC “Rain Screen Principles”.
- 6.13.1.1(7) Enclosure elements will be designed to accommodate damage to infills, racking of joints, breakage of seals, water penetration, and glass breakage by using expansion joints, and allowing wall and structural movement without permanent distortion.
- 6.13.1.1(8) Completed cold rooms will have exterior-to-interior sound attenuation of not less than STC 30.
- 6.13.1.1(9) Room elements will be designed and assembled to be secured to room frame so that stresses in sealants and seals are within sealant manufacturer’s recommended maximum.
- 6.13.1.1(10) Room assembly will be designed to permit easy replacement of components.
- 6.13.1.1(11) Allowance will be made for ceiling, piping, conduits, and other interior dead loads imposed on cold room.

6.13.1.1(12) Doors will be manufacturer's standard, complete with pre-wired light switch, door closer, and dial thermometer. Freezer door will be supplied with anti-condensate heater, heated vent, and pre-wired sill.

6.13.1.1(13) Enclosure assembly will be complete with exterior skin, glass units, access units (doors, etc), inner air/vapour seal membrane, thermal insulation, interior finish, alarms, condensing unit, evaporating coil, compressor, drainage, and lighting as required for cold room or freezer operation. Defrost heating strips will be installed at doors and at wall-floor interfaces.

6.13.1.1(14) Rooms will be complete with shelving, bins, or other storage equipment to suit the specific and particular goods or materials to be stored.

#### 6.13.1.2 Kitchen Equipment

6.13.1.2(1) The Design Builder will design the kitchen to accommodate the food service equipment described in Appendix 1K. The Design Builder will be responsible for the design, supply and installation of the food service equipment.

## 6.14 Conveying Equipment (Division 14)

### 6.14.1 Basic Requirements

6.14.1.1 The elevator and systems will be designed to accommodate the requirements / needs of the building in a manner which contributes to the overall efficiency and effectiveness of building operations.

6.14.1.2 Elevator systems will be designed to ensure there is sufficient capacity to accommodate the wide range of user and functionality requirements, in a manner which satisfies expectations for safety, reliability, responsiveness, accessibility and operational efficiency.

- 6.14.1.3 Provisions will be considered for persons with special mobility needs and other forms of disabilities, such as learning difficulties or mental disorders.
- 6.14.1.4 Elevators will support access provisions, for people and materials, to all functional areas. Elevator access to all building levels will be provided.
- 6.14.1.5 Equipment provided will have a proven track record of at least five years field operation in Canada in similar environments and of similar configuration.
- 6.14.1.6 Durable elevator cab finishes (including stainless steel fronts, impervious plastic laminate wall panels, and stainless steel hand and bumper rails) will be provided.
- 6.14.1.7 Emergency power operation of elevators will be provided such that all elevators are fed with emergency power and at least one is capable of operating at a time.
- 6.14.1.8 Elevators used for support services will be configured with platforms to accommodate easy movement of material carts. Requirements for transport of heavy equipment will be considered and accommodated.

#### 6.14.2 Performance Criteria for Elevators

##### 6.14.2.1 Scope of Work

- 6.14.2.1(1) Supply and install a group of two (2) elevators minimum (or as required to service the building), with equipment and performance characteristics as generally described in this specification. Provide all necessary components to make elevator systems fully operational and functional, whether or not specifically referenced in this outline specification.
- 6.14.2.1(2) Provide all permits, labour, materials, products, equipment, services and all else necessary for the design, manufacture, delivery, installation and services required for a complete and fully functioning elevator system.
- 6.14.2.1(3) Obtain and pay for governmental design submission, registration, inspection and permit, as required (except for ownership and operation license), and

make such tests as required by the British Columbia Safety Authority prior to licensing.

#### 6.14.2.2 Codes, By-laws, and Regulations

- 6.14.2.2(1) Provide equipment and perform work in accordance with all local, provincial and federal codes, by-laws, and regulations.
- 6.14.2.2(2) Provide equipment and perform work in accordance with the latest edition of the B44 Safety Code for Elevators and any other code which may govern the installation.
- 6.14.2.2(3) At the time of bid submission and during the contract provide written notification of any proposed changes in codes, by-laws, or regulations which may affect the work.

#### 6.14.2.3 Wiring Diagrams and Manuals

- 6.14.2.3(1) Prior to substantial performance, supply to the Owner, three sets of manuals which include information itemized below.
  - 6.14.2.3(1)(a) Design Submission documents submitted to BCSA for permit
  - 6.14.2.3(1)(b) Final shop drawings
  - 6.14.2.3(1)(c) Description of special features such as firefighters emergency operation, independent service, emergency power operation, two-way voice communication, and security operation.
  - 6.14.2.3(1)(d) As-built wiring and schematic diagrams.
  - 6.14.2.3(1)(e) Schedule of recommended routine maintenance procedures.
  - 6.14.2.3(1)(f) Description of diagnostic procedures, including complete Fault Code listing and troubleshooting instructions.

#### 6.14.2.4 Training

- 6.14.2.4(1) At completion of the job, provide a training session for the Owner consisting of a review of the documentation and operation of the equipment and features.
- 6.14.2.5 Trademarks
  - 6.14.2.5(1) Arrange that no equipment visible to the public has any trademark, company name, or logo.
- 6.14.2.6 Barrier-Free Access
  - 6.14.2.6(1) Arrange the controls and fixtures to meet barrier-free access requirements of the B44 Safety Code for Elevators (latest edition) and any other code which may govern the installation.
- 6.14.2.7 Fixtures
  - 6.14.2.7(1) Unless indicated otherwise in the Specifications, provide a choice of fixtures from a third party supplier and use their standard products.
  - 6.14.2.7(2) Provide buttons with LED illumination and stainless steel targets.
- 6.14.2.8 Operating Conditions
  - 6.14.2.8(1) Provide equipment that will operate normally when the machine room and hoistway temperature is between 10 and 30 degrees Celsius.
  - 6.14.2.8(2) Provide equipment that will operate normally when the power supply is within 10 percent of its rated voltage.
- 6.14.2.9 Seismic requirements
  - 6.14.2.9(1) Comply with Section 8.4 (Elevator Safety Requirements For local Seismic Risk Zone) of the B44 Safety Code for Elevators and any other code which may govern the installation.
- 6.14.2.10 Maintainability

- 6.14.2.10(1) Arrange the equipment such that there are no times, dates, trips, or other counters that would shut down the equipment or change its operation.
- 6.14.2.10(2) Elevator equipment provided under this specification shall not contain proprietary features which limit the Owner's ability to engage a registered elevator maintenance contractor, other than the original manufacturer / installer, to provide routine maintenance services.
- 6.14.2.10(3) In the event specialized tools or software are required to perform routine maintenance services, such tools shall be either provided as "on board" equipment, or as separate devices. Such tools or software shall be provided with the equipment and shall become the property of the Owner.

#### 6.14.2.11 Equipment Summary

- 6.14.2.11(1) Provide the minimum performance and dimensional requirements. Final requirements to be adjusted to suit specific design:
  - 6.14.2.11(1)(a) Machine-room-less traction equipment.
  - 6.14.2.11(1)(b) Minimum Contract speed of 1.00 m/s.
  - 6.14.2.11(1)(c) Capacity of 2275 kg.
  - 6.14.2.11(1)(d) Two-speed side-opening entrances with a width of 1220 mm and a height of 2134 mm.
  - 6.14.2.11(1)(e) Floors served: Elevators 1+2: Lower to Upper
  - 6.14.2.11(1)(f) Stops / Openings :
    - E1: 2 Stops / 2 Openings
    - E2: 2 Stops / 4 Openings (Rear at Lower & Upper floors)
  - 6.14.2.11(1)(g) Approximate Travel:
    - E1: 5.4 m; E2: 5.4 m
  - 6.14.2.11(1)(h) Minimum clear inside cab dimensions of 1730 mm wide by 2740 mm deep.

- 6.14.2.11(1)(i) Minimum Clear cab height to suspended ceiling of 2745 mm.
  - 6.14.2.11(1)(j) Hoistway, pit, overhead dimensions as per manufacturer's specifications.
  - 6.14.2.11(1)(k) Car Loading Classification: Class A
  - 6.14.2.11(1)(l) Core Configuration: 1 across 1;
  - 6.14.2.11(1)(m) Operation: Duplex, full selective collective.
  - 6.14.2.11(1)(n) Control: VVVF with Regenerative Drive
- 6.14.2.12 Elevator Car Machine Room Equipment – Machine-Room-Less Traction Elevators
- 6.14.2.12(1) Provide a gearless traction hoisting machine located within the hoistway.
  - 6.14.2.12(2) Provide a spring applied electric brake, held open by an electro-magnet actuated by the controller. Design the brake to automatically apply in event of interruption of power supply from any cause.
  - 6.14.2.12(3) Provide an automatic reset governor located in the hoistway that can be maintained from the car top. When the governor has tripped, arrange that it will be reset when the car is moved in the up direction.
  - 6.14.2.12(4) Provide sound and vibration isolation pads such that there is no direct contact between the machine and the building structure.
  - 6.14.2.12(5) Provide an emergency brake to stop the elevator if it overspeeds or if it moves more than 500 mm away from the floor with the doors open.
  - 6.14.2.12(6) Provide a solid state drive complete with isolation transformers, filters (to meet IEEE Standard 519-1992 for Special Applications), and isolation pads.
  - 6.14.2.12(7) Provide a digital velocity encoder on the motor, giving feedback to the controller on motor speed and position.



- 6.14.2.12(8) Provide a microprocessor based controller consisting of relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, circuit boards, static drive units, wiring terminal strips, and related components all enclosed in a cabinet with hinged door panels.
- 6.14.2.12(9) Provide an electrically released brake system, to permit momentary nudging of elevator within the hoistway under test or emergency conditions.
- 6.14.2.12(10) Locate controller room remotely at roof level, immediately above, or in rear proximity to elevator core.

#### 6.14.2.13 Hoistway Equipment

- 6.14.2.13(1) Provide entrances consisting of doors, frames, sills, sight guards, door hangers, tracks, interlocks, door closers, gibs, and all other equipment required for a complete installation. Provide entrance doors and frames finished in brushed stainless steel.
- 6.14.2.13(2) Provide standard 'T' section steel guide rails for the car (and counterweight). Install guide rails using brackets fastened to the building structure. Clamp the guide rails to the bracket with clips arranged to prevent any horizontal movement of the rail. Join the rail sections using steel backing plates.
- 6.14.2.13(3) Provide hoist ropes/belts of sufficient size and number to lift the load and ensure proper wearing qualities. Provide either steel ropes consisting of at least six strands wound around a hemp core centre or Polyurethane coated belts with high-tensile-grade zinc-plated steel cords. Ensure that all the ropes for a particular elevator are from the same manufacturing run.
- 6.14.2.13(4) Provide a counterweight to counterbalance the elevator for smooth and economical operation with cast iron or steel plate weights contained in a structural steel frame. Provide a counterweight equal to the weight of the elevator car plus between 45 and 50 percent of the rated capacity.

- 6.14.2.13(5) Provide for the car (and counterweight) either spring mounted roller guides or slipper guides located at the top and the bottom of the car (and counterweight frame).
- 6.14.2.13(6) Provide fascias from each hall sill to the entrance header below. Include express zones. Extend the fascias into the pit and the overhead.
- 6.14.2.13(7) Provide a car frame constructed of steel channels and a platform constructed of steel channels with a wood or metal sub-floor. Isolate the frame and platform from one another so that there is no metal to metal contact in order to prevent the transmission of noise and vibration. Mount the elevator cab shell on the platform in alignment with the hoistway entrances. Isolate the cab from the car frame and platform.

#### 6.14.2.14 Cab Equipment

- 6.14.2.14(1) Provide durable elevator cab finishes (including stainless steel fronts, hand and bumper rails, and indirect lighting) to suit the building. Cab finishes to be selected from the manufacturer's standard range of options and approved by the Owner.
- 6.14.2.14(2) Provide car doors, jambs, headers, hangers, tracks, door closers, gibs, electrical contacts, and all other equipment required for a complete installation.
- 6.14.2.14(3) Provide swing return car stations incorporating floor push buttons, door open and close buttons, an alarm button, and other fixtures required for normal operation. Provide for each floor button a call registered light and momentary audible tone. Provide a Firefighters' Emergency Operation panel. Provide below the car station a locked service cabinet containing devices other than those used for normal operation. Engrave the car station with the elevator capacity, identification number, government installation number, and other markings required by code.

- 6.14.2.14(4) For each elevator with front and rear doors provide 2 car stations. Otherwise, provide one car station per elevator.
  - 6.14.2.14(5) Provide a digital (dot matrix or segmented) car position indicator located above each car station with a minimum 50 mm (2") high display.
  - 6.14.2.14(6) Do not install any certificates or licences in the cab. Arrange and pay for a variance from the Authority Having Jurisdiction for this if required.
  - 6.14.2.14(7) Provide a voice synthesizer for each elevator with automatic verbal announcement of each floor at which the elevator stops. Provide a system that will handle a variety of other messages and indications as may be required by the Owner at a later date.
  - 6.14.2.14(8) Provide an infra-red multiple beam door protective device that protect the full width and up to 1830 mm from the floor of the door opening. Locate the device 25 mm behind from the leading edge of the door.
  - 6.14.2.14(9) Provide battery operated emergency cab lighting.
  - 6.14.2.14(10) Provide a two speed exhaust fan mounted in the cab top.
  - 6.14.2.14(11) Provide one set of cab protective pads that cover all walls and the cab front return panel along with pad hooks. Provide pad hooks in each elevator.
  - 6.14.2.14(12) Provide a heavy duty closed loop door operator to open and close the car and hoistway doors simultaneously.
  - 6.14.2.14(13) Provide a hands-free two-way voice intercommunication / telephone system with a lobby rescue station and remote handset. Provide communication from each car enclosure to designated security station located in Hospital.
- 6.14.2.15 Hall Equipment

- 6.14.2.15(1) Where required, provide hoistway access switches located in the entrance frame or in the hall door sight guard.
  - 6.14.2.15(2) Provide hoistway door unlocking devices (by lunar key) on the hall doors at all floors.
  - 6.14.2.15(3) Provide one riser of hall stations for each elevator. Provide in each hall station illuminating up and down push buttons (at terminal floors, provide only one button) located with their centreline 1070 mm  $\pm$  25 mm above the floor.
  - 6.14.2.15(4) Provide a digital (dot matrix or segmented) hall position indicator located above the main floor entrance with a minimum 50 mm high display.
  - 6.14.2.15(5) Provide hall lanterns with electronic tones at each entrance.
  - 6.14.2.15(6) Provide a remote fire recall switch for each group of elevators.
  - 6.14.2.15(7) Provide a lobby panel for the elevators that includes car position indicators, in service pilot lights, parking switches, emergency power switches and indicators, firefighters emergency operation keyswitch and indicators, voice communication and other elements required by the specification.
- 6.14.2.16 Electric Wiring
- 6.14.2.16(1) Provide copper wiring to connect the equipment.
  - 6.14.2.16(2) Run the wire in metal conduit, duct or electrical metallic tubing.
  - 6.14.2.16(3) Provide travelling cable between car stations and the controller in the machine room.
  - 6.14.2.16(4) Provide at least six pair spare shielded wires and a spare coaxial conductor in the travelling cable. This is in addition to the wiring identified elsewhere in this specification.
  - 6.14.2.16(5) Provide at least ten percent spare wires in each travelling cable.

- 6.14.2.16(6) Provide on one controller a separate junction box for non-elevator devices such as telephones, cameras, and security systems.

#### 6.14.2.17 Operational Features

- 6.14.2.17(1) Provide electronic card access to any elevators which serve any mechanical levels including the roof.
- 6.14.2.17(2) Provide for installation of security cameras in the elevators. Install and wire the security cameras provided by another trade. Provide the required wiring in the travelling cable run between the car top and the controller as well as power to the car top for the camera.
- 6.14.2.17(3) Provide equipment and labour for installation of a card reader security system. Provide the required wiring between the card reader and the elevator security box in the machine room along elevator controller connections and circuits for the security system (including floor tracking).
- 6.14.2.17(4) Provide independent service.
- 6.14.2.17(5) Provide Firefighters' Emergency Operation (Phase 1 and Phase II) for all elevators.
- 6.14.2.17(6) Provide emergency power operation of the elevators such that all elevators are fed with emergency power and capable of operating at least one at a time. Arrange that at least one elevator in each group can operate at the same time on emergency power
- 6.14.2.17(7) Provide separate riser operation for Elevator 1, including control keyswitch and indicator located at Level1 (rear) hall station. Provide separate, discrete hall stations and indicators within each entrance frame, that may be activated by authorized personnel via card reader or keyswitch.

#### 6.14.2.18 Operating Performance

- 6.14.2.18(1) Levelling - Arrange that the car stops within 3 mm of the floor level.

- 6.14.2.18(2) Operating time - Adjust the equipment so that the operating time is 17.0 seconds or less (based on 1220 mm wide two speed side opening doors and a speed of 150 fpm and travel of 4.5m). Measure the operating time from the time that the doors begin to close until they are 3/4 open at the next floor.
- 6.14.2.18(3) Ride quality - Arrange that the lateral acceleration (front to rear and side to side) measured during express runs is less than 150 mm/s/s peak to peak.
- 6.14.2.18(4) Adjust the door equipment so that the noise level is less than 60 decibels during a full door open and door close operation. Measure the noise levels using a sound level meter set to the "A" scale for a fast response.
- 6.14.2.18(5) Arrange the machine room equipment so that the noise level with the elevator running is less than 78 decibels. Measure the noise levels using a sound level meter set to the "A" scale for a fast response.

#### 6.14.3 Dock Lift Basic Requirements

- 6.14.3.1 The dock lift and systems will be designed to accommodate the requirements / needs of the building in a manner which contributes to the overall efficiency and effectiveness of building operations.
- 6.14.3.2 The dock lift systems will be designed to ensure there is sufficient capacity to accommodate the wide range of user and functionality requirements, in a manner which satisfies expectations for safety, reliability, responsiveness, accessibility and operational efficiency.
- 6.14.3.3 Equipment provided will have a proven track record of at least five years field operation in Canada in similar environments and of similar configuration.
- 6.14.3.4 Durable equipment finishes will be provided.
- 6.14.3.5 Emergency power operation of dock lift will be provided .

- 6.14.3.6 Dock lift will be configured and positioned on site to accommodate easy movement of material carts. Requirements for transport of heavy equipment will be considered and accommodated.

#### 6.14.4 Performance Criteria for Dock Lift

##### 6.14.4.1 Scope of Work

- 6.14.4.1(1) Supply and install a group of one exterior dock lift, with equipment and performance characteristics as generally described in this specification. Provide all necessary components to make dock lift systems fully operational and functional, whether or not specifically referenced in this outline specification. Components included shall include but not be limited to the following: electrical power to Power Unit, hydraulic hoses linking power unit and lift, underground pathway in concrete or metal connecting dock lift to Power Unit in building, dock pit sized to accommodate flush bottom level, two site bollards of concrete filled steel, storm drain in pit base and any other equipment, fittings or systems required for a fully functioning dock lift.
- 6.14.4.1(2) Install dock lift outside of receiving bay door in paved receiving area . Exact Location to be agreed upon with Owner and indicated on shop drawings.
- 6.14.4.1(3) Provide all permits, labour, materials, products, equipment, services and all else necessary for the design, manufacture, delivery, installation and services required for a complete and fully functioning dock lift system.
- 6.14.4.1(4) Obtain and pay for governmental design submission, registration, inspection and permit, as required (except for ownership and operation license), and make such tests as required by the British Columbia Safety Authority prior to licensing.

##### 6.14.4.2 Codes, By-laws, and Regulations

- 6.14.4.2(1) Provide equipment and perform work in accordance with all local, provincial and federal codes, by-laws, and regulations.

6.14.4.2(2) Provide equipment and perform work in accordance with the latest edition of any Safety Code for Dock Lifts and any other code which may govern the installation.

6.14.4.2(3) At the time of submission and during the contract provide written notification of any proposed changes in codes, by-laws, or regulations which may affect the work.

#### 6.14.4.3 Wiring Diagrams and Manuals

6.14.4.3(1) Prior to substantial performance, supply to the Owner, three sets of manuals which include information itemized below.

6.14.4.3(1)(a) Final shop drawings

6.14.4.3(1)(b) Description of special features such as independent service, emergency power operation and security operation.

6.14.4.3(1)(c) As-built wiring and schematic diagrams.

6.14.4.3(1)(d) Schedule of recommended routine maintenance procedures.

6.14.4.3(1)(e) Description of diagnostic procedures, including complete troubleshooting instructions.

#### 6.14.4.4 Training

6.14.4.4(1) At completion of the job, provide a training session for the Owner consisting of a review of the documentation and operation of the equipment and features.

#### 6.14.4.5 Trademarks

6.14.4.5(1) Arrange that no equipment visible to the public has any trademark, company name, or logo.

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#### 6.14.4.6 Operating Conditions



6.14.4.6(1) Provide equipment that will operate normally when the exterior temperature is between minus 40 and plus 35 degrees Celsius.

6.14.4.6(2) Provide equipment that will operate normally when the power supply is within 10 percent of its rated voltage.

#### 6.14.4.7 Maintainability

6.14.4.7(1) Arrange the equipment such that there are no times, dates, trips, or other counters that would shut down the equipment or change its operation.

6.14.4.7(2) Dock Lift equipment provided under this specification shall not contain proprietary features which limit the Owner's ability to engage a registered maintenance contractor, other than the original manufacturer / installer, to provide routine maintenance services.

6.14.4.7(3) In the event specialized tools or software are required to perform routine maintenance services, such tools shall be either provided as "on board" equipment, or as separate devices. Such tools or software shall be provided with the equipment and shall become the property of the Owner.

#### 6.14.4.8 Equipment Summary

6.14.4.8(1) Provide the minimum performance and dimensional requirements. Final requirements to be adjusted to suit specific design:

6.14.4.8(1)(a) Pentlift HED 68 or Equivalent.

6.14.4.8(1)(b) 72" x 96" deck size

6.14.4.8(1)(c) Remote 1 HP Power Unit located in Receiving Room.

6.14.4.8(1)(d) Maximum 30 second lift time.

6.14.4.8(1)(e) Capacity of 8000 lb.

6.14.4.8(1)(f) Bevel toe guards.

- 6.14.4.8(1)(g) Removable guard rail with mid level rail and kick plate.
- 6.14.4.8(1)(h) Plated access Chain.
- 6.14.4.8(1)(i) Deck mounted push button – removeable.
- 6.14.4.8(1)(j) Up travel limit switch
- 6.14.4.8(1)(k) Hydraulic powered bridge.
- 6.14.4.8(1)(l) Toe sensor.
- 6.14.4.8(1)(m) Wall mounted push button.
- 6.14.4.8(1)(n) Two second warning bell.
- 6.14.4.8(1)(o) Manual lowering Valve.
- 6.14.4.8(1)(p) Swing-out night stop.
- 6.14.4.8(1)(q) Hoistway, pit, as per manufacturer's specifications.

#### 6.14.4.9 Hoistway / Pit Equipment

- 6.14.4.9(1) Provide structure and material consisting of reinforced concrete, guards, and all other equipment required for a complete installation.
- 6.14.4.9(2) Provide pit surface sloped to drain which is connected to site storm drainage system..

#### 6.14.4.10 Electric Wiring

- 6.14.4.10(1) Provide copper wiring to connect the equipment.
- 6.14.4.10(2) Run the wire in metal conduit, duct or electrical metallic tubing.
- 6.14.4.10(3) Provide travelling cable between dock lift and the Power Unit in the Receiving room and the Power unit and local electrical panel.

#### 6.14.4.11 Operational Features

6.14.4.11(1) Provide independent service capability.

6.14.4.11(2) Provide emergency power operation of the dock lift such that dock lift is fed with emergency power and capable of operating in power outages .

#### 6.14.4.12 Operating Performance

6.14.4.12(1) Levelling - Arrange that the lift stops within 3 mm of the floor level.

6.14.4.12(2) Operating time - Adjust the equipment so that the operating time is 30 seconds or less.

6.14.4.12(3) Arrange the Power Unit equipment so that the noise level with the Dock in operation is less than 72 decibels.

#### 6.14.5

## **PART 7. FACILITIES SERVICES SUBGROUP SPECIFICATIONS**

### **7.1 Fire Suppression (Division 21)**

#### 7.1.1 Fire Protection

##### 7.1.1.1 Basic Requirements:

- 7.1.1.1(1) The sprinkler system and equipment will be designed to the occupancy classification that it protects.
- 7.1.1.1(2) Future expansion shall be in the form of larger capacity through pipe main sizing, fire pump sizing etc. This is to provide a system that can be adjusted, redistributed and added to without requirement of replacing mains or equipment. Refer also to 3.8.1.7.
- 7.1.1.1(3) Provide on the sprinkler system take-off from water supply an approved detector type double check valve assembly with approved listed OS&Y gate valves on both sides complete with tamper switches.
- 7.1.1.1(4) The fire pump, if required, will be provided by the Design Builder and will require emergency power supply and will have a transfer switch which is part of the fire pump controller, package mounted in separate mechanically attached enclosure to form one assembly, specifically approved for the purpose as a complete unit. Fire pump shall have 20% future capacity at design flow.
- 7.1.1.1(5) Sprinklers subject to freezing temperatures will be supplied by a dry system. This shall include all relevant components related to a dry system such as, but not limited to, an air compressor, automatic air maintenance device, control power.
- 7.1.1.1(6) Quick response concealed type sprinklers will be provided throughout, with temperature ratings to suit the specific hazard area.

- 7.1.1.1(7) Provide a double interlocked, cross zoned pre-action supplied sprinkler system to all rooms with sensitive equipment such as communications closets and/or records storage.
  - 7.1.1.1(8) Each fire extinguisher will be located per relevant codes and to the satisfaction of the Authority having Jurisdiction inspection department and approved for the hazard and classification of the space it serves.
  - 7.1.1.1(9) Future capacities will be proven through submission of design documents clearly showing design flows and sizing as well as the design + 20% flows and sizing.
- 7.1.1.2 Performance Criteria:
- 7.1.1.2(1) All fire protection systems will be hydraulically sized to NFPA standards. Including NFPA 45 where applicable..
  - 7.1.1.2(2) All equipment and installation will be in accordance with manufacturers' requirements.
  - 7.1.1.2(3) All equipment will be ULC approved.
  - 7.1.1.2(4) Qualified contractor licensed and regularly engaged in such installations will install all fire protection systems and equipment.
  - 7.1.1.2(5) Provide backflow protection on all fire protection systems in accordance with CSA requirements.
  - 7.1.1.2(6) Locate zone shut-off valves so they are visible and accessible from the floor. Do not conceal from view: do not locate in janitor rooms, storage rooms, or stairwells. All valves controlling water flow will be monitored.

7.1.1.2(7) Fire Department Connection will be installed at a location approved by the local Authorities having Jurisdiction.

7.1.1.2(8) Install fire extinguishers in a semi or fully recessed cabinet.

## 7.2 Plumbing (Division 22)

### 7.2.1 Site Services:

7.2.1.1 All materials will be in accordance with CSA standards. Minimum standard for domestic water systems to be Type K copper pipe. Ductile iron pipe is permitted for sizes 100mm and above. Type L copper pipe is permitted above ground.

7.2.1.2 Provide individual water, fire protection, gas, sanitary, and storm services as required and sized to suit the usage needs of the building.

7.2.1.3 Provide one domestic water service connection. The supply into the Site will have a water meter, reduced pressure backflow preventer, 25 micron filtration system, and independent shut-off valve. Submit the projected domestic water supply load. Connection point shall be from main located on street adjacent to the site.

### 7.2.1.4 Basic Requirements:

7.2.1.4(1) Domestic water systems will be to the National and Provincial Plumbing Standards. The municipal water in Burns Lake is hard. Therefore, to protect equipment and fixtures, provide a water softening system as required for full treatment, including all kitchen and laundry areas and general potable water.

7.2.1.4(2) Provide utilities-commission approved meters for domestic water. Meters will be used to measure water consumption.

7.2.1.4(3) The HVAC, plumbing, fire protection, and medical gases systems will be designed to avoid disruption to the operation of the building during maintenance or repairs. The systems must be designed so laboratory rooms and Admin/Patient do not need to be entered when performing these functions. All isolation, maintenance, balancing, and other service valves located in the corridor ceiling spaces will be accessible from standing or when using a maximum 2440 mm tall ladder.

- 7.2.1.4(4) The design should incorporate flexibility for future alterations or changes in technology standards. Include capacity for future expansion within each system. This shall include extra capacity in mains and risers. As well major equipment shall have spare capacity for future alterations or changes in technology standards. Refer also to 3.8.1.7.
- 7.2.1.4(5) All systems will be clearly labelled. Labelling will include, but not be limited to, painting and labelling of all pipes, ceiling identification dots, valve tagging, emergency valve identification signage and flow direction. Each system shall be labelled or identified at least once in each room and at maximum 15 m intervals. Identify systems where they pass through walls, partitions and floors.
- 7.2.1.4(6) All fixtures and equipment will be designed and installed to manufacturer's specifications and standards.
- 7.2.1.4(7) All fixtures and equipment will be provided by manufacturers with supply and service forces capable of maintenance response within 24 hours.
- 7.2.1.4(8) The water systems will ensure delivery of water supplies at the required pressures to all water outlets.
- 7.2.1.4(9) Provide water inlet connections on the exterior of the building for supply water through tanker truck connections. The system will be designed in such a way that it may be used as a backup should the municipal services fail during a disaster such as an earthquake.
- 7.2.1.4(10) Provide durable materials to allow for 24 hour a day operation with minimal downtime.
- 7.2.1.4(11) Consideration should be given to easy access and serviceability and avoiding interference with other services.
- 7.2.1.4(12) Provide floor drains with trap primers on all mechanical floors and where required for equipment drainage.
- 7.2.1.4(13) Floor drains located in chemical storage areas shall not be connected to the drainage system.
- 7.2.1.4(14) Equipment drains may require hub drains or elevated hubs complete with air gaps as required.

- 7.2.1.4(15) Provide backflow preventers on the incoming water service as well as at equipment source connections where required by code.
- 7.2.1.4(16) Provide interceptors as required by Authority having jurisdiction guidelines to intercept oil, grease, dirt, and solids. Provide acid neutralization tanks at drains where acid neutralization is required such as slide preparation sinks.
- 7.2.1.4(17) Provide domestic water filtration at the incoming service into the building. Filtration shall be dynamic, minimizing backwash and shall have redundancy to maintain water service during flushing or maintenance.
- 7.2.1.4(18) If a water booster pump is required, ensure it is designed with 100% redundancy and emergency power capability to provide uninterrupted water service and pressure in the event of malfunction, maintenance, or power loss. It must also be able to work in conjunction with a water tanker truck under post-disaster conditions.
- 7.2.1.4(19) For proposed plumbing fixture count, refer to Room Data Sheets.
- 7.2.1.4(20) All eyewash stations shall be accessible within 10 seconds from work station. All emergency shower assemblies shall be combination shower and eye wash.
- 7.2.1.4(21) All hand wash sinks shall be vitreous china and meet all infection control standards referenced in this document.
- 7.2.1.4(22) Water lines servicing the Facility should not be designed and installed above, below, or adjacent to communications closets and server room.

7.2.1.5 Performance Criteria:

- 7.2.1.5(1) All drainage systems will be designed such that the system connects to the Site services. Designs will utilize gravity drainage where possible.
- 7.2.1.5(2) In the case where pile foundations are used to support the structure, all underslab piping shall be supported (hung) from the concrete slab above. Hangers and rods shall be of sufficient strength and installed at intervals sufficient to carry the pipe and load, at the required slope. Hangers and rods



shall be corrosion resistant. Install light-weight fill above all piping that is supported (hung) from the concrete slab above. Dissimilar metals shall be separated by a di-electrical coupling or membrane (tape). Hanger spacing shall be to the requirements of the B.C. Building Code.

- 7.2.1.5(3) If a pumping system is required for subsurface, storm, or sanitary drainage, then the design will include 100% redundancy with equipment on emergency power such that the system does not flood the space it is housed in. The sump will have twin compartments: a settling and a pumping compartment, and will be sized to prevent short cycling of the pump. Provide alarm points for high water and pump failure.
- 7.2.1.5(4) Insulate interior storm drainage, domestic water piping, and exposed p-traps throughout as per BCICA quality standards. Where piping and / or piping components are subject to freezing, provide insulation and heat tracing on life-safety systems. The heat trace system will be monitored and alarmed for malfunction or service disruption. Ensure that heat trace systems on life-safety systems will be on emergency power.
- 7.2.1.5(5) All plumbing drainage designated as requiring acid waste system will be 'acid' or equivalent to a point such that dilution renders discharge ineffective or upstream of 'acid neutralizer tanks'. Acid neutralizer tanks shall be located and installed such that removal, maintenance and servicing are reasonably achieved.
- 7.2.1.5(6) Consideration should be given to reclaiming waste heat.
- 7.2.1.5(7) Provide flushing and disinfection of domestic water systems. Provide independent testing of piping systems once flushing and cleaning has been completed.
- 7.2.1.5(8) Provide automatic trap primers in floor drains. Trap primers shall be connected to a control valve and set to run every 24 hours by the DDC system. Trap primers that rely on fixture use shall not be acceptable. Provide adequate backflow prevention.

## 7.2.2 Plumbing Fixtures:

### 7.2.2.1 Basic Requirements:

- 7.2.2.1(1) All plumbing fixtures to be barrier free and suitable for a Healthcare Facility.
- 7.2.2.1(2) Provide anti-splash fittings (i.e. Laminar flow) that do not entrain air in all care areas, at all handwash sinks and at all non-laboratory sinks. Laboratory sinks shall have application specific outlets.
- 7.2.2.1(3) Fixtures will not have an overflow.
- 7.2.2.1(4) Public toilets will be floor mounted, elongated and low-consumption. They will have an open front seat with no lid, and electronic hands-free flush valve operation.
- 7.2.2.1(5) Urinals will be wall-hung and low-consumption. They will have electronic hands-free flush valve operation.
- 7.2.2.1(6) Public washroom lavatory fixtures will be made of an impervious, durable material. They will have electronic hands-free type faucets with single temperature supply.
- 7.2.2.1(7) Staff handwash sinks will be porcelain. They will have electronic hands-free type faucets with single temperature supply and gooseneck spouts.
- 7.2.2.1(8) All fixtures and/or equipment receiving domestic hot water shall have a domestic hot water recirculation connection sufficiently close to ensure the delivery / discharge / supply of domestic hot water within a reasonable amount of time (i.e. less than 15 seconds).
- 7.2.2.1(9) Showers will have slip resistant flooring and pressure compensated thermostatically controlled valves.
- 7.2.2.1(10) Provide suitable quantities of janitors' sinks, hose bibbs, eye wash stations, and drinking fountains to provide sufficient service to the building and in accordance with ANSI Z358.1-1998.
- 7.2.2.1(11) Laboratory water faucets with goosenecks must be protected by vacuum breakers.
- 7.2.2.1(12) Fixture and faucet combinations for sinks, scrub sinks and handwash basins shall be selected to ensure the faucet water stream does not fall directly into fixture drain opening to prevent contaminated trap water splashing out.

- 7.2.2.1(13) Provide a handwash sink in each patient room in a functional location.

#### 7.2.2.2 Performance Criteria:

- 7.2.2.2(1) Provide isolation valves for all floors and individual rooms for all plumbing services. Clearly identify all valves. Locate valves in corridors.
- 7.2.2.2(2) Provide accessible clean-outs for all sinks and lavatories (and future sinks and lavatories) minimum 150 mm above the flood-level rim of the sink.
- 7.2.2.2(3) Toilets will be selected with special attention to reducing spread of infection. Flush valves will be suitably sized for the water consumption of the bowl. Toilet bowls will not splash or spray water onto the toilet rim or anywhere outside of the toilet bowl and will be designed to minimize the aerosolization of the toilet contents.
- 7.2.2.2(4) All electronic sensor-activated fixtures will be battery powered.
- 7.2.2.2(5) Provide pressure reducing valves with 100% redundancy in accessible locations if system pressure exceeds acceptable delivery pressure.

#### 7.2.3 Domestic Hot Water Systems:

##### 7.2.3.1 Basic Requirements:

- 7.2.3.1(1) Domestic hot water demand will be calculated in accordance with ASPE Plumbing Engineering Design Handbook and the National and Provincial Plumbing Codes.
- 7.2.3.1(2) Domestic hot water will be stored at adequate temperature to serve the needs of the building at not less than 70°C. Provide mixing valves with thermal safety (fail safe) shut-off valves where temperatures are required to be less than 60°C at point of use. Generally piping distribution is 60°C and patient/public outlets shall be 43°C (CSA 2317.1)
- 7.2.3.1(3) Domestic hot water system will be designed with sufficient capacity and recovery rate for the building's hot water requirements.

- 7.2.3.1(4) Domestic hot water system will be designed with a recirculation system to ensure delivery of hot water within 10 seconds to all fixtures.
- 7.2.3.1(5) Domestic hot water system will be designed to prevent growth and spread of Legionella bacteria within the tanks, piping, fixtures, or any other component. Design methods to use include, but are not limited to, eliminating dead-leg piping, and minimizing uncirculated piping by connecting the circulation system as close as possible to fixtures.
- 7.2.3.1(6) Domestic hot water storage shall have the capability of maintaining 80°C for sanitation purposes.
- 7.2.3.1(7) Hands free fixture mixing valves shall have hot water recirculation connection within 50 mm of thermal mixing device.

#### 7.2.3.2 Performance Criteria:

- 7.2.3.2(1) Hot water generating equipment and /or storage will be designed to meet redundancy requirement outlined in CSA Standard for Health Care Facilities, latest edition.
- 7.2.3.2(2) Generate and store domestic hot water at 70°C to minimize Legionella.
- 7.2.3.2(3) Distribute domestic hot water at 60°C.
- 7.2.3.2(4) Recirculate domestic hot water from the distribution system(s) back to the generating and/or storage equipment.
- 7.2.3.2(5) Provide separate booster heaters, with adequate capacity, to serve equipment requiring water above 60°C.
- 7.2.3.2(6) Monitor hot water supply temperatures via the BMS system and provide alarm outputs when the temperature exceeds the design setpoint. Provide fail safe devices on distribution.
- 7.2.3.2(7) The domestic hot water generating equipment will meet the energy efficiency requirements of ASHRAE 90.1.

#### 7.2.4 Medical Gas Systems:

##### 7.2.4.1 Basic Requirements:

- 7.2.4.1(1) The medical gases for the building will be supplied from on-site central supply.
- 7.2.4.1(2) Medical gases will include Oxygen, Air, and Vacuum. Make provision for future gases, including Nitrous-Oxide and Nitrogen. Medical Oxygen (and future Nitrous-Oxide and Nitrogen) shall be provided via compressed gas cylinders, with redundancy back-up. Capacity shall be determined through equipment /process usage, availability of supply, frequency of supply and coordination both with the supplier and the designed usage. Medical Air and Vacuum shall be supplied via central source equipment.
- 7.2.4.1(3) All pipe and pipe fittings will be in accordance to ASTM B819, de-greased copper Type 'L'.
- 7.2.4.2 Service Outlets:
- 7.2.4.2(1) Provide recessed service outlets boxes designed for concealed piping and fabricated for straight insertion of secondary equipment.
- 7.2.4.2(2) Each recessed wall outlet will have a permanently marked, colour-coded non-interchangeable index system so to prevent the connection of the wrong gases. Provide a secondary check valve to hold the line pressure if the primary valve is removed for maintenance.
- 7.2.4.2(3) Provide 2-part DISS type outlet connections for each medical gas where applicable. Provide equipment specific outlets/connections at equipment identified as requiring a medical gas supply..
- 7.2.4.2(4) Ball type shut off valves will have a U.L. listed label showing the gas service & pressure rating. Valves will swing out during installation and have a quarter turn from full open to close.
- 7.2.4.2(5) Area Zone shut off valves will be housed in a single box with multiple shut off valves with tube extensions, lexan glass door with hinges and pull out opening ring. Provide pressure / vacuum gauges for each service.
- 7.2.4.2(6) Provide connections, with shut off valves, with sufficient capacity to equipment that has specific gas requirements.

7.2.4.2(7) All Medical Gas mains, systems and supplies / reserves shall have 20% future capacity above design capacity.

7.2.4.3 Performance Criteria:

7.2.4.3(1) Install all medical gas piping in the building in accordance with CSA Standards.

7.2.4.3(2) Design the system such that there is one zone shut off system per laboratory.

7.2.4.3(3) All medical gas piping in normally inaccessible areas (e.g.: behind walls and boarded ceilings) will be identified.

7.2.4.3(4) Provide BMS alarm interface signal to the central DDC system for critical alarms such as low or high pressure.

7.2.4.3(5) All on-site storage of medical gases will be to CSA Standards.

7.2.4.3(6) All piping, valves and filters will be factory cleaned and capped or sealed to prevent contamination.

7.2.4.3(7) All departments will be provided with local valve boxes and alarm panels in accordance with CSA Standards.

7.2.4.3(8) A master medical gas alarm panel will be provided to monitor all medical gas functions.

7.2.4.3(9) All Master alarm panels will be connected to the Building Management System to meet relevant codes and as per Northern Health Standards.

7.2.4.3(10) All medical gas systems will be certified in accordance with CSA standards by an independent testing agency.

7.2.4.3(11) All medical gas outlets and piping systems will be cleaned in accordance with CSA standards.

7.2.4.3(12) All systems components requiring electrical power will be on emergency power.

7.2.4.3(13) Medical gas outlets will be provided to suit CSA and the building location requirements.

### 7.3 High Pressure Cylinder Manifold (Primary Source of Supply)

### 7.3.1 Basic Requirements

- 7.3.1.1 Manifold shall consist of two high-pressure header bar assemblies to facilitate connection of primary and secondary cylinder supplies. Each header bar shall be provided with the required number of CGA cylinder pigtail connections incorporating a check valve at the header connection. The high-pressure header bar shall be designed in such a manner that it can be extended to facilitate additional cylinder connections. Each header bar assembly shall be provided with a high-pressure shut-off valve. The manifold shall be fully automatic in operation and shall not require any levers or handles for resetting by maintenance staff.
- 7.3.1.2 Control equipment shall be made up of a series of regulators to reduce the cylinder pressure to line delivery pressure. The unit shall be capable of automatically changing over from a primary bank of cylinders to a secondary bank of cylinders without interruption or fluctuation in delivery pressure. The manifold shall be housed in a CSA 1 enclosure.
- 7.3.1.3 A Microprocessor circuit board assembly shall provide a relay output to give indication when or just before the manifold switches from one bank of cylinders to another. The switch over shall be mechanically controlled. Manifolds using electrically controlled shuttling devices shall not be acceptable.
- 7.3.1.4 To avoid excess pressure being supplied to the distribution system, a pneumatically relieved valve for the line regulator shall be incorporated. An intermediate pressure relief valve shall be installed between the high-pressure regulators and the line delivery regulators.
- 7.3.1.5 Gauges shall be installed within the enclosure downstream of each high-pressure regulator and also at the output end of the delivery pressure pipe. Gauges will indicate the regulated pressures of the left and right banks of the manifold.
- 7.3.1.6 All pressure transducers, micro switches, and display LED's shall be pre-wired to an internal microprocessor circuit board. The manifold must interface with the Building Management System (BMS).
- 7.3.1.7 Manifold shall be UL/CSA listed.

7.3.1.8 Each manifold shall have the following information labelled:  
 Gas Name \_\_\_\_\_. Size:  
 \_\_\_\_\_X\_\_\_\_\_. Delivery Pressure \_\_\_\_\_  
 kPa (\_\_\_\_\_ psig).

7.3.1.9 Manifolds shall be sized for 20% future extra capacity.

## 7.3.2 Natural Gas System

### 7.3.2.1 Basic Requirements:

- 7.3.2.1(1) This Section of the Specification applies to all natural gas piping systems.
- 7.3.2.1(2) Submit to the Provincial Gas Inspection Department, drawings, applicable sections of specifications and detailed drawings as required to obtain approval for the gas installation before the work commences.
- 7.3.2.1(3) Approvals must be received prior to commencing work.
- 7.3.2.1(4) Arrange and pay for the natural gas connection to the gas utility's distribution system.
- 7.3.2.1(5) Provide chain link enclosure around gas meter with locking access door.
- 7.3.2.1(6) Provide spool piece at branch serving outpatient specimen collections area for future meter. Provide minimum 300 mm spool complete with unions. Provide DDC conduit from nearest DDC panel to meter location complete with future pull string.
- 7.3.2.1(7) Below ground exterior piping shall be polyethylene pipe, CSA certified.



- 7.3.2.1(8) Above ground piping shall be Schedule 40 seamless Carbon Steel to ASTM A53 and CSA B-63.
- 7.3.2.1(9) Fittings shall be: Screwed fittings shall be malleable iron with beaded ends. Dielectric type shall be used where a buried service enters and connects to building piping; Welded shall be forged steel of the same weight as the connecting pipe; Unions shall be malleable iron with ground joints.
- 7.3.2.1(10) Joint Materials: Screwed: Thread lubricant; Flanged: Full faced gasket materials, flanged steel weld neck, raised face type, carbon steel (ASTM A307) square headed bolts with hexagon nuts, bolts bull diameter of bolt holes.
- 7.3.2.1(11) Valves shall be:
  - 7.3.2.1(11)(a) Provincial Gas Department approved and suitable for temperature to which they are exposed.
  - 7.3.2.1(11)(b) Provide a seismic actuated automatic shut-off valves, 20 to 150 mm: C.G.A., UL and State of California certified seismic gas shut-off check valve with acceleration trigger mechanism, soft seat construction, visual open/close indicator and a manual reset capable of operating between  $-23^{\circ}\text{C}$  to  $66^{\circ}\text{C}$ ; The sensing means of the valve shall actuate the shut off within 5 seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of 0.3 G ( $2.94 \text{ m/s}^2$ ) and a period of 0.4 seconds;
- 7.3.2.1(12) Master Gas Shut Off (for laboratories):
  - 7.3.2.1(12)(a) Valve: Ball type, full line size minimum 2065 kPa [300 psi] ULC listed with locking handle.

- 7.3.2.1(12)(b) Box: Flush mounted box to accommodate one master gas shut off valve.
- 7.3.2.1(13) Gas pressure reducing valves shall be: Corrosion resistant; High performance reducing pounds to inches.
- 7.3.2.1(14) Gas meters shall conform to the following:
- 7.3.2.1(14)(a) Positive Displacement Meters: Natural gas meter for up to 42.5 m<sup>3</sup>/hr at 34.5 kPa, non-temperature compensated; 12 mm threaded connections; Low frequency pulsed output (4-20 mA) for monitoring by the BAS.
- 7.3.2.1(14)(b) Rotary Meters: Natural gas meter for up to 11.8 m<sup>3</sup>/hr at 34.5 kPa, non-temperature compensated; 30 mm threaded connections; Low frequency pulsed output (4-20 mA) for monitoring by the BAS.
- 7.3.2.1(15) Interior gas service - screw or weld up to 50 mm, weld 65 mm and larger.
- 7.3.2.1(16) Interior gas service in unvented space, in supply or return air ceiling plenum, or operating at 35 kPa pressure - weld all sizes.
- 7.3.2.1(17) Exterior gas service - weld all sizes except for polyethylene pipe which shall have no joints other than those allowed in NSC CAN/CGA-B149.1.
- 7.3.2.1(18) All branch connections except those less than half diameter of main shall be made with welding tees.
- 7.3.2.1(19) Branch connections less than half diameter of main may be made with weldolets or thredolets.

- 7.3.2.1(20) Do not paint dielectric isolating couplings.
- 7.3.2.1(21) Provide pressure regulator and lockable shut-off at discharge of gas meter before entry into the building.
- 7.3.2.1(22) Heat shrink factory extruded polyethylene sleeves over bare metallic pipe at weld.
- 7.3.2.1(23) Employ an independent testing agency to test the continuity of the polyethylene jacket, when metallic piping is buried, using a 12,000 volt Holiday Detector. Repair any breaks in polyethylene jacket with two layers of polyken tape. Submit report from testing agency certifying continuity of polyethylene jacket.
- 7.3.2.1(24) Install unions or flanges in connections to all equipment and specialty components.
- 7.3.2.1(25) Arrange piping connections to allow ease of access and for removal of equipment.
- 7.3.2.1(26) Align and independently support piping connections to prevent piping stresses being transferred to equipment.
- 7.3.2.1(27) Install gas shut-off valves complete with handle at the following locations:
  - 7.3.2.1(27)(a) At the service entry point to the building immediately prior to entry.
  - 7.3.2.1(27)(b) At each branch to an individual item of equipment or appliance.

- 7.3.2.1(27)(c) At each service to each laboratory and laboratory bench (install valve in readily accessible location).
- 7.3.2.1(27)(d) Note that individual shut offs are required to each individual outlet in all fume hoods.
  - 7.3.2.1(28) All building isolation valves shall possess locking lugs. Provide seismic valve at building main.
  - 7.3.2.1(29) Terminate vent outlets to atmosphere at the following minimum lateral distances:
    - 7.3.2.1(29)(a) 1.5 m [5 ft] from any door, openable window or building opening.
    - 7.3.2.1(29)(b) 3.0 m [10 ft] from any forced air intake.
  - 7.3.2.1(30) Allow for expansion with suitable anchors, guides and expansion loops to prevent undue stress on any part of the system. Such anchors and guides shall be rigidly fastened to structural members through the roof deck. Supports shall be set in sheet metal gum pans wrapped into the roofing. Coordinate with roofing subtrade.
  - 7.3.2.1(31) All piping shall be welded with approved flexible connectors at point of connection to gas fired equipment.
  - 7.3.2.1(32) Apply one coat of Rust-Oleum 769 damp proof red primer, one coat of Rust-Oleum 960 zinc chromate and one finish coat of Rust-Oleum 850 grey to piping.
  - 7.3.2.1(33) Test piping in accordance with the National Standard of Canada "Natural Gas Installation Code" CAN/CGA-B149.1.

### 7.3.3 Specialty Systems

#### 7.3.3.1 Basic Requirements:

7.3.3.1(1) Supply and install all specialty systems as required to provide a complete installation. These systems include, but are not limited to:

7.3.3.1(1)(a) Acid waste, venting, and neutralization;

7.3.3.1(1)(b) Oil, grease, dirt, and solids interceptors,

7.3.3.1(1)(c) Medical gas systems.

#### 7.3.3.2 Performance Criteria:

7.3.3.2(1) Filtration system must be sized to handle 120% design flow rate with redundant filters piped in parallel to allow for cleaning and repair.

7.3.3.2(2) Provide and install cross-connection capability including valves and piping on domestic water service.

7.3.3.2(3) The incoming water filtration system will be capable of removing particulates larger than 25 microns.

7.3.3.2(4) Acid waste, vent piping, and fittings will be suitable for the pH levels of the waste system.

7.3.3.2(5) Interceptors will be designed to manufacturer's specifications.

## 7.4 Heating, Ventilating and Air Conditioning (Division 23)

### 7.4.1 Heating

#### 7.4.1.1 Basic Requirements

7.4.1.1(1) The heating plant will be provided with adequate backup capacity and equipment redundancy to ensure continuous building operation at all times, with no noticeable reduction in

service outcomes. Redundancy will be as per CSA standards and as per Section 3.8.1.7.

- 7.4.1.1(2) Space heating capacity will be sufficient to meet the required indoor design temperatures outlined in CSA Standards while using the January 1 outside design temperature outlined in the BC Building Code.
- 7.4.1.1(3) The heating equipment will be sized sufficiently to meet the maximum simultaneous building demand for all systems served by the heating plant. It also must be capable of controlling and responding to periods of low usage. Modular or multiple units shall be employed within the heating plant.
- 7.4.1.1(4) Apply energy recovery systems to offset plant heating requirements. These shall be glycol heat exchanger loops or similar means to prevent cross contamination or mixing of exhaust flows.
- 7.4.1.1(5) It is essential that perimeter heating with radiant ceiling panels be utilized for the entire building.
- 7.4.1.2 Performance Criteria
  - 7.4.1.2(1) Any ventilation, electric or electronic filtration, air cleaner system and/or radiant heating sources serving the laboratories will be connected to the building's emergency power supply.
  - 7.4.1.2(2) Boilers will operate at a minimum AFUE efficiency of 80% at all firing rates when using natural gas as the primary fuel source. The minimum operating efficiency is relaxed to 81.5% for hot water boilers and minimum of 80% for the steam boiler when boilers are operating using a secondary fuel oil source. Consideration shall be given to designing and providing a heating system with condensing boilers.
  - 7.4.1.2(3) Provide adequate expansion compensation for heating piping throughout. Location of anchors and guides, design of expansion compensation loops and selection of expansion compensation devices will be based upon a thorough review of piping layout, and piping stress analysis.
  - 7.4.1.2(4) All high points in piping will be equipped with automatic air removal devices such as air collection chambers and air vents. Air vents shall be piped to drain.

- 7.4.1.2(5) Equipment and piping will be installed with adequate service space, access panels and ability to remove equipment from building for servicing or replacement.
- 7.4.1.2(6) Isolation valves, unions and bypass piping will be provided to allow for equipment isolation and removal without unduly affecting the system operation or major drain down.
- 7.4.1.2(7) Balancing valves, flow-measuring devices, temperature and pressure sensors will be provided throughout the system to facilitate system balancing.
- 7.4.1.2(8) Pumps will be selected to operate at the system fluid temperature without vapour binding and cavitation, will be non-overloading in parallel or individual operation, and will operate within 25% of the mid point of published maximum efficiency curve.
- 7.4.1.2(9) Pump construction and installation will permit complete pump servicing without breaking piping or motor connections.
- 7.4.1.2(10) Boilers will be dual fuel fired with natural gas as the primary fuel and fuel oil as the secondary fuel. Adequate storage of secondary fuel will be provided on-site to operate the boilers for a minimum of 24 hours (CSA), under maximum demand conditions. Complete boiler plant shall be sized such that low load and shoulder season loads can be achieved at high efficiency.
- 7.4.1.2(11) Locate services that require regular maintenance access above non-critical spaces such that there is minimal to no disruption to the laboratory spaces.
- 7.4.1.2(12) Insulate all heating water piping, equipment and accessories to BCICA and ASHRAE Standards.
- 7.4.1.2(13) Utilize screw fittings for 50mm piping and smaller and welded fittings for 65mm piping and larger.

## 7.4.2 Air Conditioning

### 7.4.2.1 Design Principles:

- 7.4.2.1(1) The cooling plant will be provided with adequate back up capacity and equipment redundancy to meet the

requirements of Class Two spaces as defined by CSA Z317.2-01 Table 1. Class One spaces in the building will have 100% cooling capacity redundancy.

- 7.4.2.1(2) Cooling will be available continuously, particularly where continuous internal heat gains exist such as electrical rooms, communications closets and server room. The systems serving these areas shall be on emergency power. Each communications closet and server room will have a thermostat with room control setting.
- 7.4.2.1(3) Space cooling capacity must be sufficient to meet the required indoor design temperatures outlined in CSA Standards while using the July 2.5% outside design wet and dry bulb temperatures outlined in the BC Building Code.
- 7.4.2.1(4) Utilize 100% outdoor air for free cooling as the first means of space cooling.
- 7.4.2.1(5) Utilize heat recovery chillers where there is demand for cooling all year round to offset plant heating requirements.
- 7.4.2.1(6) Investigate and utilize, if possible alternate source of cooling such as ground source heat pump systems.

#### 7.4.2.2 Performance Criteria

- 7.4.2.2(1) Ensure no air within the air conditioning system, outside of the central air handling equipment, drops below its dew point temperature.
- 7.4.2.2(2) CFC and HCFC based refrigerants will not be used in the refrigeration equipment.
- 7.4.2.2(3) Piping will be installed in an orderly manner. Slope piping to permit complete drainage of the system.
- 7.4.2.2(4) All high points in the closed loop piping will be equipped with automatic air removal devices, such as air collection chambers and air vents. Pipe vents to drain.
- 7.4.2.2(5) Equipment and piping will be installed with adequate service space, access panels and ability to remove equipment from building for servicing or replacement.



- 7.4.2.2(6) Isolation valves, unions and bypass piping will be provided to allow for equipment isolation and removal without unduly affecting the system operation or major drain down.
- 7.4.2.2(7) Pumps will be selected to operate without vapour binding or cavitation, will be non-overloading in parallel or individual operation, and will operate within 25% of the mid-point of published maximum efficiency curve.
- 7.4.2.2(8) Pump construction and installation will permit complete pump servicing without breaking piping or motor connections.
- 7.4.2.2(9) Locate services that require regular maintenance access above non-critical spaces such that there is minimal to no disruption to the delivery of health care services.
- 7.4.2.2(10) Insulate all chilled water and condenser water piping, equipment and accessories to BCICA and ASHRAE Standards.
- 7.4.2.2(11) Utilize screw fittings or welded fittings for all piping.

### 7.4.3 Ventilation

#### 7.4.3.1 Design Principles:

- 7.4.3.1(1) Heating, ventilation and air conditioning (HVAC) system will provide a comfortable internal environment of  $\pm 21$  degrees C for patients and staff and will meet the required environmental conditions for the equipment, as per the manufacturer's recommendations.
- 7.4.3.1(2) The HVAC system will maintain required pressure relationships between various areas of the building and will provide necessary air filtration, cleansing and exhaust to mitigate transmission of infection and / or contamination.
- 7.4.3.1(3) HVAC systems will be provided with adequate backup capacity and equipment redundancy to ensure continuous building operation as per CSA Z317.2-01 at all times. HVAC systems serving laboratories shall be on emergency power.
- 7.4.3.1(4) Air handling units will be provided with sectional heating and cooling coils with manual isolation valves, enabling isolation of the damaged sections of the coils.

- 7.4.3.1(5) Class 1 and Class 2 spaces will be provided with redundant capacity so that in the event of a failure or scheduled service shutdown of one unit, the other units will continue to run and provide 100% capacity to the affected area. Class 3 spaces will be provided with redundant capacity so that in the event of a failure or scheduled service shutdown of one unit, the other units will continue to run and provide approximately 50% capacity to the affected area.
- 7.4.3.1(6) 100% redundancy will be provided for: Prep Room, Complex Procedure room, GYN, ENT room, Minor Procedure room, Trauma Room, the future Operating Suite, Laboratory and Morgue.
- 7.4.3.1(7) Design the ventilation system and all components in accordance with ASHRAE Standards and CSA Standards.
- 7.4.3.1(8) At a minimum, ventilation rates for all spaces will meet the design requirements described in CSA Standards. If a space is not listed, ventilation rates will comply with the applicable standards and codes. Comparisons shall be made to applicable laboratory standards and make-up air requirements for hoods etc. and provide the greater ventilation rate.
- 7.4.3.1(9) Provide the minimum filtration levels as described in CSA and all other Appliance Standards.
- 7.4.3.1(10) Spaces will maintain pressurization requirements described in CSA Standards.
- 7.4.3.1(11) Air handling equipment will be factory fabricated to ensure the highest construction standard. No Site built-up units will be allowed.
- 7.4.3.1(12) Fans will be designed with Variable Frequency Drives (VFDs) for energy savings under part-load conditions.
- 7.4.3.1(13) Provide an indirect and/or direct heat recovery system on the general exhaust air systems.
- 7.4.3.1(14) Provide supply and exhaust filtration as required by the specific equipment / hoods. Laboratory exhaust shall not be mixed with exhaust from other laboratories or spaces.

#### 7.4.3.2 Performance Criteria

- 7.4.3.2(1) The building design will incorporate a strategy to install and remove major building equipment such as fans, etc.
- 7.4.3.2(2) Locate fans, common filters (e.g.: HEPA), and other equipment in the central mechanical rooms. Allow for adequate clearance for service access as outlined in the BC Building Code.
- 7.4.3.2(3) All supply air, return air and general exhaust air systems will be located in interior mechanical rooms free from exposure to the elements.
- 7.4.3.2(4) Make allowances in duct sizing and equipment selections to accommodate flexibility for future horizontal expansion. Allow for a future 20% increase in capacity in duct mains, branch lines and Air Handling Unit sizing.
- 7.4.3.2(5) Design the fresh air intakes, cooling coil drain pans, air handling units; duct mounted humidifiers, ductwork, and all other interconnected components to prevent moisture or contaminants from collecting within the system. Utilize double scoped drain pans to eliminate standing water. Provide sufficient access panels to allow for inspection and cleaning.
- 7.4.3.2(6) Fresh air intakes will be located to not entrain contaminants from outdoor sources. All intakes will be located in areas not accessible by the public.
- 7.4.3.2(7) All supply, return, and exhaust air will be fully ducted to the space being served.
- 7.4.3.2(8) Locate services that require regular maintenance access above non-critical spaces such that there is minimal to no disruption to the delivery of health care services.
- 7.4.3.2(9) All laboratory area ventilation shall utilize laminar or non-aspirating air diffusion to minimize disturbances at work areas and fume/biological safety hoods.
- 7.4.3.2(10) Generally air shall be designed to flow from clean to dirty areas.
- 7.4.3.2(11) Provide a gas scavenging system that meets the requirements of CSA Z7396.2-06 Medical Gas Pipeline Systems – Part 2: Anaesthetic Gas Scavenging

#### 7.4.4 Sound Attenuation and Vibration Isolation

##### 7.4.4.1 Design Principles:

- 7.4.4.1(1) Design all mechanical systems to prevent sound and vibration transmission between spaces, and transmission from mechanical equipment to the spaces and maintain sound to levels as per design standards. Design mechanical systems located at or near the Building exterior to minimize sound transmission to the neighbouring residential community. Daytime sound levels at the property line shall not exceed 60 dBa. Nighttime (after 22:00) sound levels shall not exceed 50 dBa.
- 7.4.4.1(2) Provide vibration isolation devices on all equipment with rotating components.
- 7.4.4.1(3) All hung equipment will utilize spring isolators designed for the weight and vibration characteristics of the equipment.
- 7.4.4.1(4) Provide flexible connectors on all pump, duct, and wiring connections to isolated equipment.

##### 7.4.4.2 Performance Criteria

- 7.4.4.2(1) Ensure duct silencers meet or exceed the requirements of the ductwork for cleanliness and inspection.
- 7.4.4.2(2) Utilize fibre free internal insulation and packless attenuators.
- 7.4.4.2(3) Duct silencers shall be manufactured, engineered devices not fabricated built-up devices.

#### 7.4.5 Testing, Adjusting, Balancing and Commissioning:

- 7.4.5.1 Demonstrate to the Owner that the mechanical and electrical systems are substantially operational by testing, adjusting, balancing, and commissioning the systems in accordance with Good Industry Practice.
- 7.4.5.2 Provide system testing, adjustment, balancing and commissioning after 3 months of building and systems usage following Occupancy.
- 7.4.5.3 Retain complete records of all TAB and commissioning data; and provide the Owner with a copy of the final documents for review.

## 7.5 Major Equipment – Performance Specification

### 7.5.1 Custom Air Handling Units

- 7.5.1.1 Air handling units shall be designed and manufactured to the specific requirements of this project. This specification applies to the custom air handling units.
- 7.5.1.2 The following shall be used as selection criteria and shall be as specified: airflow rates, external static pressures, water flow rates. The following are to be equalled or bettered: coil face velocities, filter face velocities, casing leakage rates, casing and base deflection. The following shall be met within 10% of specified values: water pressure drop, air pressure drop.
- 7.5.1.3 Units shall be produced by a recognized manufacturer who maintains a local service agency and parts stock.
- 7.5.1.4 Air handling units and major components shall be products of manufacturing firms regularly engaged in production of such equipment whose products have been in satisfactory use in similar service for not less than 10 years.
- 7.5.1.5 Fans shall conform to AMCA bulletins regarding testing and construction.
- 7.5.1.6 Coils shall be ARI certified.
- 7.5.1.7 Filter media shall be ULC listed.
- 7.5.1.8 Units with factory wiring shall be factory approved and labelled. Failure to comply with this requirement will necessitate the manufacturer, at his expense, to have a certified representative inspect the equipment prior to affixing a label.

### 7.5.2 Approved Equals (Also See List of Manufacturers 3.8,2.)

- 7.5.2.1 The following manufacturer is the basis of design: Haakon Industries.
- 7.5.2.2 The following manufacturers are approved provided all aspects of the specifications, plans and Haakon standard of construction are met.

- 7.5.2.3 Approved Manufacturers: PACE, RACAN, SCOTT SPRINGFIELD, HUNTAIR, VENMAR. This specification shall over-ride any other published approved manufacturer's list.
- 7.5.2.4 Contractor shall assume all risks and extra costs associated with using approved manufacturers these manufacturers in lieu of the specified product.
- 7.5.3 Submittals:
- 7.5.3.1 The submittal shall provide all technical information relevant to the product being provided, including but not limited to, all the information shown in the schedules of this specification. It is the responsibility of the supplier to highlight any variances his equipment has with the requirements of this specification whether or not pre-approval has been obtained. Information shall be provided in the same measurement units as indicated elsewhere in this specification.
- 7.5.3.2 The submittal shall provide fan curves [not fan tables], with specified operating points clearly plotted.
- 7.5.3.3 The submittal shall provide coil selection worksheets, clearly showing proper consideration for altitude, air density, glycol corrections and indicate coil tube fin and casing construction.
- 7.5.3.4 The submittal shall provide filter information, including: initial APD, final APD, dust spot efficiency, final dust holding capacity, filter media description, filter frame details, and filter removal details.
- 7.5.3.5 The manufacturer shall submit sound power levels for both air handling unit inlet and outlet at rated capacity. If the unit exceeds sound power levels at scheduled conditions, the manufacturer must provide additional sound attenuators and meet specified BHP.
- 7.5.3.6 The manufacturer shall submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- 7.5.3.7 The manufacturer shall submit the manufacturers recommended installation instructions.

- 7.5.3.8 Omission of any of the above information will cause shop drawings to be immediately returned without review. Approval of submittal drawings of other manufacturers other than specified will not constitute final acceptance. This contractor will remedy any variances found on units that vary from the specification or plans to match the specified unit at no cost to the Owner.
- 7.5.4 Operating and Maintenance Data
  - 7.5.4.1 The manufacturer shall submit operation and maintenance data.
  - 7.5.4.2 The manufacturer shall include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
- 7.5.5 Environmental Requirements
  - 7.5.5.1 Units shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, isolators adjusted, belt tension checked, sheaves aligned and the fan has been test run under observation.
- 7.5.6 General
  - 7.5.6.1 The manufacturer shall provide a factory assembled air handling unit. The unit shall include all specified components installed at the factory. Field fabrication of units and their components will not be accepted. The units shall include spring-isolated supply fans (with inlet isolation damper), pre-filters and final filters, dampers, cooling coil, heating coil, and factory mounted and wired VFD's. Space in the units will be provided to allow Northern Health the ability to install Dynamic Sterile Sweep microbial eliminators in the future.
  - 7.5.6.2 Units too large to be legally shipped by truck may be shipped to the site in sections. Contractor shall allow for site assembly of the factory supplied unit sections. This includes mounting of all accessories shipped loose, wiring across splits, touch up painting, etc. Otherwise units shall be shipped in one piece.
- 7.5.7 Casing

- 7.5.7.1 Walls and roofs shall be constructed of 16 gauge satin coat galvanized steel 50 mm thick acoustic thermal panels. Insulation shall be 50 mm thick 3 lbs/cubic ft. rigid neoprene coated insulation. All permanently joined flanged panel surfaces shall be sealed with an individual strip of 3mm x 9.6 mm tape sealer. Wall seams shall be turned inward to provide a clean flush exterior finish. All panel seams shall be sealed during assembly to produce an airtight unit.
- 7.5.7.2 The internal liner shall be 22 gauge 304 stainless steel and shall be suitable for washing with a pressure washer or steam cleaner without risk of wetting the insulation (in all sections). The liner shall be installed over top of the panel flanges and each liner seam shall be sealed with a lap joint. The wall liner shall be installed over top of the base water dam such that any water run-off from the liner will drip into the water tight base rather than into the wall panel. The roof liner shall be installed over top of the roof support so that water cannot enter the roof insulation.
- 7.5.7.3 All panels shall be joined on 200 mm centers using cadmium plated TEK screws.
- 7.5.7.4 All insulation edges shall be protected with metal lagging. Insulation systems using stickpins or adhesives are not acceptable.
- 7.5.7.5 Stiffeners of angle steel shall be supplied as required to maintain casing deflection criteria of 1/200 at 1.5 times the working pressure. If panels cannot meet this deflection, an additional internal reinforcing shall be added.
- 7.5.7.6 Acoustical Performance:
  - 7.5.7.6(1) The housing shall have been tested for acoustical performance by an accredited independent laboratory.
  - 7.5.7.6(2) Test methods and facilities used to establish sound transmission loss values shall conform explicitly with the ASTM designation E90-85 and E413-73..
  - 7.5.7.6(3) The manufacturer shall submit the lab report for approval
  - 7.5.7.6(4) Sound Transmission Loss DB ASTM E-90 & E413-73.

	1	2	3	4	5	6	7	8	
50 mm (2") Walls	18	19	27	33	43	52	52	52	STC=37



7.5.7.6(5) Test methods and facilities used to establish sound absorption values shall conform explicitly with the requirements of the ASTM Standard Test Method for Sound Absorption Coefficients by the Reverberation Method: ASTM C423-84A and E795-83.

	7.5.7.6(6) Sound Absorption ASTM C423-84A & E795-83								
	1	2	3	4	5	6	7	8	
50 mm (2") Walls	.10	.23	.75	1.08	1.05	.99	.97	.95	STC=37

#### 7.5.7.7 Base Construction:

- 7.5.7.7(1) Units shall be constructed from structural steel C-channel around the perimeter of the unit with intermediate channel and angle iron supports. Unit shall have a minimum 150 mm channel.
- 7.5.7.7(2) A 12 gauge aluminum checker plate floor shall be installed on the base. All seams on aluminum floor shall be continuously welded. The floor shall be flat, reinforced below with all seams continuously welded. Drive screw attachment and caulking are not acceptable. The base shall be provided with lifting lugs, a minimum of four [4] per unit section. The base shall be insulated with 50mm fiberglass insulation and sheeted with a 22 gauge galvanized steel liner. Floors that "oil can" are not acceptable and will be site-remedied at this contractor's expense.
- 7.5.7.7(3) The manufacturer shall provide a 40mm perimeter collar around the entire unit and around each floor opening to ensure the unit is internally watertight. The entire base shall act as an auxiliary drain pan and hold up to 40mm of water.
- 7.5.7.7(4) The manufacturer shall provide auxiliary drains in fan sections downstream of cooling coils and in mixing sections.
- 7.5.7.7(5) All drain connections on floor mounted air handling units shall terminate at the side of the unit.
- 7.5.7.7(6) Maximum base deflection shall be 6 mm on 600cm in unsupported span.
- 7.5.7.7(7) Unit shall be constructed to sit on a concrete housekeeping pad. Drain traps coil drain pans and unit sections shall be field provided and installed by this contractor.

#### 7.5.7.8 Access Doors

- 7.5.7.8(1) Access doors shall be manufactured from 16 gauge. The doors shall be double wall construction with 22 gauge stainless steel liner on the inside. Stainless steel liner shall be "wash-down compatible" as specified in the preceding casing section. Corners of the doors shall be continuously welded for rigidity. 50mm of 3 lbs/cubic ft density insulation shall be sandwiched between the 16 gauge outer layer and the 22 gauge inner layer (stainless steel). Doors MUST be

the same thickness as the unit casing to maximize thermal and acoustical resistance. A 300mm HERMETICALLY SEALED double glazed laminated glass window shall be provided in each door. Hinges shall be continuous piano type stainless steel.

7.5.7.8(2) Two [2] "Ventlok" Model #310 high pressure latches operable from either side of the door shall be provided. The door opening shall be fully gasketed with continuous 12 mm closed cell hollow round black gasketing and a metal encapsulated reinforcing backing that mechanically fastens to the door frame. Door frames shall be made from 16 gauge with the outside of the door flush with the unit. The minimum door opening size shall be 450 mm x 1780 mm [where height permits]. Fan compartments must have a door of minimum width to remove the motor.

7.5.7.8(3) All access doors must swing against the air pressure [positive pressure plenum doors must swing in]. Access doors that do not comply must be remedied by this contractor at the jobsite.

#### 7.5.7.9 Non-Scrolled Fans – Plenum Type

7.5.7.9(1) Fans shall be manufactured by Haakon, Twin City or Pace. Fans shall be airfoil as indicated in the schedule or the fans shall be centrifugal plenum [plug] type, designed without a scroll type housing. Fans shall incorporate a wheel, heavy gauge reinforced steel inlet plate with removable spun inlet cone, structural steel frame, and shaft and bearings in AMCA Arrangement 3 configuration as an entire assembly.

7.5.7.9(2) All fan wheels shall have tapered spun wheel cones or shrouds providing stable flow and high rigidity. The wheels shall be non-overloading type.

7.5.7.9(3) The blades shall be continuously-welded, die-formed aluminum Airfoil type, designed for maximum efficiency and quiet operation. Partial welding will not be acceptable on airfoil blades.

7.5.7.9(4) Impellers shall be statically and dynamically balanced and the complete fan assembly shall be test balanced at the operating speed prior to shipment.

- 7.5.7.9(5) Shafts shall be of AISI C-1018, 1040 or 1045 hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy.
- 7.5.7.9(6) Shafts shall be sized for first critical speed of at least 1.43 times the maximum speed for the class. Bearings shall be heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for minimum average bearing life [AFBMA L-50] in excess of 200,000 hours at the maximum class RPM.
- 7.5.7.9(7) When specified, the fans shall be supplied with internal or nested type variable inlet vanes for wheel diameter 420 mm and larger.
- 7.5.7.9(8) Cantilevered vane blades shall be used through Size 490 to minimum air performance insertion losses and noise. The operating mechanism shall be outside the inlet air-stream.
- 7.5.7.9(9) The manufacturer shall provide WORKSAFEBBC / OSHA approved fully enclosed metal belt guard sides of galvanized steel and an expanded metal face. The belt guard shall be sized to allow either sheave to be increased by two sizes.
- 7.5.7.9(10) The plenum fan assembly MUST have an enclosed safety screen as per WORKSAFEBBC / OSHA Standards. Safety screen shall completely encase the fan and assembly per OSHA requirements. No exceptions. Fans that are provided without a safety screen that covers the complete fan, motor and belt assembly will have one field-provided at this contractor's expense.
- 7.5.7.9(11) Fans shall have inlet WORKSAFEBBC / OSHA approved inlet screens.
- 7.5.7.9(12) DELETED.
- 7.5.7.9(13) DELETED.
- 7.5.7.10 Vibration Isolation:
- 7.5.7.10(1) An integral all welded steel vibration isolation base shall be provided for the fan and motor.
- 7.5.7.10(2) Isolators shall be free standing with sound deadening pads and levelling bolts.

7.5.7.10(3) The spring diameter to compressed operating height ratio shall be 1 to 1.

7.5.7.10(4) The spring deflection shall be 75 mm.

7.5.7.10(5) Isolators shall have earthquake restraints.

#### 7.5.7.11 Motors, Drives and Variable Frequency Drives

7.5.7.11(1) Fan motors shall be mounted and isolated on the same integral base as the fan.

7.5.7.11(2) Fan motors shall be heavy duty, premium efficiency open drip-proof, operable at scheduled electrical duty. MOTORS SHALL MEET USA EPACT OF 1992.

7.5.7.11(3) The V-belt drive shall have a constant pitch sheave rated at 1.5 times the motor nameplate.

7.5.7.11(4) Air handling units shall have factory mounted, factory wired variable frequency drives with bypass to allow fan operation while frequency drive is removed. VFD shall accept 0-10 V or 4-20 mA signal provided by controls contractor. VFD's shall be mounted on the exterior wall of the AHU. All power wiring from VFD's to motors shall be factory supplied. All control wiring shall be by controls contractor. Control contractor shall run control wiring per unit manufacturer's requirements and direction.

7.5.7.11(5) Div 16 shall provide power and connect 575 Volt / 3 phase power to each AHU SF VFD's and RF VFD's, and 120 volt power circuits to the lighting circuit within the unit. VFD's shall include a disconnect switch, internal link reactors and CSA 3R enclosure. Keypad functions shall include Hand/Off/Auto feature.

7.5.7.11(6) VFD's shall be commissioned and fans sheaved so that each SF and RF will have their speed increased by 12% on a failure of the redundant fan. (IE. If one SF fails – the second SF will have its RPM increased by 12%). DDC controls shall be programmed to increase the speed of one fan upon failure of the other fan. DDC system shall monitor failure contact of each VFD separately.

- 7.5.7.11(7) VFD's shall automatically adjust the voltage to the motor to optimize energy savings under changing load and speed conditions.
- 7.5.7.11(8) Fan motors and speed drives shall be warranted for a period of 3 years by VFD manufacturer. VFD manufacturer shall include required internal components (LRC filter, Line and Load Reactors as required).
- 7.5.7.11(9) Trane TR200 is the basis of this specification. Acceptable VFD manufacturers include: ABB and Allen Bradley.
- 7.5.7.11(10) VFD start up shall be by factory trained representative. Provide start-up report.

#### 7.5.7.12 Airflow Measuring Probes:

- 7.5.7.12(1) Provide on each fan air flow measuring probes capable of continuously monitoring the air handling capacity of the respective scrolled (plenum) fan.
- 7.5.7.12(2) Each airflow probe shall contain multiple, averaged velocity pressure taps located symmetrically around the throat of the fan inlet and a single static pressure tap located on the fan housing. The entire airflow monitoring probe must be located outside the inlet throat as to not obstruct airflow.
- 7.5.7.12(3) The probes shall be capable of producing steady, non-pulsating signal of the velocity pressure, independent of the upstream static pressure without adversely affecting the performance of the fan. The sensing probes shall be accurate  $\pm 3\%$  of actual fan airflow. The fan inlet sensing rings shall be **FreeFlo Sensing Ring** as manufactured by Haakon Industries Ltd. Approved equivalent: EBTRON.

#### 7.5.7.13 Airflow Display:

- 7.5.7.13(1) Provide on indicated fans a method of displaying digitally, in real time, the fans current air flow.
- 7.5.7.13(2) The display shall be capable of showing the airflow of two (2) independent fans simultaneously.
- 7.5.7.13(3) For interaction with a controller, the display shall output one (1) 0-10VDC signal for each fan being monitored. Integrate all air flow displays and sensors with the BMS.

- 7.5.7.13(4) The output signal shall be accurate to  $\pm 0.5\%$  of Natural Span, including non-linearity, hysteresis and non-repeatability.
- 7.5.7.13(5) The display must be water tight allowing for use in outdoor locations. If the display is not water tight it shall be enclosed in a weatherproof housing.
- 7.5.7.14 Coils:
- 7.5.7.14(1) Coils shall be manufactured by Haakon, Trane, Colmac, or Pace. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall be mounted in the unit casing to be accessible for service. Capacities, pressure drops and selection procedure shall be certified in accordance with ARI Standard 410.
- 7.5.7.14(2) Coils shall be fully enclosed within the casing. Cooling coils shall be on mounted 304 stainless steel angle racks manufactured to allow coils to slide out individually. Heating coils shall be mounted on galvanized angle racks manufactured to allow coils to slide out individually.
- 7.5.7.14(3) Removable coil access panels shall be provided for removal of coils through the casing wall. Coils shall be individually removable towards the access side. Coils must be individually racked, removable through the side access panels.
- 7.5.7.14(4) All pipe connections shall be on the same unit end, extended through the casing for ease of connection.
- 7.5.7.14(5) Water coils handling recently mixed air, or direct outside air, shall be fully drainable by removing a single threaded plug for each coil row.
- 7.5.7.14(6) The primary surface shall be round seamless 16 mm dia. x 0.508 mm wall thickness copper tube on 38 mm centers. All joints shall be brazed.
- 7.5.7.14(7) The secondary surface shall consist of rippled plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Bare copper tube

shall not be visible between fins and the fins shall have no openings or holes which might accumulate lint and dirt. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

- 7.5.7.14(8) The casings shall be constructed of continuous 16-gauge galvanized steel casings for heating coils and 304 stainless steel for cooling coils, and heat extraction coils. Coil side plates shall be of reinforced flange type.
- 7.5.7.14(9) The coil connection locations shall permit universal mounting of the coil for right or left hand airflow and have equal pressure drop through all circuits. Coils shall be circuited for counterflow heat transfer to provide the maximum mean effective temperature difference for maximum heat transfer rates.
- 7.5.7.14(10) The complete 5W coil core shall be tested with 300 lbs air pressure under warm water and be suitable for operation at 200 psig working pressures. Individual tube and core tests before installation of headers is not considered satisfactory. Hydrostatic tests alone will not be acceptable.
- 7.5.7.14(11) All cooling coils shall have stainless steel drain pans pitched in 2 directions to ensure complete drainage. Drain pans found to have "standing water" shall be remedied by this contractor at the job site. Drain pans must be recessed below AHU floor level.
- 7.5.7.14(12) Heating and cooling coils shall have capacities as scheduled.
- 7.5.7.14(13) Heat recovery coils shall be provided. Heat extraction coils shall comply with cooling coil and drain pan specification.

7.5.7.15 Filters:

- 7.5.7.15(1) Air Handling Unit Filtration shall meet CSA Z317.02-01 requirements.

7.5.7.16 Filter Gauges:

- 7.5.7.16(1) The manufacturer shall provide Dwyer 2000 magnehelic gauges.



- 7.5.7.16(2) Magnehelic gauges shall be accurate to +/- 2% of full range.
- 7.5.7.16(3) One gauge shall be provided for each filter bank.
- 7.5.7.16(4) Gauges shall be recessed into the exterior cabinet casing to provide a "flush" finish.

#### 7.5.7.17 Lights:

- 7.5.7.17(1) Provide 1220 mm vapour proof fluorescent lights with T8 ballasts in each section. Duplex receptacles shall be installed in each fan section on the wall across from the access doors. A switch with an indicator light shall be installed on the unit outer wall at each access door location. Electrical power shall be 120V/1/60. All lights shall be wired back to a single point on the unit for connection of power by Div 26. This circuit shall also be factory wired to the Dynamic Air cleaner system for single point 120 Volt power.
- 7.5.7.17(2) Please refer to AHU sections shown on mechanical plans. Lights shall be located as drawn on sections.

#### 7.5.7.18 Finish:

- 7.5.7.18(1) The unit shall be finish painted with two components, etch bond primer and alkyd enamel. All uncoated steel shall be painted with grey enamel. All metal surfaces shall be prepainted with vinyl wash primer to ensure paint bonds to metal. Unit colour shall be Haakon standard grey.

#### 7.5.7.19 Unit Mounted Silencers:

- 7.5.7.19(1) Each silencer pod shall consist of radiused noses and tails and perforated metal panels stiffened for flatness. Silencers shall be rated in accordance with ASTM E477.
- 7.5.7.19(2) Acoustic media shall be compressed and supported to minimize dusting and erosion. Mineral wool is not acceptable. Insulation shall be encapsulated with Tedlar.
- 7.5.7.19(3) One 915 mm silencer with 50% free area shall be provided for each of supply fan and return fan.
- 7.5.7.19(4) Silencer pods shall be full height and full width of the plenum.
- 7.5.7.19(5) Stacked duct type silencers are not acceptable.

- 7.5.7.19(6) Sound Power Levels: The following octave band data shall be met or exceeded. Sound data shall be submitted as part of the submittal process to confirm these numbers will be met.

Octave Band Sound Power Levels								
Band	63	125	250	500	1000	2000	4000	8000
AHU typical SA discharge	85	90	88	77	65	59	62	59
AHU typical RA inlet	84	87	77	62	56	55	55	55

7.5.7.20 Aluminum Airfoil Dampers:

- 7.5.7.20(1) Aluminum airfoil frames and blades shall be a minimum of 12 gauge extruded aluminum. Blades shall be of a single unit airfoil design 152 mm wide.
- 7.5.7.20(2) Frames shall be extruded aluminum channel with grooved inserts for vinyl seals. Standard frames shall be 52 mm x 102 mm x 16 mm on the linkage side, 52 mm x 102 mm x 25 mm on the other 3 sides.
- 7.5.7.20(3) Pivot rods shall be 22.4 mm in hexagon extruded aluminum interlocking into the blade section. Bearings shall be of a double sealed type with a Celcon inner bearing on a rod within a Polycarbonate outer bearing inserted into the frame to prevent the outer bearing from rotating.
- 7.5.7.20(4) The bearing shall be designed so there are no metal-to-metal or metal-to-bearing riding surfaces. The interconnecting linkage shall have a separate Celcon bearing to eliminate friction inside the linkage.
- 7.5.7.20(5) Blade linkage hardware shall be installed in a frame outside the airstream. All hardware shall be of non-corrosive, reinforced cadmium plated steel.
- 7.5.7.20(6) Damper seals shall be designed for minimum air leakage by means of overlapping seals.
- 7.5.7.20(7) Actuators shall be provided, installed and wired by controls contractor.
- 7.5.7.20(8) Jack-shaft assemblies shall be provided for multiple damper installations.
- 7.5.7.20(9) Dampers shall be TAMCO 1000 or equivalent.

## 7.5.7.21 Humidifiers – Gas-Fired Steam Humidification System

- 7.5.7.21(1) DRI-STEEM Corporation GTS Model, gas-fired steam humidifier.
- 7.5.7.21(2) Electrical Services and Connections – Section 7.8.
- 7.5.7.21(3) Certifications:
  - 7.5.7.21(3)(a) CSA/AGA/CGA
  - 7.5.7.21(3)(b) CE
- 7.5.7.21(4) Submittals:
  - 7.5.7.21(4)(a) Comply with Submittal Procedures and Execution and Closeout Requirements.
  - 7.5.7.21(4)(b) Submit product data (manufacturer's specifications, and technical data including performance, construction and fabrication) for each manufactured component.
- 7.5.7.21(5) Warranty: Product shall be warranted to be free from defects in materials and fabrication for a period of two years after installation.

## 7.5.7.22 Products:

## 7.5.7.22(1) Fabrication requirements:

- 7.5.7.22(1)(a) Tank: 14-gauge 304-stainless steel with Heli-arc welded seams.
- 7.5.7.22(1)(b) Removable cover allowing easy access to probe assembly in the tank.
- 7.5.7.22(1)(c) Easily accessible cleanout plate.
- 7.5.7.22(1)(d) Steam outlet on top of tank configured to connect to hose or pipe(GTS Models 100-200) or a flange (GTS Models 300-800).
- 7.5.7.22(1)(e) Stainless steel round flue outlet to vent products of combustion. Humidifier shall be certified to use Class B flue materials.
- 7.5.7.22(1)(f) Painted aluminum enclosure to protect all humidifier components. Enclosure shall have integral base with openings designed for moving with a fork lift or pallet jack.
- 7.5.7.22(1)(g) Enclosure with integral base and openings designed for moving with a forklift or pallet jack.
- 7.5.7.22(1)(h) Stainless steel heat exchanger with welded joints.
- 7.5.7.22(1)(i) Factory insulation: Humidifier shall be covered with 25 mm thick, rigid, foil-faced fiberglass insulation. All surfaces except front face panel shall have insulation.
- 7.5.7.22(1)(j) Size: Units with capacities of 136 kg/hr or less shall be capable of fitting through 915 mm door.

7.5.7.22(2) Water Requirements: The humidifier shall be capable of generating steam from tap, softened or DI/RO water.

7.5.7.22(3) Drain: An electric drain valve shall be mounted on humidifier assembly to allow tank to drain automatically at the end of a humidification season (standard water models only).

## 7.5.7.22(4) Burner Assembly:

- 7.5.7.22(4)(a) Humidifier and burner assembly shall be CSA/AGA/CGA certified and tested to support natural or LP gas.
- 7.5.7.22(4)(b) Gas train assembly shall be complete with burner/mixing tube assembly, igniter, sight glass, flame rod electrode, gas manifold integral gas valve and venture.
- 7.5.7.22(4)(c) Each burner shall freely modulate or time proportion with a gas input turndown ratio of up to 4:1, and shall time-proportion below that threshold.

7.5.7.22(5) Integral water tempering device: A factory-installed thermostatically controlled water valve shall meter an amount of cold water into a stainless steel mixing chamber to temper 100°C water with a 0.38 l/s in-flow rate to a 60°C discharge temperature to sanitary system.

7.5.7.23 Humidifier Options: Tank and heat exchanger shall be type 316 stainless steel with Heli-arc welded seams.

## 7.5.7.24 Humidifier Controls:

- 7.5.7.24(1) Control subpanel: Control subpanel shall be factory - attached to humidifier with all wiring between subpanel and humidifier completed at factory. A wiring diagram shall be included.
- 7.5.7.24(2) Vapour-logic4 microprocessor controller with the following features or functions:
  - 7.5.7.24(2)(a) Web interface and server, included standard on all models:
  - 7.5.7.24(2)(b) Web interface shall have same functionality as Vapor-logic4 keypad/display.
  - 7.5.7.24(2)(c) Web interface shall allow multiple remotely located users to simultaneously view system operation and/or change system parameters.
  - 7.5.7.24(2)(d) Web interface shall have password-protected secure access.

- 7.5.7.24(2)(e) Web interface shall be compatible with standard Internet browsers.
- 7.5.7.24(2)(f) Interoperable with any Modbus® network.
- 7.5.7.24(2)(g) Redundant low water safety control.
- 7.5.7.24(2)(h) Fully modulating (0% to100%) control of humidifier outputs.
- 7.5.7.24(2)(i) PID control capability with field-adjustable settings.
- 7.5.7.24(2)(j) Water level control for softened or hard water.
- 7.5.7.24(2)(k) Automatic refill, low water cut-off field adjustable skimmer bleed off functions and automatic drain-down of humidifier. System shall consist of: (1) a water level sensing unit comprised of three metallic probes screwed into a threaded probe head. Probe head shall incorporate probe isolation chamber to eliminate short- circuiting between probes caused by mineral coating of probe head. Probe head shall be mounted on the humidifier assembly; (2)A solenoid operated fill valve factory mounted on the humidifier assembly; (3) End-of-season drain automatically drains humidifier tank after a user-defined period of system inactivity.
- 7.5.7.24(2)(l) Temperature sensor: A factory mounted sensor, with a temperature range of -40° C to 120° C mounted on the humidifier to enable the following functions: (a) Maintain the evaporating chamber water temperature above freezing; (b) Maintain a user-defined preset evaporating chamber water temperature; (c) Allow rapid warm-up of water in evaporating chamber after a call for humidity, providing 100% operation until steam production occurs.
- 7.5.7.24(3) USB port on the control board for software updates, data backups, and data restoration.

- 7.5.7.24(4) Real-time clock to allow time-stamped alarm/message tracking, and scheduled events.
- 7.5.7.24(5) Factory commissioning of humidifier and control board, including system configuration as-ordered, factory unit testing, and operation with water before shipping.
- 7.5.7.24(6) Unit-mounted keypad/display operable within a temperature range of 0° C to 70 °C, and that provides backlighting for viewing in low light.
- 7.5.7.24(7) Alarms, unit configuration, and usage timer values shall remain in non-volatile memory indefinitely during a power outage.
- 7.5.7.24(8) The capability to monitor, control, and/or adjust the following parameters: (a) Relative humidity (RH) set point, actual conditions in the space (from humidity transmitter), RH offset; (b) Dew point set point, actual conditions in the space (from dewpoint transmitter) dew point offset; (c) Relative humidity (RH) duct high limit set point (switch) and actual conditions; (d) Relative humidity (RH) duct high limit set point, actual conditions (from transmitter), high limit span, and high limit offset; (e) Total system demand in % of humidifier capacity; (f) Total system output in lbs/hour (kg/h); (g) Drain/flush duration, allowed days, and frequency based on usage; (h) End-of-season drain status (on standard water systems and if ordered as a DI water option) and hours humidifier is idle before end of season draining occurs; (i) Window glass surface temperature (in % RH offset application using sensor ordered as an option) with programmable offset; (j) Air temperature or other auxiliary temperature monitoring with programmable offset (using sensor ordered as an option); (k) System alarms and system messages, current and previous; (l) Adjustable water skim duration; (m) Programmable outputs for remote signalling of alarms and/or messages, device activation (such as a fan), or for signalling tank heating and/or steam production; (n) System diagnostics that include: (i) Test outputs function to verify component operation; (ii) Test humidifier function, by simulating demand to validate performance; (iii) Data collection of RH, air temperature, water use, energy use, alarms, and service messages for viewing from the keypad/display or Web interface; (o) Service notification scheduling; (p) Password-protected system parameters; (q)

Keypad/display or Web interface displays in English; (r)  
Numerical units displayed in inch-pound or SI units.

#### 7.5.7.25 Humidifier Control Options

- 7.5.7.25(1) Interoperability using LonTalk. Integrate all air flow displays and sensors with the BMS.
- 7.5.7.25(2) Multiple humidifier tank control. Vapor-logic4 shall be programmed and configured at the factory to control multiple humidifier tanks. Controller functions shall include all Vapor-logic4 functions listed above plus:
  - 7.5.7.25(2)(a) The controller shall control up to 16 humidifier tanks.
  - 7.5.7.25(2)(b) Automatic run-time balancing. The controller shall assign duty to all humidifier tanks in the multi- tank group such that each humidifier accrues approximately the same hours of duty, thereby ensuring equal wear across all humidifiers in the multi-tank group.
  - 7.5.7.25(2)(c) One humidifier tank shall be capable of being controlled as a redundant tank.
  - 7.5.7.25(2)(d) One Vapor-logic4 keypad/display shall be included with each multi-tank group.
- 7.5.7.25(3) Control input accessory options:
  - 7.5.7.25(3)(a) Humidity transmitter, room: Humidity transmitter shall be a room-mounted device that measures from 0% to 100% of RH range and provides a linear output (10% RH to 90% RH) from 4 mA to 20 mA. Accuracy  $\pm 2\%$  RH. Supply voltage 21 VDC. Operating temperature range:  $-20^{\circ}$  C to  $60^{\circ}$  C.
  - 7.5.7.25(3)(b) Humidistat, on-off, high limit: Electric humidistat control shall be an off-on style, duct mounted with a control range of 15% to 95% RH. Compatible with 24, 120, 240 VAC. Operating temperature range  $4^{\circ}$  C to  $52^{\circ}$  C.



- 7.5.7.25(3)(c) Modulating high limit control: The modulating high limit control system shall include two modulating electronic humidity transmitters (one space-mounted, the other duct-mounted downstream of the humidifier). Both shall transmit to the microprocessor controller to modulate humidifier output and maintain the highest desired space humidity possible, at all airflow volumes, without saturation of the airstream. (For this application, it is recommended to use a sail type airflow-proving switch).
- 7.5.7.25(3)(d) Airflow proving switch, pressure type: Airflow proving switch shall be diaphragm-operated with picot tube for field installation. Switch shall have an adjustable control point range of 0.05" wc to 12" wc (12.5 Pa to 2988 Pa) Operating temperature range -40 °C to 82°C. Compatible with 24, 120 and 240 VAC.

#### 7.5.7.26 Humidifier Dispersion Options

- 7.5.7.26(1) Ultra-sorb® steam dispersion panel:
- 7.5.7.26(1)(a) The factory assembled steam dispersion panel shall include the following components: (1) Steam supply header/separator; (2) Condensate collection header; (3) Closely spaced steam dispersion tubes spanning the distance between the two headers.
- 7.5.7.26(1)(b) Each dispersion tube shall be fitted with two rows of steam discharge tubelets inserted into the tube wall, centered on the diametric line, and spaced 38 mm apart. Each tubelet shall be made of a thermal-resin material designed for high steam temperatures. The two rows of tubelets in each dispersion tube shall discharge steam in diametrically opposite directions, perpendicular to airflow.
- 7.5.7.26(1)(c) Each tubelet shall extend through the wall of and into the center of the dispersion tube and

contain a steam orifice sized for its required steam capacity.

- 7.5.7.26(1)(d) The humidifier shall provide absorption characteristics that preclude water accumulation on any in-duct surface within 381 mm of the humidifier tube panel while maintaining conditions of 80% maximum relative humidity at a minimum of 13°C in the duct airstream.
- 7.5.7.26(1)(e) Air pressure loss across the humidifier panel shall not exceed 4 Pa water column at a duct air velocity of 2 m/s.
- 7.5.7.26(1)(f) Each packaged humidifier panel assembly of tubes and headers shall be contained within a galvanized metal casing to allow convenient duct mounting, or to facilitate the stacking of and/or the end-to-end mounting of multiple humidifier panels in ducts or air handler casings. When so designated, the humidifier panel shall be shipped unassembled.
- 7.5.7.26(1)(g) All tubes and headers shall be 304 stainless steel and be Heli-arc welded.
- 7.5.7.26(1)(h) Tubes shall be joined to headers with slip-fit couplings.
- 7.5.7.26(1)(i) Tubes and headers shall be 316 stainless steel and be Heli-arc welded.
- 7.5.7.26(1)(j) Dispersion tubes shall be insulated with a plenum-approved insulating material for in-duct installation and have an R-value not less than 0.5 at a thickness not more than 3.2 mm, for minimal increase in dispersion tube diameter. (i) Airstream heat gain shall not exceed the values as scheduled; the values shall be supported by the manufacturer's published data. (ii) Insulating material shall meet the following criteria at 3.2 mm thickness; (1) Fire/smoke index shall be 0/0 per any of the following test procedures: - UL

723 fire/smoke index (Test for Surface Burning Characteristics of Building Materials) – NFPA 255 (Standard Method of Test of Surface Burning Characteristics of Building Materials) - ASTM E84 (Surface Burning Characteristics for Materials Used in Plenums) (2) Stable up to 148 °C continuous - to prevent material degradation, hardening, or crumbling at high temperatures; (3) Closed-cell construction does not absorb water or support microbial growth - to negate the need for vapour barriers and jackets; (4) Non-toxic and pure as documented in manufacturer’s data - to prevent off-gassing and to facilitate use in clean rooms, pharmaceutical applications, and food industries; (5) Will not degrade when exposed to UVC light - to negate the need for UV wraps; (6) Continuous, seam-welded, and held in place without bands or clamps – to minimize surfaces for the accumulation of particulate matter.

7.5.7.26(1)(k) Dispersion tubes that are not insulated will not be considered.

7.5.7.26(1)(l) Dispersion tubes are to be factory installed in air handling units.

#### 7.5.7.27 Air Leakage Testing

7.5.7.27(1) The unit manufacturer shall factory pressure test each air handling unit to ensure the leakage rate of the casing does not exceed 1.0% of the unit air flow at 1.5 times the rated static pressure. A leakage test shall be performed with VSD installed.

7.5.7.27(2) The test shall be conducted in accordance with SMACNA duct construction manual. A calibrated orifice shall be used to measure leakage airflow.

7.5.7.27(3) An officer of the manufacturing company shall certify test results and forward copies of the certified test results to the consultant.

7.5.7.27(4) "Double duct" or "side by side" units shall have each duct or side tested independently.

7.5.7.27(5) Positive pressure plenums shall be tested positively and negative pressure plenums shall be tested negatively.

#### 7.5.7.28 Drains

7.5.7.28(1) The manufacturer shall provide 25 mm capped floor drain connections on the side of the unit for complete drainability of the base pan for the following sections:

7.5.7.28(1)(a) Fresh air plenums.

7.5.7.28(1)(b) Fan sections.

7.5.7.28(1)(c) Sections upstream and downstream of coils.

7.5.7.28(1)(d) All sections in unit with wash-down liner.

### 7.5.8 Cooling Tower Specification

#### 7.5.8.1 Options:

7.5.8.1(1) Stainless Steel Cold Water Basin

7.5.8.1(2) Factory Mutual Approved

7.5.8.1(3) Air Inlet Screens

7.5.8.1(4) Motor Outside Airstream

7.5.8.1(5) Equalizer Flume Weir

7.5.8.1(6) Basin Equalizers

7.5.8.1(7) Basin Heaters

7.5.8.1(8) Ladder and Guardrail

7.5.8.1(9) Ladder Safety Cage

7.5.8.1(10) Vibration Switch

7.5.8.1(11) Variable Speed Drive

7.5.8.1(12) Premium Efficiency Motor

- 7.5.8.2 Base: Provide an induced draft, cross-flow type, factory assembled, film fill, industrial duty, galvanized steel cooling tower situated as shown in the plans. The limiting overall dimensions of the tower shall be 5.538 M wide, 7.856 M long, and 3.64 M high. Total operating horsepower of all fans shall not exceed 30 Hp, consisting of 3 @ 10 Hp motor(s). Tower shall be similar and equal in all respects to Marley Model NC8403NAN3.
- 7.5.8.3 Thermal Performance:
- 7.5.8.3(1) The tower shall be capable of cooling 1260 gpm of water from 38 °C to 32.2 °C at a design entering air wet-bulb temperature of 19.4 °C, and its thermal rating shall be Certified by the Cooling Technology Institute.
- 7.5.8.3(2) The tower shall be capable of a minimum efficiency per ASHRAE Standard 90.1.
- 7.5.8.4 Performance Warranty:
- 7.5.8.4(1) CTI Certification notwithstanding, the cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to plan. If, because of a suspected thermal performance deficiency, the Owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are agreeable to the Owner to compensate for the performance deficiency.
- 7.5.8.5 Design Loading:
- 7.5.8.5(1) The tower structure, anchorage and all its components shall be designed by licensed structural engineers per the International Building Code to withstand a wind load of 146 kg/m<sup>2</sup>, as well as a .3g seismic load. The fan deck and hot water basin covers shall be designed for 244 kg/m<sup>2</sup> live load

or a 75 kg concentrated load. Guardrails, where specified, shall be capable of withstanding a 75 kg concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.

7.5.8.6 Construction:

7.5.8.6(1) 1 Except where otherwise specified, all components of the cooling tower shall be fabricated of heavy-gauge steel, protected against corrosion by G-235 galvanizing. The tower shall be capable of withstanding water having a pH of 6.5 to 8.0; a chloride content (NaCl) up to 300 ppm; a sulfate content (SO<sub>4</sub>) up to 250 ppm; a calcium content (CaCO<sub>3</sub>) up to 500 ppm; silica (SiO<sub>2</sub>) up to 150 ppm; and design hot water temperatures up to 51.7°C. The circulating water shall contain no oil, grease, fatty acids or organic solvents.

7.5.8.6(2) The specifications, as written, are intended to indicate those materials that will be capable of withstanding the above water quality in continuing service, as well as the loads described in paragraph 4.1. They are to be regarded as minimum requirements. Where component materials peculiar to individual tower designs are not specified, the manufacturers shall take the above water quality and load carrying capabilities into account in the selection of their materials of manufacture.

7.5.8.6(3) The tower shall include all design and material modifications necessary to meet the fire rating requirements of Factory Mutual (FM). The product proposed shall be listed in the FM Approval Guide, latest edition.

7.5.8.7 Mechanical Equipment:

7.5.8.7(1) Fan(s) shall be propeller-type, incorporating wide-chord aluminum alloy blades and galvanized hubs. Blades shall be individually adjustable. Maximum fan tip speed shall be 3962 m/min. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. The gearbox bearings shall be rated at an L10A service life of 100,000 hours or greater.

7.5.8.7(1)(a) The motor shall be mounted outside the casing of the tower, and shall be connected to the gear reducer by a dynamically-

balanced, stainless steel tube and flange driveshaft.

- 7.5.8.7(1)(b) The cooling tower shall consist of a minimum of 3 cells, with 3 separate fans, motors, and VFDs.
- 7.5.8.7(2) Motor(s) shall be 10 Hp maximum, TEFC, 1.15 service factor, variable torque, and specially insulated for cooling tower duty. Speed and electrical characteristics shall be 1800 rpm, single-winding, 3 phase, 60 Hz, 575 volts. Motor shall operate in the shaft-horizontal position, and nameplate horsepower shall not be exceeded at design operation.
- 7.5.8.7(3) The complete mechanical equipment assembly for each cell shall be supported by a rigid steel structural support that resists misalignment between the motor and the gear reducer. The mechanical equipment assembly shall be warranted against any failure caused by defects in materials and workmanship for no less than five (5) years following the date of tower shipment. This warranty shall cover the fan, speed reducer, drive shaft and couplings, and the mechanical equipment support. The electric motor shall carry a manufacturer's warranty of at least one year.
- 7.5.8.7(4) A complete ULC listed Variable Speed Drive system in a CSA 1 indoor, CSA 12 indoor or CSA 3R outdoor enclosure shall be provided. The VFD shall use PWM technology with IGBT switching and integrated bypass design. Provide harmonic filters on the line side of variable-frequency drives and UPS system to limit the input current harmonic distortion (iTHD) to less than 5% of the full-load fundamental current. Bypass should have sort-start system. VFD out put switching shall not cause mechanical issues with gearbox teeth or drive shafts. The VFD shall catch a fan spinning in the reverse direction without tripping. The panel shall include a main disconnect with short circuit protection and external operating handle, lockable in the off position for safety. The VFD system shall receive a speed reference signal from the Building Management System monitoring the tower cold-water temperature. As an option to receiving the speed reference signal from a building management system, the drive must have the capability to receive a 4-20 ma temperature signal from an RTD transmitter. The VFD shall have an internal PI regulator to modulate fan speed

maintaining set point temperature. The drive's panel display shall be able to display the set-point temperature and cold-water temperature on two separate lines. The bypass shall include a complete magnetic bypass circuit and with capability to isolate the VFD when in the bypass mode. Transfer to the bypass mode shall be manual in the event of VFD failure. Once the motor is transferred to the by-pass circuit the fan motor will run at constant full speed. The bypass circuit will not modulate ON and OFF based on cold-water temperature. The application must be able to handle very cold water while VFD is in a by-pass mode. Operator controls shall be mounted on the front of the enclosure and shall consist of start and stop control, bypass/VFD selection, Auto/Manual selections, manual speed control. To prevent heating problems in the cooling tower fan motor the VFD system shall de energize the motor once 25% motor speed is reached and cooling is no longer required. The cooling tower manufacturer shall supply VFD start-up assistance. Tower vibration testing throughout the speed range is required to identify and lockout any natural frequency vibration levels which may exceed CTI guidelines.

- 7.5.8.7(5) A vibration limit switch shall be installed on the mechanical equipment support assembly and wired into the control panel. The purpose of this switch will be to interrupt power to the motor in the event of excessive vibration. It shall be adjustable for sensitivity, and shall require manual reset.
- 7.5.8.7(6) An externally mounted and wired terminal box shall be provided for each cell providing a single access location to the internal wiring. Terminate wiring for fan motor and options such as vibration switch, oil level switch and water level probes to the terminal box. The terminal box shall be built to UL508 standards and all terminal points marked for ease of connection in the field. The enclosure shall be CSA 4X fiberglass. Entry points shall be into and out of the bottom of the enclosure preventing water collection in the enclosure.
- 7.5.8.8 Louvers and Drift Eliminators:
- 7.5.8.8(1) Fill shall be film type, thermoformed of 15 mil thick PVC, with louvers formed as part of each fill sheet. Fill shall be suspended from hot dip galvanized structural tubing supported from the tower structure, and shall be elevated above the floor of the cold water basin to facilitate cleaning.



Air inlet faces of the tower shall be free of water splash-out. Fill shall be capable of withstanding a hot water temperature of 125°F.

- 7.5.8.8(2) Drift eliminators shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.

7.5.8.9 Hot Water Distribution System

- 7.5.8.9(1) Two open basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. These basins shall be installed and sealed at the factory, and shall be equipped with removable, galvanized steel covers capable of withstanding the loads described in Section 4.1. The water distribution system shall be accessible and maintainable during tower fan and water operation.

- 7.5.8.9(2) Each basin shall include an inlet hole and bolt circle to accept a 125# flange connection per ANSI B16.1. Removable, interchangeable polypropylene nozzles installed in the floor of these basins shall provide full coverage of the fill by gravity flow.

- 7.5.8.9(3) The water distribution system shall be accessible and maintainable while tower is operating.

7.5.8.10 Casing, Fan Deck and Fan Guard:

- 7.5.8.10(1) The casing and fan deck shall be heavy-gauge galvanized steel, and shall be capable of withstanding the loads described in Section 4.1. The top of the fan cylinder shall be equipped with a conical, non-sagging, removable fan guard, fabricated of welded 8 mm and 7 gauge rods, and hot dip galvanized after fabrication. Fan cylinders 1530 mm in height and over shall not be required to have a fan guard.

- 7.5.8.10(2) The air inlet faces of the tower shall be covered by 25 mm mesh hot-dipped galvanized welded wire screens. Screens shall be secured to removable galvanized U-edge frames. Screens shall be designed so bottom half can be removed for easy access to the cold water basin.

7.5.8.11 Access:

- 7.5.8.11(1) A large galvanized, rectangular access door shall be located on both end panels for entry into the cold water basin. Doors

shall provide access to the fan plenum area to facilitate inspection and allow maintenance to the fan drive system.

7.5.8.11(2) The top of the tower shall be equipped with a sturdy guardrail, complete with kneerail and toeboard, designed according to OSHA guidelines and factory welded into subassemblies for ease of field installation. Posts, top rails and kneerails shall be 38 mm square tubing. The guardrail assembly shall be hot dipped galvanized after welding and capable of withstanding a 75 kg concentrated live load in any direction. Posts shall be spaced on centers of 2440 mm or less. A 457 mm wide aluminum ladder with 75 mm I-beam side rails and 32 mm diameter rungs shall be permanently attached to the endwall casing of the tower, rising from the base of the tower to the top of the guardrail.

7.5.8.11(3) Ladder Safety: A heavy gauge aluminum safety cage shall surround the ladder, extending from a point approximately 2135 mm above the foot of the ladder to the top of the guardrail.

#### 7.5.8.12 Cold Water Collection Basin:

7.5.8.12(1) The collection basin shall be heavy-gauge S300 stainless steel, and shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. Suction connections shall be equipped with stainless steel debris screens. A factory-installed, float-operated, mechanical make-up valve shall be included. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt which may accumulate. Towers of more than one cell shall include stainless steel flumes for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating. All steel items which project into the basin (columns, diagonals, anchor clips, etc.) shall also be made of stainless steel.

7.5.8.12(1)(a) A hole and bolt circle shall be provided in the depressed section of the basin for equalizer piping between cells. A full-face, 6.4 mm thick, 50 durometer gasket shall be provided at each equalizer location.

- 7.5.8.12(2) Provide a system of electric immersion heaters and controls for each cell of the tower to prevent freezing of water in the collection basin during periods of shutdown. The system shall consist of one or more stainless steel electric immersion heaters installed in threaded couplings provided in the side of the basin. A CSA 4 enclosure shall house a magnetic contactor to energize heaters; a transformer to provide 24-volt control circuit power; and a solid-state circuit board for temperature and low water cut-off. A control probe shall be located in the basin to monitor water level and temperature. The system shall be capable of maintaining 4.44°C water temperature at a Village of Burns Lake winter design temperature.
- 7.5.8.12(3) The interconnecting flume between cells shall be equipped with a removable cover plate to permit the shutdown of one cell for maintenance purposes, or to permit independent cell operation.

#### 7.5.9 Laboratory Systems and Controls – Electric

- 7.5.9.1 The intent of this Specification is to define the hardware and control requirements for the airflow and temperature control of laboratories. The system specified shall be based on variable fume hood exhaust volume with sash position reset control of fume hoods, synchronization of supply and exhaust airflows, and control of lab room temperature via reheat coils and airflow reset.
- 7.5.9.2 All control equipment required to fulfill this Specification shall be manufactured and provided by the laboratory airflow control equipment manufacturer.
- 7.5.9.3 The laboratory airflow control systems (LACS) shall digitally interface to the Central Building Automation System (BAS) as provided by the temperature control contractor. The laboratory airflow control contractor shall be responsible for providing an interface device between the laboratory airflow controls and the BAS.
- 7.5.9.4 The BAS contractor shall be responsible for the following:

- 7.5.9.4(1) Installation of all LACS controllers, with exception to sash sensors and fume hood monitor displays. (Sash sensors and fume hood monitor

displays shall be supplied by the LACS and factory mounted by fume hood manufacturer.)

- 7.5.9.4(2) Provision, installation and connection of all LACS-required pneumatic tubing and devices for a complete and operable system. (Refer to BAS section for pneumatic tubing specifications.)
- 7.5.9.4(3) Provision, installation and final termination of all control wiring, including network communications wiring to LACS. (Refer to BAS section for control wiring specifications.)
- 7.5.9.4(4) Provision and installation of power wiring to all LACS controllers as required.
- 7.5.9.4(5) Provision of laboratory reheat control valve (where required). Valve requirement shall receive either a 4-20 MA or 2-10 VDC signal.

7.5.9.5 The HVAC contractor shall:

- 7.5.9.5(1) Install all laboratory airflow control system air valves provided by the LACS contractor.
- 7.5.9.5(2) Provide a minimum of three (3) duct diameters of straight duct upstream from every laboratory airflow control system air valve provided by the LACS contractor to ensure lowest pressure drop for the device.
- 7.5.9.5(3) Install all airflow measuring devices in ductwork provided by the LACS contractor.
- 7.5.9.5(4) Standard fittings, hangers, and ancillary devices required to install

duct devices shall be provided by this contractor.

7.5.9.6 The air balancing contractor shall:

7.5.9.6(1) Verify fume hood face velocities, airflow volume readings and control points in each control mode. Coordination of such shall be through LACS contractor.

7.5.9.7 System Turnover:

7.5.9.7(1) Equipment shall be commissioned by the LACS contractor.

7.5.9.7(2) The LACS contractor shall demonstrate to the Engineer the ability of the controls to maintain setpoints in all modes of operation.

7.5.9.8 Training/Owner's Instruction

7.5.9.8(1) The LACS contractor shall provide thirty-two (32) hours in two (2) sessions (introductory and follow-up) of training to site personnel in the use and maintenance of the laboratory airflow controls provided. Training shall be conducted during normal working hours and shall consist of both hands-on and classroom training at the job site.

7.5.9.8(2) The ATC contractor shall be responsible to provide training to site personnel in the use and maintenance of all controls and systems related to the lab controls, including the Central BMS computer.

7.5.9.9 Guarantee

7.5.9.9(1) The laboratory airflow control system contractor shall provide two (2) years standard warranty.

7.5.9.9(2) If a Venturi valve is provided by the LACS contractor, said Contractor shall provide the Owner with a 5-year maintenance contract at no additional cost to the Owner, due to the higher maintenance associated to the Venturi type valve. The maintenance contract shall provide for every valve to be inspected via the inspection doors once per quarter. The LACS contractor shall provide the Owner with a quarterly report verifying that the cones are not sticking and no debris from the exhaust airstream has attached itself to the valve mechanism.

#### 7.5.9.10 Quality Assurance

7.5.9.10(1) LACS contractor shall provide written approvals and certifications after installation has been completed.

7.5.9.10(2) LACS contractor must prove that he has been engaged in the provision, installation and service of this type of equipment for at least ten (10) years and has a fully equipped, factory trained and authorized service organization.

7.5.9.10(3) For any equipment submitted for approval, the LACS contractor shall state what, if any, specific points of the system operation differ from these Specifications.

7.5.9.10(4) The LACS contractor shall continue to bear the liability for replacement of substituted equipment in the event that the equipment fails to perform as specified, or to meet approval of all authorities having jurisdiction,

within twelve (12) months after beneficial use by the Owner.

7.5.9.11 Acceptable Manufacturers: Tek-Air Systems, Inc. (Basis of Design) and AccuValve™ (Contact: Trane Northwest, Timo Lucas, 250-414-7523).

7.5.9.12 The laboratory airflow control system shall include the following components:

7.5.9.12(1) Fume Hood Exhaust Air Valves (consists of airflow control valve with airflow sensor and electric actuator).

7.5.9.12(2) Fume Hood Face Velocity Controllers and Display units (consists of controller, display and sash sensors).

7.5.9.12(3) General Exhaust Air Valves (consists of airflow control valve with airflow sensor and electric actuator).

7.5.9.12(4) Supply Air Valves (consists of airflow control valve with airflow sensor and electric actuator).

7.5.9.12(5) Exhaust Airflow Measuring Device if required (consists of insertion airflow probe w/ integral transmitter).

7.5.9.12(6) Room Temperature Sensor.

7.5.9.12(7) Duct Mounted Temperature Sensor.

7.5.9.13 Fume Hood Airflow Volume Controller

7.5.9.13(1) Exhaust airflow volume shall be controlled based on sash position at each laboratory fume hood by a dedicated fume hood controller. The fume hood controller shall be a fully functioning, independent control unit, capable of operating as a standalone element in a distributed laboratory airflow control system.

Control hardware distribution shall be such that the failure of one controller shall not affect any other fume hoods on the network.

7.5.9.13(2) The fume hood controller shall consist of a controller, display module, sash position sensors, sash position transmitter and vortex-shedding type duct airflow probe. The sash position sensors shall mount physically on the fume hood sash and frame assemblies and cable-connect to the transmitter. The transmitter shall cable-connect to the controller.

7.5.9.13(3) The fume hood controller shall also have integral Airflow Measurement Circuitry to receive a signal directly proportional to duct air velocity, from a vortex-shedding type airflow measuring device, for the purpose of monitoring and controlling fume hood airflow volume. The signal shall be digitally processed by the controller, with no analog-to-digital circuitry required, eliminating A/D conversion error. The airflow measurement shall be incorporated in the control sequence as performed by the airflow controller, and communicated to other airflow controllers, via the network, as required. Measurement system accuracy shall be plus or minus 2% of volumetric airflow rate. Turndown capability shall be at least 10:1.

7.5.9.13(4) The fume hood sash shall be fitted with sash position measuring sensor(s) and associated sash position transmitter. Vertical position measuring devices shall be of the retracting drawstring potentiometer



type. The sensors shall be permanently affixed to the fume hood structure and the drawstring affixed to the moving sash frame as best fits the particular hood design. The sash sensor transmitter shall convert potentiometer resistance values to a linear 4-20 mA output signal. The monitor shall have input ports for up to four (4 sash position measuring arrays for application on multiple-sash hoods. The monitor shall be cable-connected to and powered by the controller.

7.5.9.13(5) Horizontal position sensors shall be magnetic reed switch type, and utilize true proximity location sensing technology as opposed to resistance measurement. The sensor strip shall mount on the hood structure and a magnet shall be affixed to each sash frame. The horizontal sensing system shall be capable of measuring any number of sashes for hood widths up to 4880 mm.

7.5.9.13(6) The transmitter/controller module shall be microprocessor based. The transmitter module shall be powered by 24VAC. It shall be provided with two 4-20mA analog outputs, two contact inputs, a SPDT alarm relay output, and an RS-485 communications port.

7.5.9.13(7) The RS-485 communications port shall provide communications with all other lab airflow and fume hood face velocity controllers in the building via a single network operating at 625 kilobits speed. This shall be a peer-to-peer, token pass type of communications network. The individual controllers shall not

be dependent upon this communications port for operation, and communication interrupts shall not slow the control response of the system. In the event that the network continuity is broken, the controllers shall automatically re-configure so that the labs will continue to control.

- 7.5.9.13(8) In the controller, the actual fume hood exhaust duct airflow (CFM) shall be compared to the desired fume hood exhaust airflow setpoint. The setpoint shall be continuously reset proportional sash open area, based on sash position.
- 7.5.9.13(9) Control equations shall be of the P+I type. Microprocessor based controllers shall read the airflow, perform control calculations, and update the output to the damper a minimum of ten times per second.
- 7.5.9.13(10) The controller shall output a 4-20mA electronic signal to a dedicated electronic to pneumatic converter and airflow control valve, as specified elsewhere in this document. Control response time shall be sufficient to contain fumes at all times when the sash is opened.
- 7.5.9.13(11) The fume hood controller shall be capable of communicating digitally with the supply and general exhaust airflow controllers and a communications adapter via an RS485 digital peer-to-peer, token-pass network operating at 625 kilobits speed. The adapter shall permit connection to the BAS. All parameters, including sash position,

face velocity, airflow, setpoint, alarm limits, output, and override condition, shall be available for communication to the BAS.

- 7.5.9.13(12) The fume hood controller shall be fully configurable via a hand-held setup tool or a PC. The tool shall have a keypad and digital display. Configuration shall be accomplished through simple operator-selectable menus.
- 7.5.9.13(13) The Controller shall have unoccupied mode capability. A digital input shall be assignable, through menu selection, to effect the transfer from occupied to unoccupied mode. The “Low Face Velocity Alarm” setpoint shall be replaced by a lower, adjustable, “Low-Low Alarm” setpoint during the unoccupied mode.
- 7.5.9.13(14) The unoccupied mode shall have the menu-selectable option for a countdown period with audible and visual warnings of the pending transfer to unoccupied mode. The duration of the countdown period shall be adjustable from 10 to 60 minutes in 10 minute intervals. The adjustable parameters shall be adjusted using the hand-held programming tool or a PC.

#### 7.5.9.14 Fume Hood Controller Display

- 7.5.9.14(1) The fume hood controller shall provide a 4-digit display to indicate the calculated face velocity and actual exhaust airflow in CFM, plus setpoint parameters. Energy use meters shall not be acceptable

alternatives to the digital display of the above parameters.

7.5.9.14(2) A green LED shall indicate a safe condition at the fume hood. A red LED indicator shall display either a high or low face velocity alarm condition. When an alarm condition occurs, the alarm LED shall flash and the alarm beeper shall sound. The operator shall be able to silence the beeper through a mute button located on the face of the controller.

7.5.9.14(3) The display shall provide the option to read in "Alpha" mode instead of numeric. The "Parameters" button on the face of the display shall allow the operator to scroll through all operating parameters and alarm setpoints, which shall be displayed on the LCD, including but not limited to:

7.5.9.14(3)(a) Controller Software Revision Number.

7.5.9.14(3)(b) Controller Output Level, %.

7.5.9.14(3)(c) Sash Position, %

7.5.9.14(3)(d) Calculated Face Velocity, FPM

7.5.9.14(3)(e) Exhaust Airflow Measurement, CFM

7.5.9.14(3)(f) High Airflow Alarm Setpoint, CFM

7.5.9.14(3)(g) Low Airflow Alarm Setpoint, CFM

7.5.9.14(3)(h) Low-Low Airflow Alarm Setpoint, CFM

#### 7.5.10 Electronic Airflow Controllers: Supply Air Valves

7.5.10.1 An electronic airflow controller shall be factory mounted on the respective airflow control valve and pre-programmed to provide control schemes applicable for a variety of room sequences which can be implemented by menu-selection via a lap-top or personal computer. The airflow controllers shall

be programmed in a high level language designed for airflow control. Pre-programmed functions shall include: scaling of flow inputs, flow summation, flow subtraction, flow bias, flow control, temperature input scaling and temperature control. The controller shall be powered by 24VAC. It shall be provided with four analog inputs, three analog outputs, two contact inputs, two digital outputs a SPDT alarm relay output, and an RS-485 digital communications port

- 7.5.10.2 The RS-485 communications port shall provide communications with all other lab airflow and fume hood face velocity controllers in the building via a single network operating at 625 kilobits speed. This shall be a peer-to-peer, token pass type of communications network. The individual controllers shall not be dependent upon this communications port for operation, and communication interrupts shall not slow the control response of the system. In the event that the network continuity is broken, the controllers shall automatically re-configure so that the labs will continue to control.
- 7.5.10.3 The controller shall store controller configuration programs in EEPROM indefinitely. Memory shall not be affected by loss of power or "brown-outs". The controller configuration program shall be stored in non-volatile memory to allow for any future modifications required to the configuration. The use of disk based systems shall not be acceptable.
- 7.5.10.4 The controller shall scan all inputs, perform control calculations, and update all outputs at least five times per second. Slower scan times shall not be acceptable because of the detrimental effect on laboratory airflow control.
- 7.5.10.5 The airflow controller shall be fully configurable via a lap-top computer or a PC utilizing a user-friendly Graphic User Interface software package. Configuration shall be accomplished through simple operator-selectable function blocks. Display of current readings of all flows, outputs, tuning values, setpoints, and status values shall be available through this interface. Entry of control setpoints, and scaling and tuning constants shall also be provided by this interface.
- 7.5.10.6 The airflow control supplier shall provide a full documentation package to the Owner on completion of the project. Documentation shall include as-built drawings,

device lists, and controller configuration lists for each controller.

7.5.10.7 Power voltage requirements for the controllers shall be 24VAC. Power can be provided by individual or centralized power transformers, provided by the installing contractor.

7.5.10.8 The Controller shall have the following I/O compliment

7.5.10.8(1) Four analog inputs, 4-20mA (two configurable for thermistor).

7.5.10.8(2) Three analog outputs, 4-20mA.

7.5.10.8(3) One airflow direct input for vortek probes.

7.5.10.8(4) Two digital inputs.

7.5.10.8(5) Two digital outputs.

7.5.10.8(6) Communications port, RS485.

7.5.10.8(7) One SPDT relay output.

#### 7.5.11 Supply, Exhaust and Fume Hood Exhaust Airflow Control Valves

7.5.11.1 The Airflow Control Valve shall be a multichamber AccuValve™ or approved equal.

7.5.11.2 The Airflow Control Valve shall consist of a compression section, two airflow control surfaces, factory-mounted digital VorTek airflow measuring device and factory-mounted high speed actuator.

7.5.11.3 The compression section shall divide the airstream into at least two separate airstreams. Each airstream shall be approximately equal in size and the total open area shall be approximately 50% of the duct open area. The divided sections shall cause compression therefore creating a more laminar flow for better airflow measurement and turndown. The compression section shall be of an aerodynamic shape with a static regain section to insure minimal pressure drop. The valve shall not require any duct straight runs either upstream or downstream of the airflow valve to achieve required performance.

- 7.5.11.4 Airflow control valves shall be a linear type and shall operate with a minimum turndown ratio of 8 to 1.
- 7.5.11.5 The airflow control valve shall respond within one second of a change in duct static pressure when provided with factory controls.
- 7.5.11.6 Accuracy of the airflow valve shall be 5% of reading in the 8 to 1 range of the damper.
- 7.5.11.7 Valves for fume hood or other corrosive service shall incorporate stainless steel materials of all components in contact with the airstream. Valves made of aluminum or steel that are coated will not be acceptable. Valves for non-corrosive service shall be made of galvanized steel.
- 7.5.11.8 Airflow control valves shall operate without linkages, springs, levers, or bearings, in the airstream due to the effect of fume hood exhaust on those materials, and shall exhibit no deadband or hysteresis. Airflow control valves shall be field selectable fail-safe to either the open or closed position depending on the application.
- 7.5.11.9 All critical components of the airflow control valve shall be easily accessible from one side of the valve. All linkages shall be out of the airstream to avoid possible corrosion and loss of accuracy.
- 7.5.11.10 Airflow control valves shall be of a low pressure drop design for energy efficiency. Valves shall not require greater than 62 Pa pressure drop at 8 m/s and 100 Pa pressure drop at 10 m/s. Airflow control valves that require higher pressures to operate shall not be acceptable. The airflow valve shall be complete with a digital vortex type airflow sensing device providing true airflow feedback for the system.
- 7.5.11.11 Airflow measuring devices shall be of the Vortex Shedding type, capable of continuously monitoring the airflow volume of the duct served and electronically transmitting a signal linear to the airflow volume. A VorTek airflow sensor shall be provided in each chamber of the airflow control valve. Airflow measuring devices shall be capable of measuring velocity over the full range of 400 to 5000 FPM.
- 7.5.11.12 Velocity measurements from individual sensors shall be summed in the associated Airflow Controller via integral

Airflow Measurement circuitry or an integral Airflow Transmitter. The measurement shall be input and conditioned digitally to eliminate Analog-to-Digital conversion error. The airflow measurement shall be incorporated in the control sequence as performed by the Airflow Controller, and communicated to other Airflow Controllers, via the network, as required. Measurement system accuracy shall be plus or minus 2% of volumetric airflow rate. Turndown capability shall be at least 8:1.

- 7.5.11.13 The airflow sensors shall be easily accessible in the valve for inspection.
- 7.5.11.14 Direct airflow measurements must be taken.
- 7.5.11.15 Airflow Control Valve shall have factory installed electric actuator which shall operate on 24VAC. Actuator shall accept either a 4-20maDC or 2-10VDC signal and shall modulate the valve over the range of CFM. The actuator shall modulate the valve between 0 to full scale CFM in under 2 seconds.

#### 7.5.12 Laboratory Airflow Control

- 7.5.12.1 The lab temperature sensor shall report the room temperature to the supply airflow controller where it will be scaled and compared to the setpoint. The controller shall reset the duct-mounted temperature setpoint. The duct mounted temperature sensor shall report the duct room temperature to the airflow controller where it will be scaled, compared to the setpoint and modulate the reheat valve as required (see Section 1.4 below). The temperature value shall also be utilized in the calculation of lab ventilation rate, in conjunction with lab air change requirements. Alternate approaches using just duct temperature sensors or just room temperature sensors shall not be acceptable as they will result in large room temperature swings or hunting of the reheat control valve.
- 7.5.12.2 The total exhaust airflow volume from the lab shall be measured by one vortek airflow sensor in the common exhaust duct leaving the lab. This airflow measurement shall be transmitted to the supply airflow controller. The controller shall compare this value to the lab general exhaust setpoint and modulate its air valve to supplement the



exhaust airflow volume as required to maintain the required lab ventilation rate.

- 7.5.12.3 The supply air valve airflow sensor shall measure the supply airflow volume and transmit its value to the supply air valve controller. The controller shall compare the airflow to its setpoint. The setpoint shall be calculated as lab ventilation rate less a differential airflow value (100 CFM). The differential airflow value shall be sufficient to induce a negative pressure in the Lab Room with doors closed and with hoods and ventilation system under normal operating conditions. The supply air valve controller shall modulate its air valve to maintain the required supply airflow volume, thereby tracking the exhaust airflow.
- 7.5.12.4 As hood sashes are raised and lowered, changing the total exhaust airflow volume, the tracking scheme outlined above shall vary the supply and general exhaust airflow volumes to compensate and maintain the room at a negative pressure at all times.

#### 7.5.13 Airflow Execution

- 7.5.13.1 The laboratory airflow control system contractor shall functionally check all controls prior to setup by the test and balance contractor.
- 7.5.13.2 The laboratory airflow control system contractor shall assist the test and balance contractor in adjusting the setpoints to meet the specified airflow, pressure and temperature setpoints.
- 7.5.13.3 It shall be the responsibility of the General Contractor to secure the room envelope sufficiently to maintain required pressure levels with the airflow volumes specified. The laboratory airflow control system contractor shall advise the General Contractor of any condition which might compromise the ability of the room to achieve the specified pressure levels.
- 7.5.13.4 All dampers shall be fast-acting in operation without any sticking or binding.
- 7.5.13.5 All controls shall operate without cycling or hunting.

- 7.5.13.6 The laboratory airflow control system contractor shall demonstrate to the Engineer and/or Commissioning Agent the ability of the controls to maintain setpoints in all modes of operation.

#### 7.5.14 Multistack®MagLev™ Centrifugal Chiller

- 7.5.14.1 Summary: Section includes design, performance criteria, refrigerants, controls, and installation requirements for Multistack water cooled centrifugal chillers.
- 7.5.14.2 References Comply with the following codes and standards: ARI 550/590-2003; ANSI/ASHRAE 15; ASME Section VIII; NEC; OSHA.
- 7.5.14.3 Submittals shall include the following:
  - 7.5.14.3(1) Chiller dimensional drawings with elevation overview. Drawings to include required service clearances, locations of all field installed piping and electrical connections.
  - 7.5.14.3(2) A summary of all auxiliary utility requirements for normal system operation required. Auxiliary utility requirements include: electrical, water, and air. Summary of auxiliary equipment shall include quantity and quality of each specific auxiliary utility required.
  - 7.5.14.3(3) Chiller Control documentation to include: Chiller control hardware layout, wiring diagrams depicting factory installed wiring, field installed wiring with points of connection, and points of connection for BAS control/interface points.
  - 7.5.14.3(4) Sequence of operation depicting overview of control logic used.
  - 7.5.14.3(5) Installation and Operating Manuals.
  - 7.5.14.3(6) Manufacturer certified performance data at full load in addition to either IPLV or NPLV.
- 7.5.14.4 Quality Assurance:
  - 7.5.14.4(1) Regulatory Requirements: Comply with the codes and standards as defined in Section 7.5.19.2 titled References.

- 7.5.14.4(2) Chiller is required to be run test at manufacturer's facility to job specific requirements, prior to shipment. Report available upon request.
- 7.5.14.5 Delivery and Handling:
- 7.5.14.5(1) Chillers shall be delivered to the job site completely assembled and charged with complete refrigerant charge.
- 7.5.14.6 Warranty
- 7.5.14.6(1) The manufacturer's equipment warranty shall be for a period of (1) One year from date of equipment start up or 18 months from the date of shipment, whichever occurs first.
- 7.5.14.6(2) The warranty shall include parts and labour costs for the repair and or replacement of defects in components or workmanship.
- 7.5.14.7 Acceptable Manufacturers:
- 7.5.14.7(1) Multistack LLC, Turbocor.
- 7.5.14.7(2) Approved Equal – note that a total of 6 MagLev compressors are required – 3 per machine – for those vendors wishing to apply for equal.
- 7.5.14.8 Product Description
- 7.5.14.8(1) Provide and install as shown on the plans a factory assembled, charged, and run tested, water-cooled packaged chiller.
- 7.5.14.8(2) Each unit shall include: MagLev®, oil-free, magnetic bearing, variable speed two stage centrifugal compressor equipped with inlet guide vanes and load balancing valve. Each compressor to utilize its integrated variable speed drive in conjunction with the compressors inlet guide vanes and load balancing valve, to optimize the chillers part load efficiency.
- 7.5.14.8(3) The chillers evaporator, condenser, and electronic expansion valves shall be common to all compressors. The chiller shall operate with (1) one refrigerant circuit. Each chiller shall utilize a minimum of 3 MagLev compressors per chiller.
- 7.5.14.8(4) Chiller shall utilize R-134A refrigerant only.

- 7.5.14.9 Design Requirements:
- 7.5.14.9(1) Provide a complete factory assembled, water cooled, oil free centrifugal chiller equipped with MagLev® compressors as specified herein.
- 7.5.14.9(2) Chillers to utilize one of the following compressor arrangements for the specified nominal tonnages found in this specification.
- 7.5.14.9(3) Each chiller shall be equipped with the following: One (1) flooded evaporator heat exchanger, one (1) water cooled condenser heat exchanger, three (3) or more MagLev® Compressors (refer to section 2.03 B) with integrated variable speed drive, soft start, magnetic bearings, and inlet guide vanes, two (2) or more electronic expansion valves, one (1) liquid level refrigerant sensor, one (1) load balance valve per compressor, one (1) master chiller control with necessary operating controls and system safeties, while all mechanical pressure safeties to be located at each individual compressor.
- 7.5.14.9(4) Unloading: Chiller shall be capable of unloading to 15 tons. All unloaded capacity values are without the use of hot gas bypass.
- 7.5.14.9(5) Loading: Chiller shall be able to load lag compressor(s) without drastically unloading compressors on-line or creating check valve chatter on lag compressors. Total pressure ratio shall not be decreased below 2.4 pressure ratio as observed at the suction and discharge flanges of each individual compressor.
- 7.5.14.9(6) Acoustics: Sound data shall be measured in accordance with ARI 575-87 Standard. Unit sound performance data shall be measured at the highest level recorded at all load points. Unit sound performance shall not exceed a level of 70 DBA measured at a distance of 1530 mm. Daytime sound levels at the property line shall not exceed 60 dBA. Nighttime (after 22:00) sound levels shall not exceed 50 dBA.
- 7.5.14.9(7) Electrical: Chiller shall feature single-point power connection not utilizing adjoining power cabinets as pull boxes.
- 7.5.14.9(8) Minimum Operating Conditions: Lowest evaporator saturated suction temperature shall not be below 1.11°C. Lowest

leaving chilled water temperature shall not be below 3.33°C. Lowest entering condenser water temperature shall not drop below 12.77°C. A differential of 6.67°C between the leaving chilled water temperature and entering condenser water temperature is required to ensure chiller can maintain minimum lift requirements.

7.5.14.10 Chiller Components:

7.5.14.10(1) Compressors:

- 7.5.14.10(1)(a) Chiller to have three (3) or more MagLev®, magnetic bearing, oil-free, two-stage, hermetical centrifugal compressor(s). Each compressor to contain integrated variable speed drive with soft start, movable inlet guide vane assembly.
- 7.5.14.10(1)(b) Each compressor to be microprocessor controlled. Each compressor to be networked to master controller via Etherbus connection with a refresh rate of 50 microseconds and the micro processor of each compressor to control the variable speed drive and inlet guide vanes on each compressor to maximize unit efficiency.
- 7.5.14.10(1)(c) Each compressor shall be capable of coming to a controlled safe stop in the event of a power outage. Unit shall be capable of auto restart in the event of a power outage, once power has been restored.
- 7.5.14.10(1)(d) All compressors are required to be mechanically and electrically isolated to facilitate proper maintenance, service, and or removal.

7.5.14.10(2) Refrigerant, Evaporator and Condenser:

- 7.5.14.10(2)(a) All heat exchangers to be built in accordance to Section VIII of the ASME code and carry a manufacturer's name plate certifying ASME compliance.

- 7.5.14.10(2)(b) The evaporator to be of shell and tube construction. Evaporator to be constructed of a single shell. Evaporator to be of flooded type with refrigerant surrounding the tubes and water passing through the tubes. Tubes to be enhanced and rifled. Minimum tube velocity of 610 mm per second required. Design to not exceed a maximum tube velocity of 2440 mm per second. Internal intermediate tube supports, liquid eliminator baffle plate, pressure relief vent, water drains and vents required. Pressure relief to be spring loaded self seating type in accordance to ASHRAE 15 standard. Evaporator to be pressure tested at a test pressure of 1.1 times the operating pressure however no less than 100 PSIG. Evaporator, water boxes, suction piping, and any other component subject to condensate shall be insulated with a UL recognized 19 mm or 38 mm closed cell insulation. All joints and seams to be sealed so a vapour barrier is created. Factory mounted differential pressure transmitters required for flow safety. Flow switches are not to be used.
- 7.5.14.10(2)(c) The condenser to be of shell and tube construction. Condenser to be constructed of a single shell. Condenser to be water cooled type with refrigerant surrounding the tubes and water passing through the tubes. Tubes to be enhanced and rifled. Minimum tube velocity of 610 mm per second required. Design to not exceed a maximum tube velocity of 2440 mm per second. Internal intermediate tube supports, pressure relief tree with isolation valves, water drain and vents required. Pressure relief tree to be equipped with isolation/transfer valve to prevent the loss of refrigerant when relief is removed for testing and or replacement. Rupture disks are not acceptable. Condenser to be pressure tested at a test pressure of 1.1 times the operating pressure however no

less than 100 PSIG. Factory mounted differential pressure transmitters required for flow safety. Flow switches are not to be used.

- 7.5.14.10(2)(d) Heat Exchangers to feature enhanced and rifled individual tubes. Tubes shall be individually replaceable. Tubes shall be mechanically rolled into steel tube sheets and sealed with Loctite® or equivalent sealant. Tubes shall be supported by intermediate tube supports at a maximum spacing of 457 mm apart. Waterside to be designed to a minimum of 150 psig or 300 psig, whichever is specified. Heat exchangers to be equipped with either dished heads or marine boxes with drain and vent reports, whichever is specified. Piping connections to be either mechanical grooved connection or flange, whichever is specified.
- 7.5.14.10(2)(e) Refrigerant Control: Chiller with multiple compressors to feature dual electronic expansion valves with a step count of 6386 steps to full open. A single compressor machine to have one electronic expansion valve with 6386 steps. Fixed orifices and float controls are not acceptable. The electronic expansion valve to operate from minimum chiller capacity to the full load of the chiller's capacity. A high side refrigerant level sensor, constructed out of stainless steel, with a stainless steel canister with sight glass is to be used to provide feedback to the expansion valves for proper control. This ensures that a proper liquid seal is always present on the compressors power electronics. A refrigerant sight glass is required on the main liquid line feeding the electronic expansion valves. Isolation valves before and after the EXV required for proper service without removing the entire refrigerant charge.

7.5.14.10(3) Prime Mover:

7.5.14.10(3)(a) The prime mover shall be of sufficient size to effectively meet the compressor horsepower requirements. Prime mover shall be a one or more liquid refrigerant cooled, hermetically sealed, permanent magnet synchronous motor. Motor shall be controlled by variable speed drive. Motor shall utilize soft start capabilities with an inrush current no greater than two (2) amps. Motor shall have internal thermal overload protection devices embedded in the winding of each phase of the motor.

7.5.14.10(4) Variable Speed Drive:

7.5.14.10(4)(a) The chiller shall be equipped with multiple variable speed drives unless one compressor is used. Please refer to section 2.03 B for compressor requirements. The variable speed drive to utilize Insulated Gate Bi-Polar Transistors. Variable speed drive to create its own simulated AC voltage for the motor connected to it. Voltage shall be 575 volt.

7.5.14.10(4)(b) Variable speed drive in conjunction with the compressors inlet guide vanes will be controlled via compressor microprocessor to optimally match the lift and load requirements.

7.5.14.10(4)(c) Each compressor circuit is required to have a line reactor and circuit breaker.

7.5.14.10(5) Chiller Controls:

7.5.14.10(5)(a) The unit shall have an industrial grade CPU with an Intel-based processor. Chiller required to have fail to run mode. All chiller and compressor I/O to be controlled via Etherbus with an update rate of 50 microseconds. Controller to have 380 mm touch screen interface that can be disconnected and chillers still runs properly. Controller to use proprietary control logic to optimize loading, unloading, and control of



multiple MagLev compressors. User shall operate chiller via HMI located on touch screen or remote web connection. All system parameters, compressor status, alarms, and faults, trend graphing, fault logging, bas communication window , manuals, wiring diagrams, log book, and control set points shall be viewable. Shall be able to fully commission and adjust all components on the chiller, including the compressors without an auxiliary computer or software.

- 7.5.14.10(5)(b) The chiller controller shall include the following features: Hardware - Two EXV Outputs; Eight Digital Inputs; Eight Digital Outputs; Ten Analog Inputs; Eight Analog Outputs (0-10 VDC); Eight Temperature Inputs; One Compressor hub per compressor including – Addressable Bus Couple; RS-485 Module; RS-232 Module; Four Digital Inputs; Two Digital Outputs;
- 7.5.14.10(5)(c) Windows®-based industrial PC featuring Intel® Processor for maximum reliability and performance.
- 7.5.14.10(5)(d) Dual-Hard drives for maximum reliability and redundancy. Hard drives feature no moving parts to ensure nothing mechanically fails. With dual-hard drives there is no need to partition a single drive. One drive handles the operating system while the other handles all data acquisition to ensure no data is corrupted.
- 7.5.14.10(5)(e) DC Powered to ensure maximum resistance to EMI and RFI noise.
- 7.5.14.10(5)(f) Built in 2-port Ethernet Switch for easy integration to BAS interface and web control feature.
- 7.5.14.10(5)(g) Features industrial-style battery back-up in the event of a power outage.

- 7.5.14.10(5)(h) On board USB drives to support external peripheral devices including, keyboard, mouse, and printer, 380 mm TFT Display featuring 1024 X 768 Resolution.
  - 7.5.14.10(5)(i) All hardware, including I/O is CE and UL Certified.
  - 7.5.14.10(5)(j) I/O features modular design to simplify troubleshooting and or replacement if required.
  - 7.5.14.10(5)(k) I/O has LED Indicators for all inputs and outputs to ease the troubleshooting process.
  - 7.5.14.10(5)(l) I/O can be directly connected to without the use of terminal blocks.
  - 7.5.14.10(5)(m) All wiring utilizes spring capture technology to prevent loose connections or wires from falling out.
  - 7.5.14.10(5)(n) Dedicated Ethernet communication at a communication rate of 50 microseconds to all compressors and I/O.
  - 7.5.14.10(5)(o) MagLev hubs feature dedicated inputs for high pressure switch, low pressure switch, dedicated compressor interlocks, and dedicated compressor communications. This allows for each compressor to be handles independently by itself without affecting the rest of the system.
- 7.5.14.10(6) Controls:
- 7.5.14.10(6)(a) BACNET MSTP; BACNET IP; LONWORKS.
- 7.5.14.10(7) Warranties: 5 year compressor parts warranty.
- 7.5.14.11 Installation
- 7.5.14.11(1) Chiller must be installed per all of the manufacturer's documentation. This includes: IOM Manual, submittal documentation, CAD drawings, other.

- 7.5.14.11(2) All local structural codes must be observed. Chiller to be mounted and aligned on chiller pad or mounting rails as specified.
- 7.5.14.11(3) All local plumbing codes must be observed. Piping must be run in such a way that the proper required clearances for head removal for tube cleaning are observed.
- 7.5.14.11(4) All National and Local Electrical codes must be observed. Electrical installation must follow the associated documentation from the chiller manufacturer and be coordinated with electrical contractor. Controls installation shall be coordinated with the controls contractor.
- 7.5.14.11(5) Provide all material required for a fully operational and functional chiller.

#### 7.5.14.12 Start-Up

- 7.5.14.12(1) Units shall be factory charged with R-134A refrigerant unless unit is knocked down.
- 7.5.14.12(2) Factory Start-Up Services: An authorized factory start agent is required. At minimum, (2) two days shall be spent on-site to ensure proper unit operation.
- 7.5.14.12(3) During the start up period, the factory authorized agent will instruct the Owner's representative on proper care and operation of the chiller.

### 7.6 Reserved for Future Expansion (Division 24) – not used

### 7.7 Integrated Automation (Division 25)

#### 7.7.1 Controls:

##### 7.7.1.1 Design Principles:

- 7.7.1.1(1) The Building Management System (BMS) will perform the following functions:
  - 7.7.1.1(1)(a) Automatically operate, monitor and manage the building mechanical systems to provide a high level of occupant comfort and maintain a healthy and productive environment without disruption to the clinical and patient treatment delivery.

- 7.7.1.1(1)(b) Display building related alarms locally at the management control centre located in the Maintenance Supervisor's Office.
- 7.7.1.1(1)(c) Provide a form of external monitoring for the Owner including all associated hardware and software.
- 7.7.1.1(1)(d) Meter and trend data related to flow of electrical power, natural gas and domestic water to the building and as required to monitor energy performance.
- 7.7.1.1(1)(e) Interface with the building electrical and communication systems including fire alarm, lighting, UPS and emergency power systems for monitoring, control and alarming.
- 7.7.1.1(1)(f) Monitor equipment status and provide alarms for temperature, humidity and alarms in clinical areas, such as freezers, coolers, labs and other medical equipment as identified in the program.
- 7.7.1.1(2) The BMS system will be non-proprietary and designed with open protocol.
- 7.7.1.1(3) The BMS system will optimize the system performance under all operating conditions to minimize the building energy usage.
- 7.7.1.1(4) The BMS system configuration will accommodate future technological changes and the architecture of the BMS system will be capable of expanding in scope and size with future building renovations.
- 7.7.1.1(5) The controls system will be designed as a Building Management System (BMS), to allow monitoring and operation of the entire building from a single location or remote Internet connection.
- 7.7.1.1(6) The BMS will be a completely integrated (front-end and back-end) Native BacNET DDC system.
- 7.7.1.1(7) The BMS system will be an independent system separate from the building fire alarm and other control systems.

- 7.7.1.1(8) The BMS will be provided as a complete package from one manufacturer, not a composite system from several manufacturers.
- 7.7.1.1(9) Provide airflow sensors at infectious control isolation dampers in ductwork to ensure isolation has been achieved. Provide local audio and visual alarms for these sensors in addition to the BMS alarms.
- 7.7.1.1(10) Provide differential pressure sensors between pressure critical areas where required. Provide local audio and visual alarms for these systems in addition to the BMS alarms.
- 7.7.1.1(11) Provide current sensors on all HVAC and exhaust fans, pumps and rotating equipment to provide status of the equipment back to the BMS.
- 7.7.1.2 Performance Criteria
  - 7.7.1.2(1) Zoning for HVAC systems will be based on occupancy, room location within the building, room orientation, and thermostatic room loads.
  - 7.7.1.2(2) Failsafe components will be hard-wired to provide reliable operation in all circumstances.
  - 7.7.1.2(3) The BMS will meter and trend all data related to the flow of services into and out of the building including, but not limited to, domestic water and electricity.
  - 7.7.1.2(4) The BMS will meter and trend all data related to the flow of services within the building, including but not limited to, chilled water, heating water, medical gases and fuel-oil. All metering and trending shall be in accordance with ASHRAE guidelines
  - 7.7.1.2(5) The BMS will monitor, control, indicate alarms, and provide trending where applicable for all connected sensors and control points.
  - 7.7.1.2(6) The BMS will be connected to emergency power and on a UPS system for no interruption..
  - 7.7.1.2(7) The BMS will monitor critical alarms for essential building and life safety systems. These alarms will notify the Owner

as well as the building's master control centre. These critical alarms include, but are not limited to:

- 7.7.1.2(7)(a) Fire alarm system for alarm, supervisory and trouble;
  - 7.7.1.2(7)(b) All temperature alarms resulting from setpoint deviations;
  - 7.7.1.2(7)(c) Medical gas system high and low pressure alarms;
  - 7.7.1.2(7)(d) All alarms relating to the fire protection system.
  - 7.7.1.2(7)(e) Critical pressure relationships and critical equipment including, but not limited to, biological safety hoods, refrigerators and freezers.
- 7.7.1.2(8) The BMS system will control all public area lighting such as parking lots, walkways, roadways, exterior signage, stairs and corridor and lobby lights located in areas not occupied 24 hours per day. Exterior lighting will include an input for photocell over-ride.
  - 7.7.1.2(9) The BMS documentation will include a detailed narrative description of the sequence of operation of each system.
  - 7.7.1.2(10) User interface will be graphical in nature with animated graphics to indicate equipment operation. Graphics will be grouped in systems and in departments.
  - 7.7.1.2(11) The central BMS contractor shall provide thirty-two (32) hours in two (2) sessions (introductory and follow-up) of training to site personnel in the use and maintenance of the BMS. Training shall be conducted during normal working hours and shall consist of both hands-on and classroom training at the job site. All training shall be recorded (audio and visual) and DVD's of the footage shall be included with the O&M manuals.

## **7.8 Electrical (Division 26)**

### 7.8.1 Electrical General

#### 7.8.1.1 Basic Requirements

- 7.8.1.1(1) All electrical systems, materials, and equipment in the building will be of a type and quality intended for use in a permanent health care facility. The electrical systems will provide redundancy, proper protection, continuity of service and a safe working environment for patients, visitors, and staff.
- 7.8.1.1(2) All electrical systems and equipment required for the function of each identified program will be provided and configured with due regard for the details of delivery of the programs. Devices identified as provided by other divisions will be the responsibility of their respective divisions, with coordination of all electrical or systems interfaces between all divisions involved.
- 7.8.1.1(3) Understand and incorporate into the design and construction the principle that change will be a constant and inevitable fact within the building. All systems will be constructed so as to facilitate this change while minimizing the cost of change and the amount of interruption to the regular activities of the building. Electrical rooms, equipment and systems control panels are to have extra space and provisions for future. Clearly demonstrate the design concept for serving future expansion, i.e.- future electrical distribution equipment should be shown dotted in the extra space in electrical rooms. Spare capacities allowed for in the main equipment (transformers, diesel generators, UPS, and associated switchboards and panelboards) for future expansion should be separately identified in the equipment sizing calculations required under 7.8.6.2(5).
- 7.8.1.1(4) Systems and equipment will be designed and installed in a coordinated fashion. Systems will work together where advantageous, take advantage of current best available technology and through synergy and provide the building with reliable electrical systems performance directed to facilitating the various functions of the building, now and into the future.
- 7.8.1.1(5) Comply with all Applicable Standards including, but not limited to, those standards listed in Section 2.1 Standards and the following:
- 7.8.1.1(5)(a) Standards produced by Northern Health;
  - 7.8.1.1(5)(b) CAN/CSA Standard C282-09 Emergency Electric Power Supply for Buildings

- 7.8.1.1(5)(c) CSA Z32-04-09 Electrical Safety and Essential Electrical Systems in Health Care Facilities
- 7.8.1.1(5)(d) CSA C22.1 22<sup>nd</sup> Edition Canadian Electrical Code
- 7.8.1.1(5)(e) IEEE Standard 519 – Harmonics;
- 7.8.1.1(5)(f) IEEE Standard 1250 – Voltage Quality; and
- 7.8.1.1(5)(g) IEEE Standard 1346 – Recommended Practice for Evaluation Electric Power System.

#### 7.8.1.2 Performance Criteria

- 7.8.1.2(1) Every electrical system will be installed in a fixed and permanent manner, seismically restrained to meet the standards for a post-disaster building. The installation will economically occupy available space, leaving space for future additions and will be planned to facilitate easy access to other systems and equipment, including but not limited to mechanical equipment, building systems access ways, and architectural building components which may require periodic inspection or maintenance.
- 7.8.1.2(2) Redundancy will be incorporated into systems and equipment such that the failure of a single piece of major equipment or major conductor will not impair the operation of the building.
- 7.8.1.2(3) The protection, grounding and/or isolation, insulation and control of all circuits and systems will be designed and constructed specifically to address the clinical and functional requirements of the locations where they are installed.
- 7.8.1.2(4) Automatic type power factor correction equipment will be provided to correct the facility power factor to above 0.9 lag. All components in each automatic power-factor correction cabinet will be designed to accommodate an additional 10% of the initial kVAR capacity in the future. The harmonic profile of the building distribution system will be verified and a tuned circuit design will be provided to minimize resonance conditions. The final installation will be tested at site during commissioning and within one month of building occupancy to



verify harmonic profile, and the system will be re-tuned as necessary.

## 7.8.2 Wiring Methods and Materials

### 7.8.2.1 Basic Requirements

- 7.8.2.1(1) Wiring methods and materials will result in safe reliable and flexible electrical power, control, communication, data, and life safety systems in the building.
- 7.8.2.1(2) All wiring will be neatly and securely installed in such a way that it is protected from damage, is not in conflict with mechanical or architectural components of the building(s) and allows for future changes and additions.
- 7.8.2.1(3) Wiring methods will accommodate additions removals and relocations within the building for the projected working life of the building.
- 7.8.2.1(4) Main trunk wiring connected to emergency power will consist of two-hour fire rated wiring or equal.

### 7.8.2.2 Performance Criteria

- 7.8.2.2(1) All conductors and all conducting components of electrical equipment, which form part of the wiring systems in the building will be of non-alloyed copper. Conductors and conducting components larger than 150A may be aluminum.
- 7.8.2.2(2) Wiring and wiring support systems will be concealed from public view unless specific exemption is granted by the Owner.
- 7.8.2.2(3) All wiring will be protected from mechanical damage throughout each wiring system. Entry or accumulation of moisture into any wire, cable, or wire way will be prevented. Wiring to be in conduit unless otherwise noted. Final connection of branch wiring from ceiling space conduit and junction box systems to electrical devices on dropped ceilings may be in BX or flex such that the length of flex connection does not exceed 3050 mm. Final connection to motorized devices to be in liquid tight flex.
- 7.8.2.2(4) Wiring for systems of different voltages and from different sources of supply will be separated and will not be run in

common systems such as conduits and cable trays.

Interference between wiring of power supply systems and wiring of data and communication systems will be prevented by maintaining adequate separation, a minimum of 300 mm, or adequate shielding throughout with a minimum of 50 mm separation.

- 7.8.2.2(5) Ease of maintenance and continuous service to the clinical operations is considered essential such that the wiring systems while being serviced or added to do not cause or require major service disruptions in the building.
- 7.8.2.2(6) Conduit fill will not exceed 40%.
- 7.8.2.2(7) Back boxes and junction boxes will not exceed 80% of the maximum fill allowable by Code. Splitters to have at least 3 spare terminals on each set of lugs.
- 7.8.2.2(8) All conductors and cables will be clearly labelled at both ends.
- 7.8.2.2(9) All pull boxes, junction boxes and conduits will be identified with purpose-manufactured durable and clearly legible marking to identify the function and voltage of the system. Follow the identification systems or methods advised by NH.
- 7.8.2.2(10) Approved fire stopping will be installed and maintained at all fire separations and at any locations required by Code or by the local inspection authority.
- 7.8.2.2(11) All circuits to be complete with insulated copper ground wires, or insulated aluminum ground wires if feeders are aluminum.

### 7.8.3 Raceways

#### 7.8.3.1 Basic Requirements

- 7.8.3.1(1) For the purpose of this specification, the word "raceway" will have the same meaning as defined in the Canadian Electrical Code, Section 0.
- 7.8.3.1(2) Raceways for wiring and cabling will be provided to support, protect and organize wiring and cabling systems throughout the building.
- 7.8.3.1(3) Raceways will be designed and installed in such a way to provide ease of access, capacity for expansion and change,

which is consistent with the requirements of the equipment and systems that they serve.

#### 7.8.3.2 Performance Criteria

- 7.8.3.2(1) Separate raceways or barriered raceways will be provided for cables and conductors of different voltages or system types.
- 7.8.3.2(2) Conduits, other than conduits dedicated to a single feeder or branch circuit, will have space for installation of a minimum of 50% additional capacity in future circuits. Cable trays, in-floor tray or duct systems will have space for installation of a minimum of 50% additional capacity in future cables. Wherever multiple raceways are required in a group, such as a duct bank or tray system interconnecting two or more major areas, provide matching empty raceway equal to a minimum of 50% of the total installed group. Raceways for high voltage cables shall have space provisions for an additional three phase feeder including any necessary neutrals or grounds.
- 7.8.3.2(3) Raceways will be planned to facilitate easy access to other systems and equipment, including but not limited to mechanical equipment, building systems access ways, and architectural building components which may require periodic inspection or maintenance.
- 7.8.3.2(4) Raceways will be designed and installed without sharp edges or sharp bends, must be a minimum of 10 times the radius, so that cables can be pulled in or laid in and removed without damage to the cables. Manufacturer's maximum bend radii will be observed.
- 7.8.3.2(5) All metallic raceways will be continuously bonded with a bonding conductor installed within the raceway. Raceways to be metallic except when underground or in slab on grade they are to be PVC. High voltage cable raceways external to the building are to be buried underground and encased in re-enforced concrete. High voltage cable raceways internal to the building to be rigid metal conduit.
- 7.8.3.2(6) Provide spare raceways/ducts from the main electrical room to all sub-electrical rooms.
- 7.8.3.2(7) Install conduits or raceways to conserve ceiling heights.

- 7.8.3.2(8) Use rain tight connectors or hubs where conduits are exposed in sprinklered areas.
- 7.8.3.2(9) Run two spare 27 mm conduits to ceiling and floor spaces from lighting panels for future use. Terminate in 150 x 150 x 100 mm junction boxes.
- 7.8.3.2(10) Do not install conduits in ceiling slabs.
- 7.8.3.2(11) Plated heavy-gauge wire mesh basket type tray will be utilized for data, telephone and systems cabling.
- 7.8.3.2(12) Power duplex receptacles (when all power sources are considered) are to be located such that each 500mm of laboratory bench has a minimum of one receptacle. Maximum of three (3) receptacles per two (2) normal power circuits. Maximum of two (2) receptacles per one (1) emergency power circuit. Maximum of one (1) receptacle per one (1) UPS power circuit.

#### 7.8.4 Electrical Utilities

##### 7.8.4.1 Basic Requirements

- 7.8.4.1(1) Ensure that the supply of electrical energy from BC Hydro to the building will be designed and installed to meet the IEEE Standards listed in 7.8.1 General.
- 7.8.4.1(2) Ensure the arrangement of BC Hydro power service to the building complies with applicable codes and standards.

##### 7.8.4.2 Performance Criteria

- 7.8.4.2(1) Provide one BC Hydro service at 600V to the building.
- 7.8.4.2(2) The capacity of the utility connections, cable and incoming switchgear, will, in the initial installation, allow for the initial demand load requirements plus 10% spare capacity. The design will anticipate the need for future expansion of the electrical facilities to accommodate projected future growth to the building and to the connected load. The cost for any additional expansion will be borne by that expansion project.
- 7.8.4.2(3) Vulnerability of the Utility connections will be reduced by the mechanisms of burial, concrete encasement and location

marking and other available means to guard against accidental disruption by on-site or near-site activities. Concrete encased duct bank for utility incoming service from BC Hydro to have one spare 103mm duct for future.

- 7.8.4.2(4) The location of the BC Hydro switches, metering cabinets, and underground concrete duct banks will not interfere with any known future expansion of the Facility.

## 7.8.5 Emergency Power

### 7.8.5.1 Basic Requirements

- 7.8.5.1(1) Provide diesel generators as a source of power to all essential areas and systems within the building. The emergency power system will be available 100% of the time.
- 7.8.5.1(2) Fuel system will comply with CSA B139 and ULC CAN4-S601.
- 7.8.5.1(3) Diesel generators supplied will comply with local noise by laws and levels noted in 7.8.5.2(5).

### 7.8.5.2 Performance Criteria

- 7.8.5.2(1) A minimum of two (2) generators will be supplied with automatic transfer between normal and emergency sources.
- 7.8.5.2(2) Generators will be fuelled with commercial grades of diesel fuel oil readily available locally to ensure a continuous fuel supply as in the case of an extended power outage.
- 7.8.5.2(3) Fuel supply stored on Site is to be in permanent storage base tanks (possibly supplemented with day tanks) and will provide for continuous operation of the Emergency Power System at 80% rated load for a period of at least 72 hours.
- 7.8.5.2(4) Generators will be located within a self-contained enclosure. Enclosure to include panelboard (208 / 120V minimum 24 circuit), electric heating, housekeeping receptacles, (one on non-essential power), lighting (half on non-essential power), emergency battery lighting unit, motorized dampers, smoke detector (connected to building fire alarm system), remote alarm connections to transmit all alarms to the BMS.
- 7.8.5.2(5) Generators will be located, vibration isolated, and muffled so that sound and vibration are limited to the associated plant areas of the building. Daytime sound levels at the property

line shall not exceed 60 dBa. Nighttime (after 22:00) sound levels shall not exceed 50 dBa.

- 7.8.5.2(6) Generator sets will be capable of undergoing testing each week for at least ½ hour with actual building load.
- 7.8.5.2(7) Ease of maintenance and the ability to maintain continuous service to the clinical operations is considered essential such that the distribution equipment while being serviced or added to does not constitute major service disruptions in the building. The main emergency switchboard will be configured with draw-out type air circuit breakers and have minimum two prepared spaces, with internal bus connections and equipped with draw-out cradles, for future outgoing breakers.
- 7.8.5.2(8) The automatic transfer switches will be close-transition-transfer type to allow seamless transfer between Hydro and emergency generators. The automatic transfer switches will have dual-source bypass and isolation features to permit servicing the automatic transfer switch without interruption to the emergency loads.
- 7.8.5.2(9) The generator loads and alarms will be annunciated and recorded on an engine-mounted digital control system panel which will also be interfaced to the Building Management System.
- 7.8.5.2(10) The generators will be sized for a minimum 65% of the total initial normal power demand of the Facility, or greater as required to meet the initial emergency loads, including capacity for future expansion. Each generator shall have the capacity to carry the entire vital and delayed vital load.
- 7.8.5.2(11) In addition to code requirements, the following areas will be supplied with emergency power:
  - 7.8.5.2(11)(a) all Communication closets including equipment;
  - 7.8.5.2(11)(b) fire alarm systems;
  - 7.8.5.2(11)(c) Uninterruptible Power Supply (UPS) systems;
  - 7.8.5.2(11)(d) emergency communications devices;

- 7.8.5.2(11)(e) Server room including equipment;
  - 7.8.5.2(11)(f) security / access control systems;
  - 7.8.5.2(11)(g) laboratory equipment (minimum 80%);
  - 7.8.5.2(11)(h) exterior signage and walkway lighting (selective, to 50%);
  - 7.8.5.2(11)(i) rooms designated as emergency operations centres;
  - 7.8.5.2(11)(j) alarmed freezers and coolers; and
  - 7.8.5.2(11)(k) DDC/BAS control systems.
  - 7.8.5.2(11)(l) both elevators to be connected to emergency power. Diesel generator to be sized to allow for the operation of either elevator at any time.
  - 7.8.5.2(11)(m) Mechanical equipment designated to be provided with diesel generator backup.
  - 7.8.5.2(11)(n) Imaging equipment
- 7.8.5.2(12) Where emergency power is needed to meet program requirements or to protect equipment from damage, it will be provided.
- 7.8.5.2(13) Uninterruptible Power Supplies (UPS) will be provided for all equipment that requires a continuous and uninterrupted source of power in accordance with the equipment list. Loads larger than 1 kilowatt will be circuited from a UPS distribution panel which is energized from a centralized UPS system. Centralized UPS system supplying UPS panels will have integral static bypass and be sized for the connected load plus minimum 20% for future and configured with multiple modules to provide N+1 redundancy. The multi-module UPS system will be provided with an external 'wrap-around' maintenance bypass path to permit concurrent maintenance of the UPS modules or static bypass without interrupting power to the critical loads. Centralized UPS system shall be provided with the Ethernet communications port and UPS management software that will connect to Hospital LAN. System will be monitored from remote location using LAN and web browser.

- 7.8.5.2(14) UPS units will be fed by circuits supported by an emergency generator and will be rated for a minimum of 15 minutes at full rated load. Where vital functions are connected to a UPS circuit, an audible warning will sound in the vital function area 5 minutes before the UPS battery supply is exhausted.
- 7.8.5.2(15) 3-phase UPS units larger than 1500 watts will have static bypass maintenance switching to permit servicing of the UPS without power interruption. All UPS units will automatically transfer the load to and from the emergency power supply without any interruption or disturbance of supply to the load.
- 7.8.5.2(16) Areas or equipment requiring UPS power will include but not be limited to:
  - 7.8.5.2(16)(a) server rooms;
  - 7.8.5.2(16)(b) computer network equipment;
  - 7.8.5.2(16)(c) communication closets; and
  - 7.8.5.2(16)(d) lab equipment.
  - 7.8.5.2(16)(e) Post Disaster Communication and Control room.
  - 7.8.5.2(16)(f) The existing exterior self-enclosed generator set shall be turned over to Northern Health. After the owner has completely vacated the existing building, the design builder shall deliver the self-contained generator system a distance equivalent to the location of the Health Centre in Valemount BC from Burns Lake. Delivery location to be determined by NH.

## 7.8.6 Transmission and Distribution

### 7.8.6.1 Basic Requirements

- 7.8.6.1(1) Electrical power of the voltage, current, and phase(s) required will be provided, from the main sources of supply, to each load requiring supply of power, and to convenience and special purpose outlets designed to meet all requirements of building operation and clinical and administrative functions.



- 7.8.6.1(2) Distribution equipment and feeder systems form the backbone of all electrical operation of the Facility. They will be robust, reliable, easily operated and maintained and will be designed with 10% extra capacity to accommodate load growth and equipment additions. The spare capacity for each distribution equipment and feeder will be proven through sizing calculations submitted during the design stage.
- 7.8.6.1(3) The transmission and distribution systems will allow for future changes and additions.
- 7.8.6.1(4) Transmission and distribution equipment will be of a "specification grade" and "institutional" or "industrial" quality and not of a "light duty" or "commercial" quality.

#### 7.8.6.2 Performance Criteria

- 7.8.6.2(1) Major electrical equipment, which includes but is not limited to transformers, main distribution centres, transfer switches, motor control centres, and power factor correction equipment will be grouped together in a configuration that allows for addition or expansion of each type of equipment, logical arrangement in terms of the interconnection, operation and maintenance of the equipment. The 600V main distribution will consist of drawout type power-circuit breakers.
- 7.8.6.2(2) Major electrical equipment will be located in rooms dedicated to electrical equipment so as to provide a clean, dry, safe, accessible installation protected from unauthorized access.
- 7.8.6.2(3) All components of transmission and distribution systems will be selected, configured, located, and installed so as to minimize the transmission of noise, vibration or unwanted heat into other parts of the building.
- 7.8.6.2(4) Protection and coordination of protection equipment will be designed and installed so that the initial electrical installation, and future additions and modifications to the installation will be protected and fully coordinated, meaning that in the event of a fault or overload, protective devices will act to isolate only the faulty portion of the system and areas downstream, leaving all other portions of the system fully operational. Protection equipment will adequately protect against injury to persons and damage to property. The 600V main switchgear will consist of breakers not fuses.

- 7.8.6.2(5) The following engineering studies will be provided for review prior to starting the installation:
- 7.8.6.2(5)(a) Building power load demand calculations, separate for normal and emergency branches.
  - 7.8.6.2(5)(b) Equipment and feeder sizing calculations
  - 7.8.6.2(5)(c) Short circuit study
  - 7.8.6.2(5)(d) Voltage drop study
  - 7.8.6.2(5)(e) Protective device co-ordination study
  - 7.8.6.2(5)(f) Arc-flash hazard analysis
- 7.8.6.2(6) Where required by system characteristics or operational requirements, special shielding, isolation, grounding, bonding, harmonic filtration or other treatment will be provided to prevent interference between systems or degradation of performance of an individual system. Provide harmonic filters on the line side to UPS system to limit the input current harmonic distortion (THD) to less than 5% of the full load fundamental current. Provide minimum 20% extra space in distribution centres fully equipped to permit addition of circuit breakers in the future.
- 7.8.6.2(7) Components of the transmission and distribution systems which are in any public, clinical, administrative or staff area will be of a type which gives both long life expectancy without perceptible deterioration, and good appearance, and will be designed, selected and installed so as to permit cleaning. These components include but are not limited to light switches, receptacles, wire ways, equipment grounding points, and status displays.
- 7.8.6.2(8) Single phase 120VAC grounding receptacles conforming to CEC and specifically to CSA Configuration 5-15R are to be provided at each location where electrical equipment requiring a supply of normal or emergency power will be plug connected.
- 7.8.6.2(9) Locations of receptacles will comply with all applicable codes and standards. See Appendix 1C for the minimum required for each functional area.

- 7.8.6.2(10) Receptacles in patient care areas will be Hospital Grade. Receptacles in all other areas will be Specification Grade. Residential Grade and commercial grade receptacles will not be permitted. All receptacles will have stainless steel cover plates, except for the receptacles on the lab-bench raceways.. Grouped receptacles will have a single cover plate covering the whole group. Receptacles on normal power circuits will be white, receptacles on emergency power circuits will be red, and receptacles on UPS circuits will be red and identified as UPS circuits.
- 7.8.6.2(11) All receptacles will be permanently marked with lamicoid labels identifying the circuit and panel number.
- 7.8.6.2(12) A complete enlarged single line schematic diagram of the electrical distribution will be framed and wall mounted in the main Electrical room.
- 7.8.6.2(13) A block heater system will be provided to serve staff parking (minimum 25 vehicle stalls) and fleet/maintenance vehicle stalls (minimum 6 stalls) as follows:
- 7.8.6.2(13)(a) A weatherproof receptacle per vehicle stall.
  - 7.8.6.2(13)(b) Staff parking block heater receptacles shall be arranged for controlled use.
  - 7.8.6.2(13)(c) Arrangement, location and construction of block heater system components to be resistant to vehicular damage.

## 7.8.7 Metering

### 7.8.7.1 Basic Requirements

- 7.8.7.1(1) Digital pulse metering will be supplied to provide detailed information about power quality and power consumption at the following key points in the building:
- 7.8.7.1(1)(a) Main switchboard;
  - 7.8.7.1(1)(b) Input mains of each motor control centre, or distribution panel feeding mechanical equipment;
  - 7.8.7.1(1)(c) Input of the main 600V emergency switchboard.

7.8.7.1(1)(d) Comply with LEED requirements for measurement and verification regarding building loads.

7.8.7.1(2) Any metering which is to be used to charge tenants or agencies for their power consumption will be "revenue certified".

7.8.7.1(3) The metering system will be a networked system, with terminals for maintenance and plant administration, and data transfer to the Building Management System.

7.8.7.1(4) Electrical consumption meters will be connected to the Building Management System.

#### 7.8.7.2 Performance Criteria

7.8.7.2(1) The metering system will provide easily read locally displayed information for all distribution at primary voltage and for each secondary distribution switchboard.

7.8.7.2(2) Historical data from the metering system network will be stored and will be capable of generating user configurable electronic and printed reports on demand.

7.8.7.2(3) The metering system will not be dependant on power from the metered circuit for its operation, and will be supported by a backup power source or sources, which ensure operation when the metered circuit is de-energized.

7.8.7.2(4) The metering system will, at a minimum, provide the following information about each metered circuit: Phase-to-Phase Voltage (all phases), Line-to-Neutral Voltage (all phases), Phase Current (all phases and neutral), KW, KVA, Power Factor, KWH, VAR hours.

7.8.7.2(5) The meters will be power quality type able to monitor harmonics and surges / sags.

7.8.7.2(6) Draw-out circuit breakers on the 600V generator will be provided with trip units with integral 3-phase true RMS digital meter with local LCD display to indicate the phase current for each phase, and the present energy demand.

### 7.8.8 Grounding and Bonding

#### 7.8.8.1 Basic Requirements

- 7.8.8.1(1) All electrical equipment and systems in the building will be bonded and grounded to meet code requirements, IEEE guidelines, and any special requirements for lab equipment.
- 7.8.8.1(2) Grounding and bonding will provide for safety of personnel and for protection against damage to equipment or property in the case of a fault occurring in any of the equipment or systems.

#### 7.8.8.2 Performance Criteria

- 7.8.8.2(1) All conductors and all conducting components of electrical equipment which form part of the grounding and bonding systems in the building will be of non-alloyed copper or aluminum.
- 7.8.8.2(2) The electrical system will be a solidly grounded system.

### 7.8.9 Seismic Requirements for Electrical Systems

#### 7.8.9.1 Basic Requirements

- 7.8.9.1(1) Seismic restraint for all electrical equipment and components of electrical systems which are part of the building electrical systems in all parts of the building will be seismically restrained to post disaster standards to prevent injury or hazard to persons and equipment, and to retain equipment in a safe position in the event of a seismic disaster.
- 7.8.9.1(2) Seismic restraint systems and methods will be selected to facilitate ease of maintenance and ease of replacement and reconfiguration of electrical equipment and systems and other equipment and building components.
- 7.8.9.1(3) Seismic restraint systems and methods shall coordinate with the building Architecture and finishes. Components of seismic restraints will be concealed from public view.
- 7.8.9.1(4) Seismic restraints will meet or exceed the requirements of the current edition of the B.C. Building Code.
- 7.8.9.1(5) Seismic restraint design will follow the recommended practices published in the Seismic Restrain Standards Manual (AIBC) as adopted by the Electrical Contractors Association of BC and CSA S832-06 Guidelines for Seismic Risk Reduction of Operational and Functional Components.

### 7.8.9.2 Performance Criteria

- 7.8.9.2(1) Seismic restraint systems will either be designed by a professional engineer registered in British Columbia, or, where an identified pre-designed standard restraint device or system exists for a particular item, that equipment may be used provided that written confirmation of its acceptability for the installation is provided by a professional engineer registered in British Columbia.

### 7.8.10 Power Quality

#### 7.8.10.1 Basic Requirements

- 7.8.10.1(1) An overall power quality which assures suitable conditions for operation of all electrical and electronic equipment throughout the building will be established.
- 7.8.10.1(2) A wide variety of electrical and electronic equipment types will be in use in the building. Equipment and systems which assure that electrical equipment and systems will not be harmed or impaired either by external events or conditions, such as lightning and disturbances on the utility service, or by internal events or conditions generated within the building are to be provided.
- 7.8.10.1(3) Power quality will meet or exceed the IEEE established standards for power quality, including but not limited to Harmonic Mitigating Transformers, Harmonic Filters, Surge Protective Devices (SPD's), etc., provided where deemed necessary by the Design-Builder and the following publications:
- 7.8.10.1(3)(a) IEEE Standard 519 - Harmonics
  - 7.8.10.1(3)(b) IEEE Standard 1250 - Voltage Quality
  - 7.8.10.1(3)(c) IEEE Standard 1346 - Recommended Practice for Evaluation Electric Power System Compatibility with Electronic Process Equipment
- 7.8.10.1(4) Methods and equipment consistent with IEEE Standard 1159 - Monitoring Electric Power Quality will be provided by installing a built-in power quality meter at the BCH incoming service. All other system testing will be done by a technician using

portable test equipment. Power quality meters will be provided at all secondary distribution centres. Prove that power quality meets or exceeds published standards.

#### 7.8.10.2 Performance Criteria

- 7.8.10.2(1) The building is to include equipment specifically designed to control and remove all adverse power quality conditions that could damage or impair function of any of the electrical or electronic equipment, which will be in use in the facilities. Adverse power quality conditions to be addressed include but are not limited to voltage spikes, dips and droops, transients, harmonics, power factor and radio frequency interference.
- 7.8.10.2(2) demonstrate to the Owner during the commissioning phase that there are no potentially harmful power conditions present and that equipment intended to guard against such conditions is in proper working order.

#### 7.8.11 Lighting

##### 7.8.11.1 Basic Requirements

- 7.8.11.1(1) All luminaires of greater than 60W to have lamps with minimum efficacy of 50 lumens/watt.
- 7.8.11.1(2) Lighting will optimize use of daylight and will be achieved through a combination of natural light and luminaires and controls.
- 7.8.11.1(3) Exterior and interior lighting will create a safe and secure environment for patients and staff.
- 7.8.11.1(4) Lighting will comply with all characteristics recommended by the CSA Standard Z317.5-98 Illumination Systems in Health Care Facilities.
- 7.8.11.1(5) Lighting energy consumption will comply with ASHRAE Standard 90.1 and will exceed that standard by as much as possible with a reasonable standard being a 10% reduction range while still meeting program requirements.
- 7.8.11.1(6) Lighting will follow LEED for New Construction Gold Certification when selecting lighting source types, e.g. low mercury content light sources.

7.8.11.1(7) Lighting design will comply with the light pollution reduction requirements as outlined in LEED Canada-NC 1.0 to eliminate light trespass from the building and site, improve night sky access and reduce development impact on nocturnal environment. This light pollution reduction credit will be incorporated into the overall LEED certification application for this building.

#### 7.8.11.2 Performance Criteria

7.8.11.2(1) Selection of luminaires and light sources will meet stated energy efficiency and quality and quantity requirements, but will also meet the objective of providing both a comfortable working environment and an environment conducive to healing and recovery.

7.8.11.2(2) Special task lighting designed for the types of procedures conducted will be provided for rooms and areas where treatment is provided, and rooms and areas where specialized analytical or diagnostic work is carried out.

7.8.11.2(3) Luminaires in all areas will be so constructed as to require minimal cleaning and will permit practical and easy access and disassembly. All lighting components will be institutional grade.

7.8.11.2(4) Lighting in areas where computer terminals and similar screens will be used will be specifically designed to eliminate glare and will meet or exceed the IES recommended cut off for VDT luminaires.

7.8.11.2(5) Lighting in technology conference rooms and video conferencing facilities will maximize viewing of monitors and screens and will provide suitable illumination of people being viewed.

7.8.11.2(6) Exterior luminaires will be vandal resistant.

7.8.11.2(7) Use of battery-operated unit emergency lighting will be minimized, however battery-operated emergency lighting or an acceptable alternative will be provided as a second level of emergency lighting in areas such as nurse units, and mechanical areas.



- 7.8.11.2(8) Lighting in main lobbies, waiting areas and the main entrances are features of the building and will be designed of high quality products aesthetically pleasing to the public and staff.

## 7.8.12 Lighting Standards

### 7.8.12.1 Offices

- 7.8.12.1(1) Recessed fluorescent luminaires. Lamps: 3500°K CRI 85.
- 7.8.12.1(2) Provide uniformly luminous luminaires.
- 7.8.12.1(3) Minimum of two lighting levels for general illumination with local off override switches.
- 7.8.12.1(4) Ideally, the ceiling luminaires shall straddle the work station to avoid reflected glare.
- 7.8.12.1(5) Controlled by motion detectors.

### 7.8.12.2 Procedure Rooms

- 7.8.12.2(1) Recessed fluorescent luminaires. Lamps: 3500°K CRI 85.
- 7.8.12.2(2) Provide K12 acrylic lenses (.125") mounted in a latched door. Provide general illumination with an exam light mounted on an arm directly mounted over the table.
- 7.8.12.2(3) Provide multiple switching to suit various functions (minimum of four).

### 7.8.12.3 Laboratory

- 7.8.12.3(1) Recessed fluorescent luminaires to provide three levels of illumination using 32 watt T8 lamps, 3500°K CRI 85.
- 7.8.12.3(2) Luminaires to be located to avoid reflected glare.
- 7.8.12.3(3) Allow sufficient power for task lighting which will be supplied by the Owner as required.

### 7.8.12.4 Lounges/Reception Areas

- 7.8.12.4(1) Downlights/wallwash units.
- 7.8.12.4(2) Feature lighting used in combination with the above. Fluorescent or LED's.

7.8.12.4(3) Lamps: 3500°K CRI 85.

7.8.12.4(4) Provide dimming or multiple switching to suit various functions (minimum of two).

#### 7.8.12.5 Corridors

7.8.12.5(1) In patient, public and office corridors provide recessed linear lighting with feature down lights.

7.8.12.5(2) In back of house corridors provide recessed linear lighting.

7.8.12.5(3) Lamps: 32 watt T8 with a 3500°K CRI 85.

7.8.12.5(4) Provide multiple switching to suit various functions (minimum of two).

#### 7.8.12.6 Exits

7.8.12.6(1) All exit lights shall utilize LED technology.

7.8.12.6(2) Edge lit in finished areas and metal in back of house.

#### 7.8.12.7 Patient Rooms – General

7.8.12.7(1) Recessed downlights to facilitate reading by patient laying on right or left side and not directly overhead.

7.8.12.7(2) Recessed downlights to provide general level of lighting throughout room.

7.8.12.7(3) Wall mounted sconce for low level lighting.

7.8.12.7(4) Amber night light to assist patient finding washroom.

7.8.12.7(5) Amber night lights in patient washroom.

7.8.12.7(6) Flush ceiling mounted vanity lighting in patient washroom.

7.8.12.7(7) Provide multiple switching to suit various functions (minimum of five).

7.8.12.7(8) Provide integration with two switches in patient bed.

### 7.8.13 Lighting Control

#### 7.8.13.1 Basic Requirements

- 7.8.13.1(1) Lighting controls will comprise a significant part both of the energy management of the facilities and of the flexibility required to adjust lighting to suit functions and activities.
- 7.8.13.1(2) Lighting control will permit simple and integrated control of lighting; controls will be easily operated and conveniently located for each area and function.
- 7.8.13.1(3) All of the lighting in a space will be capable of being switched at each entrance to the space unless specific local control from a location other than the door is required.
- 7.8.13.1(4) The BMS system will control all public area lighting such as parking lots, walkways, roadways, exterior signage, stairs and corridor and lobby lights located in areas not occupied 24 hours per day. Exterior lighting will include an input for photocell over-ride.
- 7.8.13.1(5) Staff will have the ability to control the lighting in their environment. Area Lighting Control and Lighting Control Interface Table (included in this section) will be followed as a minimum standard for control.
- 7.8.13.1(6) Occupancy sensors and daylight control systems will be utilized to maintain light levels at levels based upon the occupancy of the room and the quantity of daylight.

#### 7.8.13.2 Performance Criteria

- 7.8.13.2(1) Where lighting controls are required to be located in areas accessible to the public, they will be protected from unauthorized operation. Corridor lighting controls will be located at the reception desks. Controls will be multilevel and capable of overriding the BMS night setback control.
- 7.8.13.2(2) All manually operated lighting controls will be of a type, which can be completely cleaned and disinfected without requiring any disassembly. Manually operated controls will not be deteriorated or otherwise adversely affected by frequent cleaning and disinfections.
- 7.8.13.2(3) Lighting controls in locations where they may be subjected to excessive moisture or to chemicals that might cause deterioration are to be rated specifically for the application.

- 7.8.13.2(4) Lighting in open areas and common areas will be zoned and subdivided to permit energy management control and variation of light levels.
- 7.8.13.2(5) Unless otherwise specified by the Authority IT Representative in the form of Video Conference specifications, provide multiple switching controls with at least one group of dimmed fixtures to reduce the lighting level throughout the room to less than 100 LUX.
- 7.8.13.2(6) Controls for all corridors and circulation may be interfaced to the BMS system to provide zone control of lighting. Zoning control to include floor by floor and department by department as a minimum and provide automatic night setback with sweep "off" per programmable time (i.e. 2 hours) throughout the night to turn off lights that may have been manually turned on by staff via a local light control.
- 7.8.13.2(7) Lighting control system will be interfaced to the Building Management System to permit override '100% on'. Lighting program will be established by NH and Design-Builder to address different conditions such as power outage and fire alarm.
- 7.8.13.2(8) Occupancy sensors will be provided in all housekeeping rooms, locker rooms, storage rooms, waiting areas, and washrooms. Occupancy sensors will be automatic on/off type.
- 7.8.13.2(9) Vacancy sensors, a subset of occupancy sensors, will be provided in all offices, conference rooms, exam rooms, laboratory areas, staff rooms, and work areas. Vacancy sensors will be manual on/off, automatic off type.
- 7.8.13.2(10) Design-Builder will consider implementation of daylighting controls to meet LEED® requirements.
- 7.8.13.2(11) Daylighting controls will be provided for all lighting in areas adjacent to exterior glazing and provide dimming to 10% of lamp output. Provide combination daylight harvesting and occupancy control to the rooms requiring occupancy sensors.
- 7.8.13.2(12) Daylighting will meet the following performance criteria:
  - 7.8.13.2(12)(a) The average illuminance across a representative portion of the task surface will be at least 30% of the target design level for

that space type within 5 meters of the daylight source;

- 7.8.13.2(12)(b) Overhead lights within the space will be dimmed as low as possible (or turned off) while satisfying above criteria (a).
- 7.8.13.2(13) Occupancy sensors and daylighting controls will be integrated into the lighting control system and located on ceilings to avoid interference with furniture. Occupancy sensors will typically be dual technology type with other types to suit application.
- 7.8.13.2(14) Exterior lighting will be controlled via BMS and photocell.
- 7.8.13.2(15) Lighting control schedules will respond to individual departmental requirements and occupancy/use. Design to include a schedule of lighting control and be included in the design specifications.
- 7.8.13.2(16) Except in conference and meeting rooms, provide 10% lamp output dimming within all rooms designated to have dimming capability.
- 7.8.13.2(17) Multilevel lighting controls will be provided in all exam rooms.
- 7.8.13.2(18) Each lighting control panel will have programmable switches to allow relays which are 'soft wired' into groups to be controlled while retaining individual relay control. Master switches will be capable of direct on/off control or on/flick-then-off control ('flick-then-off' function is that the lights will flick prior to turning completely off). Any master switch which could cause an occupant to be left in the dark shall have the 'flick-then-off' warning function.
- 7.8.13.2(19) Area Lighting Control and Lighting Control Interface Table:

Requirements		
Room Type	Control Type	Interface Type
Ambulance Bay	ML	BMS
Bathing	MC	BMS
Conference Room	VS, DD, DL, ML	BMS
Exam Room	VS, ML	BMS
Exterior Lighting	PC	BMS
Housekeeping	OS	BMS
Laboratory Areas	OS, DL	BMS
LDRP	DL, ML, MC, DD	BMS

Locker Room	OS	BMS
Office	VS, DL, ML	BMS
Inpatient Room	MC, ML	BMS
Roof level	TS	BMS
Reception	MC, DL	BMS
Service Room (Elec, Comm, etc)	TS	BMS
Staff Room/Lounge	VS, DL	BMS
Storage	OS	BMS
Waiting	OS, DL, MC (MC at Reception Desk)	BMS
Washroom	OS	BMS
Work Area	VS, DL, ML	BMS

Control Type Legend:

*DD – Digital Dimming*

*DL – Daylighting (when room is adjacent to exterior glazing)*

*HI-LO – High Low Switching (Metal Halides only)*

*MC – Manual Control*

*ML – Multilevel Control*

*OS – Occupancy Sensor*

*PC – Photocell*

*TS – Timer Switch*

*VS – Vacancy Sensor (Occupancy Sensor with Manual 'On/Off' switch)*

## 7.8.14 Major Laboratory Equipment

### 7.8.14.1 Basic Requirements

- 7.8.14.1(1) Provide all electrical requirements for connection, operation and monitoring and control of any supplied major laboratory equipment.

### 7.8.14.2 Performance Criteria

- 7.8.14.2(1) Each item of equipment will be installed and electrically connected for proper and full operation.
- 7.8.14.2(2) Electrical characteristics of this equipment, including but not limited to voltage, wattage, phase, demand, inrush, frequency, connection method and control and monitoring requirements will be confirmed by the manufacturer and provided for.
- 7.8.14.2(3) Space, access and ventilation requirements and other operation critical characteristics of this equipment will be provided for and outlets and connection points will be located correctly for installation and so as to permit proper and safe isolation for servicing and disconnection for removal or replacement.
- 7.8.14.2(4) Any motorized equipment is to be equipped with a local lockable disconnect switch.
- 7.8.14.2(5) Provide three cell steel wireways for duplex receptacles and data jacks on laboratory benches. Lowest cell to be for normal hydro powered duplex receptacles and/or UPS powered receptacles. The second cell to be for generator powered duplex receptacles located on maximum 1000 mm centres. The third cell to accommodate two data jacks on maximum 1000 mm centres. Circuiting to consist of two duplex receptacles per circuit. Mount raceway 100 mm above bench. Provide a minimum of one receptacle for each 500 mm of wireway when all power sources are considered.

## 7.8.15 Energy Management

### 7.8.15.1 Basic Requirements

7.8.15.1(1) The integrated energy management system will monitor, record, report on and control energy from all sources which supply energy to the building. This system shall form part of the BMS.

7.8.15.1(2) The energy management systems and equipment will be flexible, controllable, and will form an integral part of the buildings design and construction.

#### 7.8.15.2 Performance Criteria

7.8.15.2(1) The energy management system will be accessible from any networked computer using required software.

7.8.15.2(2) A minimum of (5) Site software licenses will be provided if licensing is required.

### 7.8.16 Mechanical Equipment Connections

#### 7.8.16.1 Basic Requirements

7.8.16.1(1) Electrical power control and monitoring connections will be provided to all mechanical equipment as required for proper operation, protection and maintenance of the equipment. Materials and installation methods will result in safe reliable and serviceable mechanical equipment and systems in the building.

#### 7.8.16.2 Performance Criteria

7.8.16.2(1) Cables, connectors, conduit systems, fittings and hardware used to make connection to mechanical equipment will be of institutional or industrial quality, and will be so selected and installed as to provide for high levels of reliability, durability and ease of maintenance of the equipment.

7.8.16.2(2) Connections made to motors and/or motor driven equipment or equipment with noticeable levels of vibration will be of a type specifically designed to accommodate the vibration.

7.8.16.2(3) Connections to mechanical equipment will be designed and installed to easily permit removal and replacement of the equipment and will provide for the eventuality that equipment may be replaced in the future with upgraded and dissimilar equipment types.



- 7.8.16.2(4) Motor control centres (MCC's) and mechanical distribution centres (MDC's) will be sized to accommodate the current mechanical equipment plus 30% of that amount in additional spare capacity.
- 7.8.16.2(5) MCC'S will be used when three (3) 3-phase motors that require a starter and are located within 50m of each other.
- 7.8.16.2(6) Provide labelling on MCC's and MDC's to match motors.
- 7.8.16.2(7) Provide wiring diagrams of each starter type.
- 7.8.16.2(8) Full size starters to be provided.
- 7.8.16.2(9) For motors 20 hp and above provide reduced current starters. Provide integral harmonic cancellation devices to limit harmonics to 5% current harmonics (iTHD) of the full load fundamental current if solid-state starters are employed.
- 7.8.16.2(10) Starters and MCC's to be indoor sprinkler-proof, type 2 enclosures.
- 7.8.16.2(11) Provide individual control transformers for each starter.
- 7.8.16.2(12) Provide power factor correction at each motor 10hp and above and at MCC's.
- 7.8.16.2(13) Starters or MCC's connected to emergency and normal power to be coloured to NH requirements.

## 7.8.17 Building Control Systems Interface

### 7.8.17.1 Basic Requirements

- 7.8.17.1(1) A fully functional building management system whose primary function will be to control the mechanical systems within the building will be provided by the Mechanical Division. The building management will interface with building electrical and communication systems. This system is to be utilized to annunciate security alarms, freezer alarms, laboratory alarms, UPS, generator, and switchgear alarms, and control the building and site lighting via its software program.
- 7.8.17.1(2) The system is to be used for energy management functions as well as energy related data acquisition and trending. The

digital meters monitoring the electrical power systems are to be connected to this system.

#### 7.8.17.2 Performance Criteria

7.8.17.2(1) Refer to Mechanical sections for details of the Building Management System.

### 7.8.18 Specialty Systems

#### 7.8.18.1 Basic Requirements

7.8.18.1(1) Special electrical and communications systems are required in the building and form essential parts of the complete Facility. Power supply, specially conditioned power and communication conduits and other electrical operational support equipment will be supplied and installed in order to provide for all the requirements of permanent installations of these special electrical and electronic systems.

#### 7.8.18.2 Performance Criteria

7.8.18.2(1) Cables, connectors, conduit systems, fittings and hardware used to make connection to special equipment will be of institutional or industrial quality, and will be so selected and installed as to provide for high levels of reliability, durability and ease of maintenance of the equipment.

7.8.18.2(2) Connections to special equipment will be designed and installed to easily permit removal and replacement of the equipment and will provide for the eventuality that equipment may be replaced in the future with upgraded and dissimilar equipment types.

## 7.9 Communications (Division 27)

### 7.9.1 Basic Requirements

7.9.1.1(1) The latest technology for transferring, securing, and storing information will be utilized by the Design-Builder. The Owner expects to receive the most current technology and systems available at the start of construction.

7.9.1.1(2) Installed structured cabling system solution will meet or exceed the requirements as set forth in the NH Information Management Information Technology(IMIT) Cabling Specifications.

- 7.9.1.1(3) The Design-Builder will provide, at its expense, a 3<sup>rd</sup> party commissioning agent which will provide a commissioning report to the Design-Builder and the Authority IT Representative to confirm the integration of the IT and communications systems. Commissioning will confirm that each output device can be activated by all specified input devices. A minimum of 5% of input and output devices of each type will be tested.
- 7.9.1.1(4) The design and configuration of any portion of the IT network designed and/or installed by the Design-Builder will need to be approved by the Authority IT Representative. Throughput tests, packet tests, and connectivity tests will be set up by the Design-Builder and witnessed and confirmed by the Authority IT Representative.
- 7.9.1.1(5) Prior to Financial Close, the Design-Builder will provide the Authority IT Representative the schedule for providing building layout, MEP and other design drawings as well as other information required for the Owner to complete its work as identified in the IT Systems Specifications.
- 7.9.1.1(6) The Design-Builder will complete, at no expense to the Owner, any warranty work that is required on any portion of the IT Systems. The Warranty period will be the greater of 90 days, the vendor's warranty period or the warranty period for construction specified elsewhere in the design and construction specifications.
- 7.9.1.1(7) Installed solution shall meet or exceed the requirements of NH's standard IMIT Telecommunications Cabling. Where requirements in the TIA and NH's standard conflict, the more stringent requirement shall apply.
- 7.9.1.1(8) The Design-Builder will procure all software and user licenses required for the operation of the IT Systems. Licenses will include a 20% buffer for future expansion.

#### 7.9.1.2 Performance Criteria

- 7.9.1.2(1) The IT and communications systems will be proven technology, effectively used in other health facilities, will be easy to operate, and easy to maintain. Where needed, these systems will need to have the ability to integrate readily with the other systems in the building and with technology provided

in other health facilities to allow Province wide communications.

- 7.9.1.2(2) The Design-Builder will be responsible for training / educating all clinical / non-clinical staff on the proper use of IT equipment and systems that are provided by the Design-Builder unless otherwise instructed by the Authority IT Representative.
- 7.9.1.2(3) The IT systems will be chosen because they are cost effective, provide efficiencies for staff and patients, perform the necessary tasks to meet Authority IT Representative requirements, are adaptable to change, flexible in implementation and are expandable to accommodate growth.
- 7.9.1.2(4) The Design-Builder will turn over the fully functional, fully tested and commissioned, including equipment installation, patching and finalized documentation, of the structured cabling network, communications closets and server room to the Authority IT Representative at least eight (8) weeks prior to Service Commencement for exclusive use by the Authority IT Representative.
- 7.9.1.2(5) The Design-Builder will need to grant access to the Authority's IT Representative to the Communication Closets and Server Room prior to the handoff described in 7.9.1.2(4) when requested by the Authority IT Representative.

## 7.9.2 Network Design and Installation

### 7.9.2.1 Basic Requirements

- 7.9.2.1(1) The Owner will design the logical IT network and provide the design to the Design-Builder.
- 7.9.2.1(2) The Design-Builder will design the physical IT network infrastructure in accordance with the Owner's logical IT network design and physical IT requirements as specified by the Authority IT Representative. The Design-Builder will procure and install a complete, redundant and secure IT network system to support the Owner according to the Owner's logical network design and as specified by the Authority IT Representative. The Design-Builder will be responsible to test and commission all portions of the system that it installs.

- 7.9.2.1(3) The IT network will be configured by the Owner, which will also undertake final testing.
- 7.9.2.1(4) The IT specifications contemplate a server room which is separate from all communications closets. If the Design-Builder obtains authorization from the Authority IT Representative, it could include the server room requirements as part of an expanded Communication Closet. The Design-Builder must provide all relevant information to the Authority IT Representative prior to a decision being made by the Authority It Representative regarding this matter.
- 7.9.2.1(5) The Design-Builder will provide the Authority IT Representative with the design of all building, clinical and communications systems which the Design-Builder is designing and which are IP connected or enabled. The Authority IT Representative will direct the Design-Builder on whether the Design-Builder is required to integrate any or all of these systems with the IT Network and/or identify any other integration requirements that must be provided by the Design-Builder. The systems which may need to be integrated include, but are not necessarily limited to, video conferencing, RFID, patient entertainment, patient education, Vocera, access control, CCTV, timing, intrusion detection, and specialized clinical equipment such as picture archiving and communication systems (PACS), cancer treatment systems, electronic registration, and dictation systems.
- 7.9.2.1(6) Any building, clinical and communications system equipment, which is purchased by the Design-Builder, should at minimum integrate with the Authority's Enterprise Network equipment identified on the Equipment List or by the Authority IT Representative.

#### 7.9.2.2 Performance Criteria

- 7.9.2.2(1) The building will include communication closets as required to service voice/video/data requirements of the building.
- 7.9.2.2(2) The Design-Builder will need to provide details of its designs which would include at minimum building layout and room configuration designs, MEP designs, designs of other systems which the Design-Builder is required to design and which are IP enabled, room locations and numbering and any other information deemed necessary by the Authority IT

Representative in order for the Owner to complete its required work with respect to the IT Systems.

- 7.9.2.2(3) The design and construction by the Design-Builder of the communications closets and server room must meet environmental conditions as specified by the Authority IT Representative. The Authority IT Representative must review the Design-Builder communications closets and server rooms design.
- 7.9.2.2(4) All communications closets and server rooms will be constructed as restricted access rooms with access card entry. The Design-Builder will provide the Owner with the necessary number of access card it requests.

### 7.9.3 Network Equipment

#### 7.9.3.1 Basic Requirements

- 7.9.3.1(1) The network equipment will be specified by the Authority IT Representative and will be provided and set in place by the Design-Builder.
- 7.9.3.1(2) The Design-Builder will provide sufficient racks of the type (2 post or 4 post) specified by the Authority IT Representative for the Owner's IT network equipment in each server room and communication closet.
- 7.9.3.1(3) All communications closets and server room will be protected by the Design-Builder against water leakage and damage. The Design-Builder will submit plans in this regard to the Authority IT Representative for review and approval.
- 7.9.3.1(4) The wired and wireless infrastructure will support the network end use equipment provided by the Owner.
- 7.9.3.1(5) The core switch will be based upon the Cisco 6500 series, but will be the latest model supplied at the time of purchase.
- 7.9.3.1(6) The Design-Builder and the Owner will purchase network equipment as late as possible to take advantage of technological changes. The core switch will have a redundant 720 supervisor engine or equivalent, and will come with fully redundant power supply, and sufficient card modules with fibre uplinks supporting at minimum 10 Gbps for all communications closets. A minimum of two connections will

be provided for each communications closet. The Owner's core network standards will be made available.

- 7.9.3.1(7) Switches intended for supporting real time applications such as video conferencing, VoIP, IP CCTV cameras will be layer 3 or higher switches. The Design-Builder to provide and install Cisco 3750X series POE Plus (30 watts per port) Switches. If a higher quality and/or more efficient switch is available at the time of ordering, it will be priced and presented by the Design-Builder to the Authority IT Representative to determine if the Owner wants to utilize the latest standard. Multiple switches in communications closets will be stacked in a manner consistent with the Authority IT Representative specifications.
- 7.9.3.1(8) All network equipment will be connected to the building based UPS managed central power supply.
- 7.9.3.1(9) The Design-Builder will provide an additional 25% growth capacity in the communications closets for the switches, rack space and patch panel.

#### 7.9.3.2 Performance Criteria

- 7.9.3.2(1) The Design-Builder will work with the local telco to install the wide area network connections to the building.
- 7.9.3.2(2) A server room within the building will be provided to host servers procured by the Design-Builder and the main core internal backbone network equipment. An exception to this may be that the Dec Server used for the lab may need to be located in a communications closet closer to the lab. The Owner will provide a list of equipment for the purposes of space, power and environmental control planning in the server room.
- 7.9.3.2(3) The network design will include redundancy which will be included in the Owner's logical network design provided to the Design-Builder to incorporate during construction.

### 7.9.4 Structured Cabling

#### 7.9.4.1 Basic Requirements

- 7.9.4.1(1) The data ports will be suitable to accommodate Authority IT equipment not be differentiated on the type of end-use device.

- 7.9.4.1(2) The cabling infrastructure will be designed by a Registered Certified Data Designer (RCDD) or professional engineer and will be to the latest TIA / EIA solution. The current solution is a category 6 cable infrastructure. The colour of the outer cable coating should be a single blue colour.
- 7.9.4.1(3) All cables are to terminate in communication closets sized in accordance with the TIA / EIA 569 standard. Maximum cable distance from room outlet to communication closet will be 85m.
- 7.9.4.1(4) Communication closets will serve the floor they are on and will be placed to maximize the area they serve. All communication closets and server room will be fed by the building UPS, with a back-up emergency power feed.
- 7.9.4.1(5) Cable types will be unshielded twisted pair and fibre optic multimode and single mode. The bandwidth requirements and distance limitations will determine the type of cable installed. At minimum, a 12 Strand Single-Mode Fibre and 12 Strand OM4 Multi-Mode Fibre must be drawn from the server room and the other communication closets.
- 7.9.4.1(6) To accommodate potential future clinical systems, the Design-Builder will also be required to procure and install fibre cabling between communications closets.
- 7.9.4.1(7) The Design-Builder will use conduit between the server room and the communication closets. The conduits, pathways, room layouts, and design will comply with the TIA / EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces, latest edition and will be reviewed and approved by the Authority IT Representative.
- 7.9.4.1(8) The cabling design and installation will comply with the TIA / EIA – 568C family of Commercial Building Cabling Standards and Optical Fibre Cabling Standards.
- 7.9.4.1(9) Testing of the fibre optic cable will meet the TIA / EIA 526-7, and TIA / EIA 526- 14 standards for Optical Power Loss measurement of single mode and multimode fibre cable plant.
- 7.9.4.1(10) The management and administration of the cabling plant will be done in accordance with the TIA / EIA 606 standard – the Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.



- 7.9.4.1(11) The grounding of the conduit pathways and components is to meet the TIA / EIA 607 Standard – Commercial Building Grounding and Bonding Requirements for Telecommunication.
- 7.9.4.1(12) All structured cabling components will be of the same manufacturer and will be supplied by one of the recognized industry leaders. The system will be installed by a data contractor who is certified by the manufacturer consistent with the manufacturer's best warranty.
- 7.9.4.1(13) High density RJ45 patch panels will be used for all copper terminations in the communication communications closets. The Design-Builder will terminate fibre cabling on patch panels in communication closets with connector type as directed by the Authority IT Representative.

#### 7.9.4.2 Performance Criteria

- 7.9.4.2(1) The Design-Builder to provide and install a complete category 6 structured cabling solution throughout the building. If a category better than category 6 is the latest standard at the time of ordering, it will be presented by the Design-Builder to the Authority IT Representative to determine if the Owner wants to utilize the latest standard at the Owner's cost.
- 7.9.4.2(2) A star wired cabling approach will be utilized to wire all outlet locations back to communication closets and all communication closets to the server room.
- 7.9.4.2(3) All rooms that have or are anticipated to have data, phone, fax, computer, video, or other end-use devices will have a cable system drop for each anticipated piece of equipment that will run to the appropriate communications closet. The Authority IT Representative may instruct the Design-Builder that fewer drops and a switch be used to accommodate video conference equipment.
- 7.9.4.2(4) For every drop location, a minimum of 3 cables will be run (three RJ45's per location) each connected to a data port accessible for use with end devices.
- 7.9.4.2(5) The Design-Builder will provide cable for all public phones, allowing for a minimum of two (2) public phones per main lobby and two (2) public phones per emergency department waiting area.

- 7.9.4.2(6) Data ports will be installed at table height, except where floor located data ports are specified (such as for video conferencing equipment) or unless otherwise identified by the Authority IT Representative. The location of each data drop will be identified by the Authority IT Representative
- 7.9.4.2(7) In addition, the Design-Builder will provide an additional 33% drop count over and above those prescribed and locate these additional drops as directed by the Authority IT Representative.
- 7.9.4.2(8) All IT Systems conduit pathways and cable trays will have maximum 40% fill.
- 7.9.4.2(9) All communication closets will have spare capacity as recommended by TIA / EIA – 568C family of Commercial Building Cabling Standards and Optical Fibre Cabling Standards. All cabling will be run in conduit or cable tray. J-hooks may be used but must be approved by the Authority's IT Representative for use.
- 7.9.4.2(10) Fibre optic cabling will be utilized to connect communication closets to the server room. Both multimode and single mode fibre will be provided with type depending on equipment requirements.
- 7.9.4.2(11) Note that fibre optic cabling may also be required to be provided by the Design-Builder in rooms requiring video streaming, in digital operating rooms and areas where bandwidth requirements necessitate. The Authority's IT Representative will provide information on these requirements during design.
- 7.9.4.2(12) All data cabling will be pulled, end to end terminated, tested and labeled. This must be complete at least eight (8) weeks prior to Service Commencement. The Authority IT Representative will provide the labelling method and requirements. The appropriate flame spread rating will be provided by the Design-Builder for the cabling system.
- 7.9.4.2(13) All category cable labeling will be implemented by the Design-Builder and provided to the Authority IT Representative for confirmation.

- 7.9.4.2(14) The Design-Builder will terminate data cables at the patch panel in the communications closet with proper labeling as outlined in 7.9.4.2(12).
- 7.9.4.2(15) The Design-Builder will provide data and power cables for all end-use devices in sufficient quantity to make each device operational plus 10% spare of the length and quality specified by the Authority IT Representative. The Authority IT Representative will specify the length of cables required for procurement by the Design-Builder.
- 7.9.4.2(16) The Design-Builder will provide patch cables in sufficient quantity, based on Owner network design and Authority IT Representative approval, plus 10% spare. Patch cable will allow complete connection from end to end. The Design-Builder will patch from the patch panel to the applicable network switch using short patch method as defined by the Authority IT Representative.
- 7.9.4.2(17) If self-registration systems, electronic directional systems and patient education kiosks are to be provided in reception areas during construction or planned to be provided at some time in the future, the Design-Builder will provide floor data outlets and floor power to connect these floor mounted systems.
- 7.9.4.2(18) The Design-Builder will ensure that specialized systems requiring multiple drops will have sufficient drops at each location to ensure system operation. NH will provide the specific location and requirements for these specialized system data drops.
- 7.9.4.2(19) The Design-Builder should ensure that all patch cables and end use device cables should be dressed and concealed to the Authority IT representative standards.
- 7.9.4.2(20) At a minimum there must be one duplex power drop beside every data drop unless otherwise specified by the Authority IT Representative for video conference or other IT facilities.

## 7.9.5 Wireless Infrastructure

### 7.9.5.1 Basic Requirements

- 7.9.5.1(1) The entire building will be provided with a digital wireless network infrastructure that will allow wireless end-use devices

access to the Owner's network and all its associated applications.

- 7.9.5.1(2) The wireless network components will meet the current IEEE 802.11a, b, e, g, i, k, n standards. The latest standards will be adopted and the bandwidth of the network will meet the requirements of the building at the time of installation.
- 7.9.5.1(3) Access points will be Cisco, as specified by the Owner, powered by Cisco PoE and be 802.3af compliant and will be LWAPP enabled. Wireless system design to be developed in consultation with the Authority IT Representative and will have sufficient density to allow the Vocera System to be used throughout the building. As there may be a requirement for an RFID or RTLS system within the building, the final design must take into account the requirements of these systems.
- 7.9.5.1(4) The wireless products will use advanced random data encryption protocol to secure the information.
- 7.9.5.1(5) The Design-Builder must ensure that he wireless equipment and infrastructure will not have an adverse effect on the biomedical equipment.
- 7.9.5.1(6) Wireless end points will require a data drop and these data drops will form part of the basic data drop requirements and not count against the extra capacity, and are not considered to be data drops as described in 7.9.4.2(6).

#### 7.9.5.2 Performance Criteria

- 7.9.5.2(1) The Design-Builder to provide a complete wireless network throughout the building, with no dead spots, allowing any standard network applications or telephone applications to utilized the wireless network. The Authority IT Representative will be consulted to help prepare the wireless design and the Authority IT Representative will identify locations for Wireless Access Points (WAP). The Design-Builder will procure and install the WAPs. The wireless system must integrate with the Owner's Cisco wireless controller and the Vocera System, and utilize Cisco wireless 5500 series or equivalent LAN controllers. If 50 or more access points are to be connected to the Wireless LAN, the Design-Builder will need to procure and install an onsite wireless controller.

- 7.9.5.2(2) Installation of UTP cables and termination equipment required for the proposed Wireless LAN will be provided by the communications wiring system contractor and will conform to the standards set forth in the specifications. All cables to be tested/certified and will match or exceed industry specs. Results of tests to be submitted to the Authority IT Representative after completion of cable installation.
- 7.9.5.2(3) Supporting infrastructure will be positioned to accommodate installation of RTLS system (Real Time Locator Solution).
- 7.9.5.2(4) Supporting infrastructure for implementation of wireless local area network shall be provided to accommodate minimum of 100 users connected to the Wireless LAN.
- 7.9.5.2(5) All access points and wireless components will be seismically supported.
- 7.9.5.2(6) The wireless infrastructure must demonstrate a minimum of 5.5 Mbits/s throughout the building statistically accurate to within 2%, 95% of the time.
- 7.9.5.2(7) The wireless network will be fed by the building UPS power source.
- 7.9.5.2(8) The Owner may require a wireless metro network and to support this, the Design-Builder must provide a structured cabling system that will connect the wireless Metro roof top access points to the nearest communication rooms using 52 mm conduit. The Design-Builder will follow the cabling standard for the wireless access point cabling.
- 7.9.5.2(9) The Design-Builder will construct a specific roof box for the conduit and cable for the wireless antennae. Conduit will include weatherhead, gooseneck or termination box with cover plate.
- 7.9.5.2(10) The Design-Builder will provide a structure on the roof to which a wireless antenna can be mounted.
- 7.9.5.2(11) The Design-Builder will evaluate solutions for lightning strikes impacting all rooftop communication towers.

## 7.9.6 Wireless Staff Communication Systems

### 7.9.6.1 Basic Requirements

- 7.9.6.1(1) The wireless staff communication system must be a Vocera system, will be required to function throughout the entire building and cannot be used as a primary life safety system (for example fire alarm, code blue etc.). The Design-Builder will ensure network connectivity between all devices meets vendors' recommended specifications for latency requirements and quality of service.
- 7.9.6.1(2) The Design-Builder will provide a Vocera system that will integrate with the nurse call system, telephony system and the Owner's Wireless LAN system.
- 7.9.6.1(3) The Design-Builder will ensure that the Vocera system will meet the IEEE 802.11a, b, g, and n standards and allow sufficient bandwidth to display clinical data.
- 7.9.6.1(4) Wireless data security encryption techniques are to be employed by the system in compliance with IEEE 802.11i.

#### 7.9.6.2 Performance Criteria

- 7.9.6.2(1) The Design-Builder will provide a complete Vocera system that will allow staff to place calls from wireless handheld devices and initiate a two-way voice conversation.
- 7.9.6.2(2) The Design-Builder will design and build the Vocera system to integrate with the Owner's Enterprise Vocera system. The design and construction of the integration will be based on specifications and direction provided by the Authority IT Representative.
- 7.9.6.2(3) The Vocera system will tie into the head end CPU and application server, and consist of antennae base stations, line cards, and software and wireless handheld devices. Antennae base stations are to be located in concealed areas throughout the building to provide full coverage with no dead spots.
- 7.9.6.2(4) The Vocera system server will include application software for full programming as well as gateway software to integrate at minimum with the nurse call system and telephony system and to annunciate all necessary local alarms on the wireless handset.
- 7.9.6.2(5) The Design-Builder will procure all software and user licenses for the system.

- 7.9.6.2(6) The Design-Builder will coordinate with the Authority IT Representative for proper programming and initialization of Vocera devices.
- 7.9.6.2(7) In consultation with the Authority IT Representative, the Design-Builder will meet with the Authority Clinical Representative and determine programming requirements such as phone groups, personal profiles, extensions, long distance access, dialling plan, nurse call assignment plan, text messaging, web access, email access, encryption requirements and fully program system. Prior to RFP Financial Close, the Design-Builder will provide the Authority IT Representative the schedule for meeting with the Authority Clinical Representative.
- 7.9.6.2(8) The Design-Builder will procure 75 Vocera badges for this project as directed by the Authority IT Representative. The Design-Builder will also provide 2 batteries for each device and 10 8-bay battery chargers for the Vocera system device including the necessary mounting accessories to allow the hospital staff to properly utilize them in their day to day operation. Fully charged battery will have a minimum of 8 hours of talk time and the necessary power sources will be provided by the Design-Builder for use by the Vocera battery chargers.
- 7.9.6.2(9) The Design-Builder will procure and install a Vocera telephony server.
- 7.9.6.2(10) The Vocera telephony server will be located in the server room along with applications servers. The server will be connected to a building based UPS that will provide a minimum of 30 minutes of continuous power.
- 7.9.6.2(11) The Design-Builder will provide all user training prior to Go Live at date and times that are agreed upon by the Design-Builder, Authority IT Representative and Authority Clinical Representative. The Design-Builder will need to ensure all vendors provide user training on vendor equipment.

## 7.9.7 Telephony

### 7.9.7.1 Basic Requirements

- 7.9.7.1(1) The Authority IT Representative will work with the telephone service provider to design the telephony system.

- 7.9.7.1(2) The Design-Builder will procure all telephony equipment as required for the telephony system designed by the Authority IT Representative. The Design-Builder will provide the telephone switch and associated components, servers, cabling including entrance cabling, necessary work stations, all software, new phonesets and voice mail storage as specified by the Authority IT Representative. TDM phonesets will be required for clinical space. IP phonesets will be required in all other areas.
- 7.9.7.1(3) The Design-Builder will procure and install two (2) pay-telephones to be located in the Outpatient Reception Lobby, one of which will be designed for access and use by persons with disabilities. The Design-Builder will also procure and install two (2) pay telephones to be located in the Emergency Waiting area, one of which will be designed for access and use by persons with disabilities.
- 7.9.7.1(4) The Design-Builder will procure and install internal only telephones to be located in the elevator lobbies and Patient waiting areas.
- 7.9.7.1(5) The Design-Builder will also acquire all software and licences required for the telephony system as designed by the Authority IT Representative. Licenses will include a 20% buffer for future expansion.
- 7.9.7.1(6) The Design-Builder will acquire the necessary voice mail requirements as designed by the Authority IT Representative.
- 7.9.7.1(7) The Design-Builder will construct and install the telephony system based on the Authority IT Representative's design and specifications and test and commission all parts of this installation, including phonesets, to ensure it is functional. After testing and commissioning, the Design-Builder will seek the Authority IT Representative's approval that it meets the Authority's design requirements.
- 7.9.7.1(8) The Authority IT Representative will supply all voice mail requirements, telephone system standards and specifications including telephone handset specifications.
- 7.9.7.1(9) The Authority IT Representative will configure the telephony system after testing and commissioning of the build has been completed by the Design-Builder. The incoming telephone service will be ordered by the Authority IT Representative.



7.9.7.1(10) The Authority IT Representative is responsible to provide a mapping of phone and fax numbers with the hospital's new and old locations. The Authority IT Representative is also responsible for transferring all new phone and fax numbers to the new phones in the building.

7.9.7.1(11) As part of the telephony system design specifications, the Authority IT Representative will incorporate analog service requirements. The Design-Builder will be responsible for supplying and installing fax machines, special modems, point of sale devices, portable phones, and other analog devices identified by the Owner as being required for the building.

#### 7.9.7.2 Performance Criteria

7.9.7.2(1) The telephony system will have a full UPS system with enough capacity to operate the entire system for four (4) hours and include a disaster recovery option.

7.9.7.2(2) The Design-Builder will provide all necessary components for the telephony system to interface with dictation systems, Vocera System and public address system as specified by the Authority IT Representative.

7.9.7.2(3) The physical conduits and duct banks are to be provided by the Design-Builder. The Design-Builder will also provide a separate incoming telephony entry room for this service entry and connect it to the server room with at minimum a 200 pair copper cable and 2x24 fibre cables.

7.9.7.2(4) The Design-Builder will cover operational/maintenance costs of the incoming telephony/data services prior to Service Commencement.

7.9.7.2(5) The Design-Builder to provide 2 separate 2U mount spaces specifically for telephony system expansion.

7.9.7.2(6) DELETED.

7.9.7.2(7) The Design-Builder will turn over the fully commissioned telephony system to the Authority IT Representative eight (8) weeks prior to Service Commencement in order for the Authority IT Representative to configure the telephony system program and integrate the phonesets and complete all final testing.

## 7.9.8 Clinical Information Systems

### 7.9.8.1 Basic Requirements

- 7.9.8.1(1) The Owner will design, build and test the Clinical Information Systems required for the building.

### 7.9.8.2 Performance Criteria

- 7.9.8.2(1) The Design-Builder will provide information including but not limited to building layout, room numbers and MEP drawings and any other relevant information as requested by the Authority IT Representative to support the Owner's design, build and testing of the Clinical Information Systems.
- 7.9.8.2(2) The Design-Builder will procure Clinical Information System equipment as identified on the Equipment List or specified by the Authority IT Representative. The Design-Builder will supply all licenses as specified by the Authority IT Representative.

## 7.9.9 Public Address

### 7.9.9.1 Basic Requirements

- 7.9.9.1(1) The paging system will connect to the telephone system allowing any telephone to page in the building.
- 7.9.9.1(2) Integration with the fire alarm system is not acceptable.

### 7.9.9.2 Performance Criteria

- 7.9.9.2(1) The public address system will consist of amplifiers, mixers, speakers, zone paging modules, telephone interface modules, microphones, and other devices as needed to facilitate overhead paging in the building.
- 7.9.9.2(1)(a) Provide complete speaker coverage of the building so that emergency pages can be heard everywhere in the building with high intelligibility and low loss of articulation of consonants (%ALCONS).
- 7.9.9.2(1)(b) The paging system will be a constant voltage system with speakers placed to cover all areas and provide at minimum 60 dB in all areas of the building. Amplifiers to

be sized to drive all speakers in each zone plus 20% additional spare capacity for future growth. The mixers will accommodate all inputs and provide the required signal to the amplifiers and speakers.

- 7.9.9.2(2) The system is to be zoned to allow paging into individual departments. It is necessary to drive different inputs into each department. Auxiliary audio inputs will be overridden when paging takes place. Each zone to be accessible by telephone to allow department paging or building wide paging. A page in one department will be isolated to that department.
- 7.9.9.2(3) Speakers will be recessed in ceiling whenever possible and come complete with speaker back box.
- 7.9.9.2(4) Paging sound levels will be at least 15 dB above ambient noise levels in mechanical rooms and similar locations.
- 7.9.9.2(5) Paging speakers are not required within patient rooms, treatment/procedure rooms, and offices. Audibility into such rooms shall be accomplished by placement of speakers near door openings.
- 7.9.9.2(6) Amplifiers to be distributed such that the failure of one set of amplifiers does not cause the entire system to malfunction.
- 7.9.9.2(7) Telephone access to paging will be less than 2 seconds from the time the telephone dials to the time the message is sent over the speakers.

## 7.9.10 Video Conferencing

### 7.9.10.1 Basic Requirements

- 7.9.10.1(1) The Design-Builder will design, procure and install the infrastructure for full video conferencing systems and video conferencing building infrastructure in all rooms requiring audio/video conferencing as identified on the Equipment List and/or by the Authority IT Representative.
- 7.9.10.1(2) Based on the room design provided by the Design-Builder, the Authority IT Representative will identify the requirements for floor boxes, 52 mm conduit, cabling and power outlet locations on the floor and quantity. The Design-Builder is responsible to

provide and install the floor boxes, 52 mm conduit, cabling and power as per Authority IT Representative specifications.

- 7.9.10.1(3) The audio / video conferencing systems will comply with the latest IP based video conferencing standards.
- 7.9.10.1(4) The location of microphones, video cameras, video monitors, and the design of the lighting systems will be based on input from the Authority IT Representative and optimize the performance of the video conferencing system.
- 7.9.10.1(5) The Owner will provide video conference room specifications including standards for lighting, room control, centralized control of equipment, configuration of tables for data, audio, video and power based on Owner video conference standards for room size purpose and layout.

#### 7.9.10.2 Performance Criteria

- 7.9.10.2(1) Video conferencing systems will be procured by the Design-Builder as per the Authority IT Representative's standard and installed by the Design-Builder to meet the Authority IT Representative specifications.
- 7.9.10.2(2) The video conferencing equipment to be provided by the Design-Builder for the clinical rooms, education rooms, small meeting rooms, and medium meeting rooms and large meeting rooms will meet the Owner's Video Conference standards as specified by the Authority IT Representative. Telephones required to meet these standards will be procured and installed by the Design-Builder. Wiring infrastructure, connectors and any miscellaneous equipment required to make the video conference system functional and which are not listed in the Equipment Schedule are the responsibility of the Design-Builder.
- 7.9.10.2(3) The Design-Builder will meet with the Authority IT Representative to determine exact specifications of equipment, room configuration, set up, and commissioning.
- 7.9.10.2(4) The Design-Builder will provide training for building staff of all videoconferencing and audio visual equipment unless otherwise specified by the Authority IT Representative.

- 7.9.10.2(5) The Design-Builder will turn over complete, full functional Video Conference Rooms to the Authority IT Representative four (4) weeks in advance of Service Commencement.

#### 7.9.11 Central Dictation

##### 7.9.11.1 Basic Requirements

- 7.9.11.1(1) All telephones in the building will be programmed by the Authority IT Representative to access the dictation system.

##### 7.9.11.2 Performance Criteria

- 7.9.11.2(1) All telephones will allow staff the ability to dictate onto the central dictation systems. An access code will be needed to access the dictation system.

#### 7.9.12 Intercommunication System

##### 7.9.12.1 Basic Requirements

- 7.9.12.1(1) Internal communication systems within hospitals are an important part of ensuring clinical staff can deliver and receive timely information.
- 7.9.12.1(2) Local Video Intercom systems are required at locked entrance doors that delivery personnel or the public will need access through.
- 7.9.12.1(3) The local intercom systems will be manufactured by recognized industry leaders in the intercom business.

##### 7.9.12.2 Performance Criteria

- 7.9.12.2(1) A video intercom system will be provided at all entrance locations.
- 7.9.12.2(2) The Design-Builder shall provide local intercom systems at all locations requiring Public delivery access. The system will be capable of remotely unlocking the door.
- 7.9.12.2(3) A camera shall view the face of anyone using any outside entrance door intercom station.
- 7.9.12.2(4) Intercommunication shall be provided between elevators and central elevator controller and switchboard/help desk/ call centre.

## 7.9.12.2(5) Overview

- 7.9.12.2(5)(a) The system shall consist of all parts necessary to create a fully functional system. This includes stations, cabinets, and cables.

## 7.9.12.2(6) Work Included

- 7.9.12.2(6)(a) Work to be done under this Section shall include furnishing of labour, materials, and equipment required for installation, testing and putting into proper operation complete systems as specified and as otherwise required.

- 7.9.12.2(6)(b) System as provided by the manufacturers will include the following:

- (b).1 Supply and installation of control equipment including auxiliary power supplies.
- (b).2 Supply and installation of all system equipment and devices
- (b).3 Supply and installation of all wiring required for complete system operation.
- (b).4 All required device set-up and system programming, testing and verification including all user selectable functions set up to Owner's desired settings. Review settings with Owner prior to implementation.
- (b).5 Complete layout, wiring and installation diagrams for overall system design, updated to "as built" condition at the Design-Builder's completion and incorporated into maintenance manual.
- (b).6 Complete instruction to Owner on system operation.
- (b).7 Technical data on each product, including finishes
- (b).8 Description of system operation.
- (b).9 Riser diagrams and system data.
- (b).10 Equipment design considerations for future expansion when indicated.
- (b).11 Materials list and backbox schedule (including unique backboxes).

- (b).12 Factory prepared operation and service manual for each system, operation details, schematics, wiring diagrams, colour coding, terminal numbers, and component values for printed circuit board

#### 7.9.12.2(7) System Verification

- 7.9.12.2(7)(a) Test and demonstrate the operation of the complete system to the Owner. This shall include, but not be limited to:

- (a).1 Detailed test and demonstration of each operable device
- (a).2 Detailed test and demonstration of overall system operation
- (a).3 Interfacing of various components.

#### 7.9.12.2(8) PRODUCTS – Stations

- 7.9.12.2(8)(a) Stations shall be of the following types:

- (a).1 Desk mounted,
- (a).2 Wall mounted
- (a).3 Flush mounted.

### 7.9.13 Integration with Health Authorities

#### 7.9.11.1 Basic Requirements

- 7.9.13.1(1) The electronic health record (all patient information is stored electronically) is the standard the Owner has adopted. The building's IT Systems are to allow for the transmission, storage, and retrieval of the electronic health record within the building.
- 7.9.13.1(2) IT Systems integration will comply with all applicable IEEE, CSA, TIA / EIA, and BICSI standards and all applicable Owner standards in effect at the time of installation of the IT, building and communications systems.

#### 7.9.13.2 Performance Criteria

- 7.9.13.2(1) The Design-Builder will at minimum provide IT and communications systems that are capable of integration with the Owner's existing systems and future new systems to allow

seamless communications between other health facilities in the region and the building.

#### 7.9.14 TV System

##### 7.9.14.1 Basic Requirements

- 7.9.14.1(1) Provide TV service including end use devices such as televisions (minimum 812 mm diagonal viewing area) in all reception areas, waiting areas, and patient rooms.
- 7.9.14.1(2) The Owner will be responsible for on-going contracts with content providers and for any interface with users of the system. Following initial installation, maintenance and refresh of equipment such as replacement televisions will be the responsibility of the Owner. Maintenance of the wiring infrastructure is the Design-Builder's responsibility with the nominal demarcation point being the face plate on the wall.
- 7.9.14.1(3) The type of end-use device is dependent upon the type of system the Design-Builder utilizes but patients and staff will be able to change program channels as easily as a standard television via a menu and remote control.
- 7.9.14.1(4) The system will be manufactured by an industry leader and all components will be of that manufacturer.
- 7.9.14.1(5) If the system is NTSC broadband video, it will meet the CRTC standards and operate in the 8dbmv to 7dbmv range.
- 7.9.14.1(6) All Televisions need to be Hospital Grade Televisions (Televisions that are specially manufactured to meet the needs of hospitals and healthcare facilities. Hospital Grade Televisions are equipped with approved hospital-grade plugs and include features used by hospitals such as ports for pillow speakers).
- 7.9.14.1(7) Patient room televisions require Pillow Speakers with built in remote.
- 7.9.14.1(8) All televisions need IP and coax ports.
- 7.9.14.1(9) All Power, data, coax and audio cable for pillow speakers will be terminated and centered behind all patient room TVs. In addition, audio lines for pillow speakers will be terminated at head of patient beds.



7.9.14.1(10) All waiting room and reception area televisions require either infrared remotes with programmable remote id capability or radio frequency remotes.

7.9.14.1(11) Television mounting height should be between 60" and 65" from the floor and positioned for optimal viewing from the patient bed.

#### 7.9.14.2 Performance Criteria

7.9.14.2(1) All waiting areas will be provided with free access to a TV.

7.9.14.2(2) Public area TVs will require access to patient education and local TV channels only.

7.9.14.2(3) Portable cart based systems with personal computers or TVs and DVD / Blue Ray players will be provided that can connect to this system in the conference room.

7.9.14.2(4) The system will access the network allowing the Owner to display education materials and potentially other clinical applications on the in-room display / computer / TV.

7.9.14.2(5) System shall be capable of accepting a video input for rebroadcasting throughout the internal RF TV distribution network for display on any TV.

#### 7.9.15 Patient/Staff Education System

##### 7.9.15.1 Basic Requirements

7.9.15.1(1) The Owner will provide the application services, programs and electronic educational material that will be displayed on the Patient/staff education system.

7.9.15.1(2) The Authority IT Representative will provide specifications for the design, procurement and construction of the Patient/Staff Education System that will allow these applications to be displayed to Patients and building staff.

#### 7.9.16 Time Systems

##### 7.9.16.1 Basic Requirements

7.9.16.1(1) Provide a wireless centralized master clock system that will synchronize all network clocks to matching time, provide

automatic correction for daylight savings time and self correct if power fails.

7.9.16.1(2) The master time controllers and all clocks will be provided by a recognized industry leader and all components will be of the same manufacturer.

7.9.16.1(3) Pre-approved manufacturers are:

7.9.16.1(3)(a) Visiplex

7.9.16.1(3)(b) Primex

7.9.16.2 Performance Criteria

7.9.16.2(1) 50 wall-mounted clocks will be provided, as a minimum. Clocks will be analogue type, at least 355 mm diameter with 24-hour numbering.

7.9.16.2(2) Clock correction signals will be available throughout the building.

7.9.17 Responsibility Matrix

7.9.17.1 The responsibilities of the Design-Builder and the Authority IT Representative with respect to the IT system are summarized within the table below:

	Guidelines/Comments	Design	Procure, Install
<b>Network Design and Installation</b>	<p><b>The Design-Builder:</b> Design the physical infrastructure, procure, install, and commission/test all of its installations. Supply of design requirements for any building, clinical or communications system being designed by the Design-Builder and requiring IP configuration, for approval by the Authority IT Representative. Procurement of all required licenses.</p> <p><b>Authority:</b> Design the Logical IT Network, configure the Network, provide instructions with respect to integration and complete final testing.</p>	<p>The Design-Builder (Physical Infrastructure)</p> <p>Authority (Logical IT Network)</p>	The Design-Builder
<b>Structured Cabling</b>	<p><b>The Design-Builder:</b> Design of physical cabling infrastructure, procure, install, commission/test of all its installations for end to end cabling. Responsible for terminating at both ends, testing, and labeling. Procurement of all required licenses.</p> <p><b>Authority:</b> Approval of the Design-Builder design and commissioning/testing work and labeling method and requirements. Provide location of data drops and complete final testing.</p>	<p>The Design-Builder (Physical Infrastructure)</p> <p>Authority (Logical IT Network)</p>	The Design-Builder

<b>Network Equipment</b>	<p><b>The Design-Builder:</b> Procure and installation of network equipment based on the Authority's Logical IT Network design, Equipment List or as specified by the Authority IT Representative. Testing/commissioning of all installations and user training. Procurement of all required licenses.</p> <p><b>Authority:</b> Design the Logical IT Network, provide specification for network equipment, complete network equipment configurations and final testing of network equipment with functional network.</p>	<p>The Design-Builder (Physical Infrastructure)</p> <p>Authority (Logical IT Network)</p>	<p>The Design-Builder</p>
<b>Wireless Infrastructure</b>	<p><b>The Design-Builder:</b> Design the physical infrastructure based on the Logical IT Wireless Network design provided by the Authority IT Representative. Procure, install, and commission/test of wireless infrastructure. Provide training. Procurement of all required licenses.</p> <p><b>Authority:</b> Design the Logical IT Wireless network, Approve all design and commissioning/testing work completed by the Design-Builder. Provide specifications as required to ensure that the system meets Authority requirements and conduct final testing.</p>	<p>The Design-Builder (Physical Infrastructure)</p> <p>Authority (Logical IT Network)</p>	<p>The Design-Builder</p>
<b>Wireless Staff Communications System</b>	<p><b>The Design-Builder:</b> Design, procure, install, and commissioning/testing of infrastructure and system components and clinical user training. Procurement of all required licenses.</p> <p><b>Authority:</b> Provide IT information to the Design-Builder as required and approve design, installations and final testing/commissioning.</p>	<p>The Design-Builder</p>	<p>The Design-Builder</p>
<b>Telephony</b>	<p><b>The Design-Builder:</b> Procure, install, commissioning/testing of all equipment and the Design-Builder installations. Supply of all licences with extra capacity as required by the Authority IT Representative. Operational and maintenance costs of the incoming telephone/data services prior to Service Commencement.</p> <p><b>Authority:</b> Design and final testing and configuration of telephony system.</p>	<p>Authority</p>	<p>The Design-Builder</p>
<b>Clinical Information Systems</b>	<p><b>The Design-Builder:</b> Procure equipment required for the Clinical Information Systems. Supply of all licenses as specified by the Authority IT Representative.</p> <p><b>Authority:</b> Design, build and testing of the Clinical Information System.</p>	<p>Authority</p>	<p>The Design-Builder (Procure)</p> <p>Authority (Install)</p>
<b>Video Conferencing</b>	<p><b>The Design-Builder:</b> Design, procure and installation, commissioning/testing of video conference infrastructure as set out in the Authority's Video Conferencing Standards. Procurement of all required licenses.</p> <p><b>Authority:</b> Approval of design and installation and user training.</p>	<p>The Design-Builder</p>	<p>The Design-Builder</p>
<b>Central Dictation</b>	<p>Central dictation is provided as part of the telephony system. Design-Builder is responsible for procurement of all required licenses.</p>	<p>Authority</p>	<p>Authority</p>
<b>Staff/Patient Education</b>	<p><b>The Design-Builder:</b> Design, procure and installation, commissioning/testing of patient education infrastructure as set out in the Authority's specifications. Procurement of all required Licenses.</p>	<p>The Design-Builder</p>	<p>The Design-Builder</p>

	<b>The Authority:</b> Provision of Staff/Patient Education system specifications and approval of design and installation.		
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## 7.9.18 Nurse Call

### 7.9.18.1 Basic Requirements

- 7.9.18.1(1) Supply and install nurse call systems in each patient care area in the Facility. The nurse call system will be the latest proven technology at the time of the Construction.
- 7.9.18.1(2) The nurse call system will be of the same manufacturer throughout. The system will be capable of network operation to allow the tracking of calls via the system manufacturers' call management software if required.
- 7.9.18.1(3) The call management software will record all calls from all departments, response time and allow trending and report generation.
- 7.9.18.1(4) Programming and staff communication device allocation will be accessible from the associated nursing station computer.
- 7.9.18.1(5) The nurse call system will integrate with marqueees or LCD electronic message boards and wireless staff communication devices (PDA's, phones, badges) for near instant alarm response. The wireless staff communication device will be user friendly (no more than 2 buttons to answer a nurse call), be impact and water resistant, and operate seamlessly with the nurse call system allowing two-way voice communication into all patient rooms.
- 7.9.18.1(6) The nurse call system corridor lights will have a minimum of (4) four lamps. Lamps will be LED and fully programmable.
- 7.9.18.1(7) The nurse call systems will be:
  - 7.9.18.1(7)(a) Rauland, Responder V or better;
  - 7.9.18.1(7)(b) General Electric, Telligence or better;
  - 7.9.18.1(7)(c) Simplex, EZ Care 5009 or better; or

7.9.18.1(7)(d) Austco, MediCom or better.

#### 7.9.18.2 Performance Criteria

- 7.9.18.2(1) The nurse call systems will be supplied and installed in each medical department that contains patient care areas. All nurse call systems will have two-way voice capabilities as well as tone and light communication.
- 7.9.18.2(2) All nurse call systems will be networked together to allow calls to be forwarded to other areas and for call management.
- 7.9.18.2(3) All patient care areas will have nurse call devices installed in locations described; Each location where a patient receives care or treatment (bed, stretcher, chair, table, etc) will have a staff assistance call pushbutton and a code blue call pushbutton. At each of these locations where a patient could be left unattended a patient call will also be required. Each location where a patient has access to bathing or bowel relief facilities (shower, toilet, tub) will have an emergency call station. Such stations will be within reach of a patient without the patient having to move from the facility.

Each nurse call initiation device will have visual annunciation to the corridor immediately outside the room containing the device. Where multiple devices of similar type are provided in the same room individual annunciation will be required adjacent each location of patient care or treatment.

Every major corridor within an area of patient care will be required to clearly annunciate the exact location of all rooms where a nurse call initiation device within the same nurse call control area (department) has been activated.

- 7.9.18.2(4) Call cords, bath stations, staff assist, and emergency call buttons will be located for ease of use for their intended purpose.

- 7.9.18.2(5) All rooms where a nurse call device is installed will have a multi-call classification dome light (minimum 4-lamps) to annunciate the calls. The dome light will be located to provide staff the best possible view on the outside of the room where the nurse call stations are located.
- 7.9.18.2(6) All calls will be annunciated at nurse call master stations. Master stations will be capable of linking together to allow shift programming (day/night) annunciation of calls at different nursing stations.
- 7.9.18.2(7) Work with the Authority, including meeting with Authority staff as required, to determine functional programming requirements for the nurse call system. Allow for three (3) two hour training sessions for nursing staff and two (4) four-hour training sessions for maintenance staff, and five (5) hours of extra programming.
- 7.9.18.2(8) Tone stations will be provided in each department in sufficient quantities such that the calls can be heard from all locations within the department.
- 7.9.18.2(9) Nurse call field panels will be located in communication rooms as near as possible to the department they serve.
- 7.9.18.2(10) Utilize structured Cat 6 cabling for all nurse call system devices.
- 7.9.18.2(11) Fault monitoring will be a standard feature of the nurse call system. Faults such as communication failure, power failure, and CPU faults will be monitored.
- 7.9.18.2(12) System faults or failures will be repaired within twelve (12) hours of call origin.
- 7.9.18.2(13) For all electronic patient beds with built in patient operated functions allow connection into the nurse system, provide the appropriate interface cable.
- 7.9.18.2(14) All nurse call systems will be supplied power from the vital power distribution system and will have a minimum 30 minutes of battery standby.

## 7.9.19 Code Blue System

### 7.9.19.1 Basic Requirements

- 7.9.19.1(1) The code blue system will form part of the nurse call system.
- 7.9.19.1(2) The system will annunciate at a location designated by the Authority so that the clinical code blue response team will be paged automatically, and the code blue will automatically display on the wireless handheld devices.
- 7.9.19.1(3) Meet with clinical staff and set in place the Authority's response criteria for code blue situations.

### 7.9.19.2 Performance Criteria

- 7.9.19.2(1) All patient care departments will have code blue buttons located at the nurse's station or reception desk as well as individual patient care and treatment environments to initiate the code blue response.

## 7.10 Electronic Safety and Security (Division 28)

### 7.10.1 Fire Alarm

#### 7.10.1.1 Basic Requirements

- 7.10.1.1(1) The fire alarm system will be designed, installed and verified to meet the latest applicable versions of the following standards.



7.10.1.1(1)(a) Can / ULC S524-06 with Addendum Standard for installation of Fire Alarm Systems

7.10.1.1(1)(b) Elevator Code CSA B44-07

7.10.1.1(2) In addition to the building wide audio and visual fire alarm indications, the fire alarm system will annunciate the approximate fire location on the in use wireless staff communications devices and on the building management system.

7.10.1.1(3) The system will utilize the latest proven technology available at the time of installation.

#### 7.10.1.2 Performance Criteria

7.10.1.2(1) Provide a fully addressable, two stage computer based fire alarm system throughout the new building.

7.10.1.2(2) The fire command centre will include a fire alarm control panel, a fire alarm graphic annunciator panel, a fire alarm colour graphics computer, and an elevator status/control panel.

7.10.1.2(3) Smoke and heat detectors will be individually field programmable and include multiple elements for earliest detection, individually adjustable for ambient environmental conditions.

7.10.1.2(4) Audible annunciation will be a zoned overhead fire alarm speaker system. Audible alert levels will be 15dBA above ambient with minimum of 75dBA and be audible in every room in the building.

7.10.1.2(5) Emergency paging will be accessible via microphone at the fire command centre.

7.10.1.2(6) Train staff on operation of system and incorporate fire plan in training to alert staff to policy and procedures in case of fire alarm and safe gathering points in case of evacuation.

7.10.1.2(7) Visual annunciation will be via building graphic annunciators, a computer workstation, room annunciators provided at all care (nursing) stations (excluding care substations) and main control reception areas.

- 7.10.1.2(8) All alarms, trouble signals and other information will be enunciated at the building call centre location.
- 7.10.1.2(9) The system will include pre-programmed voice messaging to automatically audibly announce the location of the alarm.
- 7.10.1.2(10) After installation is complete the system will be verified in accordance with CAN/ULC-S537 and report submitted.

## 7.10.2 Access Control and Panic Duress Systems

### 7.10.2.1 Basic Requirements

- 7.10.2.1(1) Provide an access control system, intrusion detection systems, and a building wide panic duress system (wired and wireless). Provide data drops where required for all end use devices that may be IP connected or enabled.
- 7.10.2.1(2) Determine security needs with the Owner. Supply one hundred fifty (150) access cards including programming, fifty (50) blank access cards, and all software and equipment required to do card programming. Additional access cards will be the responsibility of the Owner.
- 7.10.2.1(3) Location of all security devices and monitoring requirements to be identified.
- 7.10.2.1(4) All alarm annunciation requirements are to be identified.
- 7.10.2.1(5) All security systems will connect to the structured cabling system and network devices to allow the Owner to review and monitor these systems from off-site locations.
- 7.10.2.1(6) The Owner staff shall be fully trained on the use, operation, and location of all security devices.
- 7.10.2.1(7) All systems to be the latest proven technology supplied by industry leading manufacturers in the security industry at the time of construction.
- 7.10.2.1(8) Systems will be interconnected to the fire alarm system where required.

### 7.10.2.2 Performance Criteria

- 7.10.2.2(1) Design, provide and install the security systems with Owner input to meet the objectives of their security programs.

- 7.10.2.2(2) Card access control of all staff entrances, staff lounges, the clinical office and exam room suite and all laboratory entrances from the public corridors and elevators will be provided. Card access control of select spaces within department areas will be provided as required for additional tiered security. The Card Access System will have multiple zones to distinguish access between the many departments.
- 7.10.2.2(3) The access control system will be PC based, contain an integral photo identification card system, and have sufficient capacity to handle at minimum 10,000 regional employees down to the field panel level, can grant or restrict access to employees via a programmable classification system, and run over a standard TCP/IP Ethernet network.
- 7.10.2.2(4) The system will utilize a central Owner's file server. Allow for a minimum of (5) additional workstation licenses.
- 7.10.2.2(5) Alarms will be annunciated at the building management call centre / alarm management centre location at minimum.
- 7.10.2.2(6) Location of access control doors and door alarms will be coordinated with the building. Areas to be included are:
  - 7.10.2.2(6)(a) Labs
  - 7.10.2.2(6)(b) Elevators
  - 7.10.2.2(6)(c) Stairwells
  - 7.10.2.2(6)(d) Exterior entrances
  - 7.10.2.2(6)(e) Pharmacy
  - 7.10.2.2(6)(f) Seclusion Room
  - 7.10.2.2(6)(g) Morgue

### 7.10.3 Intrusion Detection

#### 7.10.3.1 Basic Requirements

- 7.10.3.1(1) Intrusion detection systems will be part of the access control system and installed in all areas where protection of physical assets is critical, such as Pharmacy, Supply areas, and PYXIS area. Minimum requirement to be as per specification and Section 7.10.3.2 below.

#### 7.10.3.2 Performance Criteria

- 7.10.3.2(1) The intrusion detection system will utilize industry proven devices for intrusion detection. These devices include motion

detectors, magnetic door contacts, and glass breakage detectors.

#### 7.10.4 CCTV

##### 7.10.4.1 Basic Requirements

- 7.10.4.1(1) Areas which have CCTV cameras installed will have signage posted to notify the public that the area is under video surveillance.
- 7.10.4.1(2) CCTV processes will be governed by the Public Surveillance System Privacy Guidelines for the Province of BC as well as the Freedom of Information and Protection of Privacy Act.
- 7.10.4.1(3) System(s) will be a software-based virtual matrix using the structured cable plant for transmission and recording of images.

##### 7.10.4.2 Performance Criteria

- 7.10.4.2(1) The system must be able to record clear images of individuals, which would allow distinction of gender, ethnicity and age category. System will provide recorded images of sufficient quality to be used as court evidence in Canada.
- 7.10.4.2(2) Cameras will not be placed or reviewed for the purpose of observing work performance of employees.
- 7.10.4.2(3) Viewing monitor will have a visible range from 200mm to 450mm, depending on location and application.
- 7.10.4.2(4) Provide encoding/decoding capability to support 2 way (video and control) communications with any and all CCTV cameras, individually and/or in predetermined clusters via the security Ethernet infrastructure.
- 7.10.4.2(5) Provide CCTV system video monitors for department staff to locally monitor cameras associated with the general activity outside the main entrance to the area and adjoining waiting areas.
- 7.10.4.2(6) Provide digital PC based video recorder (network video recorder) complete with software that controls all parameters of each individual camera, pan tilt zoom functionality, frame by frame recording, pre and post alarm recording, motion detection, sequence switching, multiplexing, adjustable frame

speeds, and will record all cameras 24-hours per day, 7 days a week in real time (30 frames per second). All cameras will be IP addressable. At a minimum, the system will include super-dynamic digital cameras.

- 7.10.4.2(7) Provide video storage capacity for minimum of 30 days at 30 frames per second, minimum D1 resolution. Provide NVR's, workstations and connect to network. System will have the ability to choose recording rates and quality for each camera, have activity detection and incorporate smart search capabilities.
- 7.10.4.2(8) CCTV system will integrate with access control, duress panic stations, intercoms and intrusion detection to allow for higher recording rates during alarm conditions.
- 7.10.4.2(9) CCTV display and review system will be network based application allowing for authorized users to remotely view, control and manage all aspects of the CCTV system across the network. System will have network and web access for remote monitoring, using predefined user authentication.
- 7.10.4.2(10) Display and review for all the cameras will be accessible through dual screen workstations located in the security office/kiosk . Provide CCTV workstations with all required operating and application software, monitors, keyboard, mouse with interconnection to security system network.
- 7.10.4.2(11) Provide color high-resolution, high sensitivity (day/night) fixed smoke dome type with an auto iris fixed dome cameras with auto-iris lens operation.
- 7.10.4.2(12) Mounting will be unobtrusive, matching colour with hidden cabling. Fixed cameras will be vandal resistant wall mounted and / or mounted at protective locations and heights.
- 7.10.4.2(13) PTZ color dome cameras will be high resolution, high-speed with low light day/night operation capability with 360 degrees rotation in less than 3 seconds. Domes will mount on poles, parapets and walls located to provide optimum unobstructed viewing of the area under surveillance. PTZ cameras will have the ability to mask portions of view through software and remote programming.

- 7.10.4.2(14) Outdoor cameras will be complete with weatherproof housing and internal heater/ defroster/blower/wiper as required for suitable operation under varying environmental conditions.
- 7.10.4.2(15) Cameras will not be set up in private areas such as patient rooms, treatment rooms or clinical areas (unless specifically identified for use by clinical department staff), locker rooms or washrooms.

**PART 8 SITE AND INFRASTRUCTURE SUBGROUP SPECIFICATIONS****8.1 Earthwork (Division 31)**

## 8.1.1 Clearing and Grubbing

## 8.1.1.1 Performance Criteria

- 8.1.1.1(1) Prevent damage to trees, benchmarks, existing curbs and subsurface utilities to remain. Remove cleared and grubbed materials off-site to disposal area as directed by the Owner and the Village of Burns Lake Soil Deposit Bylaw requirements.

**8.2 Exterior Improvements Division (32)**

## 8.2.1 Aggregate Base Courses

## 8.2.1.1 Basic Requirements

- 8.2.1.1(1) Granular sub-base will be utilized for stability of surface treatment through freeze thaw cycles and for its ability to store rainwater

## 8.2.1.2 Performance Criteria

- 8.2.1.2(1) The depth of aggregate base courses will be designed to exceed limits defined by regional freeze thaw cycles averaged over a twenty year period.

## 8.2.2 Asphalt Paving

## 8.2.2.1 Basic Requirements

- 8.2.2.1(1) Asphalt paving will be utilized in areas where vehicle traffic and snow clearing equipment require a smooth surface for travel.

## 8.2.2.2 Performance Criteria

- 8.2.2.2(1) Asphalt mix will be designed for use in climatic conditions found on Project Site.

## 8.2.3 Unit Paving on Sand Bed

## 8.2.3.1 Basic Requirements

- 8.2.3.1(1) Unit pavers will be utilized in areas where a high level of finish is desired and/or a requirement for removal and replacement of paved surface in the future.
- 8.2.4 Concrete Paving
  - 8.2.4.1 Basic Requirements
    - 8.2.4.1(1) Concrete paving will be utilized in areas that require firm, long lasting hard surfaces for activities such as pedestrian pathways, loading docks and building entrances.
- 8.2.5 Fences and Gates
  - 8.2.5.1 Performance Criteria
    - 8.2.5.1(1) Fence materials will be designed and fabricated to guarantee a minimum 5-year lifetime.
    - 8.2.5.1(2) Fences will be installed as per manufacturer's directions, or custom designed with footings to withstand freeze thaw cycles in the region averaged over the last twenty years.
- 8.2.6 Exterior Site Furnishings
  - 8.2.6.1 Basic Requirements
    - 8.2.6.1(1) Site Furnishings will consist of benches, garbage containers, tables and chairs, and umbrellas, to provide seating for a minimum of eight (8) people in any outdoor area adjacent to the building for staff, patients and visitors. Products will be selected on the basis of safety, comfort, design and materials that relate to the building architecture and landscape design, durability and required maintenance.
  - 8.2.6.2 Performance Criteria
    - 8.2.6.2(1) Products will be selected for their suitability and durability for the Northern climate.
- 8.2.7 Growing Medium
  - 8.2.7.1 Basic Requirements
    - 8.2.7.1(1) Growing medium will be a mixture of mineral particulates, micro organisms and organic matter which will provide a suitable topsoil medium for supporting plant growth.



## 8.2.8 Hydroseeding

### 8.2.8.1 Basic requirements

- 8.2.8.1(1) Hydroseeding will be located in areas near building entrances, and outdoor patio spaces to provide a usable surface for staff breaks, visiting, passive recreation and occupational therapy.

### 8.2.8.2 Performance criteria

- 8.2.8.2(1) Hydroseeding will comply with the current edition of the BC Landscape Standard, published by the BC Society of Landscape Architects and the BC Landscape and Nursery Association.

## 8.2.9 ~~Trees, Shrubs and Ground Cover Planting~~ DELETED

## 8.3 Utilities (Division 33)

The Utility works must service the building and the expected land use with a reliable infrastructure that must be maintainable without disrupting the effective operation of the hospital and related land uses. Where applicable all work in this section will be carried out in accordance with the Master Municipal Construction Documents (MMCD) latest addition.

### 8.3.1 Manholes and Catch Basins

#### 8.3.1.1(1) Section Includes

- 8.3.1.1(1)(a) Monolithic concrete manholes with transition to lid frame, covers, anchorage, and accessories.
- 8.3.1.1(1)(b) Modular precast concrete manhole sections with tongue and groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

### 8.3.2 Site Water Utility Distribution Piping

#### 8.3.2.1 Basic requirements

#### 8.3.2.1(1) Section Includes

- 8.3.2.1(1)(a) Pipe and fittings for Site water line including domestic water line and fire water line.

8.3.2.1(1)(b) Valves, fire hydrants and domestic water hydrants.

### 8.3.3 Site Sanitary Sewerage Piping

#### 8.3.3.1 Basic requirements

##### 8.3.3.1(1) Section includes

8.3.3.1(1)(a) Sanitary sewerage drainage piping, fittings, accessories, and bedding.

8.3.3.1(1)(b) Connection of building sanitary drainage system to municipal sewers.

8.3.3.1(1)(c) Clean out access.

### 8.3.4 Storm Sewer Water Drains

#### 8.3.4.1 Basic requirements

##### 8.3.4.1(1) Section includes

8.3.4.1(1)(a) Site storm sewerage drainage piping, fittings and accessories, and bedding.

8.3.4.1(1)(b) Connection of drainage system and stormwater retention facility.

8.3.4.1(1)(c) Catch basins, plant area drains, paved area drainage, and Site surface drainage.

#### 8.3.4.2 Performance Criteria

8.3.4.2(1) Design the onsite storm water retention to hold storm runoff in accordance with rainfall predicted by the BC Building Code but at a minimum the amount of retained water will be not less than 200 cubic metres unless it can be demonstrated that other site features or strategies will account for the full volume.

### 8.3.5 Foundation Drainage

#### 8.3.5.1 Basic requirements

##### 8.3.5.1(1) Section includes

8.3.5.1(1)(a) Building perimeter, retaining wall and under slab on fill weep drainage system.

- 8.3.5.1(1)(b) Filter aggregate, fabric and bedding.
- 8.3.5.1(2) Pipe materials will be
  - 8.3.5.1(2)(a) Polyvinyl Chloride pipe: to ASTM D2729, with required fittings or;
  - 8.3.5.1(2)(b) Concrete pipe: to ASTM C412, with required fittings.
- 8.3.5.1(3) Accessories will be
  - 8.3.5.1(3)(a) Pipe coupling: solid.
  - 8.3.5.1(3)(b) Joint cover: No. 15 or 30 asphalt saturated roofing felt or polyethylene.
  - 8.3.5.1(3)(c) Filter Fabric: Water pervious type, black polyolefin or polyester.
- 8.3.5.2 Performance criteria
  - 8.3.5.2(1) Foundation drainage will carry all sub-surface ground water away from footings and foundation walls and into the onsite storm drainage system.
  - 8.3.5.2(2) Installation will meet the requirements of the B.C. Building Code, and all applicable municipal codes and bylaws.
- 8.3.6 Natural Gas Site Piping
  - 8.3.6.1 Basic requirements
    - 8.3.6.1(1) Section includes
      - 8.3.6.1(1)(a) Pipe and fittings for Site utility natural gas distribution.
    - 8.3.6.1(2) Quality Requirements
      - 8.3.6.1(2)(a) ANSI B31.2 Fuel Gas Piping
      - 8.3.6.1(2)(b) NFPA 54 National Fuel Gas Code
      - 8.3.6.1(2)(c) NFPA 58 Liquefied Petroleum Gas Code
  - 8.3.6.2 Performance Criteria

- 8.3.6.2(1) Perform work in accordance with the requirements of the gas transmission utility, and all local governing codes and bylaws.
- 8.3.6.2(2) Welding Materials and procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable provincial regulations.
- 8.3.6.2(3) Welders Certification: In accordance with ASME SEC IX.
- 8.3.6.2(4) Conform to NFPA 54, NFPA 58, ANSI B31.2, ANSI B31.8.

**8.4 Transportation (Division 34) – not used**