

INTEGRATED INFRASTRUCTURE SERVICES

Facility Engineering Services
Facility Planning & Design
Facility Infrastructure Delivery



Edmonton Tower
10111 - 104 Avenue
Edmonton, Alberta
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Facility Design & Construction Consultant Manual

Volume 2

COE-IM-GUIDE-0002

**Technical
Guidelines
v05**



Date of Issue: 2021-09-10



INTENT OF USE

This section was developed for establishing guidelines for the City of Edmonton expectations in designing their facilities. The greatest care has been taken to confirm the accuracy of the information contained herein. The views expressed herein do not necessarily represent those of any individual contributor. Building and building system design continually evolves, and practices change and improve over time, so it is necessary to regularly consult relevant technical standards, codes, and other publications rather than relying on this publication exclusively. The City of Edmonton, authors, and members of the review committee, want to convey that this document does not constitute a project specific design. As such, no part of this guideline alleviates the responsibility of the professionals retained to design and construct specific projects from taking full responsibility and authenticating their designs in accordance with APEGA, AAA, Alberta Building Code, and any other statutory or safety requirements.

Please note all additions and changes made to the Consultant Manual Volumes 1 and 2 have been highlighted in green.

VER	Date	Revision Summary
05	2021-09-10	Additions / revisions highlighted in green
04	2019-07-26	Additions / revisions highlighted in yellow

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Professional Work Product (PWP) Responsibility Matrix		
Authenticator (Seal)	Validator (Permit)	Section(s)
Structural		4.6 - Building Structure
Mechanical		4.11 - Mechanical 4.15 - Pool Systems and Other Water Treatment 4.15.1.2, 4.15.1.11, 4.15.3, 4.15.6, 4.15.7, 4.15.8, 4.15.9, 4.15.10, 4.15.11 4.16 - Arenas 4.16.1.6, 4.16.1.9, 4.16.3, 4.16.4, 4.16.2 thru .5, 4.16.6, 4.16.2 Appendix A - section 1 mechanical Equipment Appendix G - Gas Detection Guideline Appendix H - Spray Park 1.4.4.3, 1.8
Electrical		4.9.7 - Acoustic Considerations: Electrical 4.13 - Electrical 4.15.1.27 - Natatorium Lighting 4.15.1.28 - Equipotential Bonding 4.15.1.31.1 - Chlorine Room Hazardous Assessment 4.15.2.1 - Salt Water Pool Grounding 4.16.2.4- Refrigeration System Appendix A - Section 2 Electrical Equipment Appendix B1 - Standard Network Access Room Layout Appendix C - Security and Card Access System Design Guidelines Appendix C1 - Standard Security Drawings Appendix C2 - Security Specifications Template Card Access Appendix C3 - Security Specifications Template Non-Card Access



		<p>Appendix D - Video Surveillance System Design Guidelines Appendix E - Arc Flash Design Guidelines Appendix F - Fire Alarm Communication Design Guidelines Appendix F1 - Standard Fire Alarm Dialer Drawings Appendix G - Guideline for Gas Detection System Sections 2.3.20, 2.4.7, 2.12.11 Appendix H - Section 1.9 Electrical</p>
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4. Technical Guidelines

4.1. Introduction

- 4.1.1. This document is Consultant Manual - Volume 2 of 2, and contains Section 4 – Technical Guidelines. This document is intended to be used with Volume 1 of 2 to form a complete manual.
- 4.1.2. The Consultant Manual – Volume 1 of 2 contains the following sections:
 - 4.1.2.1. Section 1 – Introduction. Establishes the scope of the document and gives general contact information.
 - 4.1.2.2. Section 2 – Design Process. Describes the information flow on a typical project, standard deliverables expected at each design phase and an overview of minimum document and CAD standards to be followed.
 - 4.1.2.3. Section 3 – Design Guidelines. Describes policies and design requirements specific to the City of Edmonton Integrated Infrastructure Services Group that are to be considered when designing buildings. The contents of this section may not apply to all building projects.
- 4.1.3. [Consultant Manual – Volume 1 of 2.](#)
- 4.1.4. No content in either volume of this manual is designed for verbatim specification use and in general, content should not be copied directly into a book spec for any project unless the consultant is explicitly so instructed. Note: this does not apply to Fire Alarm Dialer and typical security and card access details in this Volume.

4.2. General

- 4.2.1. This section contains technical guidelines to follow when designing new buildings or major renovations for the City of Edmonton. These guidelines are to be used in conjunction with professional judgment to ensure that they are followed only to the extent they are appropriate. Consultants remain ultimately responsible for the design.
- 4.2.2. More specifically, the intent of this section is to:
 - 4.2.2.1. Describe the minimum requirements for various building components, assemblies, and systems that have an impact on serviceability and anticipated life cycle of the facility.
 - 4.2.2.2. Alert consultants to design aspects that historically have been problematic.
 - 4.2.2.3. Provide solutions or problem avoidance techniques that have been developed through experience and have proven to be practical and effective.
 - 4.2.2.4. Provide a vehicle for communicating departmental design standards to consultants in an effective and expedient manner.
 - 4.2.2.5. Indirectly, provide a basis for evaluating designs.
- 4.2.3. No attempt is made to address every conceivable condition. Rather, common sense solutions are provided where experience has indicated that problems commonly arise. This experience can be applied to new designs as a preventative measure, and to existing buildings to address problems that are attributable to design and/or execution that does not conform to these technical design requirements.

- 4.2.4. Where these guidelines do not address a technical design issue that arises on a project, it is the consultant's responsibility to address it. When a requirement, though normally applicable, may not be appropriate for a specific project, the consultant should propose an alternative for consideration by the project team. This may include the design of facilities for temporary or short-term use.
- 4.2.5. Innovative designs or products are encouraged after thorough consideration of potential benefits and risks, value analysis, and life cycle cost. Consult project team members and persons with expertise in facility operation and maintenance.
- 4.2.6. Designs are required to comply with all applicable codes and regulations. Where the technical design requirements contained herein differ from building codes and other applicable codes and standards, apply the more stringent requirements.

4.3. Site Services

4.3.1. References

- 4.3.1.1. Alberta Environmental Protection:
 - .1 Standards and Guidelines for Municipal Water Supply, Wastewater and Storm Drainage Facilities
 - .2 Stormwater Management Guidelines
 - .3 Risk Management Guidelines for Petroleum Storage Tank Sites
- 4.3.1.2. Alberta Fire Code, by the Alberta Fire Prevention Council
- 4.3.1.3. City of Edmonton Design and Construction Standards. These documents can be found on the City of Edmonton website.
- 4.3.1.4. City of Edmonton Policy C463: Access to City Buildings. This document can be found on the City of Edmonton website.
- 4.3.1.5. Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE 38-02.
- 4.3.1.6. Geometric Design Standards for Canadian Roads and Streets, by the Roads and Transportation Association of Canada

4.3.2. Site Selection

- 4.3.2.1. Existing projects where work may affect landscaped areas will require coordination with Parks.

4.3.3. Site Survey Plan and Site Plan

- 4.3.3.1. Include the following items on the site plan in the contract documents (CI/ASCE 38-02 or similar – Level D and C):
 - .1 Legal description and address of the property, property lines and their legal dimensions, and legal pins.
 - .2 Adjacent trees, sidewalks, roadways, utilities, easements, and how the new development will tie to them.

- .3 Work of the contract and work by other forces and contracts.
- .4 Main floor elevations and geodetic datum and the equated elevation.
- .5 All utilities, including power, water, gas, storm and sanitary sewer, telephone, fiber, and Supernet (required for Libraries).

4.3.4. Site Access

- 4.3.4.1. Design the location of site access in consideration to driveways and intersections adjacent to and opposite the site.
 - .1 Consider accessibility, garbage pick-up, deliveries, fire, and ambulance.

4.3.5. Site Signs

- 4.3.5.1. Determine the locations of signs with due consideration to vehicular sight lines.

4.3.6. Site Grading and Water Management

- 4.3.6.1. A positive sloped surface is to effectively drain water away from the foundation walls. Minimum grade requirements are:
 - .1 10% for 2 meters (Foundation with basement) – Minimum 20 cm drop for final grade on soft landscaping;
 - .2 5% for the first 2 meters (Slab-on-grade) – Minimum 10 cm drop for final grade on soft landscaping;
 - .3 2% for concrete, asphalt, or other impervious surface treatment
- 4.3.6.2. Where rainwater leaders are permitted to splash to grade, address potential ponding, erosion, and icing problems. Provide splash pads and locate rain water leaders away from building entrances and exits.
- 4.3.6.3. Provide drainage as required to meet City bylaw requirements. Coordinate with adjacent properties.

4.3.7. Roads, Walks, and Parking

- 4.3.7.1. Follow the City of Edmonton Design and Construction Standards for design of roads, walks and parking.
- 4.3.7.2. Lay out parking lots and walkways and locate parking fixtures, benches, bike racks, flower beds, etc to facilitate snow clearing and removal and to avoid damage from snow moving equipment. Provide adequate width and turning radii for snow moving equipment. Provide allowances for snow storage on site from snow clearing of walks and pathways and ensure drainage of these areas during melting.
- 4.3.7.3. Ensure separation of vehicular traffic from main pedestrian traffic.
- 4.3.7.4. Design for snow dumping areas to reduce snow removal requirements.
- 4.3.7.5. Provide a pavement structure cross-section for parking and roadways.
- 4.3.7.6. For parking lots where heavy trucks or fire lanes are anticipated, design pavement structures

based on traffic projections.

- 4.3.7.7. Pedestrian walkway surfaces shall be stable, firm, and slip-resistant. A slip-resistant surface provides sufficient frictional counterforce to the forces exerted in walking to permit safe travel. Consideration for site specific attributes is a must: wet, icy, barefoot vs. footwear, speed of travel, etc. Mock-ups may be required to confirm in situ suitability.
 - .1 Exceptions to slip resistance requirements include;
 - .1 Animal containment areas and,
 - .2 Areas of sport activity

4.3.8. Utilities

- 4.3.8.1. All utility service providers are to be contacted to obtain the following information:
 - .1 Existing active and abandoned utilities that may affect or be affected by the construction.
 - .2 Proposed utilities that may affect or be affected by the construction.
 - .3 Determination of the responsibility for relocation and notice timeline requirements (as per existing agreements with the City).
- 4.3.8.2. Where utilities are to be connected to municipal systems, confirm with the City of Edmonton and utility companies the adequacies of their systems to service the site.
- 4.3.8.3. Ensure specification instructs the contractor to provide horizontal and vertical GPS locations of all utilities.
- 4.3.8.4. Early in the design, confirm with City of Edmonton about any restrictions on stormwater discharge to the stormwater drainage system and confirm any impacts that the new development will have on the existing stormwater drainage system or stormwater management facilities. If applicable, provide on-site stormwater storage solutions in cases of limited stormwater drainage system capacity (i.e. storm water retention, bioswales, etc).
- 4.3.8.5. Early in the design, confirm that existing level of building and/or site fire flows are adequate. Efforts must be made to ensure adequate levels of fire protection.
- 4.3.8.6. Contact the utility provider to confirm the municipal water pressure, and fire flow capacity. Determine whether on-site boosting is required for a fire sprinkler system.
- 4.3.8.7. On large sites, locate utilities in utility corridors, keeping in mind any potential for future development.
- 4.3.8.8. Coordinate provisions for future utilities with the City.
- 4.3.8.9. Utilities within integrated sites and park areas with multiple buildings are typically managed and maintained by the City. Assistance from utility companies and cadastral information may not be available. In the absence of information, perform CI/ASCE 38-02 or similar – Level D to Level A collection and depiction of existing subsurface utility data.
- 4.3.8.10. Perform a complete review of all utilities when developing a site within an Integrated Site or park area. Necessary upgrades to existing utility distribution or service connections are to be included as part of the new development.
- 4.3.8.11. Where possible, provide single service connections to each property or integrated site. Size

service connections for anticipated future needs.

4.3.9. Tanks for Petroleum Products

- 4.3.9.1. Comply with the requirements of the Alberta Fire Code, published by the Alberta Fire Prevention Council.
- 4.3.9.2. Comply with the requirements of the Petroleum Tank Management Association of Alberta.
- 4.3.9.3. Verify the need for fuel tanks. Consider using day tanks for emergency generators.
- 4.3.9.4. When tanks are required, above ground tanks are preferred.
- 4.3.9.5. Tanks are to be double-walled complete with leak monitoring of interstitial space between tank walls.

4.3.10. Waste

- 4.3.10.1. Refer to the [City of Edmonton website](#) for up to date Waste Storage Guidelines including preferred bin enclosure plans, bin sizes, and truck specifications, and turning radius.
- 4.3.10.2. Ensure adequate design of concrete pads and paved approaches for front load recycle and waste bins and waste equipment.
- 4.3.10.3. Refer to the City Zoning Bylaw, Section 55.5(6) provides information on waste storage area screening requirements.

4.4. Environment

4.4.1. Hazardous Materials Audit

- 4.4.1.1. The City will independently undertake a Hazardous Materials Audit that shall be included in all applicable project reports and design documents.

4.4.2. Building Considerations

- 4.4.2.1. All identified hazardous materials that will be disturbed in a renovation/demolition are usually completely removed. Hazardous materials removal/disposal is usually the first component of work in a renovation/demolition.
- 4.4.2.2. When selecting materials for a new building or an existing building renovation, asbestos containing materials should be avoided. Typical asbestos products manufactured today are considered non-friable materials (i.e. board and pipe products only).
- 4.4.2.3. Wherever possible avoid the potential for harmful chemical off-gassing when selecting materials for a new building or an existing building renovation. Examples include materials or products such as carpeting, glues, paints, particleboard furniture, etc. that may contain formaldehyde or volatile organic compounds. These materials or products should be off-gassed off site, prior to installing them in the building.
- 4.4.2.4. Construction dust control and clean-up procedures should be implemented to assure building occupants are not overexposed to dust. Controls would include dust barriers, negative air pressure within the construction area, and sealing mechanical ventilation ductwork. Clean-up

procedures would include HEPA vacuuming, wet wiping techniques, and ductwork cleaning.

4.5. Landscape Development

4.5.1. References

- 4.5.1.1. City of Edmonton landscape requirements as per Zoning Bylaw 12800.
- 4.5.1.2. City of Edmonton, Design and Construction Standards, [Volume 5 – Landscaping](#).
- 4.5.1.3. [City of Edmonton Access Design Guide](#)
- 4.5.1.4. [Downtown & The Quarters Downtown Streetscape Design Manual](#)

4.5.2. Exterior Landscape Development

- 4.5.2.1. Refer to City of Edmonton Design and Construction Standards, [Volume 5 – Landscaping](#).
- 4.5.2.2. [City of Edmonton Access Design Guide](#)

4.5.3. Planting Near Buildings and Utilities

- 4.5.3.1. Refer to City of Edmonton Design and Construction Standards, [Volume 5 – Landscaping](#).

4.5.4. Irrigation Systems

- 4.5.4.1. Consult with user department before considering irrigation systems for landscape areas other than those adjacent to facilities.
- 4.5.4.2. Where geotechnical information indicates the presence of highly plastic clay, avoid locating irrigation outlets close to buildings. Changes in moisture content in this type of clay result in volume changes and movement that can damage floors and foundations.
- 4.5.4.3. Provide exterior hose bibs on buildings at every 50 m along building walls.
- 4.5.4.4. Where sewage treatment charges are based on water consumption, provide a separate meter if cost efficient.
- 4.5.4.5. Where practical, contain all irrigation systems and equipment within the property lines of the project.
- 4.5.4.6. Provide pipe sleeves for irrigation systems under roadways and sidewalks. Ensure complete coverage of landscape areas. Design irrigation systems to allow for emptying water from distribution pipes.
- 4.5.4.7. Incorporate rain sensors in irrigation systems to prevent over watering
- 4.5.4.8. Specify low water use systems where appropriate.

4.5.5. Interior Landscape Development

- 4.5.5.1. Provide gravel for drainage in all planting areas and planters.
- 4.5.5.2. In atria, ensure access for maintenance requirements.
- 4.5.5.3. Provide adequate lighting conditions to meet the growing requirements of selected interior

plants.

- 4.5.5.4. Provide interior hose bibs every 15 m along building walls in atria where landscaping exists.

4.5.6. Environmental and Conservation Considerations

- 4.5.6.1. Design to minimize maintenance requirements. Consider irrigation, mowing, trimming, pruning, fertilizing, pesticide application, and general clean-up requirements.
- 4.5.6.2. Use mulches to reduce maintenance and watering requirements for trees and shrubs.
- 4.5.6.3. Irrigation should not be a consideration unless establishment of plant material is threatened.
- 4.5.6.4. Minimize mowed grass areas. Use low maintenance ground cover plantings, including low maintenance grass mixes, where there is no determined function of the grassed space.
- 4.5.6.5. Use plant material to reduce heating and cooling requirements for buildings.
- 4.5.6.6. Use plant material to control snow drifting.

4.6. Building Structure

4.6.1. Design Loads

- 4.6.1.1. The following design loads shall be a minimum. Professional experience and/or the current revision of the Alberta Building Code shall govern:
 - .1 Multi-service facilities: minimum floor occupancy live load 4.8 kPa or 9 kN concentrated, whichever produces the more critical effect.
 - .2 General Office Areas: minimum floor occupancy live load 4.8 kPa or 9 kN concentrated, whichever produces the more critical effect.
 - .3 Records Storage Areas: design live load to be based on type and layout of the proposed storage system, but not less than 7.2 kPa.
 - .4 Mechanical Loads: minimum floor live load 3.6 kPa. Discrete loads from equipment shall be obtained from mechanical and electrical consultant where applicable. In mechanical rooms, allow for a minimum of 100 mm thick concrete housekeeping pads. Effects of vibration should be considered.
 - .5 Roof structures shall be designed with special consideration for plugged roof drains.
 - .6 When there is a known plan to change the usage of an area in the future, design for the more stringent of current and future live loads.
 - .7 Maintenance and Equipment Loads: when the need for heavy equipment due to maintenance and replacement of various components is anticipated, an access path will be designated to accommodate these loads.
- 4.6.1.2. Lift equipment commonly used:
 - .1 Genie Z-30/20N, Z-30/20 RJ, S-40/S-45, Z-34/22 IC
 - .2 JLG 340AJ, 400S

.3 Skyjack SJIII 3226

4.6.2. Photovoltaic Installations

- 4.6.2.1. See Photovoltaic Program Guidelines
 - .1 [Volume 1 - Site Selection Guideline](#)
 - .2 [Volume 2 - Design Guideline](#)
 - .3 [Volume 3 - Construction Guideline](#)
 - .4 [Volume 4 - Operations & Maintenance Guideline](#)
 - .5 [Volume 5 - Asset Management Guideline](#)

4.6.3. Foundations

- 4.6.3.1. Have a Geotechnical Engineer review and approve aspects of design and construction that depend on soil or groundwater conditions.
- 4.6.3.2. Maintain the integrity of existing structures and service lines adjacent to the Work.
- 4.6.3.3. Do not incorporate “tie-back” earth retaining systems as an essential part of the permanent structure.
- 4.6.3.4. Screw piles are not acceptable without City approval.
- 4.6.3.5. A cost benefit analysis will be completed by the Consultant with the aid of the Geotechnical Engineer of record. If it is determined that the pile load testing is cost recoverable, the City will coordinate and pay for these efforts. Results of the testing will be incorporated prior to tendering of the Project.

4.6.4. Structure

- 4.6.4.1. Do not use un-bonded post-tensioned reinforcement as an essential reinforcing element of a structural member.
- 4.6.4.2. Design exterior slabs at doorways to avoid interference with outward door swings as a result of upward movement of slab caused by soil and frost heaving. Provide structural stoop where necessary.
- 4.6.4.3. Structural Systems for Car Parking: design according to CSA S413M, Parking Structures. Provide protection against corrosion of reinforcing steel, including a positive slope, passive cathodic protection system, surface protection membrane, and drainage system with adequate allowances for construction tolerances and deflections.
- 4.6.4.4. Provide protection against corrosion for structural elements that may be subject to spills or leaks of corrosive solutions (i.e. mechanical floors supporting brine tanks and water softeners).
- 4.6.4.5. Design expansion joints, including those between existing and new structures, so that an abrupt change in floor elevation is prevented. Wheelchairs and carts must be able to pass over these joints with ease.
- 4.6.4.6. Self-leveling or caulked expansion joint sealants are not accepted for use on slab-on-grade or

structural slabs. Preformed joints shall be specified.

- 4.6.4.7. In major renovations of existing buildings, investigate safety with respect to current seismic loading in areas where this is applicable. Upgrade as deemed appropriate for the specific project. At a minimum, ensure adequate lateral support for all non-structural components.
- 4.6.4.8. Provide drain holes to allow the release of water in all HSS sections.
- 4.6.4.9. Design shall allow for welding to be limited as much as is practically possible to shop fabrication.
- 4.6.4.10. Design structural steel floors to prevent transient footstep induced vibration from exceeding the annoyance threshold. Refer to CISC Handbook of Steel Construction – Appendix G, Guide for Floor Vibrations and the National Building Code of Canada – Commentary A – Serviceability Criteria for Deflection and Vibrations.
- 4.6.4.11. When floor slopes are relied upon for drainage of surface water, a minimum slope of 2.0% shall be used when runs are greater than 3.0 m. In no case shall floor slopes be less than 1.5%.
- 4.6.4.12. Drainage trenches shall slope a minimum of 2% in all cases.
- 4.6.4.13. Expansion/friction anchors will not be accepted in areas exposed to the elements, pools, or elements supporting or fixing vibration generating equipment.
- 4.6.4.14. Special consideration will be provided on renovations and new construction where gaseous chlorine or salt chlorination systems are used.
 - .1 Concrete will be specified to accommodate C1 chloride exposure as defined by A23.1
 - .2 Crack control of concrete will be held to the higher standards set by water retention structures.
 - .3 Waterproofing membrane will be installed to protect the concrete tank, gutter, and surrounding deck structure as well as an integral waterproofing admixture.
 - .4 PVC waterstops will be used.
- 4.6.4.15. Bentonite waterstops will only be used upon City's approval.
- 4.6.4.16. Below grade, concrete structure penetrations where water infiltration is an issue, sleeves with integral waterstop flanges will be used.
- 4.6.4.17. Bonded fiber reinforced polymer composites will only be used upon City's approval. Upon approval, all installations:
 - .1 Shall receive fire protection suitable to the classification of the space.
 - .2 Shall be clearly labelled, "Do Not Drill."
 - .3 Will not be used in wet locations where moisture and chlorides can infiltrate the concrete matrix and accelerate the deterioration of the reinforcement within the element, behind the RFP installation.
 - .4 Will not be used in locations easily impacted/damaged by normal operations within the facility.
- 4.6.4.18. Columns and lateral bracing elements within natatoriums shall be installed on moisture protected concrete pedestals, elevated out of splash zones. Steel may be coated, but will not

clad with materials that will trap moisture.

4.6.5. Coordination with Other Disciplines

- 4.6.5.1. Structurally design and detail the fastening, support, and backup systems for exterior walls, brick veneers, cladding, fenestrations, and attachments. Specify galvanizing of steel connections outside the air barrier.
- 4.6.5.2. Where possible, avoid thermal bridging. Where this is not possible, incorporate measures to minimize its effect. Thermal bridging must be accounted for in the energy model.
- 4.6.5.3. In the design of exterior wall back-up systems, limit deflections according to the properties of the cladding or veneer material being used. Coordinate with cladding systems design to accommodate movement.
- 4.6.5.4. For roof slopes, refer to Building Envelope Section [Roofs](#). Take into account the resulting non-uniform loads caused by an accumulation of rainwater. Account for a 24 hr rain and the effects of a plugged roof drain.
- 4.6.5.5. Design canopy structures to be outside of the building envelope.
- 4.6.5.6. All guardrails, handrails, fixed ladders, and cages shall meet Alberta Occupational Health and Safety at a minimum.
- 4.6.5.7. Fixed ladders and cages shall be detailed in accordance with PIP STF05501, as per Alberta OH&S.
- 4.6.5.8. All structural penetrations through the roof, including but not limited to roof guardrails, travel restraint, and fall arrest systems, shall be coordinated with Building Envelope requirements.
- 4.6.5.9. Advise and coordinate with the Prime Consultant, if applicable, of expected movements of the structure, including those due to deflection, shrinkage, settlement, and volume changes in the soil. Provide adequate allowances in all affected elements, including partitions and mechanical systems.
- 4.6.5.10. If the expected movements of a grade-supported floor slab cannot justifiably be accommodated or tolerated, use a structural slab. Structural slabs constructed over a degradable void-form shall not be used where a significant amount of buried piping will be provided below the floor. The piping shall be protected within trenching or other means to isolate the piping from the soil. If there is a significant amount of piping, a crawl space should be considered.
- 4.6.5.11. Specify concrete floor flatness that is consistent with the flooring material to be applied and the architect's aesthetic requirements.
- 4.6.5.12. Structural and Mechanical consultants are encouraged, where practical, to coordinate final rebar inspection prior to installation of hydronic heating lines.
- 4.6.5.13. Structural and Electrical consultants must coordinate the bonding of metal elements.
- 4.6.5.14. Ensure that the structure contains adequate access routes for heavy equipment removal and installation.
- 4.6.5.15. IT/Server rooms shall be designed to accommodate worst case loading of a fully loaded server rack. Server rack specifications will be provided by the City.

- 4.6.5.16. Special fitness use areas, such as Olympic lifting, medicine ball use, or any other high impact exercises shall be:
 - .1 Assessed accordingly to accommodate impact loading, vibration, and noise isolation.
 - .2 Located on grade supported structure OR on elevated concrete structure. The use of steel, steel composite deck, or OWSJ is not permitted. The zone of use will be isolated from surrounding structure.
- 4.6.5.17. Code minimum for crack control may not meet Architectural requirements and is to be reviewed and designed accordingly.
- 4.6.5.18. Coordination with the Prime Consultant and the City will be required to address crack control, aesthetics and serviceability limits, for the following concrete structures:
 - .1 Water retention tanks.
 - .2 Architecturally finished concrete.
 - .3 Skate parks and other high performance surfaces.

4.6.6. Coatings

- 4.6.6.1. Shop primer: to a minimum standard of Master Painting Institute MPI-23 or MPI-79. City to confirm colour.
- 4.6.6.2. Shop prime structural steel to a minimum standard of MPI-23 or MPI-79.
- 4.6.6.3. Clean and prepare structural steel exposed to view to a minimum standard of MPI-23 or MPI-79 and SSPC SP1 solvent cleaning and SSPC SP243 Hand tool cleaning.
- 4.6.6.4. Remove any requirements for spare paint from project specifications.
- 4.6.6.5. Coordinate AESS – Architecturally Exposed Structural Steel with the architectural consultant.
- 4.6.6.6. Specifications should address the need for a finish coat on glulam members. Recommended glulam finish is Sikkens Cetol 1 (first and second coat) and Sikkens Cetol 23 (third and fourth coat). Factory seal coat/wax restrictions imposed by Sikkens should be noted in the project specifications.
- 4.6.6.7. Concrete floors in mechanical rooms are to be painted.

4.7. Building Envelope

4.7.1. References

- 4.7.1.1. ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., latest adopted edition.
- 4.7.1.2. CSA S478-95, Guideline on Durability of Buildings, 1995 (R 2007).
- 4.7.1.3. National Energy Code for Buildings. National Research Council Canada, latest adopted version.
- 4.7.1.4. Commercial Buildings Building Envelope Thermal Bridging Guide, most recent version.
- 4.7.1.5. City of Edmonton Commissioning Consultant Manual: Vol. 2 - Building Envelope Commissioning

Process and Guidelines, latest adopted version.

4.7.2. General

- 4.7.2.1. Building envelope assemblies separate spaces requiring differing environmental conditions by controlling the flow of air, water, and energy. The separation between spaces that have a differential of more than 10°C or that have dissimilar environments (i.e. differences in temperature or humidity) must be controlled with environmental separations.
- 4.7.2.2. The building envelope is to be designed using rainscreen principles to minimize the following:
 - .1 Moisture deteriorating the building envelope due to ingress of exterior bulk moisture and trapping of condensation from relatively humid air introduced into the envelope by air exfiltration.
- 4.7.2.3. Detail the building envelope to ensure that water, snow, and ice sheds safely from exterior surfaces and is not trapped or allowed to build up or enter the assembly to cause deterioration or staining.
- 4.7.2.4. Materials used in the building envelope assembly should be suitable for the environmental conditions to which each will be exposed, including during the construction period. Materials should provide a service life defined in the OPR, and be consistent with accessibility for maintenance of building components and planned building life.
- 4.7.2.5. Depending on the scope and size of the project, the City of Edmonton may engage a Building Envelope Commissioning Authority (BECA).
 - .1 The Prime Consultant shall be part of the Cx Team and respond to inquiries and actions requested by BECA and/or CxA, and via the City. (Refer to your Professional Service Agreement)

4.7.3. High Interior Humidity

- 4.7.3.1. Where high humidity space cannot be “buffered” from the building envelope, design building envelope assembly to prevent surface condensation. This includes within the wall system and also on interior surfaces such as walls, ceiling spaces, and bulkheads. Refer to [Mechanical](#).
- 4.7.3.2. Mould resistant products shall be preferentially used where applicable.
- 4.7.3.3. Where high indoor humidity levels are maintained, consider providing more robust air barrier systems such as thicker torch applied membranes or thicker self-adhesive membranes with fusible laps.

4.7.4. Air/Vapour Barrier

- 4.7.4.1. The air/vapour barrier typically consists of a number of materials acting together as a system. Minimize the number of materials used to form this system. Do not consider plastic film or spun-woven fiber film as an air sealing element.
- 4.7.4.2. Air/vapour barriers with self-sealing properties are preferred.

- 4.7.4.3. Spray foam insulation and sealant are not to be relied on for air/vapour barrier continuity where possible.
- 4.7.4.4. Minimize changes of plane in the air/vapour barrier system. Air/vapour barrier detail continuity and constructability must be given particular attention at:
 - .1 Window and door frames
 - .2 Mechanical and electrical penetrations
 - .3 Wall/roof connections
 - .4 Base of wall
 - .5 Changes in plane
- 4.7.4.5. Provide large scale details, preferably with isometric views, to show how air/vapour barrier continuity will be achieved and how differential movements and construction sequences will be accommodated.
- 4.7.4.6. Ensure that the air barrier and vapour barrier are positioned properly in the wall system. Avoid double vapour barriers, such as at parapets.
- 4.7.4.7. Design air/vapour barrier elements to minimize detrimental effects caused by exposure to:
 - .1 UV radiation
 - .2 extreme temperature fluctuations
 - .3 moisture
 - .4 thermally induced movement of building elements and connected barriers

4.7.5. Insulation

- 4.7.5.1. Place insulation so as to minimize thermal bridging within the wall or roof assembly.
- 4.7.5.2. Place insulation directly against the air/vapour barrier.
- 4.7.5.3. Ensure structural elements are insulated and detailed to reduce the risk of condensation.

4.7.6. Roofs

4.7.6.1. References and Related Sections

- .1 Consultant Manual Vol. 2 - [Mechanical - Roof Drainage Systems](#)
- .2 Alberta Roofing Contractors Association (ARCA) Roofing Application Standards Manual, Product Listing, and Technical Notices
- .3 [Photovoltaic Installations - City of Edmonton Solar Program guidelines](#)

4.7.6.2. General

- .1 Provide slope through the roof structure. Sloped insulation to only be used for back-slopes.

- .2 Prepare roof plans showing elevations for slopes to drain. Indicate locations of drains, roof mounted equipment and roof penetrations. Reference roofing detail drawings to the roof plan.
- .3 All new roofing and re-roofing technical details, products and specifications should meet or exceed the guidelines required for an ARCA 5 year warranty certificate, within the latest edition of the (ARCA) Roofing Application Standards Manual.
- .4 Provide membrane below all metal roofing and flashings. Consider metal roofing and flashings to be water shedding only, not waterproofing.
- .5 Provide main access to the roof from inside the building. Provide full stairs to roof access where possible; however, fixed ship ladders are an acceptable alternative in locations where the current building code does not require stairs. Where practicable, connect additional separate roof levels with external wall-mounted ladders designed to meet or exceed safety regulations. Where external access between roof levels is not possible, provide access from inside the building.
- .6 Where practicable, do not locate rooftop access hatches adjacent to mechanical rooftop units, exterior parapets, clerestory walls, or any areas where it is anticipated that snow will accumulate (as per the structural engineering snow loading diagrams). Ensure hatches are located to allow adequate room to safely access and egress.
- .7 Ensure all rooftop penetrations, such as HVAC, electrical, and drains, are aligned so they do not restrict the roof from draining.
- .8 Do not group mechanical, electrical or structural penetrations together and allow room for detailing. Ensure all penetrations are sealed at the air barrier and vapour barrier.
- .9 Where practicable, do not locate rooftop equipment so that service areas are adjacent to parapets or other changes in roof level.
- .10 Warranty: Unless otherwise stated in the Owner's Project Requirements, provide a 5 year security for extended warranty for new roofing systems. Security for the extended warranty shall be as follows;
 - .1 If roofing system has been constructed by a member of ARCA, a ARCA 5 year warranty certificate for the performance.
 - .2 If roofing system has been constructed by a non-member of ARCA, a maintenance bond for the performance shall be specified in the amount of 100% of the cost of materials and labour associated with the roofing and roofing related work performed under the contract.
 - .3 Wherever possible, when roof mounted photovoltaic modules are being installed in contract a single source warranty for both systems is desired.

- .11 Clearly show expected rooftop work zones on the roof plan.
 - .1 No work zone shall be permitted within 4 m of an unguarded edge unless permission is granted by the City of Edmonton Facility Maintenance Services
 - .2 Should the building be permitted to have a work zone within 4 m of an unguarded edge, provisions shall be made for an OH&S compliant control zone with a raised warning line (Part 9 161(6)), or a fall restraint and/or travel restraint system as required.
 - .3 Min. 1 m shall be provided for the working side of maintainable equipment, therefore provide 5 m clearance from the working side face of equipment to any unguarded edge.
- .12 Where a roof joins a wall extending above the roof, wall cladding, window sills, door thresholds, louvers and other wall penetrations shall be located a minimum of 300 mm above the finished roof level, or as determined appropriate by snow accumulation studies.
- .13 **Rainwater Leaders:**
 - .1 Locate eavestroughs and rainwater leaders so they are accessible for maintenance and will not cause leakage into the building, either from rain, freezing, or melting.
 - .2 Size eavestroughs to accommodate water from contributory roof and wall areas and to resist expected snow and ice loads. Off-the-shelf eaves troughs typically do not provide adequate resistance to dynamic loads from ice and snow. Eaves troughs to be a minimum of 125 mm wide.
 - .3 Locate rainwater leaders and direct discharge at grade so that water does not flow onto walks or paved areas where it could freeze, or onto areas where it could cause erosion damage. Provide splash pads at landscaped areas.
 - .4 Refer to “Mechanical - [Roof Drainage Systems](#)” for additional requirements.

4.7.6.3. Near-Flat Roofs

- .1 Generally, the roofing membrane should consist of two-ply modified bitumen roofing membranes. Consult with Facility Planning and Design, Architecture Services, and Facility Maintenance Services prior to specifying other roofing systems such as single-ply (EPDM, PVC, etc.).
- .2 Slope roof surfaces to drains, including valleys and transverse slopes across top of parapets. Provide minimum slope to drain of 1:50 for field of roof.
- .3 Each roofing area is to have a minimum of 2 drains. Ensure drains are accessible for maintenance.
- .4 Sump insulation at drains to encourage drainage. The sloped insulation should have a

minimum depth of 50 mm at the roof drains.

- .5 Use scuppers only as overflow devices. Do not use scuppers to replace roof drains.
- .6 Provide overflow scuppers where plugged roof drains could create ponding water with the potential of overloading the roof. The overflow scuppers should be approximately 25 mm to 50 mm above the roofing membrane and not located over entrances or other locations that could become a hazard during overflow conditions. Size of opening to be determined by a rational analysis of the specified rain load as defined by the Building Code.
- .7 Where a controlled flow roof drainage system is required, increase the size of overflow scuppers as required to prevent overloading the building structure.
- .8 Maximum thickness of a top layer of sloped insulation should be 150 mm. The limitation of sloped roofing primary insulation maximum thickness may require additional roof drains.
- .9 Where practicable, maintain a constant elevation along the perimeter of contained roof areas. If a varying perimeter elevation cannot be avoided, provide dimensioned details indicating low and high perimeter conditions.
- .10 Detail all roof penetrations to be compliant with ARCA 5-year warranty. Penetration curbs are preferred and are to be at minimum 200 mm above the adjacent finished roof surface. ARCA compliant gum boxes are permitted. Provide minimum 1.0 m clearance around penetrations to facilitate roofing application and drainage.
- .11 Roof curbs for hot pipes, such as standby engine exhaust or other hot roof penetrations, should have metal curbs and additional clearances to combustible construction.
- .12 Design transitions from roofs to walls projecting above roofs as protected membrane transitions. Protected roofing membrane detail shall include exterior insulation and metal flashing at the base of all walls.
- .13 Provide removable precast paver units around curbs (greater than 3 m any side) and for access paths. Pavers are to be free draining, and placed on insulation blocks or sleepers. City staff uses shovels and snowblowers to clear for maintenance.
- .14 Ensure all pavers, sleepers, etc. are isolated from the roof membrane so as not to cause damage.
- .15 Access paths using membrane cap sheets should be avoided, and are permitted on a Project-by Project basis only after City approval.
- .16 When the exposed surface of a roof assembly, i.e. plaza type decks, is required to be cast-in-place concrete, provide the following:
 - .1 Drains at both deck and membrane levels, designed to allow for differential movement between those levels.

- .2 Geotechnical type filter fabric between concrete and insulation below, to prevent concrete penetrating into insulation layer.
- .3 A drainage mat between the insulation layer and membrane. This acts as both an uninhibited drainage plane, as well as a separator sheet between the insulation and membrane.

4.7.6.4. Steep Roofs

- .1 Design steep roofs (slopes greater than 1:6) with the plane of waterproofing membrane/air barrier following the plane of ventilated roofing.
- .2 Configure steep roofs and perimeters so that snow, ice, and rainwater will not create safety, maintenance, or appearance problems. Design to prevent ice and snow from sliding onto areas intended for use by vehicles or pedestrians.
- .3 Where equipment or openings occur on sloped roofs, provide crickets to keep drainage paths away from the equipment or openings.
- .4 Observe ARCA performance certification required minimum slopes for applications of shingles and shakes.

4.7.6.5. Green Roofs

- .1 Plants should be low maintenance, native to the region, or adapted to the local climate zone. Plants should not require water beyond what is typically available in the climate zone (except for the initial placement and nurturing for the first 90 days).
- .2 All green roofs shall be designed and constructed in accordance with the latest issue of the ARCA Standards Manual - Section 11 - Vegetative (Green) roofing.
- .3 Non destructive electronic leak detection systems shall be installed on green roofs, and specified in accordance with the latest issue ARCA standards.
 - .1 *“Accepted non-destructive electronic leak detection (ELD) of the roof membrane shall be completed in accordance with ASTM D7877 “Standard Guide for Detecting and Locating Leaks in Waterproof Membranes”. A qualified technician shall conduct the leak detection test and provide to the roofing contractor a detailed report with a roof plan showing locations of all detected breaches or sign-off as being watertight.*
 - .2 *Initial testing of the roof area shall be performed only when the roof membrane system is fully complete including all penetrations. The leak detection testing shall frame only the area with vegetated roof cover including a minimum of one metre outside the vegetated roof separation barrier or up-stand.*
 - .3 *The required number of leak detection tests under the roofing contractors’ scope of work*

shall be specified at the following minimum intervals:

- .1 Prior to the installation of insulation and/or vegetated roof system components above the completed roofing membrane.*
- .2 After repair of breaches in the membrane system identified and recorded by the ELD technician if caused by the roofing contractor's work. "(ARCA Standards Manual, Section 11.7- February 24, 2021)"*

4.7.6.6. Equipment on Roofs

- .1 Coordinate equipment installation with building envelope details. Seal all equipment to prevent moisture intrusion and air leakage.
- .2 Provide a minimum of 610 mm clearance between mechanical curbs. Ensure areas below mechanical equipment are capable of drainage.
- .3 Under normal building humidity and operation, permanent wood foundation (PWF) lumber should be specified for sleepers supporting mechanical roof top equipment as recommended by ARCA.
- .4 Systems and equipment placement will be in locations where engineered guardrails, travel restraint, and fall arrest are not necessary. Approval from the City to bypass this restriction is necessary. Should approval be provided, the preferred option will be guardrails.
- .5 Architectural screens shall be located a minimum of 1500 mm away from any roof top equipment. Additional clearance shall be provided where required by the equipment manufacturers.
- .6 Consultation with Structural Engineer is required when replacing any ventilation unit located on a roof. Potential snow drifting and deflections need to be addressed. Consult with Structural Engineer to accommodate snow drifting and deflection when locating any mechanical equipment on a roof.
- .7 Elevated mechanical equipment installed above roof top surfaces on structural frames shall ensure bird access through the bottom of the unit is restricted. If maintenance activities require access above the screening, screening shall accommodate access of personnel and equipment.

4.7.7. Re-Roofing

- 4.7.7.1. A pre-design review report from qualified roofing consultant is required. Cut tests are to be conducted in each different roofing assembly and roof zones to confirm roof composition.
- 4.7.7.2. Review actual depths of ponding water on roof and locations of roof deck depressions prior to designing a new sloped insulation roofing system.

- 4.7.7.3. A roof loading assessment by a structural engineer is required to determine how the contractor can load the roof during construction.
- 4.7.7.4. On structurally sloped roofs the re-roofing design may consider leaving existing primary insulation and cover panels in place if they are found to be in a dry condition and the insulation is determined to be adequate. The existing vapour barrier must be equivalent to two plies of built-up roofing and must be tied into adjacent wall air seals or vapour barriers. The metal decks are to be protected with a code approved levelling surface.
- 4.7.7.5. Where required, build new parapets or extend the existing parapets to accommodate new insulation.
- 4.7.7.6. Re-roofing should include slopes of 1:50 unless there are restrictions of wall details or limitations of raising parapets to accommodate the new sloped insulation. Consider additional drains if required to improve roof slope.
- 4.7.7.7. All re-roofing drawing details and specifications should meet or exceed the guidelines within the latest edition of the ARCA Roofing Application Standards Manual.
- 4.7.7.8. Determine if the roof to wall tie-ins have an adequate air seal. If the existing wall air seal membrane is not sufficient to prevent air leakage, provide the roof to wall connection membrane stripping that could be tied into if the wall is re-cladded at a later date.
- 4.7.7.9. Generally the re-roofing membrane would consist of two ply SBS modified bituminous membrane (MBM). Where there is a potential fire hazard with the original building construction or building occupancy creates an unacceptable fire risk, a four ply asphalt and gravel re-roofing system should be specified.
- 4.7.7.10. Sleeved re-roof drains with u-flow connectors are not to be used.
- 4.7.7.11. Check if existing roof drain piping or underside of the existing roof drain is covered with insulation containing asbestos. Coordinate with the City to test if the insulation contains asbestos.
- 4.7.7.12. If the existing rainwater leaders direct water to grade through an exterior wall, check that there are no freezing problems associated with the existing construction. Correct construction as required.
- 4.7.7.13. Remove and reinstall all mechanical rooftop equipment to accommodate re-roofing. Raise curbs, ductwork, mechanical piping, and electrical services to accommodate sloped insulation.
- 4.7.7.14. Reinstall mechanical rooftop units and pipe supports on precast pavers. Ensure pavers are free draining.
- 4.7.7.15. For walkways, install raised precast pavers on roofs that can accommodate the load. Alternatively, for roofs that cannot accept the load, install a membrane cap sheet in a contrasting colour for walkways around mechanical rooftop units and in direct lines to stairwell or roof hatches. Leave 25 mm gaps in the MBM cap sheet walkway every meter to not impede

drainage to the roof drains.

- 4.7.7.16. Where pitch pans (gum boxes) are eliminated, install insulated curbed roof openings with metal enclosures (dog houses) that have removable tops that will allow adding or deleting mechanical equipment. Ensure penetrations are air and water tight.
- 4.7.7.17. Include mechanical instructions for removal and replacement of roof top units.
- 4.7.7.18. Include mechanical plumbing instructions for adding and removing roof drains and associated piping.
- 4.7.7.19. Specify removal of all redundant rainwater leader piping and hangers if any roof drains are abandoned during the re-roof.
- 4.7.7.20. Remove curbs and repair penetrations from demolished equipment.

4.7.8. Exterior Walls

- 4.7.8.1. Provide openings in the cladding at the top and bottom to permit drainage and pressure equalization of the air space.
- 4.7.8.2. Compartmentalize air spaces in the wall cavity to restrict air flow around corners and not more than 4 m in any direction within the cavity generally. Detail and show the location of control joints and compartmentalization baffles in cladding.
- 4.7.8.3. Allow for deflection where walls are associated with structurally framed systems (as opposed to load-bearing systems). Locate and detail the deflection joints where deflection is expected in the structure.
- 4.7.8.4. Design cladding assemblies to include through-wall flashing at regular intervals and at all cladding system changes to promote drainage in the assembly.

4.7.9. Windows, Doors, and Glass

- 4.7.9.1. Specify window performance to prevent condensation from forming on window frames or glass at design criteria specified in the [Mechanical](#) section.
- 4.7.9.2. The design of the curtain wall should have mechanically keyed gaskets in the box section and pressure plate. Anchors for the framing would be located within the vertical tube sections or as strap anchors so they do not interfere with adhesion of the membrane from the wall directly to the tube face of the aluminum frame. Mechanically retain the membrane with the anti-rotation channel.
- 4.7.9.3. All windows are to have internal drainage.
- 4.7.9.4. Design main floor windows on curbs to mitigate exposure to moisture.
- 4.7.9.5. Wherever practicable, do not project the main mass of window frames beyond the exterior plane of the air/vapour barrier (such as past the roof line in a parapet). Bridge the cavity of the wall as required to provide support to the membrane. Do not caulk cover caps to flashings.
- 4.7.9.6. Design windows, window treatment, and interior surroundings to allow uniform, unobstructed

movement of heated room air across glass and frame.

- 4.7.9.7. Provide vestibules at building entrances, intended for public access, to avoid the possibility of interior humidity causing frost build-up on doors and frames and to avoid depressurization of the building.
- 4.7.9.8. Coordinate the selection of glazing with lighting and mechanical systems to avoid glare and solar overheating.

4.7.10. Skylights and Sloped Glazing

- 4.7.10.1. When light is to be introduced through the roof, vertical clerestory glazing is preferred over skylights and sloped glazing. Such designs allow for better control of overheating, condensation control, and solar glare. Skylights and sloped glazing are not permitted without City permission.
- 4.7.10.2. If, after considering the risks and alternatives, designers still opt for skylights or sloped glazing and the City accepts the risks associated with them, the following design notes are offered to help minimize adverse consequences:
 - .1 Consider engaging a qualified building envelope consultant for thorough review of design detail and to inspect construction installation.
 - .2 Slope glazing minimum 30 degrees from horizontal.
 - .3 Design air seal connections to skylight and sloped glazing curbs and adjacent walls to be fully accessible and not dependent on construction sequence.
 - .4 Design skylights and sloped glazing so that they are accessible for maintenance and cleaning from building interior and exterior.
 - .5 Make provision to drain water entering the glazing rabbet of the system back to the exterior, during all seasons. Water may enter the glazing system from the exterior. The skylight system should be designed to contain water in the glazing rabbet and drain it in an overlapped shingled fashion. Water should not contact caulked joints or seals.
 - .6 Provide an interior condensation gutter system. In high humidity buildings, it may be necessary to drain the collected condensation at the sill to the mechanical system rather than relying on evaporation. This requirement should be addressed at the initial design stage.
 - .7 Use mechanically keyed in dry glazing seals for the interior and exterior of the system. Do not depend on sealants.
 - .8 Glazing should be minimum heat strengthened exterior lite, 12 mm airspace, 0.060 PVB laminated interior lite.

4.7.11. Concealed Spaces

- 4.7.11.1. Avoid sealed cavities and “dead space” as part of or adjacent to building envelope. Enclosed spaces inside the envelope require heat and air circulation to avoid the formation of condensation. Unheated cavities are to be vented to the exterior. Spaces beneath or adjacent to roof mounted mechanical components must be accessible for maintenance.

- 4.7.11.2. Provide access to heated concealed spaces, i.e. heated overhangs, from the building interior.
- 4.7.11.3. Provide access to unheated ventilated concealed spaces from the exterior, i.e. unheated soffits with recessed lights, from the building exterior.

4.8. Furniture, Fixtures, and Equipment (FF&E)

4.8.1. Interior and Exterior Signage

- 4.8.1.1. If the Project requires Additional Services to include interior and exterior signs, the project Manager will advise coordination with a City of Edmonton approved vendor, or, the drawings and specifications will be included in the construction documents for implementation, and shall follow City of Edmonton Visual Identity Standards.
- 4.8.1.2. Signage could include; washroom, room name, door numbers, wayfinding, donor/honorary, educational, exterior pylon/podium, exterior wall mounted, exterior logo, exterior addresses, fire exiting, parking, crosswalk/traffic signage, menu boards/product selections, electrified/TV screen software and signage, etc. Confirm the scope of work with the project manager.
- 4.8.1.3. The project manager will make available any relevant signage standards, guidelines, and/or shop drawings from previous projects for information and reference only. The consultant will be expected to interpret and reconfigure to suit the project.

4.8.2. Furniture

- 4.8.2.1. If the Project scope of work requires the procurement and installation of furniture and equipment; services could include space planning, layout, and furniture selection with City of Edmonton selected vendor, review of quotes prior to ordering, review of final installation, and tracking/completion of deficiencies.
- 4.8.2.2. Reference to Volume 1 for Corporate Space Guidelines, City Furniture Standards and Life and aesthetic life Expectancy of Materials and finishes.

4.8.3. Custodial Contracts

- 4.8.3.1. In an effort to standardize the entire City portfolio, The City of Edmonton holds custodial contracts for the supply of consumable products and their related dispensers.
- 4.8.3.2. Contact your project manager to get a full list of possible City supplied fixtures for the project. These could include but are not limited to; toilet paper dispensers, paper towel dispensers, soap dispensers, etc. (Garbage receptacles are typically not within the custodial contracts)
- 4.8.3.3. The City's third party custodial contract will supply fixtures, while the Prime Consultants and related Construction Contracts will be responsible for installation.

4.9. Building Acoustics

4.9.1. References

- 4.9.1.1. Meet or exceed the guidelines and standards of the following, as applicable:
 - .1 ASHRAE: 2015 ASHRAE handbook - HVAC applications, Chapter 49: Sound and

Vibration Control.

- .2 CISC: Handbook of Steel Construction – Appendix G, Guide for Floor Vibrations.

4.9.2. General

- 4.9.2.1. The intent of these requirements is to ensure that the acoustic environment of the building is compatible with the general needs and comfort of the building occupants, and the surrounding residential areas.

4.9.3. Definitions

- 4.9.3.1. The following are definitions of common parameters used to describe the acoustic characteristics of building environments, materials, and assemblies:
 - .1 Sound Transmission Class (STC): a single number rating of the sound transmission loss properties of a wall, floor, window, or door. A good reference for wall and floor STC ratings is the Alberta Building Code.
 - .2 Apparent Sound Transmission Class (ASTC): The ASTC represents the attenuation due to the combination of all sound paths between the rooms in the finished construction, not just the attenuation due to the primary partition.
 - .3 Ceiling Attenuation Class (CAC): this is a single number rating of the sound transmission properties of a suspended ceiling system between two rooms having a common plenum.
 - .4 Articulation Class (AC): a ceiling performance rating specifically used for open plan offices. Articulation Class is a single number rating describing a ceiling boards' ability to attenuate speech sounds between workstations.
 - .5 Noise Criteria (NC): a somewhat dated method of rating HVAC system noise. NC is still often used as a design criterion because many manufacturers of mechanical equipment continue to use it.
 - .6 Room Criterion (RC): a more recent rating for HVAC system noise. RC is the referred rating for setting design goals and for qualifying field installations.

4.9.4. Acoustically Critical Spaces

- 4.9.4.1. Consult with the City for clarification of any:
 - .1 Rooms where speech privacy, sound isolations, background noise, or reverberation control is critical. In most cases, more than one of these acoustic conditions will need to be considered for interview and therapy rooms, teleconference rooms, courtrooms, auditoria, and lecture halls.
 - .2 Unusual situations where adjacent occupancies may not be acoustically compatible and special construction is required.
 - .3 Large open-plan office projects. There are numerous acoustical requirements associated with this type of space layout.

4.9.5. Acoustic Considerations: Architectural

4.9.5.1. General

- .1 Refer to the Project description of work to understand if acoustically critical spaces are present and may require subject matter expert/Acoustic Consultant services.
- .2 Develop the floor plan so that noise sensitive spaces are not next to high noise areas (i.e. conference rooms adjacent to mechanical rooms). Consider both the horizontal and vertical layouts.

4.9.5.2. Floor Construction

- .1 Evaluate the need for a floating concrete floor to isolate very loud equipment (i.e. chillers; large open-ended fan units) in mechanical areas. A floating floor is rarely necessary except when rooms with low noise criteria (i.e. auditoria and studios) are located directly below such mechanical areas. It is recommended that an acoustic consultant make a preliminary estimate of the mechanical noise and, if required, develop the details for this type of floor.
- .2 Evaluate the construction of floors for impact noise. Footstep noise and other impact sounds can be a source of annoyance, particularly through lightweight and uncarpeted floors. Design for impact sound isolation is especially important where areas of high impact (i.e. corridors, fitness centres and fitness studios, indoor play, and child-minding areas) are located above or directly adjacent to occupied rooms with less activity.

4.9.5.3. Acoustic Criteria

- .1 Design to meet the following acoustic criteria. Acoustic testing and verification may be completed by the City upon construction completion, coordinate requirements with project manager:

Space Description	ASTC Rating (min)	Recommended Range for Background Noise, dB(A)	Reverberation Time, seconds
Moderate Privacy Requirements - General Office Space	40		
Private Offices	45	40-45	
Confidential Privacy Requirements Executive Offices - Large Conference Rooms, Training Rooms, Disciplinary Rooms, Interview Rooms	50	35-40	.5
Classrooms up to 300m ³	50	35-40	.6
Acoustically Critical Spaces - Studios, Auditoria, Lecture Halls	50+ (varies)		
Gymnasiums		40-45	1.0
Library		40-45	.7

- .2 Partitions with STC 45 rating should generally be full height or incorporate a gypsum

board plenum barrier.

- .3 Use full-height wall construction or drywall ceilings in rooms that require STC 50 or greater.
- .4 Prepare large scale details that show continuous, airtight seals at building component junctions such as:
 - .1 Partition to perimeter heater cabinet,
 - .2 Partition to suspended ceiling,
 - .3 Partition to window mullion at exterior walls.
- .5 Provide a complete, airtight sound seal around piping, duct, and conduit that penetrate partitions and floors. Sealants must comply with fire separation and waterproofing requirements, as applicable.
- .6 Provide a solid airtight barrier behind perimeter heater cabinets to prevent sound transfer at common partitions.
- .7 Do not use operable partitions between areas that require a high degree of speech privacy. Where operable partitions are deemed necessary for general noise isolation, specify a partition that has a minimum STC 50 rating. Detail such partitions according to ASTM E557, Standard Recommended Practice for Architectural Application and Installation of Operable Partitions.
- .8 Use massive wall construction (i.e. concrete block, poured concrete, multi-layer drywall) to separate occupied spaces from duct shafts and mechanical rooms.

4.9.6. Acoustic Considerations: Mechanical

4.9.6.1. Background Noise

- .1 Design mechanical systems to provide background noise levels, as follows (as per ASHRAE Applications Handbook):

Space Description	Room Criterion (RC)
Radio/Recording Studio, Auditorium	20 maximum
Audio/Visual Room, Courtroom, Teleconference Room	25 maximum
Large Conference Room, Observation/Therapy Room, Classroom, Lecture Hall	25 – 30 maximum
Enclosed Office, Meeting Room	30 - 35
Open Plan Areas, Library, Cafeteria, Reception/Waiting Areas	35 - 40
Computer Room, Kitchen	45 maximum
Light Maintenance Shop	50 maximum

- .2 In most office settings, a neutral, unobtrusive background noise helps to increase speech privacy. Therefore, over-silencing is undesirable.
- .3 Consult with City of Edmonton Engineering Services on spaces that require a noise level of RC 25 or less.

4.9.6.2. Ducts, Terminal Devices, Heat Components and Silencers

- .1 Whenever possible, design the system layout so that any medium velocity ducts and terminal boxes are above service space such as corridors.
- .2 Do not locate exhaust fans directly above meeting rooms and conference rooms serving such spaces. Locate these fans in the ceiling plenum above a less critical area (i.e. Waiting/Reception or Corridor) and provide an acoustically lined duct on the fan intake.
- .3 Avoid placing rooftop equipment over noise-sensitive areas. Provide details describing acoustic treatment, duct configuration, and roof penetration seals for any rooftop installations.
- .4 Design main air distribution systems to minimize the use of acoustic duct lining, whenever possible.
- .5 Select acoustic silencers with the lowest static pressure loss, when a selection of two or more silencers exists.
- .6 Use flexible connections between fans, plenums, and all related ductwork.
- .7 Provide smooth air flow conditions near fan units to minimize air turbulence. Large, rectangular ductwork with medium and high air velocities can create low frequency duct rumble. Spiral-wound, round duct is preferred for air velocities over 9 m/s or where excessive turbulence is anticipated.
- .8 Use non-continuous perimeter heat cabinets that allow acoustic barriers to be installed behind the cabinet at all window mullion locations. Provide easy access at these locations.
- .9 Select terminal boxes on basis of both in duct and radiated noise level. Manufacturer's VAV box noise data often assume the equipment is located above a mineral fibre ceiling and that there is the use of acoustically-lined duct. Ensure that the design includes the effect of these elements.
- .10 Select diffusers/air outlets so that the combined noise from all diffusers in a room meets the design criterion. Noise from a single diffuser will typically need to be specified 6 – 10 dB lower than RC(N) goal when several diffusers are in the same room.
- .11 Locate balancing damper at least 2 m away from the diffuser.
- .12 Provide at least 600 mm of straight duct at diffuser inlet.
- .13 Use Z shape return air transfer ducts (sound traps) for offices where privacy is identified as a concern.

4.9.6.3. Plumbing Noise

- .1 Use a resilient sleeve around supply pipes with oversize clamps fastened to the structure, in areas where water flow noise may be a disturbance. Sleeves comprised of 254 mm (12") thick closed-cell elastomeric pipe insulation or proprietary resilient pipe fasteners are acceptable. Do not use hard plastic sleeves.
- .2 Ensure that pipes penetrating through drywall partitions are not rigidly connected. Provide a sleeve at the wall opening, leaving air space around the pipe, and seal with resilient caulking.

- .3 Where double plumbing walls are used (i.e. washrooms); attach supply piping only to the fixture side of the wall structure.
- .4 Consider the use of pressure reducing valves (PRVs) in the system to minimize plumbing noise for noise sensitive areas. Size PRVs to limit the pressure at fixtures to 375 kPa.
- .5 Install water hammer arrestor adjacent to any quick-acting solenoid valves.

4.9.6.4. Vibration Isolation

- .1 Use the current ASHRAE Applications Handbook, as a guide for selecting vibration isolation of mechanical equipment.
- .2 Provide vibration isolators for all vibrating pipes and ducts in mechanical chases and walls common to noise sensitive areas.
- .3 Use flexible connectors on pumps that require vibration isolation from piping. Twin sphere neoprene rubber flex connectors are preferred.
- .4 For rooftop equipment, vibration problems can usually be avoided if the static deflection of each spring isolator is at least 15 times the structural deflection of the roof due to the equipment loading. Typically, this requires springs with a static deflection of 50 – 100 mm.

4.9.6.5. Community Noise

- .1 Determine the community noise impact of large outdoor mechanical equipment, i.e. cooling towers, chillers, and large fan units with louvers to outside. Occupants of residences within 1000 m of such equipment can be annoyed by mechanical noise, particularly at night.
- .2 Silence or strategically locate outdoor mechanical equipment and intake/exhaust openings to meet local municipal noise by-law requirements. These levels are determined at the residential property line nearest to the equipment.

4.9.7. Acoustic Considerations: Electrical

4.9.7.1. Transformers

- .1 Avoid locating transformers within ceiling spaces above noise sensitive spaces.
- .2 Provide vibration isolators for transformers near occupied spaces. Use the following table as a guide for selecting vibration isolators.

Size (kVA)	Near Non Critical Areas		Near Critical Areas	
	Isolator Type	Static Deflection	Isolator Type	Static Deflection
Under 50	Neoprene pad	3 mm	Neoprene isolator	10 mm
50 – 250	Neoprene isolator	10 mm	Spring isolator or hanger	19 mm
Over 250	Spring isolator or hanger	19 mm	Spring isolator or hanger	25 mm

- .3 Provide flexible conduit to make the final connection to the transformer.

4.9.7.2. Generators

- .1 For generator room design consider the location and configuration to ensure sound

pressure level measured at the property line meet City bylaw requirements.

4.10. Doors and Hardware

4.10.1. Coordination with Security

- 4.10.1.1. Coordinate door hardware with security equipment (i.e. Card readers, door strikes, switches, etc) to ensure proper operation.
- 4.10.1.2. Reference [Appendix C “Security and Card Access System Design Guidelines”](#).

4.10.2. Lockset and Keying Standards

- 4.10.2.1. When specifying the locksets (locks and cores) and keying in a new or renovated facility, ensure the specific manufacturer and model number is indicated. All City departments have a lockset standard that must be adhered to. These standards differ between departments within the City.
- 4.10.2.2. Request the lockset and keying standard specific to the client department from the Project Manager prior to preparing the door hardware schedule.
- 4.10.2.3. In specification, include a requirement for Contractor to hand over locksets for keying with appropriate time prior to occupation.

4.10.3. Door Installation Tolerances

- 4.10.3.1. Between Steel Doors & Frame: 3 mm +/- 1.5 mm hinge, top, and latch side
- 4.10.3.2. Between Wood Doors & Frame: 3 mm +/- 1.5 mm hinge, top, and latch side
- 4.10.3.3. Between Aluminum Doors & Frame: 3 mm +/- 1.5 mm hinge, top, and latch side
- 4.10.3.4. Between any door and the finished floor: 13 mm – 25 mm, depending on threshold requirements, return air requirements, and acoustic concerns.

4.10.4. Door Naming Convention Standards

- 4.10.4.1. When developing door schedules, ensure that the door tags used are a maximum of 7 digits. (The floor plans are used to label doors, and the CCURE system is restricted to 7 digits.)
- 4.10.4.2. Coordinate the doors numbering at the same time as adding room numbers, with the input from the Cities Facility Inventory Management Team, email fim@edmonton.ca. This allows a cohesive wayfinding system to be implemented, where the room and door numbers align.

4.10.5. Door Hardware

- 4.10.5.1. Door hardware shall be specified as per the table below. Requested alternates may be considered during design however shall be reviewed and approved in writing by the City of Edmonton.

HEAVY DUTY CLOSER	LCN 4000 series	Sargent 351 series	Norton 7500 series
MED DUTY CLOSER	LCN 1000 series	Sargent 1331 Series	Corbin Russwin DC8000 series



TRACK ARM DOOR CLOSER	LCN T-series (track)	Sargent 422 Series	Corbin Russwin DC5000 Series
CENTRE HUNG DOOR CLOSER	RIXSON 345	IVES	Norton series
CONCEALED DOOR CLOSER	LCN 2030/3130/5030 series	Sargent 268 Series	Norton series
DOOR CHECK	GLYNN JOHNSON 400 series	Sargent 590/690/1540/1530	Hagar 6000/7000
HINGES	IVES 3/5KN CB/BB	McKinney 3/5KN CB/BB	Stanley 3/5KN CB/BB
ELECTRIFIED HINGE * Refer to Appendix C	Hagar	Mckinney	Stanley
KNOBSET	Schlage D Series (*SFIC)	Sargent 8 Line Series (*SFIC)	Best 83K (*SFIC)
LEVERSET	Schlage ND Series (*SFIC)	Sargent 10 Line Series (*SFIC)	Best 93K (*SFIC)
ELECTRIFIED LEVERSET * Refer to Appendix C	Schlage Elec (*SFIC)	Sargent 10 Line 70/71 (*SFIC)	Best 93K-DEU(*SFIC)
MORTISE	Schlage L-Series	Sargent	Corbin Russwin
ELECTRIFIED MORTISE * Refer to Appendix C	Schlage L9000 Series	Sargent 8200 Series	Best 40 Series-DEU
ELECTRIC STRIKE * Refer to Appendix C	VON DUPRIN	RCI/EFF	HES
CODE ENTRY	Kaba E-PLEX/Powerplex 2000	Unican 1000/L1000 w/Key O/R	Schlage CO/AD
PANIC	Von Duprin 98/99 Series	Sargent 8000 /9000 series	ED5000
FIRE EXIT	Von Duprin 98-F/99-F Series	Sargent 8000-F series	ED5000 Rated
FLUSH BOLTS	Ives	Rockwood	Canaropa
WEATHERSTRIPPING	Zero International	KNC Crowder	Reese
DOOR LOCK CORES	BEST 7 Pin cores with the keyway to be specified by FMS.		

4.10.6. Maintenance Access Doors

- 4.10.6.1. Horizontal or vertical access doors through gypsum wall board shall utilize light weight metal door and include rounded safety corners, hinges (concealed or otherwise), screwdriver latch, anchor straps and must be able to open 180°. For access doors through fire-rated barriers, access door assembly must meet or exceed the rating of the barrier and/or closure as required by Code.

4.10.7. Door Safety

- 4.10.7.1. Where large overhead doors are required, the design shall eliminate the hazard of a door free-fall, impact, or entrapment. If the hazard must remain for the product to operate, then an engineered solution (such as a fall arrestor) shall be included to guard against the hazard.

4.11. Millwork

- 4.11.1. All millwork shall be manufactured and installed in accordance with the standards incorporated in the Architectural Woodwork Standards of Canada.
- 4.11.2. Confirm with the City Project Manager if an AWMAC Guarantee Certificate is required for the Project. If the AWMAC Guarantee Certificate is not required, provide the City with a two (2) year maintenance bond, to the full value of the architectural woodwork contract.
- 4.11.3. All projects with a requirement for an AWMAC Guarantee Certificate shall be subject to an inspection at the plant and site by an appointed inspector, approved by the local AWMAC/AWI Chapter. Such inspection costs shall be included in the bid price for the project.

4.12. Mechanical

4.12.1. References

- 4.12.1.1. Meet or exceed the following guidelines and standards:
- .1 Canadian Standards Association (CSA) Standards
 - .2 National Research Council Canada (NRC) Codes:
 - .1 Alberta Building Code (ABC)
 - .2 Alberta Fire Code (AFC)
 - .3 National Plumbing Code of Canada (NPC)
 - .4 National Energy Code of Canada for Buildings (NECB)
 - .3 ASHRAE Handbooks
 - .4 ASHRAE Standards
 - .5 SMACNA Standards
 - .6 NFPA Standards
 - .7 *Industrial Ventilation: A Manual of Recommended Practice*, American Conference of Governmental Industrial Hygienists

4.12.2. General

4.12.2.1. Accessibility

- .1 Provide sufficient access space (manufacturer's recommended service clearance is considered a minimum) for servicing, maintaining, and removal of equipment and components or portions thereof (i.e. tube bundles, filter media, large motors, dehumidifiers). Service access requirements shall be shown on drawings.
- .2 For bearings requiring lubrication on belt-driven equipment, remote grease nipples shall be included to facilitate maintenance activities without removing safety guards and barriers.
- .3 Mechanical room pumps shall be arranged such that all pumps have minimum 600 mm clear service clearance to one side of the pump. Duplex pump configurations shall be located as a pair with 600 mm service clearance on both sides. Pumps shall not be stacked vertically.
- .4 Reduced pressure backflow preventers shall be installed less than 1500 mm above finished floor.
- .5 Heating and chilled water systems shall have chemical treatment equipment located such that service can be accomplished without reaching over piping and/or equipment. Chemical pot feeders shall be located less than 1000 mm above finished floor. Filter housings shall be located less than 1500 mm above finished floor.
- .6 Provide minimum 300 mm clearance between underside of rooftop equipment and roof surfaces underneath.
- .7 Provide minimum 2.13 metre (7 feet) over head height clearance in mechanical rooms.
- .8 In general, except for heating and sanitary systems, mechanical systems should not be located in slab or below slab-on-grade.
- .9 Provide an adequate lifting device or method to lift motors and other maintainable components over 22.7 kg (50 lbs). A minimum of 0.9 m (3ft) of clear space above manufacturer maintenance clearance for mechanical equipment (including pumps, boilers, etc.) is required to accommodate lifting devices if a dedicated system is not provided as part of the design.

4.12.2.2. Energy

- .1 Develop energy conservation and heat recovery options and discuss with City of Edmonton stakeholders for evaluation and approval. Consider energy conservation and cost avoidance options that are supported by economic cost analysis. Options that should be considered are:
 - .1 Free cooling
 - .2 Heat recovery and reclaim
 - .3 Reduced fan and pumping flow rates when maximum flow is not required
 - .4 Reduced outside air volumes and ventilation rates during unoccupied hours

- .5 Shut down fans and domestic hot water recirculation pumps during unoccupied hours
- .6 Specify high efficiency electric motors

4.12.2.3. Existing Building Mechanical Systems

- .1 For projects where an existing building is being renovated or being added to the basis of design for the new mechanical system is to match or exceed the existing base building system in terms of occupant comfort and energy performance.
- .2 Design Consultant shall identify existing equipment to remain in place for systems being modified. Design Consultant shall coordinate with FMS to determine shutdown, maintenance and long term preservation requirements for dormant equipment for long term construction projects as appropriate.
- .3 Design Consultant shall identify existing equipment being removed or abandoned under the project and define decommissioning procedures and requirements in the project specifications. Design Consultant shall identify if any regulatory requirements exist for equipment to be decommissioned and who will be filing the necessary documentation.
- .4 All existing piping systems in a renovation project to be balanced and flushed along with any new portions added to the system. All existing piping systems not being modified by the project to be pressure tested along with any new piping.

4.12.2.4. Winterization

- .1 Design Consultant shall include in design drawings all elements required for proper winterization of seasonal systems. This shall include but not be limited to the following:
 - .1 Blow down points with maximum allowable purge pressure identified
 - .2 Design Consultant to include in design specification a requirement for the contractor to generate a detailed winterization procedure to be included in the O&M.
 - .3 Design Consultant to ensure seasonal systems are identified to FMS staff.

4.12.2.5. Notable References

- .1 Refer to the section "[Acoustic Considerations: Mechanical](#)" for acoustic requirements related to mechanical systems and components.
- .2 Refer to the section "[Landscape Development](#)" for exterior and interior hose bib requirements related to landscaping.
- .3 Refer to the section "[Appendix A - Colour-Coding Requirements for Mechanical and Electrical Systems](#)" for identification symbols and colours for mechanical piping and equipment.
- .4 Refer to the Electrical portion of the consultant manual "Motor Control" for guidance on motors, voltages, system redundancy, and the use and application of Drives/VFDs.
- .5 Refer to the section "[Appendix G - Guidelines for Gas Detection Systems](#)" for gas detection system requirements and detection of various gases.
- .6 Refer to the section "[Pool Systems and Other Water Treatment](#)" for additional information.
- .7 Refer to the section "[Arena](#)" for additional information.

4.12.3. Design Criteria

4.12.3.1. General

- .1 Design mechanical systems according to the Alberta Building Code (current edition).
- .2 Design conditions shall be January 1% and July 2.5% as per the Alberta Building Code.
- .3 A safety factor of 10% shall be applied to heating and cooling load calculations.
 - .1 Do not allow a 10% safety factor for cooling load when sizing central cooling plant equipment.
- .4 Setpoints:
 - .1 Heating space temperature setpoint shall be 23°C.
 - .2 Cooling space temperature setpoint shall be 22°C.
 - .3 Heating space relative humidity setpoint shall be 20% when the outdoor air temperature is lower than 0°C and 30% when the outdoor air temperature is higher than 0°C.
 - .1 Where humidity sensitive elements are used within the building structure, provide appropriate humidification systems
 - .4 Enclosed Parking Structures shall be designed with the ability to heat spaces to 18°C.
 - .5 Provide heat to interior envelope surfaces as required to prevent condensation on those surfaces. Provide heat to any interior surfaces that are adjacent to spaces with different temperature and relative humidity conditions to prevent condensation.
 - .6 In enclosed ceiling spaces with roof heat loss, provide radiation elements and temperature sensors to maintain minimum 18°C within ceiling space.
 - .7 Mechanical room space temperature to be maintained between 18°C and 26°C.
- .5 Cooling and ventilation requirements for spaces housing Uninterruptible Power Supply (UPS) equipment and components, including batteries, should be coordinated with Electrical Consultant. For additional information on UPS design criteria, refer to Life Safety, Emergency, and Security System section specific to [Life Safety, Emergency, and Security Systems](#).

4.12.4. Plumbing

4.12.4.1. General

- .1 Heat domestic hot water with heaters or boilers independent of the building heating system.
- .2 Domestic water heating shall be achieved by a dedicated domestic water heater or boiler and storage tank. Instantaneous domestic water heaters shall only be used where the application requires it. Specify a water softener for all instantaneous domestic hot water installations.
- .3 Domestic hot water recirculation piping shall connect as close as practical to washroom lavatories.

- .4 Consideration shall be given to the volume of water dispensed by a lavatory per cycle.
- .5 PEX piping shall be considered for domestic hot water recirculation applications only.
- .6 Domestic water recirculation systems shall be designed to maintain a water velocity below 0.9 m/s.
- .7 Domestic hot water recirculation piping shall include a balancing valve to limit the flow to the value prescribed above.
- .8 Grey water systems will not be accepted.
- .9 Cleanouts shall be specified as 50 mm or larger. Clean-outs for urinals shall be located above the rim flood level.
- .10 For any facility with more than 4 shower heads, a feedforward digital mixing valve shall be specified. This applies to large recreation centres. The valve is to be installed in a gender neutral, accessible area.
- .11 Plumbing pipe insulation jacketing shall be PVC.
- .12 Domestic hot water recirculation pumps to be installed so they are readily accessible from ground level.
- .13 Submersible sump pumps shall be equipped with chain, rails, or removal methods to facilitate maintenance activities. Submersed impellers with motor outside the sump are preferred.
- .14 Obtain approval for water treatment consulting services from CoE Facility Engineering when special water systems are required.
- .15 High-Low systems will no longer be accepted for mixing valves for shower applications.
- .16 No under sink water filtration devices are to be installed.

4.12.4.2. Plumbing Fixtures

- .1 Flush valves shall be exposed, automatic infrared sensor type, unless specifically discussed on a project by project basis.
- .2 If technology is not in place for flush valves and faucets to be self-powering, the fixtures are to be hardwired as opposed to battery operated.
- .3 Waterless urinals will not be accepted.
- .4 The CoE has preferred plumbing fixtures. Specification of these models is not a strict requirement but encouraged so the CoE can better manage spare parts and the maintenance of plumbing fixtures.
 - .1 Lavatory
 - .1 Faucet – Self generating turbine-powered, battery operated, 0.5 GPM automatic infrared sensor activated faucet.
 - Toto model TEL105
 - .2 Basin – Self rimming vanity basin with faucet ledge.

- American Standard Cadet 9494
- Franke V1821
- .3 Basin - Wheelchair accessible
 - American Standard 9141
- .2 Flush Valve Type Water Closet
 - .1 Flush Valve – Self generating turbine-powered, battery operated, automatic, infrared sensor activated, piston operated, 1.28 GPF, flush valve.
 - Toto model TET1LA32#CP
 - .2 Bowl – Wall mounted elongated front bowl suitable for 1.28 GPF.
 - Toto CT708U
 - American Standard AFWall 3351
- .3 Tank Type Water Closet
 - .1 Tank and Bowl – Floor mount, non-pressure assisted, 1.28 GPF.
 - Toto Eco Drake CST743E
 - American Standard Cadet Pro 215DA
- .4 Toilet Seat
 - .1 Shall be open front type with no lid.
 - Bemis Commercial Sta-Tite 955CT
- .5 Urinal
 - .1 Flush Valve – Self Generating, automatic, infrared sensor activated, piston operated, 0.5 GPF flush valve. Urinals shall have a minimum drain size of 75 mm nominal diameter.
 - Toto model TEU1LA12#CP
 - .2 Basin – Wall mounted, 0.5GPF.
 - Toto model UT447E
 - American Standard Washbrook 6590-001
- .6 Recreation or Fitness Facility Showers
 - .1 Shower Limiter Valve – Symmons Showeroff 4-428
 - .2 Shower Head – 2.0 GPM Delta RP38357
- .7 Floor Drains
 - .1 Epoxy coated cast iron floor drain
 - Watts Drainage FD-200
- .8 Mop Sink

- .1 Molded stone mop service basin
 - o Fiat MSB 2424

4.12.5. Hydronic Systems

- 4.12.5.1. Where suitable, wet-rotor type inline pumps are preferred. Preferred manufacturers of these pumps include Grundfos and Wilo.
- 4.12.5.2. Preference should be given to the two-pipe reverse return system for hydronic systems. Direct return systems may be used if the design safeguards against flow imbalance to terminal units.
- 4.12.5.3. Pumps shall only be installed at floor level. No pumps shall be installed at elevation.
- 4.12.5.4. All exterior piping insulation to be clad with metal jacketing.
- 4.12.5.5. Provide isolation valves on supply and return mains, risers, and major branches.
- 4.12.5.6. Provide isolation valves for terminal units at the supply and return connections. Circuit balancing valves must be provided at each terminal unit. Pressure independent control valves are encouraged to ensure proper balancing and increase energy performance.
- 4.12.5.7. Preferred Hydronic system treatment chemicals include:
 - .1 Dispersants, phosphonates, corrosion inhibitors, and alkaline controller product.
 - .1 Preferred product is 'Aquaguard 100'. Suggested alternate products to be reviewed and approved in writing by City of Edmonton Facility Maintenance Services prior to use.
- 4.12.5.8. Piping shall not be supported by floor supports unless specifically noted as required by equipment manufacturer installation instructions. Pipe supports from floor are to be a channel strut support system (Unistrut or approved equal) with pipe clamp. Threaded rod with a half riser clamp as a floor pipe support is not acceptable.
- 4.12.5.9. Mechanical grooved couplings shall be permitted on hydronic heating and cooling systems; but only in mechanical rooms. Mechanical grooved couplings are not to be installed in concealed locations such as shafts, above ceilings, etc.
 - .1 In addition for mechanical grooved couplings to be allowed:
 - .1 The grooved supplier must furnish a warranty for the entire grooved system. This warranty is to be for a minimum of 25 years and will be for full labour and materials related to any leaks or failures in the system. The warranty will not just be for the product itself but for any ancillary building elements damaged by the product failure.
 - .2 The grooved supplier to provide inspection services to ensure that every grooved coupling is installed as per the manufacturer's specifications
 - .3 The grooved supplier to provide training for the installing contractor at the startup on any project where these couplings are to be used. Grooved supplier to also provide ongoing support throughout the project.
- 4.12.5.10. Lug style isolation valves are preferred, wafer style isolation valves will not be accepted.
 - .1 Valves sized DN150 (6NPS) and larger shall be equipment with gear operators.
- 4.12.5.11. For variable primary pumping systems for heating or cooling a flow meter is to be provided for

each chiller and / or boiler to confirm adequate flow.

4.12.6. Heating

4.12.6.1. General

- .1 A primary objective of the heating systems design is to ensure that the operating and maintenance of the system are as simple as possible.
- .2 In large mechanical rooms containing natural gas burning equipment, provide ventilation, heating, and or cooling to control the room temperature within the temperature ratings of equipment (i.e. electrical panels) and to maintain the space setpoints.
- .3 For buildings with high exhaust/ventilation requirements such as parking and repair garages, specify that combustion air is ducted directly to the unit from outside for all gas fired equipment where possible.
- .4 Hydronic Systems are the preferred heating systems for CoE buildings.
- .5 Electric heating or reheat systems will only be allowed in very specific cases where it is extremely cost prohibitive to use natural gas as the heating medium.
- .6 Pipe insulation jacketing is preferred to be canvas within mechanical rooms when not exposed to moisture.
- .7 Size heating elements for:
 - .1 exterior wall envelope heat loss;
 - .2 infiltration, ventilation, and
 - .3 where applicable:
 - .1 slab heat loss,
 - .2 roof heat loss, and
 - .3 reheat of minimum supply air quantity.
 - .4 Thermal mass of equipment entering the building.
- .8 Provide a minimum of 2 boilers, each sized at 65% of total heating design capacity. For systems with three boilers or more, utilize n + 1 redundancy.
- .10 Hydronic heating systems that include condensing boilers shall be designed to optimize return water temperatures.
 - .1 Possible optimization options include, but are not limited to,
 - .1 lowering the supply water temperature,
 - .2 sizing heating elements for large temperature drops, or
 - .3 providing a cascading system.
- .11 Variable water flow rates through the boilers will only be accepted for boilers specifically designed for variable flow. Consultants to confirm with CoE Facility Engineering prior to specifying a variable flow rate boiler and primary system.

- .12 On primary-secondary pumping systems, provide a minimum of 2 secondary circulation pumps, each sized for duty/standby operation at 100% of maximum design capacity.
- .13 Provide a temperature controlled piping loop for air handling system coils, separate from the loop supplying radiation, radiant panels, and terminal reheat coils.
- .14 Provide 50% glycol solution for heating coils in air handling units which may be subject to freezing. Specify pre-mixed inhibited propylene glycol only.
- .15 Include specification for chemical injection system for boiler treatment and maintenance. Preferred system would include injection points, diaphragm metering pumps, and totes/tanks for chemicals as required to ensure the performance and reliability of boilers.
- .16 Secondary containment is required for glycol fill tanks within mechanical rooms.
- .17 Any boreholes or areas part of a ground source heat loop shall be located outside of the building footprint.
- .18 Heat domestic hot water with heaters or boilers independent of the building heating system.
- .19 Where solar hot water is incorporated in the hydronic heating system, the system shall include 100% redundant pumps supplying flow to the solar collectors. An alarm is to be issued to the BAS upon failure of either pump.
- .20 Where a Backup Power source is installed, ensure the following equipment is connected;
 - .1 All components of any heating system within the building,
 - .2 Building Automation System
 - .3 Additional freeze protection systems
 - .4 Critical systems on a case by case basis.
 - .5 Additional non-critical systems may be placed on standby power.

4.12.7. Cooling

4.12.7.1. General

- .1 Chilled water cooling is preferred for systems over 100 kW of refrigeration.
- .2 Provide a minimum of 15% glycol concentration in chilled water circuits. Specify pre-mixed inhibited propylene glycol only.
 - .1 Allow appropriate capacity correction when sizing the chiller.
 - .2 Provide 50% glycol solution where the system may be subject to freezing.
- .3 Provide chillers that allow the supply water temperature to be reset electronically.
- .4 Air cooled chillers shall be equipped with a low ambient temperature kit to allow for cooling to be provided at an outdoor air temperature of -18°C or lower.
- .5 Do not provide mechanical refrigeration to mechanical equipment rooms.
- .6 Pipe insulation jacketing shall be PVC for piping conveying fluids with a temperature of less than 10°C

- .7 Once through cooling systems are prohibited.
- .8 Cooling tower level sensing to incorporate mechanical ball floats where possible.

4.12.7.2. Multiple Chiller Cooling Plants

- .1 Provide two chillers as a minimum with multiple and/or variable flow pumping on the chilled and condenser water circuits for:
 - .1 central cooling plants that serve more than one building;
 - .2 buildings that require a chiller larger than 1750 kW output, and
 - .3 buildings that serve a special function as determined by the City of Edmonton.
- .2 Size chillers by taking into account the magnitude and duration of lighter loads relative to the peak cooling demand to ensure optimum chiller operation.
- .3 Ensure that there are bypass valves on either side of the chiller primary pumps so that either primary pump can be used with either chiller.

4.12.7.3. Reciprocating Chillers

- .1 Provide multiple compressors for chillers over 34 kW output.
- .2 Provide at least two stages of capacity for compressors over 25 kW output and at least three stages of capacity for compressors over 125 kW output. Chillers with three stages of capacity control or less shall have an additional hot gas bypass stage.

4.12.7.4. Winter Cooling

- .1 Where the mechanical system is to provide cooling in the winter then a dry cooler or closed circuit cooling tower shall be used to reject the heat. Wet cooling towers are not acceptable for winter operation.

4.12.8. Air Handling Systems

4.12.8.1. Central

- .1 Design air systems, except 100% outside air make-up type and residential furnaces, with an economizer cycle and a return fan.
- .2 Provide air plenums with hinged, sealed access doors and lighting for inspection of each chamber.
- .3 Use factory manufactured air blenders, pre-engineered and with proven performance.
- .4 Preferred location for all air handling units is indoors within designated mechanical rooms.
- .5 Air handling units to be installed outside must be complete with a factory built walk in chase to house piping connections, valves, and allow for filter changes and access to the unit.
- .6 For applications where humid return air is anticipated, a heating coil shall be provided to temper outside air prior to entering the mixing section of the air handling unit.
- .7 Wetted media type evaporative cooling and humidification shall not be used. Kettle style humidifiers are preferred.

- .8 Specify a water softener for all steam humidification installations. If the steam humidifier is located inside the air handling unit a drain must be provided near the humidifier.
- .9 When multiple air systems are used, duct return air to each air handling system separately. Do not use common return air plenums.
- .10 Do not use mechanical rooms as return air plenums.

4.12.8.2. Zoning

- .1 Provide separate zones for corner spaces if cooling requirements are significantly different from adjacent zones.
- .2 Match heating and cooling zones.

4.12.8.3. Distribution

- .1 Take into account variable air volumes and tenant requirements so that proper air circulation is achieved under all conditions.
- .2 For unique ceilings, confirm air flow patterns with special studies, or by testing a mock-up.
- .3 Design ductwork to minimize static pressure losses.

4.12.8.4. Variable Air Volume (VAV)

- .1 Use variable frequency drives or alternate, discrete motor on/off control method with adequate granularity, on fan motors to vary supply and return air volumes.
- .2 Design interior zones with VAV boxes that close to a minimum position to ensure ASHRAE 62 minimum ventilation.

4.12.8.5. Rooftop Units

- .1 Provide a minimum of two-stages for heating sections. Modulating gas valves with larger turn downs are encouraged.
- .2 Provide units with economizer functionality.

4.12.8.6. Heat Recovery

- .1 Size heating sections in air handling units to allow the unit to meet supply air temperature setpoint if the heat recovery fails.
- .2 Mechanical Engineer shall calculate and provide optimal setpoints for all energy recovery system controls.

4.12.8.7. Filtration

- .1 Minimum MERV 8 specified for all applications. Increase performance as required where the application requires.
- .2 Heat recovery units shall be specified or installed with filtration installed separate from the heat recovery medium such that filter replacement can be completed without removing the heat recovery medium.
- .3 Fan-coil, remote heat pump, and similar equipment installations shall be located above corridors or other normally unoccupied areas, or, where not practical, shall have return air ducting installed such that filters are accessible by facility maintenance without disturbing

facility staff.

- .4 Fan-coil, remote heat pump, and similar equipment installations located within raised floor assemblies shall have return air ducted from a wall mounted return air grill complete with a filter.

4.13. Controls

4.13.1.1. General

- .1 All buildings are to be designed and installed with a Distributed Digital Control (DDC) Building Automation System (BAS).
- .2 Any renovations to a building where equipment is replaced or added, that equipment is to utilize DDC controllers. Any new DDC controllers will either connect to the existing building automation system or will be specified such that they can be added to a DDC system in the future.
- .3 Only a single BAS manufacturer is allowed in any one building. If there are multiple buildings directly connected to each other, even if they have different site IDs, there shall only be a single BAS manufacturer for those buildings. If a building is being renovated and new DDC systems are being added they must be of the same manufacturer as what is in the building already or the entire system must be removed and replaced to ensure there is only a single BAS manufacturer in the building.
- .4 The City of Edmonton has standardized control systems. The supply and installation shall be limited to the following (all controls components in the building - thermostats, controllers, etc. to be from one of these three manufacturers):
 - .1 Delta Controls, installed by ESC Automation.
 - .2 Johnson Controls Metasys, installed by Johnson Controls.
 - .3 Reliable Controls, installed by Serv-All Mechanical.
- .5 All communication between pieces of equipment and the BAS is to be done through hard point control utilizing terminal strips on the pieces of equipment. This includes, but is not limited to, boilers, chillers, large central station air handling units, rooftop units, heat pumps, ductless split air conditioners, etc. Connections done virtually through a BACnet interface are not allowed except for some auxiliary point monitoring for equipment like variable frequency drives and some auxiliary inputs off of electrical meters.
- .6 In general proprietary, stand-alone control systems for pieces of equipment will not be accepted. The base building BAS should be accomplishing the control functions for all equipment. The exceptions are boiler sequencing controllers and chiller plant controllers where we allow the manufacturer's equipment controller to control those pieces of equipment. The boiler and chiller control systems, including multi stage systems, must be provided with an enable and setpoint control supplied by the base building BAS system utilizing hard points as referenced above.
- .7 Air handling unit components including fans, dampers, heating, and cooling systems for large central station air handling units shall be controlled directly by the base building BAS. There shall not be a separate integrated controller on the air handling unit unless

that controller is manufactured by one of the three standardized control suppliers listed above. All control points for the components listed above are to be writable through the base building control system.

- .8 Ductless split/heat pump units to be specified so that the cooling enable and heating enable are controlled directly from the base building BAS. An adapter card may be required for this. Example: Mitsubishi Mr. Slim units can be controlled in this fashion by use of a thermostat interface card (part number: PAC-US444CN-1).
- .9 All gas and water meters connect to the BAS via a pulse output from the meter.
- .10 If a BACnet connection is required to a piece of equipment please consult with facility Engineering. Equipment using BACnet connections to be BACnet listed and certified and to be able to utilize native MS/TP protocol.
- .11 All BAS site name, point name, panel name, and graphics filename labeling shall follow the CoE Facility ID naming convention in Tririga
 - .1 Ex: COM102 - Commonwealth Recreation Centre
- .12 All sites shall be connected to the CoE Energy Analytics Platform (Coppertree) as part of the contract.
 - .1 All license fees, installation labor costs, and all other associated burdens shall be included in the contract price provided by the Installer.
 - .2 Approved installer for Analytics Platform Connection is ESC Automation
 - .3 For new construction projects or renovations where we are adding in 1000 or more points that project is to include a copper cube to allow for point storage.

4.13.1.2. Control Documents

- .1 Provide a complete schedule of physical control points. For each point provide a short description, the point type, its mnemonic (system name) as well as any alarm limits and fail safe position.
- .2 Provide a detailed control sequence for each mechanical system and any global optimization strategies. Include set points, interlocks, and alarms.
- .3 Laminated, permanently installed I/O lists shall be secured to all BAS panels.

4.13.1.3. Hardware

- .1 Each control system to be designed in such a way to facilitate a single connection from that control system to the City of Edmonton network
- .2 Specify that the system configuration allow for 10% spare physical point input/output capacity at each RCU.
- .3 An additional eight (8) outputs shall be specified to be allocated at the panel closest to the C-Cure security system panel for future alarm use.
- .4 The firmware on the BAS panels must be compatible with the existing building automation network infrastructure. In instances where backwards compatibility to the City server becomes an issue, the Contractor will include the cost to supply and install upgraded

software on the City's server.

- .5 All panels, systems, controllers, equipment etc. must be completely accessible by the City of Edmonton Controls staff, including the ability to make graphical changes and access to programming. Proprietary or control systems with restricted access will not be permitted. Any specialty software needed to make changes to the system or equipment must be provided to the City at no additional cost.
- .6 Operator work station
 - .1 An operator work station is not a requirement nor desired for network connected sites.
 - .2 Discuss any non-network connected project with the City of Edmonton Facility Engineering for operator work station requirements. In cases where a work station is required it will be supplied by the City of Edmonton.
- .7 Terminal Control Units (TCUs)
 - .1 Specify standalone microprocessor based controllers that will continue to control if communication with the sub-network fails.
 - .2 Use TCUs to control terminal heating/cooling devices only.
- .8 Actuators
 - .1 Specify electrically powered actuators to drive all valves, dampers, and other control devices. The sole exception is large three way valves where an electric actuator cannot be sourced.
 - .2 All damper, valve, etc. actuators to be accessible.
- .9 Control Valves
 - .1 Select control valves with flow characteristics to match the application. Do not oversize valves.
 - .2 Specify the flow coefficient (Cv) for all control valves.
- .10 Sensors
 - .1 Specify electronic room thermostats that allow access to TCU set points and configuration information, by either:
 - .1 a communication port for the PCs, or
 - .2 a display window and program keys incorporated into the room sensor. Program keys and display window only required for areas where user input is desired.
- .11 Control Wiring
 - .1 All controls wiring to be in EMT or rigid metal conduit.
 - .2 BAS communication wiring shall be communication rated, low capacity, and shielded.
 - .3 BAS communication wiring to be independent of power wiring and heat trace cabling.
- .12 Current Transducers / Switches
 - .1 Current switches shall not be used. Where status is required, a current transducer

outputting an analog signal shall be used.

.13 Variable Frequency Drives (VFD):

- .1 VFD speed command shall be via 4-20mA or 0-10v signal.
- .2 VFDs shall have hard wired connections for status and control signals.
- .3 Preferred points for VFD control through BAS include:
 - .1 Command - Start /Stop
 - .2 Speed Reference
 - .3 Speed Feedback
 - .4 VFD Alarm Point
 - .5 Amperage Draw

4.13.1.4. Software

- .1 Colour graphics user interface and application software will reside on the City of Edmonton controls servers. Contractor to supply original graphics files to City of Edmonton.
- .2 Specify dynamic colour graphic screens as follows:
 - .1 For any building where graphics are being modified or added as part of a renovation, the existing building graphics are to be modified to match the style vintage of the new graphics.
 - .2 a main screen showing the basic floor plan of the facility indicating locations of mechanical rooms and major pieces of mechanical equipment;
 - .3 a screen for each mechanical system (ahus, vav boxes, rtus, fan coils, etc.);
 - .4 a screen for each floor or zone to show space temperatures;
- .3 All BAS sites will include single point trend data, available in BACnet protocol, for each hard point and event in the entire database. These trends will be polling trends, recording at 15 minute intervals and the BAS panel(s) shall have sufficient memory to store all of these trends for a duration of 72 hours. The trends will be rolling trends.
 - .1 Change of Value (COV) trends will be preferred and used instead of a polling trend when fewer samples will generate a longer trend history. I.e.: A room temperature will be set up as a COV, single point trend with 1 degree granularity when the room temperature is expected to vary little.

4.13.2. Roof Drainage Systems

- 4.13.2.1. Provide a minimum of two roof drains per contained near-flat roof area, except a single drain, may be provided for near-flat roof areas not greater than 6 sq. m, i.e. entrance canopies, elevator penthouses.
- 4.13.2.2. Use internal drainage systems routed through conditioned building spaces with open flow drains and minimum 100 mm diameter pipes.

- 4.13.2.3. Direct flow that is discharged at grade so that it does not flow onto pedestrian or vehicle traffic areas, where it could freeze and become a safety hazard, or onto areas where it could cause erosion damage.
- 4.13.2.4. Terminate roof drain exterior discharge outlet with an elbow at least 1.0 m above grade. Provide a thermostatically controlled immersion heater from the discharge back into the building to prevent freeze-up during the winter. Open style downspouts will also be considered but must be discussed with Facility Engineering prior to implementation
- 4.13.2.5. Rainwater is not to be used in any systems unless discussed with City of Edmonton Engineering Services.
- 4.13.2.6. Exterior rainwater leaders are not to be PVC or plastic.
- 4.13.2.7. New construction rainwater leaders shall not re-enter the building envelope.

4.13.3. Radon Mitigation

- 4.13.3.1. All building designs shall have a Radon Mitigation Plan incorporated into the design.
- 4.13.3.2. Options that may be utilized in this plan include the Radon mitigation measures listed in “EPA Radon Prevention in the Design and Construction of Schools and Other Large Buildings”:
 - .1 Soil depressurization
 - .2 Building pressurization
 - .3 Sealing radon entry routes

4.14. Electrical

4.14.1. References

- 4.14.1.1. Meet or exceed guidelines and standards of the following BAS organizations:
 - .1 Canadian Standards Association
 - .2 Illuminating Engineering Society of North America
 - .3 Institute of Electrical and Electronics Engineers
 - .4 Insulated Cable Engineers Association
- 4.14.1.2. EPCOR, Customer Connection Guide
- 4.14.1.3. Refer to Appendices for additional referenced standards.

4.14.2. Existing Building Electrical Systems

- 4.14.2.1. For projects where an existing building is being renovated or being added to; the Basis of Design for the new electrical system is to match or exceed the existing base building system.
- 4.14.2.2. Design Consultant shall identify existing equipment to remain in place for systems being modified. Design Consultant shall coordinate with FMS to determine shutdown, maintenance, and long term preservation requirements for dormant equipment for long term construction projects as appropriate.

- 4.14.2.3. Design Consultant shall identify existing equipment being removed or abandoned under the project and define decommissioning procedures and requirements in the project specifications. Design Consultant shall identify if any regulatory requirements exist for equipment to be decommissioned and who will be filing the necessary documentation.

4.14.3. Service and Power Distribution

4.14.3.1. Utility Service

- .1 Coordinate new and modified services with EPCOR. Refer to latest EPCOR connection guide.

4.14.3.2. Sizing

- .1 As an aid to determining the electrical service size for a facility, the information provided below can be used as a guide to establish minimum requirements which are to be reflected in the Design Development Report.
 - .1 For multi-building sites, or sites with service voltages over 750V, coordinate electrical services with the City.
 - .2 Single building services with service voltage under 750V shall be sized as follows:
 - .1 Size main services and service transformers according to connected load with the appropriate load factor applied. Disclose service sizing criteria in design documentation.
 - .2 Calculate connected load using load factors as dictated by the type of load, plus an allowance for future load growth. Discuss future load allowances with the City.
 - .3 Calculate estimated loads based on basic power loads, plus additional loads anticipated for heavy power usage areas.
 - .4 For initial design basic power load due to lighting, general power, convenience loads, and basic mechanical equipment, calculated as follows:
 - .1 Buildings Over 1,000 m² With Air Conditioning: 60 VA/m² x total building area.
 - .2 Buildings Under 1,000 m² with Air Conditioning: 70 VA/ m² x total building area.
 - .3 Buildings Without Air Conditioning: 40 VA/ m² x total building area.
 - .5 Heavy power usage areas include kitchens, workshops, laboratories, and areas with large numbers of electrical equipment connections or receptacles. For these areas, calculate additional loads as follows:
 - .1 Each Heavy Usage Area (base initial): 100 VA/ m², or,
 - .2 Connected load at 100% demand, plus
 - .3 Other loads such as snow melting, block heater outlets, welders, and electric heating. Calculate additional connected load at 100% demand with a seasonal and work flow diversity factor applied.
 - .6 Addition to existing service/feeder: Provide calculation as per CEC Section 8.
 - .1 Preliminary sizing to adhere to W/m² listed in item 1 above for modified area. City to

provide maximum demand load for most recent 12-month period where available.

- .7 Final Load Calculation(s) to be included in drawing set.

4.14.3.3. Single Line Drawing

- .1 Provide electrical single line diagram as part of the Contract Documents, indicating the following:
 - .1 Configuration, type, voltage, and amperage ratings of switchgear, transformers, panelboards, and motor control centres (MCCs).
 - .2 Type, size, and amperage ratings of services and feeders.
 - .3 Type, frame size, and trip rating of overcurrent protective devices.
 - .4 kAIC rating of switchgear, panelboards, transformer secondaries, and overcurrent devices.
 - .5 Anticipated demand load at switchgear, panelboards, and MCCs.
 - .6 Arc flash incident energy levels at all equipment on line and load side of all transformers including load side of Utility transformer. Refer to Appendix E.
 - .7 Service and distribution grounding/bonding:
 - .8 Existing Building: Provide complete facility wide single line diagram; partial single line diagrams will not be accepted. City to provide existing master single line diagrams where available.
- .2 Provide copies of single line diagrams from Record Drawings, recording actual construction, to:
 - .1 Incorporate into Operating and Maintenance Manuals.
 - .2 Display in frame with clear plexiglass and hang in each major electrical equipment room, with equipment in the respective room highlighted. This requirement is to be included in the electrical construction specifications.

4.14.3.4. Protection and Control

- .1 Perform arc flash, short circuit, and coordination study to inform and validate requirements below. Refer to "[Appendix E: Arc Flash Guideline](#)" for additional information.
- .2 Ensure priority tripping and coordination of overcurrent and ground fault devices. Provide final consolidated trip curves for additions, services sized 600 A and over, and multi-building sites.
- .3 Ensure adequate fault interrupt ratings of all switchgear, panels, MCCs, and overcurrent devices. Provide calculation results when requested by the City of Edmonton.
- .4 Use fully-rated overcurrent protective devices throughout distribution system. Series-rated combinations may only be used with permission by the City of Edmonton.
- .5 Where ground fault protection is provided on services and feeders, ensure protection is also provided for downstream feeders and loads that are susceptible to nuisance ground faults. Ensure ground fault equipment is coordinated to prevent upstream devices tripping

before downstream devices.

- .6 Evaluate the feasibility of peak demand control through the use of load shedding or emergency generation equipment. Review all options with the City of Edmonton.
- .7 Do not provide under voltage protection on main breakers. Provide single phase motor protection using differential overloads or phase loss.

4.14.3.5. Harmonics

- .1 Building shall meet IEEE 519 requirements at PCC. 519 compliance should be determined as part of a full load commissioning test and/or monitoring of ITHD & VTHD throughout the first year of operation.
- .2 For sites with considerable motor loads preliminary calculations indicating power factor to be provided. Power factor to be corrected to at least 95%.

4.14.3.6. Service Spaces

- .1 For services under 200A: Main Electrical Service Room may be a shared Mechanical/Electrical space.
- .2 For services over 200A: Main Electrical Service Room to be dedicated room containing no mechanical/plumbing fixtures.
- .3 Electrical Room
 - .1 Locate in core areas of the facility and stack vertically where possible.
 - .2 Locate at grade or above if in flood zone when room contains critical pieces of electrical equipment (ie. Main Switchgear, Generator System, etc.).
 - .3 Electrical rooms not to communications equipment, mechanical equipment, ducts, pipes, shafts, or water contain mains unless the equipment is serving the room.
 - .4 Provide a minimum of one electrical room sized 1800 mm by 3000 mm (6' by 10') for every 930 sq. m (10,000 sq. ft.) of floor area served or portion thereof.
 - .5 Doors to be large enough (width and height) to allow for the removal and replacement of the largest piece of equipment.
 - .6 Floor drain to be provided.
 - .7 Provide raceway system between all Electrical Rooms, Closets, and Network Access Rooms (refer to IT Guideline for additional information).
 - .8 Where a room contains heat generating equipment, adequate cooling and/or ventilation shall be provided by mechanical.
- .4 Electrical Closet
 - .1 Not permitted to contain transformers, motors, or other heat generating equipment.
 - .2 Locate in core areas of the facility and stack vertically where possible.

4.14.3.7. Grounding & Bonding

- .1 Ensure the access to grounding connections are OHS compliant.

- .2 Ensure that all connections to be labelled with their destination.
- .3 Ensure that connections are made to a copper ground bar mounted on insulated standoffs.
- .4 CoE basis of design for underground or concrete embedded connections are to be exothermically welded and/or by using a compression system that meets IEEE 837-2014 standard.

4.14.3.8. Switchgear, Panelboards, and MCCs

- .1 Switching and Overcurrent Devices
 - .1 Use bolt on molded case circuit breakers with thermal, magnetic trip for all circuit protective devices except as follows:
 - .1 For services over 750V, provide relaying using relay accuracy class CTs with test block and solid state relays with trip indication for each function. Provide a DC battery source for control and tripping.
 - .2 Use industrial duty, draw out type air circuit breakers for all services and feeders 800 Amps and over.
 - .3 Use circuit breakers with maintainable contacts, complete with electronic trip units and trip indication for all main service or feeders for all services over 400 Amps and under 800 Amps.
 - .4 Use metal enclosed switchgear with air vacuum circuit breakers for all high voltage equipment.
 - .5 Obtain the approval of the City of Edmonton for the use of fused equipment. Consideration will only be given where fault duties of equipment require a limitation of the available fault current.
 - .2 Bussing
 - .1 Use solid copper for switchgear sized 200 A and over.
 - .2 Provide min. 25% spare capacity for future growth.
 - .3 Ensure bussing extends to all spaces for future growth.
 - .3 Metering & Power Monitoring
 - .1 Provide integral, multichannel, owner metering for incoming MDP utility service and distribution feeders unless otherwise directed by the City of Edmonton. Contact Engineering Services for currently recommended models. On larger, more complex distributions consider sub-metering on secondary CDPs & Panels. Consult with Engineering Services.
 - .2 Meter channels to monitor true RMS values for phase voltage (line to line and line to neutral), phase currents, kVA, kVAR, kW, PF, Hz, MWhr, kWd, kVAd, ITHD, and VTHD.
 - .3 Meter to have panel mounted, or adjacent, display capable of displaying above values for at least the service connection.
 - .4 Meter to be field programmable via front keypad and communications port or wireless

equivalent.

- .5 Size incoming service current transformers such that the initial design full load is approximately 60% of rating.
- .6 Meter to have a minimum of one (1) data output port.
- .7 Specifications are to instruct that any required meter setup, control, or monitoring software is to be supplied to the City.
- .8 Meter must be BACnet listed and natively utilize BACnet MS/TP protocol to integrate kVA, kVAR, kW, and kWh to the Building Automation system for monitoring. These parameters to be connected into CoE Energy Analytics Platform (Coppertree) for logging. No gateway devices to convert to the meter output are allowed.
 - .1 Provide 22 AWG twisted pair in braided or aluminum foil shield.
- .4 Control
 - .1 Control through MCCs generally via Building Management System (BMS)/BAS connection. When process control required coordinate with Client and consider alternatives such as “Smart” MCCs.
- .5 Panelboards
 - .1 Copper bussing.
 - .2 Bolt on style breakers.
 - .3 Maximum number of breaker positions in a single tub to be 42. Double wide is acceptable. Provide minimum 225A bussing for panelboards with 42 or more positions.
 - .4 Do not use feed through.
 - .5 Provide panel schedules indicating breaker size and wattage of all connected loads. Panels to be a maximum of 75% filled at the completion of Construction.
 - .6 Hinged, door-in-door construction.
 - .7 Lockable.
 - .8 Distribution panelboards to be located in dedicated rooms and closets. Provide additional space on wall for at least one (1) future panel.
 - .9 Single pole breakers with handle ties are not permitted in place of multi pole breakers.
 - .10 Provide minimum of two (2) spare 27 mm conduits c/w pullcord to ceiling space for all recessed panelboards.
 - .11 Combination (single cabinet) transformer and panel board are not acceptable.
 - .12 Wire splices required for panel replacements are to be completed with terminal blocks, housed in a separate enclosure.
- .6 Accessories
 - .1 Provide lifting equipment for all industrial type air circuit breakers, high voltage switches and stacked high voltage starters.

.7 Working Clearances

- .1 Provide all switchgear and MCCs with minimum 1.5 m front clearance, in addition to space required for drawout equipment in full disconnect position, and all free standing switchgear with minimum 1.0 m back and side clearance.

.8 Housekeeping Pads

- .1 Provide all floor mounted equipment with a 100 mm (4") housekeeping pad except for roll-out style switchgear.

.9 Outdoor Pedestals

- .1 Provide precast concrete base and local heat to provide minimum temper heating to 5°C to facilitate proper operation of equipment and prevent condensation.

4.14.3.9. Transformers

.1 Location

- .1 All Transformers shall be installed such that replacement is possible without unforeseen building modifications nor surface or structural damage. Provisions may include double doors, expanded hallways, reinforced and or widened routes to loading docks and grade, removable wall panels, top access pits, etc.
- .2 Main Building Transformers: locate standard 600V or 208V outside with pads and rails as per EPCOR guide. Provide screens where required by project. Location to be serviceable as required by EPCOR standards and as close as possible to building service entrance to reduce capital and operating costs (line losses). All primary, MV services to be in fully isolated, interior vault segregated from 600V or lower distribution.
- .3 All Indoor Transformers over 45 kVA: allow for removal by wheel mounted equipment.
- .4 Indoor transformers are to be preferentially floor mounted on housekeeping pads. Suspended installation only permitted for transformers within service rooms where there is lift accessibility. Transformers 45 kVA and less may be cantilevered/wall mounted where access is not impeded by other equipment. Coordinate transformer heat removal with Mechanical.

.2 Type

- .1 Use minimum K-4 rated distribution transformer. Increase K rating or opt for HMT, Zig-zag, and/or alternating phase layout where advisable due to amount of non-linear/harmonic load.
- .2 Autotransformers only permitted for dedicated equipment step-up/down applications.
- .3 Copper windings only.
- .4 Combination (single cabinet) transformer & panel board are not acceptable.

.3 Secondary Voltage (isolation/distribution)

- .1 347/600 V, three phase, four wire, solidly grounded wye.
- .2 120/208 V, three phase, four wire, solidly grounded wye.

- .3 120/240 V, single phase, three wire, solidly grounded, center tap.
- .4 Obtain approval from the City of Edmonton for other voltages, connections, or any impedance grounding schemes.
- .4 Acoustical Considerations
 - .1 Ensure adequate acoustic ratings, treatment location and mounting of transformers. Refer to Section "[Acoustic Considerations: Electrical](#)".

4.14.3.10. Feeders

- .1 Use copper conductors.
- .2 Provide a full capacity neutral and a bonding conductor with all feeders.
- .3 Other than main service feeder cables and/or raceway, feeders are not permitted to be located in slab or below slab-on-grade.

4.14.3.11. Solar Photovoltaic System

- .1 See Solar Photovoltaic Program - [Volume 2 - Design Guideline](#).

4.14.3.12. Power Factor Correction

- .1 Correct power factor to at least 95% where normal loading yields a power factor of less than 90%.
- .2 Locate PFC close to the motor or group of motors, preferably downstream of starters.
- .3 Review use of automatic correction equipment with the City of Edmonton.

4.14.3.13. Arc Flash and Shock Hazard Labelling

- .1 Refer to [Appendix E – “Arc Flash Design Guideline”](#)

4.14.4. Motor Protection and Control

4.14.4.1. General

- .1 Where possible, provide motors ½ hp (0.37kW) and larger as three phase units.
- .2 Where possible, provide motors larger than 1 hp (0.75kW) as three phase 600V units.
- .3 Provide motors smaller than ½ hp (0.37kW) as single phase, 120V units. Usually with integrated thermal overload.

4.14.4.2. Motor Protection and Control

- .1 Do not use fuses for individual motor overcurrent protection.
- .2 Provide single phase protection for all three phase motors either by relaying, differential overloads, or BAS shutdown.
- .3 Provide space on backpan for BAS current sensors.
- .4 Consider harmonic contribution when designing Variable Frequency Drives and provide filtering as required.

4.14.4.3. Control Wiring

- .1 Coordinate control requirements with mechanical designers. Indicate control branch circuits on electrical drawings and panel schedules.
- .2 Low voltage control wiring to be run in conduit or otherwise mechanically protected.

4.14.4.4. Variable Frequency Drives

- .1 **General:**
 - .1 VFD's, while effective for many control and energy saving system designs, should only be used if there is a positive payback and control effect not otherwise achievable by moderately sized, across the line motors.
 - .2 VFDs should *NOT* be used as a substitute for soft starts.
 - .3 For very small HVAC applications ECM motors should also be considered.
 - .4 Pump mounted or other equipment integrated drives with custom mountings and form factors are *NOT* acceptable.
- .2 **Location:**
 - .1 Drives shall be located as proximate to motor loads as practicable and feasible.
 - .2 Drives shall not be located in any environmentally harsh or excessively dusty or dirty environment without extraordinarily rated enclosures and other mitigating methods.
 - .3 Consider maintenance implications in terms of accessibility and replacement items such as filters.
- .3 **Bypasses, Branch Circuit Wire Size & Over Current Protection (OCP):**
 - .1 Bypasses are generally not supported or advisable as many variable speed applications cannot be run safely or effectively without speed control. High availability, when required, is best achieved by fully redundant n+1 drive trains including VFDs, motors, & rotating equipment (pump, fan, etc.) to best address all failure modes. In these scenarios be sure to consider adequate, if not necessarily full, system capacity in failure scenarios and also employ round-robinning, swapped lead, or other methods to keep all units operationally tested and worked. If a bypass is required (i.e. parkade ventilation) then all wiring, OCP, overloads, etc. shall be sized as in a standard, across the line application.
 - .2 When bypasses are not specified, VFD branch OCP and conductors should match and be sized as per manufacturer's recommendations or otherwise 125-175% of drive rated FLA.
- .4 **Branch Circuit Distribution:**
 - .1 Distribution feeds for drives should generally not be sourced from an MCC. In a mechanical room scenario, with many drives, there should be a CDP to aggregate feeds.
 - .2 Supply an SPD/TVSS device at any CDP distribution and/or individually at VFDs larger than 50HP.
- .5 **Harmonics:**

- .1 Drives with DC-link, swinging style, chokes preferred for harmonic mitigation. Additionally ~1-3% input reactors are suggested for most applications (~3-5% if no DC choke). For further harmonic mitigation in a large installation, or on a large drive, a full harmonic filter, passive or active, may be advisable on the input or at panel distribution. In the fringe cases of very large drives a 12 pulse or better solution may be indicated.
- .2 IEEE519 shall be met at building PCC. In new buildings this should be considered from the initial design and a tap for an active filter may be advisable. In renovation/retrofit application test before and after to ensure harmonic mitigation choices were appropriate give relative size of new harmonic load.
- .6 Enclosures:
 - .1 VFDs shall have adequate local LCD/LED control panel and display for configuration and control. Also full BACnet connectivity is required for monitoring and control.
 - .2 VFD component should generally be specified with integral fusing and disconnects and in a NEMA 12 enclosure.
 - .3 Drives and above input & output filter elements and bypasses may be neatly mounted separately or located in an integrator enclosure. All such integrator enclosures must be heat run tested at full load for 24h and not exceed manufacturer's published environmental limit for any interior components (i.e. drive, filters, etc.). All enclosures shall have active, redundant fan ventilation with over-temperature and fan failure alarms. Only filter inlet ports. When an integrator supplies an enclosure with multiple components they have full design, commissioning, and warranty responsibility for the entire package.
 - .4 Input voltage rating +/- 10% or better of nominal. IE. 208/240V class shall be rated up to 264V and 600V class shall be rated up to 660V or better. In heavy duty or large motor applications 690V Class drives rated up to 759V are preferred.
- .7 Motor Protection & Wiring:
 - .1 Output from drive/filter to all motors (or to motor starter, overload & disconnect distribution and on to motors) shall be correctly wired with drive/VFD "Teck" style cable similar to Beldan Symmetrical YC4936x series or Nexans DriveRX.
 - .2 All motors shall be inverter grade and explicitly rated as meeting the NEMA MG1 Part 31 standard with respect to insulation withstand of 3.1 times or greater of the rated voltage with rise time of 0.1 microseconds.
 - .3 Output to motors larger than 10 HP shall be via a dV/dT filter similar to MTE DVAGA or TCI V1K series. Full Sine filter might be considered if motor accessibility is very poor or in a retrofit application to non Part31 motor.
 - .4 Motors over 20HP should be specified with an Aegis or similar shaft grounding bushing if they are not otherwise shaft grounded by equipment connection or conductive fluid coupling.
 - .5 Where VFD's are mounted remotely, provide local safety disconnect at motor Local safety disconnect must be labeled in visible location with "Safety Lockout ONLY. Shutdown and disconnect VFD before switching."

.8 **Acceptable Manufacturers:**

.1 **Drives**

- .1 ABB ACH500, standard commercial
- .2 ABB ACS600/800, medium/heavy duty
- .3 Schneider Altivar 61, standard commercial
- .4 Schneider Altivar 71, heavy duty
- .5 Danfoss VLT HVAC, standard commercial
- .6 Emerson Commander SK, standard commercial
- .7 Emerson Unidrive M, heavy duty

.2 **Filters/Reactors**

- .1 MTE
- .2 TCI

4.14.5. Surge Protective Devices

- 4.14.5.1. Provide surge protective device (SPD) on Utility incoming mains.
- 4.14.5.2. For areas containing a large group of electrically sensitive load, provide surge protection on panelboards serving the area.
- 4.14.5.3. Coordinate surge suppression devices within the same power distribution system.

4.14.6. Branch Wiring

4.14.6.1. General

- .1 Use copper conductors minimum #12 AWG conductor size.
- .2 Provide a separate bonding conductor in all branch circuit raceways. Conduit shall not serve as bond.
- .3 Branch circuit cable and/or raceway are not permitted to be located in slab or below slab-on-grade.
- .4 Minimum raceway size to be 21 mm.
- .5 Obtain approval of the City of Edmonton for the use of non-metallic sheathed cables. Consideration will only be given for buildings of combustible construction.
- .6 Use AC-90 cable only in short lengths, less than 3 m, for final connections to luminaires and similar equipment or vibration isolation.
- .7 All receptacles to be specification grade.
- .8 Provide separate circuits for coffee makers, refrigerators, and microwave ovens. Consider 20A 5-20R T-slot type general purpose receptacles in kitchen/coffee counter areas.
- .9 Housekeeping receptacles in corridors to be located 15 m on center and 7.5 m from

corridor ends.

- .10 Floor boxes to be of heavy duty flush (<2 mm to finished floor) type that can be closed while in use and resistant to water ingress.
- .11 All branch circuits to be labelled with panel name & circuit designation.
 - .1 For circuits less than or equal to 20A and 240 volt, panel name and circuit designation to be indicated with a wrap-around style label on the faceplate and permanent marker inside the box.
 - .2 Otherwise, all higher voltage and ampacity circuits to have lamacoid style labels with panel name, circuit, and voltage/phase.
- .12 For high humidity applications, ensure surface raceways are galvanized and painted (coordinate with Architectural).

4.14.6.2. Provisions for Computer and A/V Based Equipment

- .1 A/V requirements to be coordinated with Open City & Technology (OCT) Network Analyst when a network connection is required.
- .2 Identify electronic equipment and systems likely to be affected by electrical service disturbances including voltage sags, surges, short and long term transients and outages. For this equipment, determine the extent of protection necessary for normal operation.
- .3 Protection and Power Conditioning.
 - .1 Isolation Transformers: electrostatically shielded transformers for equipment affected by transients and noise.
 - .2 Regulated Power Supplies: for equipment and systems affected by transients, noise, voltage sags, and surges.
 - .3 Electronic Filters: for equipment affected by power line noise.
 - .4 Uninterruptible Power Supplies: for equipment requiring continuity of service.
- .4 Computer Circuits
 - .1 Supply only electronic equipment with these circuits. Do not use these circuits to supply convenience receptacles or mechanical equipment.
 - .2 Generally supply only two computer workstations per circuit.
 - .3 Provide a separate, dedicated bond and neutral back to panel for each circuit.
 - .4 In situations where multiple circuits will supply potentially interconnected equipment in an area, ensure the circuits feed from a common panel.

4.14.6.3. Block Heater Outlets

- .1 Design to shut off all power to outlets when outside temperature is above -10°C.
- .2 Provide timer to cycle energized outlets on and off at a maximum 30 minute period. If there are more than 30 parking stalls, split the load into two groups and alternately cycle load.

- .3 Assuming supply sized to supply all outlets simultaneously, inhibit cycling below -30°C.
- .4 Use the building's BAS system to control parking lot loads where possible. Coordinate with the Mechanical Section.
- .5 Provide override switch (ie. H-O-A) for parking lot controller testing/maintenance.

4.14.6.4. Electric Vehicle Supply Equipment

- .1 Ensure that EV chargers are monitoring-enabled and payment-enabled including network connection.
- .2 If more than one EV charger is planned to be installed, consider utilizing dual-port chargers in place of two single port chargers.
- .3 Charging stations to be located as close as possible to the electrical supply service while also assuring that they are conveniently located for drivers. Provide self retracting cord where possible.
- .4 Provide curbs, bollards, wheel stops and/or equipment setbacks to prevent vehicle damage to equipment.
- .5 Provide adequate lighting in area of charger to facilitate nighttime use.
- .6 Consideration to be given to using higher charge rate equipment (40A, 240V)
- .7 Charger to be SAE J1772 compatible.
- .8 Currently acceptable manufacturers include ChargePoint, Sun Country, Flo, or approved equivalent.

4.14.6.5. Provisions for Equipment

- .1 Custodial
 - .1 Storage/Janitorial rooms to have adequate (number and current capacity/type) receptacles for any equipment. Ensure mechanical is aware of any exhaust requirements due to battery charging.
 - .2 Ensure adequate (number and current capacity/type) receptacles throughout facility for equipment such as floor polishers, etc.

4.14.6.6. Provisions for Mechanical

- .1 Indicate location and circuiting of all mechanical control panels on drawings.
- .2 Coordinate electrical equipment required for mechanical equipment with the mechanical designer. Items may include UPS for head end of BAS systems, power filters, regulators, electrically powered valves and dampers, lighting in air handling units, heat tracing of piping or equipment, etc.
- .3 Rooftop receptacles to be on dedicated branch circuit.
- .4 Local disconnects to be provided for humidifier units.

4.14.7. Life Safety, Emergency, and Security Systems

4.14.7.1. General

- .1 Provide emergency power for all life safety, security, and [Mechanical Systems](#). Pay particular attention to fire rating of emergency lighting feeds or feeds to smoke evacuation fans, elevators, fire pumps, or similar emergency life safety classed equipment.
- .2 Provide battery backup for all systems with volatile electronic memory.
- .3 Refer to 'Security and Card Access System Design Guideline', 'Video Surveillance System Design Guideline' and "Fire Alarm System Design" in Appendices for further information.

4.14.7.2. Fire Detection Systems

- .1 Show F/A devices on plan drawing(s). Include a fire alarm system riser diagram in contract documents.
- .2 Use horn/speaker-strobe combination devices for audio-visual signals unless site conditions dictate otherwise.
 - .1 Audibility shall be code minimums of 65 dB SPL (75 dB SPL if Residential Occupancy) and at least 10 dB SPL above predicted operational noise floor. Do not exceed 90 dB SPL in non-service spaces without explicit approval.
 - .2 When using speaker for alerting, design for lower SPL and higher density of speakers to maintain intelligibility.
- .3 Coordinate duct detectors with mechanical to ensure air velocities are compatible with detectors.
- .4 Coordinate sprinkler flow alarms and valve tamper locations with mechanical and indicate on fire alarm plan.
- .5 Indicate all auxiliary connections to the F/A panel, including elevators, BAS, emergency diallers, fire door hold-open devices, fan shut-down relays, cistern tank levels, etc.
- .6 Note that any and all consultant expenses for fire alarm verification are considered included in design and construction management fees.
- .7 All F/A wiring to be red FAS cable or fiber in conduit. BX/AC90 only acceptable for movement or vibration isolation, final device stub, or in a retrofit situation where running conduit not practical. Length to be 3 m or less without explicit CoE approval and product must be factory supplied as red armoured FAS.
- .8 [Basis of Design to be Simplex, Notifier and Mircom.](#)
- .9 Fire Alarm Communications (dialer) to be provided for all ULC and non-ULC compliant installations as per 'Fire Alarm Communication Design Guideline' in [Appendix F](#).

4.14.7.3. Generators

- .1 Locate generator and associated electrical equipment at grade or above if in area subject to flooding.
- .2 Provide sufficient clearances for maintenance and repair personnel to access all sides of the generator.
- .3 Provide provisions for removal/replacement of generator at end of life that does not require substantial building modifications.

- .4 Programming software used to program the generator is to be non-proprietary and provided to the City.
- .5 All cables or equipment required for monitoring to be provided to the *City*.
- .6 Transfer switches are to be capable of remote monitoring of generator status and state.
- .7 When fire pump transfer switch is on generator power and pump is running, generator battle short mode shall be engaged.
- .8 Provide vibration isolators for field installation.
- .9 Paralleled generator configurations shall only be considered for extremely high availability applications and/or large loads. They shall be of integrated, PLC controlled switchgear style and fully configured to operate and load shed feeder breakers under failed generator and overload conditions. BAS only load shed not acceptable.
- .10 Service and parts shall be available within 24 hours
- .11 Manufacturer shall provide a certified summary of prototype-unit test report
- .12 Manufacturer shall be experienced in installation and operation of generator set of comparable size.
- .13 Manufacturer shall guarantee availability of parts for a minimum of 25 years.
- .14 Generator shall include at a minimum:
 - .1 Remote annunciator panel
 - .2 External Battery Charger.
 - .3 Braided fuel lines c/w union connections for fuel inspections (carburetor to tank)
- .15 Final Site Design Load Calculation(s) to be included in drawing set.
- .16 Site Design load to be posted on each transfer switch with red lamacoid (white writing). Minimum size 50 mm x 100 mm.
- .17 Enclosure
 - .1 Generator to be installed within facility. Where not feasible and with City approval, a sound attenuated enclosure and Winter Package may be acceptable. Refer to section [Generator Power Supply for Life Safety Loads](#) for additional requirements for Life Safety loads.
- .18 Exhaust
 - .1 Exhaust shall discharge vertically for maximum dispersion modeling. Rain cap shall fully open without impeding the vertical discharge while the generator is operating.
 - .2 Position the exhaust point above roof level and away from air intakes.
- .19 Ventilation
 - .1 Outside air and recirculating motorized dampers to be provided.
 - .2 Ensure generator room layout allows for optimal generator cooling, intake and outake louvres to be configured as per manufacturer recommendations.

.20 Fuel Fill Port and Control Panel

- .1 Fill level indicator panel adjacent to exterior fuel fill port. Panel to contain six (6) indicator lights and lockable cover with clear plexiglass window:
 - .1 "Fuel Leak" (Red) (Local Audible Alarm at fill panel)
 - .2 "25%" (Yellow)
 - .3 "50%" (Green)
 - .4 "75%" (Green)
 - .5 "Tank Full - STOP FILL" (Red) (90%)
 - .6 "Overfill Alarm" (Red) (Local Audible Alarm at fill panel)
- .2 One (1) button:
 - .1 "Indicator Test" (momentarily activates all Indicator Lights (1 thru 6 and Local Audible Alarms)
- .3 Fill levels to be manufacturer set to allow for full -40C tank expanding to +40C. Automatic overfill prevention device to be used to comply with code.
- .4 "Fuel Leak" indicators (where applicable) to be tied to high level sensor within curbed generator room (or generator containment perimeter).
- .5 Fuel Port to have lockable cover.
- .6 Plan for fueling accessibility and spill control during fueling.
- .7 CSA 282 compliant as required.
- .8 CSA Certification or approved equal.

.21 Annunciator

- .1 Panel to be located at Service Desk or Operator's station or as directed by City.
- .2 Panel to contain four (4) indicator lights:
 - .1 "Generator Run" (Green) (Audible Alarm)
 - .2 "Generator Trouble" (Red) (Audible Alarm)
 - .3 "Generator Fail" (Red) (Audible Alarm)
 - .4 "Low Fuel" (Red) (Audible Alarm)
- .3 Two (2) buttons:
 - .1 "Silence Horn" (acknowledges and silences any alarm)
 - .2 "Indicator Test" (momentary button activating all indicators and audible alarms)
- .4 CSA 282 compliant as required.
- .5 CSA Certification or approved equal.

.22 Sub-base fuel tank

- .1 Provide curb
 - .2 Built-in fuel gauge on sub-base tank
 - .3 Two fill ports sufficient to facilitate fuel conditioning
 - .4 Exterior generator installation to have NEMA 4 spill containment device fitted to the inlet of the storage tank. Spill containment device to be at least five (5) gallons and must be lockable.
- .23 Stand-alone fuel tank
- .1 Provide integral secondary containment with leak detector tied to indicators and alarms
 - .2 Fuel tank shall rest on supports or piling made of concrete, masonry, or steel. Tank supports shall be installed on firm foundations designed to minimize uneven settling of the tank and to minimize corrosion of the part of the tank resting on the foundation.
 - .3 Provide levelometer
 - .4 Barriers shall be used to protect exterior fuel tanks from mechanical damage by vehicle or other sources
- .24 Load bank
- .1 Cam-lok connectors for load bank test to be E1016 Series, 400A (minimum), female and to be mounted in load bank quick connect (c/w non-conductive mounting plate) located inside generator room where clear path to outside is available. Otherwise to be located adjacent Fuel Port and Control Panel (exterior).
 - .2 LSI local breaker (generator) w/ shunt trip and aux. contacts for load bank connection
 - .3 Minimum load on generator to be 30% (or as dictated by monthly testing for installations to CSA C282). A permanent load bank is to be installed unless it can be shown that the site demand will not drop below the minimum load requirement.
- .25 Portable Generator Connection
- .1 Cam-lok connectors for a portable generator to be E1016 Series, male and to be mounted in quick connect (c/w non-conductive mounting plate) located in close proximity to the Load bank connection.
 - .2 Manual transfer switches are only permitted for installation to accommodate portable generator.
 - .3 Combination Manual Transfer switch - portable generator cabinets are preferred.
- .26 Acoustics
- .1 Refer to the section [Acoustic Considerations: Electrical](#)
- .27 Overfill/Leak Protection/Diesel Piping Leak
- .1 Overfill and leak protection is required on all installations as stated in 3.18
 - .2 Double wall tubing is required where fuel fill tank are stored indoors and fuel fill port is located outside
 - .3 In room spill control to be considered for elevated generator rooms or as directed by the

City. Ensure room is capable of containing the capacity of the largest tank in the room.

4.14.7.4. Generator Power Supply for Standby Loads

- .1 Refer to Section [4.12.6.1.20 - Backup Power](#)
- .2 Provide a minimum of one receptacle in electrical and mechanical rooms connected to emergency power where a generator is installed.
- .3 Power to electrically actuated washroom fixtures shall be on standby power circuits if available.

4.14.7.5. Generator Power Supply for Life Safety Loads

- .1 CSA 282 shall be met for all generator installations powering Life Safety (L/S) systems as per code.
 - .1 EXCEPTION: All police, fire, and ambulance facilities shall have C282 compliant generator installations even if not required by code for L/S system service.
- .2 Generator to be installed within the facility. Where not feasible and with City approval, a climate controlled, sound attenuated, walk-in enclosure equipped with motorized louvres may be acceptable.
- .3 Where systems are required by code to run past 30 minutes, concrete encasement of conductors/conduit may be permitted in place of MI cable. City to provide direction on a case by case basis.

4.14.7.6. Uninterruptible Power Supply

- .1 Uninterruptible Power Supply (UPS) system are required to maintain the City Fiber network for facilities' VOIP and communications function during generator tests. Provide UPS power for all Emergency Services facilities or facilities that provide City Fiber connectivity to said facilities. OCT Network Analyst to provide a list of associated City Fiber switch sites.
- .2 All LRT facilities to follow the latest "LRT Design Guidelines"
- .3 Provide centralized UPS system for groups of loads unless otherwise directed.
- .4 Provide all centralized UPS assemblies with a 100 mm (4") housekeeping pad
- .5 Locate UPS in NAR room, adjust room size to accommodate centralized UPS systems
- .6 UPS system to include the following features:
 - .1 Static Bypass
 - .2 External Maintenance Bypass Switches for centralized UPS systems
 - .3 True Sine Wave output
 - .4 Size battery for min. 20 minute runtime at full load or as dictated by site specific requirements.
- .7 Consider the following for UPS design
 - .1 Increased redundancy for complex or critical facilities

- .2 System scalability
- .3 System components to be hot swappable
- .4 Network Monitoring capabilities
- .8 Provide ventilation and cooling requirements as required by manufacturer. Coordinate requirements with Mechanical Consultant.
- .9 UPS system to be provided the following alarm outputs to the BAS
 - .1 AC power failure
 - .2 Battery failure
 - .3 Output failure
- .10 UPS to supply power to the following systems
 - .1 IT systems
 - .2 BAS Head end
 - .3 Client specific systems (Fire Rescue, Edmonton Police, Edmonton Public Library, Waste, etc)

4.14.7.7. Egress/Emergency Lighting

- .1 Design emergency lighting in such a way as to ensure local emergency lighting is activated when normal lighting in the area it serves is disrupted at the branch circuit level, not just when main building power or major feeders are disrupted.
- .2 All battery powered emergency lighting unit equipment shall have auto-self test with audible battery failure alarm.
- .3 In all electrical and generator rooms provide battery powered emergency lighting unit equipment with a minimum 2 hour capacity or greater as required by any codes.
- .4 Integral batteries within standard area lighting fixtures not permitted without explicit approval from CoE Engineering Services.

4.14.7.8. Exit Signs

- .1 Exit signs to use permanently illuminated, backlit or edgelit LEDs that illuminate the entire face (or stencil cutout when using deprecated red 'EXIT' signs).
- .2 Any particular renovation/addition must be judged on its unique merit in terms of the implementation of new standard 'Green Running Man' signage vs. older 'Red Exit' signage. The factors will include, but not necessarily be limited to:
 - .1 Percentage size of new area (however *no* absolute number such as 51%)
 - .2 Impact on egress routes and need for clear wayfinding to building exits, i.e. Only one (1) signage style permitted on any egress route.
- .3 Acceptable solutions may include:
 - .1 Usage of older "Red Exit" signage in new areas to preserve the integrity of egress route wayfinding "system" and prevent confusion when exiting (particularly in lower area

percentage renovations/additions).

- .2 Mixed use of older "Red Exit" and new "Green Running Man" signage (i.e. situation where there is basically no crossing of exit routes and little to no connection between old and new areas; or situation where there would only be one change of signage on the way out, such as a full floor renovation or additional building wing).
- .3 Retrofit of entire building to new standard "Green Running Man" signage for a consistent egress route wayfinding "system" (preferred solution when renovation and addition would be a substantial percentage, 50%+ of resultant new space, and said retrofit of old area would not result in undue cost).
- .4 Any project that is remotely questionable should be submitted to the Sustainable Development Building Inspection office for AHJ review at the conceptual stage to avoid unnecessary costs due to design changes or construction change orders.

4.14.8. Lighting

4.14.8.1. General

- .1 Design to maximize the energy efficiency of lighting systems.
- .2 Only use the task-ambient approach where work surface and task orientations are predetermined and as agreed to by the City of Edmonton.
- .3 It is not necessary to design for worst case work surface and task orientations in general office space.
- .4 Design to minimize direct and reflected glare and maximize contrast.

4.14.8.2. Recommended Lighting Levels

- .1 Design lighting levels to IES recommended lighting levels for horizontal and vertical illuminance. Refer to the latest edition of the IESNA Lighting Handbook.
- .2 Consider the following criteria when deciding the appropriate average maintained light levels within a space. Criteria may be determined upon consultation with the City of Edmonton.
 - .1 Visual Tasks performed: High, medium or low contrast, large or small size
 - .2 Occupant Age
 - .3 Task Duration: Short or Prolonged periods
 - .4 Workplane height
- .3 Consult with the Architect and consider the room finishes (colour and reflectance) when performing light calculations.
- .4 Maintained Values: Use the following criteria for calculation of maintained values.
 - .1 Luminaire Dirt Depreciation: 0.90 (Typical office environment). This value may be adjusted based on project specific criteria such as dirtiness of the environment.
 - .2 Lamp Lumen Depreciation: LLD factor is different for each lamp type. Utilize mean lumen output ratings from lamp manufacturer when calculating light levels in a space.

4.14.8.3. Uniformity

- .1 All areas in a space need not be to minimum average maintained values if functions permit. Lighting levels may be non-uniform. For example, circulation areas in an office may be of a lower level than recommended for the work surface.

4.14.8.4. Exterior Lighting

- .1 This section applies to sites within the City of Edmonton (CoE) that have metered exterior lighting (ie. Facility site lighting, Park lighting) that are maintained by the City. Unmetered installations (ie. Roadways) are to be designed to 'Road and Walkway Lighting Construction and Materials Standards', latest edition, available through the CoE Transportation Department. For additional information regarding a specific site please contact CoE Engineering Services.
- .2 All projects to adhere to the CoE 'Light Efficient Community Policy', latest edition.
- .3 Use LED for parking, roadway, area lighting, and building exterior. Acceptable voltages are 120V, 208V, 240V. 347V not permitted for new installations. In retrofit situations where only 347V is available and no conversion feasible, true integrated 347V drivers preferred (no external autotransformers) and confirm acceptability with CoE Engineering Services prior to specification.
- .4 Approved luminaire head manufacturers include "Philips Lumec", "Cooper/Eaton", or "Acuity Brands". Preferentially recognized families already approved by Transportation for roadway or MUT or those otherwise previously used by CoE. Acceptable examples include "Philips Lumec" 'Roadstar', 'Roadview', 'Streetview', 'Metroscape', 'Urbanscape' & 'Ancestra'; "Cooper/Eaton" 'Ridgeview'. Explicitly confirm exceptions with CoE Engineering Services prior to specification.
- .5 Use cast in place or precast concrete piles with internal ducts and embedded bolts/rods. 280 mm (11") BCD nominal standard. Top of pile shall be 150 mm above finished grade in soft landscaped areas, 150 mm if in sidewalk or other hard surfaced areas. Additionally, for parking lots and roadway areas where there is likely a risk of vehicular impact, top of pile shall be 1000 mm above finished grade.
- .6 Pile design & size to be coordinated with the structural consultant taking into account soil & grade conditions and final pole/head requirements. Acceptable examples for precast piles include Armtec '8-0082', '8-0083-6', & extended (3000 mm) '8-0079' depending on application. Cast in place to be fully detailed.
- .7 Poles to be square or octagonal, galvanized steel, and painted with 2 coats of enamel on primer or polyester powder coated. Approved manufacturers include Novapole & West Coast Engineering. Any aluminum and/or custom poles to be explicitly approved by CoE Engineering Services. Pole supplier to confirm design suitability for luminaire head EPA and associated installation location parameters.
- .8 If cameras are specified to be pole mounted then please ensure that poles are equipment with segregated raceways for mixed voltages with manufacturer approved camera mounts. Custom poles to be explicitly approved by CoE Engineering Services.
- .9 Luminaires including emitter diode package & driver shall be explicitly rated to operate

from -40°C to 40°C.

- .10 Exterior luminaires to have minimum colour rendering index (CRI) of 60 and correlated colour temperature (CCT) of 3000 (± 200) K with a D_{UV} of -0.006 to 0.006. Optionally a CCT of 4000 (± 200) K with a D_{UV} of 0.005 to 0.007 will only be accepted with explicit approval from CoE Engineering Services.
- .11 A single head's emitter diode package/board should not exceed 12000 lumens for general purpose horizontal illumination. Consult with the City of Edmonton for project-specific details that may fall outside this limit.
- .12 Use UV resistant diffusers/lenses for exterior luminaires and consider vandal resistance.
- .13 Use full cutoff luminaires for all parking, roadway, and area lighting. House side shielding to be specified on property perimeter luminaires unless there is otherwise lit road, or other adjacent city property, that could benefit from spill light. Wall mounted luminaires to be positioned or shielded to eliminate glare and light trespass to adjacent, non-city, properties.
- .14 Where multiple different architectural exterior luminaires are used (i.e. pole mount, bollard, building mount), select luminaires to complement each other, possibly from the same manufacturer "family".
- .15 Bench and in ground lighting by explicit approval only, please contact CoE Engineer Services prior to specification.
- .16 Bollard lighting by explicit exception approval only and used for decorative, architectural purposes only, not general area lighting. Follow above pole guidelines. Breakaway base design required except when not indicated due to security requirements.
- .17 Custom products highly discouraged and not permitted without explicit approval from CoE Engineering Services. Eg. Architectural marquee luminaires, bollards, rail and rope light installations, etc.

4.14.8.5. Interior Lighting

- .1 Lighting Supply voltage to be preferentially 120V but not to exceed 240V. 347V not permitted.
- .2 Purpose designed LED luminaires from major manufacturers preferred; must meet IES LM-79 and IES LM-80. For some architectural purposes E26/GU10 fixtures with LED lamps may be acceptable.
- .3 Minimize the number of unique lamp types used. Specialty lamps beyond E26, E39, GU5.3, GU10, G5 & G13 by exception only.
- .4 For Lighting Power Density targets, please refer to **NEC latest edition**.
- .5 Use of non-LED, generally incandescent, sources not permitted without explicit approval from CoE Engineering Services. Propose only where minimal burning hours are expected and/or significant architectural considerations are presented.
- .6 LED sources to have minimum colour rendering index (CRI) of 80 and have colour temperature of 3500K, or as determined in consultation with the City of Edmonton depending on building use. Colour temperature should be consistent throughout building

except intentional architectural purposes.

- .7 Cove lighting not permitted without explicit approval from CoE Engineering Services due to stringent reliability and service requirements. Recessed lighting may be acceptable provided fixtures are easily accessible for maintenance (ie. not over toilets which make ladders unusable).
- .8 The use of LED tube style lamps for fluorescent luminaire replacement or retrofit is not supported. Consult CoE Engineering Services for exceptions.
- .9 Custom products are highly discouraged and not permitted without explicit approval from CoE Engineering Services. Eg. Architectural marquee luminaires, bollards, rail and rope light installations, etc.
- .10 High efficiency, low brightness diffusers are preferred in areas containing computer display workstations.
- .11 Consider direct/indirect combination lighting in office areas and where glare is to be minimized, but only if adequate ceiling height exists.

4.14.8.6. Drivers and Ballasts

- .1 Use energy efficient electronic, solid state designs with built in inrush and surge suppression.
- .2 Total Harmonic Distortion of less than 12% and Power factor greater than 0.95.
- .3 Where dimming is required must be capable of 0-10V.

4.14.8.7. Control

.1 General

- .1 Lighting control systems (LCS), if implemented, shall be a Low Voltage Relay System and provide manual, automatic, or programmable lighting control. The application of this control and the controlled zones will depend on a number of factors including frequency of use, available daylighting, normal or extended work hours, and operational/security requirements. All of these factors must be considered when establishing zones, zone controls, and the overall lighting control narrative/strategy.
- .2 Do not use breaker switching.
- .3 Nightlights, if switched, are to be controlled from a keyed switch located in a secure location.
- .4 Provide time clock or programmed switching for large general use areas.
- .5 Provide an automated dimming system in office areas or other sensitive areas to prevent initial overlighting of the space and ensure adequate light levels throughout the life of the light source.
- .6 Daylight harvesting to be provided with photocell control wherever feasible and provide control narrative for facility integration.
- .7 Provide single photocell, manual electromechanical time clock, or security device control or a combination thereof for exterior luminaires. Consider facility usage and security

when determining the exterior lighting control scheme.

- .8 Wireless controls not permitted in new construction; renovations by explicit approval from CoE Engineering Services. Wireless devices for programming purposes are permitted.
- .9 Provide motion sensor control where economics are favourable. Areas to consider include washrooms, lunch/break rooms, copy rooms, individual offices, low-use corridors, and nightlights. Motion sensors in offices are to be manual on, automatic off. Use dual technology (PIR & microphonic) sensors in areas where line of sight cannot be assured, such as washrooms. Depending on technology (LED vs fluorescent) and situation, ensure adequate time outs to avoid frequent or nuisance cycling.
 - .1 Do not use motion sensor control in mechanical/electrical rooms, elevator rooms, or service areas.
 - .2 Do not use motion sensor control in rooms/areas that require roof and/or roof access
 - .3 Ultrasonic sensors are not permitted.
- .10 Ensure that equipment is UL 924 (Emergency Lighting Equipment) and UL 2043 (Heat and Smoke Release for Air-Handling Spaces) listed as required.
- .11 Provide at minimum 25% spare capacity in lighting control panels.

.2 Low Voltage Relay System

- .1 Must be capable of integrating with the building management system (BMS) and communicate over BACnet/IP with BBMD capability.
- .2 Must be fully integrated into CoE centrally monitored BMS network before turnover.
- .3 Must provide the ability to use standard BMS structure to command objects: zone controls and schedule objects.
- .4 Must provide the ability to use standard BMS structure to view objects: power/energy meters, individual lighting stem alarms or failures, motion/occupancy sensors, light output levels(intensity), and indoor ambient light levels(intensity).
- .5 Programmable relays, field devices, DACs, or similar not to be located in walls or ceiling spaces, to be logically marshaled in a common panel.
- .6 Any specialized equipment or programming required for commissioning, troubleshooting, or general maintenance to be provided at turnover.
- .7 Provide switching for conference rooms, board rooms, groups of common offices, large areas of single use, and offices.
- .8 Low voltage lighting panels to be located adjacent to lighting distribution panelboards/placed to minimize circuit lengths to a maximum circuit distance of 300 m. Panels are not to be shared between floors.
- .9 Each lighting control relay shall be capable of controlling incandescent, fluorescent, electronic ballast, and H.I.D. lighting loads and have an inrush capability of 3000 amperes. Relays shall be complete with a minimum 5 year manufacturer's warranty.
- .10 Lighting control relays shall include captive screw terminals for both the line voltage and

the low voltage connections. Switching the relay shall be accomplished with one (1) signal wire and a common return. The signal wire shall be able to signal on and off and shall carry status current that indicates if the relay is on or off.

- .11 Relays are to be individually replaceable.
- .12 Relay must be provided with a manual override.
- .13 Capable of mixed load voltages as well as mixed sources (i.e. normal and emergency power).
- .14 Ensure that relays are provided with a single 0-10V dimming output (IEC 60929 Annex E) capable of sinking 30mA (corresponding to 30 typical ballasts/LED drivers).
- .15 Ensure that under loss of utility power, relay contact returns to the normally closed position and bypasses control to the emergency/egress lighting.
- .16 All control wiring to run from device to headend, daisy-chaining of devices not permitted.

.3 Digital Addressable System

- .1 Only permissible with explicit approval from Engineering Services. CoE Engineering Services.

4.14.8.8. Installation

- .1 Support recessed luminaires independently of T-Bar.
- .2 Only use luminaire manufacturers approved for the installation method specified. Failure to do so may result in mechanical failure or heating causing reduced lifetime and/or fire hazard.
- .3 Indicate on drawings the method of support for luminaires. Provide details if required.
- .4 When fixture installation requires securing the unit with screws, dimensional lumber substrate is to be used as screw stripping and tear out in gauge metal or plywood substrate poses a risk to occupants. Where use of dimensional lumber is not feasible, toggle anchors must be specified.

4.14.8.9. Maintenance

- .1 Commonly replaced components used in specified lighting products, such as LED arrays/lamps and ballasts/drivers, are to be available locally from wholesale supplies and/or distributors. Ensure the manufacturer specified guarantees the compatible replacement parts for a minimum of 10 years.
- .2 All LED arrays, lamps, lens, ballasts, drivers, etc shall be readily accessible for service and replacement without any requirement for architectural remediation (i.e. carpentry, drywall, painting). All luminaire replacement elements such as lenses, drivers, lamps, panels, hatches, grills, etc. shall be 2.5 m or less in length and of a reasonable cross-section and weight.
- .3 Luminaires located in high areas (above 3 m) are to be positioned to allow for maintenance and replacement of parts with standard City of Edmonton maintenance equipment.
- .4 LCS to have local technical support & maintenance with factory trained technicians and

service and parts available within 24 hours.

4.14.9. Communication Equipment

4.14.9.1. Structured Wiring

- .1 Coordinate structured wiring requirements with the City of Edmonton.
- .2 Structured wiring designed to comply with IT Infrastructure Design Guidelines. A copy of this document can be found in Appendix B.
- .3 Structured wiring design to follow latest edition of TIA/EIA-568 – Commercial Building Telecommunication Standard.

4.14.10. Audio Visual Systems (A/V)

4.14.10.1. General

- .1 Coordinate A/V requirements with the City of Edmonton.
- .2 Please provide Network bandwidth calculations prior to tender.
- .3 Please provide POE Power budget calculations prior to tender.
- .4 Please provide Serial # & MAC Address for each item in tabulated form
- .5 Page zones are to be made available to all users in smaller zones:
 - .1 Emerg All Zones (entire building)
 - .2 Rec All Zones (all zones in rec section)
 - .3 Rec Common (all common public areas in rec)
 - .4 Pool All Zones (pool deck & pool change rooms)
 - .5 Fitness Common (all fitness zones)
 - .6 MPR All (all multipurpose rooms)
 - .7 Arena Common (all common public areas in arena)
 - .8 All individual rooms should still be able to split out to separate zones in the future in the event of the room changing function
 - .9 Library Zone should be isolated to be operated from the Library desk only.
- .6 Be sure to specify a wall mountable weatherproof CB style microphone to the pool deck for emergency pool page only.
- .7 All rack mount UPS shall have data ports connected back to the COE network for remote monitoring.
- .8 Basis of design is the 70V speaker line.
- .9 Basis of Design for Arena - Wireless microphone to be a dual channel wireless receiver with both audio outputs routed to the corresponding arenas.
 - .1 Only one handheld microphone will be required at time of install. Second wireless

channel is for future events or if future wireless expansion is needed.

- .2 Wireless system to have remote antennas mounted in each corresponding arena, antenna cable to be factory built cable and any RF inline amplifiers to be installed according to factory spec's to have proper RF gain structure.
- .3 Handmade cables will not be accepted.
- .10 Network switching manufacturer to be fully defined.
 - .1 POE Power budget to be coordinated with CoE IT and FES Electrical prior to tender.

4.14.10.2. Assistive Listening Device Systems (ALD)

- .1 Generally to code for assembly occupancies. Induction Loop currently preferred.
- .2 Contact City for specialty implementations in Libraries.
- .3 Make allowances in millwork, floor, or ceiling for Induction loop at public service desk locations.

4.14.10.3. Distributed Antenna Systems (DAS)

- .1 In large facilities investigate and allow for DAS systems (Bi-directional Amplifiers (BDAs), etc) to allow for both emergency responder and public cell data frequencies.
- .2 For EPS facilities, contact the Project Manager for a list of specific requirements.

4.14.10.4. Clock Systems

- .1 Arenas: Provide 175 mm model on both ice surfaces and 100 mm model in the referee room and arena office.
- .2 Other areas as instructed by COE.

4.14.11. Miscellaneous

4.14.11.1. Maintenance & Sustainable Design of Electrical Equipment & Infrastructure

- .1 Common replacement components used in electrical equipment, such as lamps, ballasts, fuses, and breakers, must be available through local distributors.
- .2 Where possible, specify electrical equipment and systems that have local service and support with 8 hr response time.
- .3 Allowances shall be made for access to electrical elements and raceway infrastructure shall be provisioned to interconnect devices, major distribution nodes, etc. Examples include spare conduit across inaccessible spaces (high ceiling, drywalled ceilings, etc.), adequate access hatches, raceway system between electrical & Datacom (NAR) rooms.
- .4 Any large electrical equipment such as UPS or Transformers must be located such that a future service replacement is possible. This includes a planned path with adequate structural rating and clearances around corners and through doors. Consider required dollies and/or potential rigging.
- .5 Any electrical elements such as luminaires that require a lift to service must have a clearly

planned and reserved serviced corridor to bring in a lift. This includes double doors, ramps, turning radii, etc. Maximum height for lift service 9 m. Maximum height for ladder service 4 m.

- .6 Any electrical elements in the vicinity of stairs, atria greater than 9 m, etc. shall be evaluated for serviceability so as not to require scaffolding, bosun's chair harnessing, specialty lifts, or other extraordinary means.

4.14.11.2. Electrical Service Rooms (ESR), Network Access Rooms (NAR), & Other Security or DataCom Equipment Locations

- .1 To be sized as per Service Spaces in the [Service and Power Distribution](#) section, building & electrical code(s), EPCOR, and other CoE guidelines to ensure serviceability and future expansion.
- .2 Collocated with mechanical or similar equipment by exception only.
- .3 Environmental conditions to be maintained to suit equipment requirements and maintained under power loss conditions if equipment will continue to function.

4.14.11.3. Software

- .1 Software used to program, monitor, or control specified electrical equipment is to be supplied to the City. Do not specify equipment that uses proprietary software that is not made available by the vendor to the end user. This may apply to equipment such as generators, distribution equipment (MCCs), lighting control systems, fire alarm panels, etc.
- .2 Specify training on all software provided.

4.14.11.4. Lightning Protection:

- .1 Provide lightning arrestors on all services connected to overhead lines or elements/systems otherwise deemed to be exposed plant (i.e. Roof mount antennas) **in compliance with CSA B72.**
- .2 As a guideline, provide lightning protection for structures that are taller than adjacent structures within a 500 m radius.
- .3 Lightning protection requirements depend on a multitude of building design, construction, & location factors. On all projects, the design professional of record shall positively confirm the requirement or exclusion of lightning protection.

4.14.11.5. Penetrations and Firestopping:

- .1 Ensure adequate treatment for all envelope penetrations such as generator exhaust piping, lightning down conductors, and points and service masts. Refer to [Building Envelope](#) for specific requirements.
- .2 Coordinate firestopping requirements with Architect. Ensure firestopping responsibility is clearly indicated in contract documentation. Any disturbance of existing firestopping to be repaired to current standards. Any previously deficient firestopping to be remediated to current standards.
- .3 For penetrations of Datacom cabling and/or trays that are subject to repeated, frequent, operational alterations specify a reusable system.

- .4 Perform non-destructive, investigative survey with radar, x-ray, sonar, or other appropriate means prior to any and all penetrating operations on floor slab, wall, structural member, or similar building element that may contain reinforcement or building systems susceptible to damage. This includes, but is not limited to, coring, cutting, boring, depth fastening, etc.

4.14.11.6. Colour Coding Requirements:

- .1 Refer to [Appendix A – Colour Coding Requirements](#) for Mechanical and Electrical Systems for identification symbols and colours for electrical conduit and equipment.

4.14.11.7. Client Specific Requirements:

- .1 While some CoE client specific requirements are noted throughout this document there are often unique demands for certain CoE business areas and associated groups. It is contingent upon the design professional to clarify and reconcile any of these elements with the Project Manager, Engineering Services, & the client group.
- .2 Notable Clients with Distinctive Requirements
 - .1 Fire Rescue Services (FRS)
 - .1 SAS dispatch system.
 - .2 Edmonton Police Service (EPS)
 - .1 Security
 - .2 IT
 - .3 Radio & DAS.
 - .3 Libraries
 - .1 Security
 - .2 IT
 - .4 LRT
 - .1 LRT Guideline
 - .5 Waste
 - .1 Security
 - .2 IT

4.15. Energy Modelling Guidelines

4.15.1. General

- 4.15.1.1. See Volume 1 for requirements for Energy Modelling deliverables at the various stages of technical review.

4.15.2. Definitions

- 4.15.2.1. Modeled Floor Area – The total floor area of the building, as reported by the energy simulation software, and generally to within 5% of the gross floor area from the architectural drawings. The

floor area specifically excludes any exterior spaces and parkades.

- 4.15.2.2. Energy Use Intensity (EUI) – The sum of all energy utilities (i.e. Electricity, natural gas, district heating) used on site by the project, divided by the Modeled Floor Area. EUI shall be reported in kWh/m²/year.
- 4.15.2.3. Greenhouse Gas Intensity (GHGI) – The total greenhouse gas emissions associated with the use of all energy utilities on site. Please consult the City of Edmonton for the latest Natural Gas and Electricity greenhouse gas emissions factors.
- 4.15.2.4. Annual Heating Demand (AHD) or Thermal Energy Demand Intensity (TEDI) – The amount of heating energy delivered to the project that is outputted from any and all types of heating equipment, per unit of modeled floor area. Heating equipment includes electric, gas, hot water, or DX heating coils of central air systems (i.e. make-up air units, air handling units, etc.), terminal equipment (i.e. baseboards, fan coils, heat pumps, reheat coils, etc.), or any other equipment used for the purposes of space conditioning and ventilation. Heating output of any heating equipment whose source of heat is not directly provided by a utility (electricity, gas, or district) must still be counted towards the AHD. For example, hot water or DX heating sources that are derived from a waste heat source or a renewable energy source do not contribute to a reduction in AHD, as per the above definition. Specific examples of heating energy that are not for space conditioning and ventilation, that would not be included in the AHD, include maintaining swimming pool water temperatures, outdoor comfort heating (i.e. Patio heaters), gas fired appliances (stoves, dryers), heat tracing, etc. AHD shall be reported in kWh/m²/year.
- 4.15.2.5. Clear Field – An opaque wall or roof assembly with uniformly distributed thermal bridges, which are not practical to account for on an individual basis for U-value calculations. Examples of thermal bridging included in the Clear Field are brick ties, girts supporting cladding, and structural studs. The heat loss associated with a Clear Field assembly is represented by a U-value (heat loss per unit area).
- 4.15.2.6. Interface Details - Thermal bridging related to the details at the intersection of building envelope assemblies and/or structural components. Interface details interrupt the uniformity of a clear field assembly and the additional heat loss associated with interface details can be accounted for by linear and point thermal transmittances (heat loss per unit length or heat loss per occurrence).

4.15.3. Acceptable Energy Modeling Software

- 4.15.3.1. The simulation program shall meet the requirements of ASHRAE 140 and ASHRAE 183.

4.15.4. Energy Model Requirements / Objectives

- 4.15.4.1. The energy model will follow the requirements of the current version of the National Energy Code for Buildings for weather files, unmet hours, schedules, internal loads, DHW loads, elevators, process loads, ventilation rates, infiltration, envelope heat loss, opaque assemblies, fenestration, and doors.

4.16. Pool Systems and Other Water Treatment

4.16.1. General

- 4.16.1.1. Pool systems shall be, at minimum, designed to the requirements of the following standards:
- .1 Alberta Building Code, especially Part 7 and Part 2
 - .2 Alberta Health - Pool Standards - 2014
 - .3 Alberta Regulation 204/2014 - Public Health Act - Public Swimming Pools Regulation
 - .4 ASHRAE guidelines for pools—outdoor airflow and air distribution designs.
- 4.16.1.2. BAS to trend all pool water systems and include historical data collection.
- 4.16.1.3. If salt-sourced chlorine generators are used:
- .1 A floor drain shall be provided next to each bank of salt-source chlorine generators (salt cells).
 - .2 Only single salt-source chlorine generators shall be specified. Duplex salt-source chlorine generators will not be permitted.
- 4.16.1.4. Only regenerative media filters or high-rate sand filters shall be specified. Review all pool filter selections with CoE Facility Engineering. Horizontal sand filters will not be accepted.
- 4.16.1.5. Drywall and suspended ceilings in natatoriums are discouraged. Please consult with CoE Architecture and Engineering Services prior to any ceiling being considered for any natatorium. If a ceiling is installed in the natatorium, Monel (nickel-copper) type hangers should be considered as an option. Ceilings must allow for investigation and repairs within the ceiling space without significant damage or deconstruction.
- 4.16.1.6. All hangers and pipe/electrical/architectural supports in natatoriums to be galvanized or nickel based alloy or corrosion resistant.
- 4.16.1.7. Flow meters are to be electronic type with the ability to be monitored from the building automation system. In addition, a non-electronic flow gauge shall be installed as a secondary flow measurement device. Flow meters to have isolation valves installed before and after the meter.
- 4.16.1.8. One flow meter and turbidity meter shall be installed on the main inlet and outlet lines of the circulation system.
- 4.16.1.9. Flow meters shall be installed on the supply line to slipstream devices such as heat exchangers and in-line chlorine generators.
- 4.16.1.10. One spare strainer basket is required for each set of strainers. A wash area is required, complete with three sides to prevent overspray, outlet for power washer, hose bib, and drain.
- 4.16.1.11. All pool pumps shall:
- .1 Be specified and installed with adequate access space for strainer maintenance and cleaning.
 - .2 Be powder coated on all wetted components and surfaces with fusion bonded epoxy

coating 134, or equivalent food-grade coating. Thickness and surface preparation requirements shall be included within the specification. In lieu of coating the impeller, a high nickel "Marlow" impeller may be specified.

- .3 Ensure shaft and frame bonding provisions are provided. Coordinate with Electrical Consultant.
- .4 All pool pumps to be base mounted on a housekeeping pad.

- 4.16.1.12. Pool basins are to be capable of being drained by gravity.
- 4.16.1.13. Pools designed for the purpose of use by small children shall be a separate pool with separate filtration, circulation, and chemical treatment systems.
- 4.16.1.14. Wave pools shall be designed to prevent waves from pushing bathers into obstructions.
- 4.16.1.15. Pool tanks to have a continuous service and pipe space around each tank. The service space shall be full height and at least 2 m wide with ventilation, lighting, drainage, and convenience power outlets.
- 4.16.1.16. Locate all elbows and tees in the service space.
- 4.16.1.17. Sand and other similar permanent filter media systems shall have a turbidity meter installed on the backwash effluent pipe.
- 4.16.1.18. Each backwash effluent pipe shall have a 600 mm linear section of transparent pipe for the purpose of confirming when backwash is complete.
- 4.16.1.19. Surge tanks should be easily accessible from the mechanical rooms and conform to confined space regulations. Access to surge tanks shall not be directly from the deck. Access ports into surge tanks shall have a minimum inside clear diameter of 900 mm.
- 4.16.1.20. Surge tanks to be exhausted with a dedicated exhaust fan and venting to allow for removal of chloramines.
- 4.16.1.21. Dedicated control systems for oxidation reduction potential, pH, and other chemical treatment shall be controlled by external devices and where required, BAS may be used to monitor these systems.
- 4.16.1.22. Pool systems controlled and monitored by the BAS shall have independent graphics from the building HVAC systems.
- 4.16.1.23. Pool circulation systems shall be controlled and monitored by BAS.
- 4.16.1.24. Gutters and Surge:
 - .1 Deck-level gutters to be designed to hold 100% of the instantaneous maximum surge.
 - .2 Gutter grates to be oriented parallel with the pool basin walls.
 - .3 Pool edge of the gutter shall use coved tile to form a lip with hand grip tile spaced throughout the perimeter of the basin.
 - .4 Pool filtration circulation surface collection shall be achieved by perimeter overflow. Where a perimeter overflow system is not practicable, skimmers will be acceptable, subject to review by Facility Engineering.
 - .5 Circulation shall be designed such that 100% of the circulated water returning to the

filtration equipment, based on the design flow rate, can be accomplished by surface perimeter overflow.

- 4.16.1.25. Acoustics design shall be done by an acoustics engineer for all natatoriums.
- 4.16.1.26. Pool circulation shall employ bottom inlets, not side inlets. If side inlets are proposed instead of bottom inlets, this matter is to be discussed with Facility Engineering.
- 4.16.1.27. Natatorium Lighting:
 - .1 Lighting in areas specified in A.B.C 7.2.3.20 to be designed to a minimum of 300lx
 - .2 Stainless steel hangers are not permitted in natatorium
 - .3 Lighting fixtures are not permitted over the pool basin.
 - .4 Underwater lighting is not permitted without explicit approval.
- 4.16.1.28. Equipotential Bonding:
 - .1 Equipotential bonding testing to occur before and after basin concrete pour by way of 4-Pole DC Resistance Test for all permanent metallic structures with 1.5m of the pool and whirlpools are bonded per CEC section 68.
 - .2 For rehabilitations, renovations and/or addition of on deck pool equipment within 1.5 m of the pool edge, please contact FES for further information and support.
- 4.16.1.29. Pool membrane should be run over the pool edge, under the perimeter drain, and onto a portion of the deck.
- 4.16.1.30. Pool Mechanical Rooms:
 - .1 The Consultant shall complete a Hazardous Assessment Report on pool mechanical rooms and acid rooms. This report shall provide the basis for rating electrical equipment within these spaces.
 - .2 Pool mechanical rooms to be properly ventilated.
 - .3 Agitation of the pool effluent within mechanical rooms should be minimized.
 - .4 Acid used for pH control for pools and acid delivery systems shall be stored in a dedicated 'acid room' which shall be properly vented and designed for this purpose.
- 4.16.1.31. Chlorine Rooms:
 - .1 The Consultant shall complete a Hazardous Assessment Report for chlorine rooms. This report shall provide the basis for rating electrical equipment within these spaces.
 - .2 The following codes and guidelines shall be followed and applied in the design of gaseous chlorine rooms. All the requirements and suggestions contained therein shall be applied to all chlorine room designs.
 - .1 Alberta Building Code - 7.2.3.41 to 7.2.3.45, inclusively
 - .2 Alberta Fire Code
 - .3 Alberta Occupational Health and Safety Act, Regulation, and Code
 - .4 WorkSafe BC - Chlorine Safe Work Practices

- .5 Workers Compensation Board (WCB) Alberta
- .6 Building Code Interpretation 06-BCI-003 (September 2007)
- .3 In addition to the codes and guidelines referenced above, the following shall apply to chlorine rooms:
 - .1 The manual switch for the chlorine room exhaust fan and the chlorine room light shall each be labelled clearly.
 - .2 The manual switch for the chlorine room exhaust fan shall be a basic manual dial timer switch, with a time range of 4 hours.
 - .3 Supply air discharges (indoors) shall be located to provide cross-ventilation using outdoor air.
 - .4 Exhaust air discharges (outdoors) shall not be positioned where they can discharge into areas where chlorine gas may cause damage or injury, such as schools, playgrounds, worksites, private homes, or shopping centres; or where they can be captured by the air intake system of the same or another building.
 - .5 Provide signage below chlorine room viewing window that indicates location of all chlorine vents or exhaust fan outlets which may discharge chlorine out of the building.

4.16.1.32. Ozone Generators:

- .1 Follow all provisions in WorkSafeBC's Ozone Safe Work Practices document.

4.16.2. Salt Water Pools

- 4.16.2.1. Ground all metals within the pool and pool circulation system (e.g. cup anchors grab rails, water features, drains, grates, wave chamber partitions, pumps, heating system components, etc.). Pump casing, shaft, and impeller shall be grounded.
- 4.16.2.2. All metal components in the natatorium that are exposed to air should be protected against corrosion (e.g. properly coated or selected as 316 stainless steel).
- 4.16.2.3. Sacrificial anodes for heat exchangers containing pool salt water and other components susceptible to corrosion due to salt concentrations shall be considered during design. Material selection for heat exchangers in salt pool applications shall consider the use of titanium or stainless steel components in preference to copper or cupro-nickel material complete with cathodic protection on these components.
- 4.16.2.4. For existing heat exchangers to remain for pools being converted to salt-cell chlorination it is preferred to replace existing copper and cupro-nickel components within the exchanger with stainless steel or titanium components and provide cathodic protection on these components.
- 4.16.2.5. Cathodic Protection on bonding/grounding of all pool components, including heat exchangers, susceptible to corrosion shall be considered during design.
- 4.16.2.6. Consider humidity control (eg. using outdoor air) to prevent corrosion of components in natatoriums.
- 4.16.2.7. Prevent condensation on cold surfaces (eg. chilled water, domestic cold water) with insulation.
- 4.16.2.8. Ensure neutral to slightly negative relative air pressure in natatoriums to prevent moist air

exfiltration through exterior walls.

- 4.16.2.9. Ensure rooms containing salt cells do not exceed 26 °C indoor air temperature and manufacturer's recommended ambient temperature.
- 4.16.2.10. Ductwork within the natatorium should be protected against corrosion.
- 4.16.2.11. Air handling units handling with mixed return air and outdoor air shall have outdoor air preheating to prevent condensation of return air humidity.

4.17. Arenas

4.17.1. General

- 4.17.1.1. The requirements contained within this section are to apply to any ice plant design completed directly by the consultant or any delegated design completed by the contractor. If there is to be a delegated design the requirements below shall be contained within the performance spec for the ice plant contractor. In addition the shop drawings for any delegated design are to be provided to Facility Engineering for review and approval prior to construction.
- 4.17.1.2. During upgrades or replacements, ensure that the current program requirements of the facility will be met.
- 4.17.1.3. Replacing units one-for-one is not acceptable if the facility has extended the seasonal duration that ice is in place (i.e. earlier in the fall, later in the spring, or has ice year-round.)
- 4.17.1.4. A Class T mechanical room is required to house a refrigeration plant and must be designed accordingly.
- 4.17.1.5. All equipment must be accessible for maintenance and ensure the manufacturer's service clearances are maintained.
- 4.17.1.6. Specify a water softener for all ice plant installations.
- 4.17.1.7. The City preference is to locate the brine header in a header trench.
- 4.17.1.8. Ice plant rooms shall have a minimum of two exit doors for egress.
- 4.17.1.9. Ventilation in Class T Machinery Rooms:
 - .1 Exhaust for ice plant rooms shall be provided by two separate exhaust (2) fans and meet CSA B52 requirements. Single fans with VFD will not be accepted.
 - .2 Class T machinery rooms require two levels of ventilation: low flow and high flow.
 - .3 Low flow shall be achieved by a make-up air unit and exhaust fan pair (interlocked), both sized exclusively for the required low flow.
 - .4 High flow shall be achieved by a separate exhaust fan and exterior wall outdoor air intake opening, both sized exclusively for the required high flow.
 - .5 The low and high flow ventilation systems shall operate independently. The high flow system shall not require the low flow system to operate in order to satisfy the high flow requirement. The low and high flow exhaust fans may use the same ductwork or part of the same ductwork.

- .6 Please refer to gas detection guidelines for additional information on ventilation system design.

4.17.2. Refrigeration System

- 4.17.2.1. The ice plant and the HVAC building cooling must be independent systems.
- 4.17.2.2. The City prefers anhydrous ammonia as the refrigerant with low charge capacity and calcium chloride or environmentally friendly propylene glycol as the secondary coolant. Ethylene glycol is not to be used.
- 4.17.2.3. The City preference is for Armstrong pumps to be utilized in brine circulation to ensure compatibility with the City standby pump.
- 4.17.2.4. Include VFD control on secondary coolant loop pumps.
- 4.17.2.5. Transformers and VFDs are not to be skid mounted. Provide proper clearance for maintenance.
- 4.17.2.6. Clamps on arena brine system headers shall be stainless steel with brass nuts.
- 4.17.2.7. Ensure that a filter is included in the brine system.
- 4.17.2.8. Consultant to add within the specifications that brine lines shall be pressurized, approx. 103.4 kPag (15 psig) over design pressure prior to construction to identify leaks. If leaks are identified, the Contractor shall repair as required.
- 4.17.2.9. The preferred compressor is the Mycom 'M' Series reciprocating compressor.
- 4.17.2.10. If screw compressors are required, select with a maximum of 1800 RPM.
- 4.17.2.11. High temperature piping (including refrigerant discharge and liquid lines) shall be coated with high temperature paint.
- 4.17.2.12. Plate and frame heat exchangers are preferred over shell and tube.
- 4.17.2.13. Follow manufacturer's service clearance recommendations but allow at a minimum 1m service clearance on all sides of the compressor.
- 4.17.2.14. Specify cooling condensers/cooling towers to be able to run without water when the outside air temperature is below 2°C.
- 4.17.2.15. The City requires closed circuit cooling towers with glycol as the working fluid, rather than evaporative condensers or other rooftop components utilizing ammonia.
- 4.17.2.16. Refrigerant systems for arenas should be sized to deliver 282kW (80 Tons) minimum at standard operating conditions. Standard operating conditions should be considered 29.5°C (85°F) condensing and -12.2°C (10°F) evaporating. Sizing for 'seasonal' operation will no longer be accepted.
- 4.17.2.17. Use plate and frame heat exchanger to capture heat from the condenser loop.
- 4.17.2.18. For any equipment that requires relief provide a dual relief valve assembly.
- 4.17.2.19. On systems where refrigerant volumes are low enough (Ammonia DX plate and frame systems):
 - .1 Route the refrigerant relief valve into a dedicated deluge tank. The system must meet the requirements of CSA B52-13 section 7.3.6.1.3. Venting of refrigerant, specifically

ammonia, directly to atmosphere will not be accepted.

- .2 The sump or deluge tank must be sealed from the ice plant room and vent to atmosphere outside. The deluge vent shall be a minimum 4.6 m above the adjoining ground level or accessible roof level and not less than 7.6 m from any window, ventilation opening, or exit.
- .3 Domestic cold water makeup system with backflow prevention shall be provided for deluge tank.

- 4.17.2.20. Manual fire-line dump valve to be installed regardless of refrigerant charge.
- 4.17.2.21. For ammonia, rupture disc assemblies (RDAs) are to be used on all pressure-relief valves to indicate which valve has discharged.
- 4.17.2.22. Ensure adequate headspace on second level of skid package.
- 4.17.2.23. Ensure adequate protection of electrical equipment from leaks on second level of skid package. (i.e. provide covers over electrical panels, provide liquid tight NEMA Class 4).
- 4.17.2.24. Working clearances on skid packages to be visually verified during a factory site tour by CoE Facility Engineering/FMS prior to shipment of skid. Design consultant shall include this in the project specifications for the Contractor.
- 4.17.2.25. Provide drainage pipe to collect glycol/brine from seal leaks and take it down from the second level of the skid package.
- 4.17.2.26. All brine balance tanks to be sealed and complete with pressure and level switches.
- 4.17.2.27. Emergency shutdown switch/buttons for fire personnel installed exterior of mechanical rooms shall be installed at a minimum height of 3.1 m (10ft) above grade. Emergency shut offs shall be identified and adequately protected from accidental activation (i.e. providing a cover).

4.17.3. Dehumidification

- 4.17.3.1. Preference for dehumidification is to use desiccant electric dehumidifiers as opposed to gas fired units.
- 4.17.3.2. The preferred suppliers of dehumidifiers are Munters, CDI, Engineered Air, or equivalent.
- 4.17.3.3. For large facilities a rooftop dehumidifier may be utilized, but the preference is for units hung in the dehumidified space.

4.17.4. Controls

- 4.17.4.1. Do not allow proprietary controls for the refrigeration system. Refer to Consultant Manual [controls](#) section for approved controls systems / contractors.
- 4.17.4.2. All ice plant graphics shall be delivered to CoE including the containing folders with unrestricted access to all provided files. These files shall be delivered to CoE FMS via USB Drive without access restrictions. The sequence of operations for the ice plant in all weather conditions will be listed on one of the ice plant graphics.
- 4.17.4.3. All developed files and contents shall be considered the property of CoE.
- 4.17.4.4. All costs associated with the development and unrestricted access to provided work product

shall be included in the Construction costs.

- 4.17.4.5. The City must be able to modulate all control valves via BAS (i.e. for setting brine temperature).
- 4.17.4.6. Provide remote reading capability for the operation of the plant.
- 4.17.4.7. The ice plant packaged control system is only to be integrated into the building control system if the two systems are supplied by the same manufacturer. If the two control systems are supplied by different manufacturers there must not be any interconnections of data and the two systems must be connected to the City network independently.
- 4.17.4.8. Ensure that BAS has full electromechanical backup with BAS / Off / Local setting. Include safety and operating switches for high pressure, low pressure, oil failure.
- 4.17.4.9. Ensure redundancy in brine temperature sensing including return temperature sensors, slab temperature sensors, and infrared sensors.

4.17.5. Ice Resurfacing Requirements

- 4.17.5.1. Ice resurfer to be fueled by compressed natural gas.
- 4.17.5.2. Ice resurfer water supply must have the capacity to fill the resurfer up to twice per hour (based on a twin arena).
- 4.17.5.3. Provide a water fill station with a 25mm cold water hose bibb, a 25mm tempered water hose bibb, and two (2) standard (12mm) hot water hose bibbs.
- 4.17.5.4. Provide a feedforward digital mixing valve connected to the BAS to control the temperature of water supplied to the ice resurfer.
- 4.17.5.5. Provide a two way valve on the tempered water line connected to a timer to allow operators to set the ice resurfer fill time.

4.17.6. Heating

- 4.17.6.1. Heating is required for the timekeeper and spectator spaces. Player boxes do not require heating.
 - .1 In-slab or in-seat heating is the preferred method of heating in the spectator and time keeper areas. Radiant tube heaters are an acceptable alternative where in-slab or in-seat heating is not feasible. Unit heaters will not be accepted.
- 4.17.6.2. Ensure heaters face away from the ice.

4.18. Elevators

4.18.1. General

- 4.18.1.1. Non-proprietary elevators controllers to be specified.
- 4.18.1.2. The CoE has preferred controller manufacturers. Specification of these brands is not a strict requirement but encouraged. Preferred controller manufacturers are:
 - .1 Elevator Controls Corporation

.2 GAL Manufacturing Corp.

.3 Motion Control Engineering

- 4.18.1.3. Specify that the contractor must provide the *City* a complete set of any specialty tools required for elevator maintenance.
- 4.18.1.4. Any elevator controller passwords required for maintenance must be given to the *City*.
- 4.18.1.5. Consider urine resistant floors on all elevators with unmonitored public access.



APPENDIX A - COLOUR CODING REQUIREMENTS FOR MECHANICAL AND ELECTRICAL SYSTEMS

1. Mechanical Equipment

1.1. Concealed Equipment within Ceiling Spaces

- 1.1.1. Locations for equipment that is concealed above a ceiling shall be identified by the use of a self adhesive “Data Dot”.
- 1.1.2. The “Data Dot” should be adhered to a non-removable surface that is clearly visible without the removal of obstruction and without the use of a ladder.
- 1.1.3. Example: For T-Bar Ceilings, the data dot should be adhered on the T-Bar frame adjacent to the panel to be removed to gain access to the equipment.
- 1.1.4. Colours for “Data Dots” should follow the recommendations identified in the table below:

Access Purpose	Colour
HVAC Equipment and Duct Cleaning	Yellow
HVAC Valves and Dampers	Blue
Plumbing equipment and valves	Green
Control dampers and sensors	Black
Fire, smoke and sprinkler equipment	Red

1.2. Piping

- 1.2.1. All pipe painting/coating and labelling (including flow direction arrows) shall be in accordance with ASME A13.1 unless otherwise specified herein.
- 1.2.2. Labels shall be applied exterior to insulation and jacketing when used.
- 1.2.3. All piping exposed to exterior weather conditions shall be coated to protect against degradation. Exposed piping shall be coated and labelled in accordance with this appendix.
- 1.2.4. Coating or painting of exposed piping within ceiling spaces that are not subject to hazardous or corrosive environments and not within mechanical rooms is at the discretion of the Design Consultant except as required by applicable code. All piping within ceiling spaces must be appropriately labelled as defined herein.
- 1.2.5. All exposed piping within mechanical room areas shall be painted and labeled. Paint colour shall match label background colour as defined in Table A-1.2.3 unless otherwise specified herein.
 - 1.2.5.1. Refrigerant line coating shall be ‘Safety Grey’ in colour, however labelling for ammonia shall be in accordance with International Institute of Ammonia Refrigeration (IIAR) Bulletin 114.
 - 1.2.5.2. Ammonia relief vent lines shall be coated ‘Safety Red’ and labeled in accordance with IIAR Bulletin 114.
- 1.2.6. All piping routed through hazardous or corrosive environments shall have appropriate surface coating to protect the piping system from degradation. Labeling and colour coding shall be similarly applied in

these areas as within mechanical room areas.

- 1.2.7. Labels shall be applied on both sides of all wall and floor penetrations, adjacent to changes in pipe direction, adjacent to valves and flanges, and at minimum every 6 m (25ft) on straight runs as appropriate.
- 1.2.8. Distance between labels for ammonia systems shall be in accordance with IIAR Bulletin 114.
- 1.2.9. Buried piping shall utilize a detectable metalized ribbon laid 150 mm (6") below ground level and above the buried pipe. Ribbon should display the same information for piping labels identified herein at intervals not exceeding 800 mm (31.5").

1.3. Labeling

- 1.3.1. Colour of background and lettering shall be in accordance with ASME A13.1 recommendations unless otherwise specified in Table A-1.2.3.
- 1.3.2. Labeling for ammonia systems shall be in accordance with IIAR Bulletin 114.

Table A-1.2.2 General Label Colouring (ASME A13.1)

Service	Label Background Colour ¹	Label Lettering Colour
Fire Protection, Suppression & Quenching Fluids	Safety Red	White
Toxic & Corrosive Fluids	Safety Orange	Black
Flammable & Oxidizing Fluids	Safety Yellow	Black
Combustible Fluids	Safety Brown	White
Potable, cooling, boiler feed, and other water	Safety Green	White
Compressed Air	Safety Blue	White
Strong Acids & Strong Caustics	Safety Purple	White
Refrigerants (Except Ammonia)	Safety Grey	White

- 1.3.3. Size and font of label lettering shall be in accordance with ASME A13.1 recommendations or IIAR Bulletin 114 as appropriate.
- 1.3.4. Flow direction arrows shall be incorporated within the label or on bands matching the scheme of the label on either side of the label. Flow arrow bands shall be self adhering and applied around the full circumference of the piping when used.
- 1.3.5. For canvas wrapped piping, labels shall be stencil painted directly to canvas surface as appropriate.
- 1.3.6. Approved abbreviations for fluid labels have been provided in Table A-1.2.3. Labels using other abbreviations for fluids shall only be used when approved in writing by the City Facility Maintenance

¹ Colours preceded by the word "Safety" shall meet the requirements of ANSI Z535.1

Services (FMS) and Facility Engineering Services (FES) or designates.

1.4. Designation of Colours

- 1.4.1. Piping systems labelling shall be colour-coded as indicated in Table A-1.2.3. If substance is not listed within Table A-1.2.3, refer to Table A-1.2.2 for general labeling colours per ASME A13.1.

Table A-1.2.3, Colour Coding Requirements for Piping Systems

Service	Coating Colour	Label Background Colour ²	Label Lettering Colour	Label Legend ³	Specialty Notes
Fire Suppression - Sprinkler	Safety Red	Safety Red	White	WET SPRINKLER	
Fire Suppression - Wet Standpipe	Safety Red	Safety Red	White	WET STANDPIPE	
Fire Suppression - Dry Standpipe	Safety Red	Safety Red	White	DRY STANDPIPE	
Fire Suppression - Carbon Dioxide	Safety Red	Safety Red	White	*[]kPa CO2	
Fire Suppression - Foam & Clean Agent	Safety Red	Safety Red	White	FOAM	Label should be product specific as appropriate.
Oxygen		Orange	Black	*[]kPa O2	
Natural Gas	Safety Yellow	Safety Yellow	Black	*[]kPa NATURAL GAS	
Vacuum		Aluminum	Green	VAC.	
Compressed Air	Safety Blue	Safety Blue	White	*[]kPa COMPRESSED AIR	
Compressed Air - Instrument	Safety Blue	Safety Blue	White	*[]kPa LAB AIR	
Water - Demineralized		Safety Green	White	DEMIN. WATER	

² Colours preceded by the word "Safety" shall meet the requirements of ANSI Z535.1

³ Where (*) is noted, insert appropriate operations condition.



Water - Softened		Safety Green	White	SOFTENED WATER	
Water - Deionized		Safety Green	White	DEIONIZED WATER	
Water - Distilled		Safety Green	White	DISTILLED WATER	
Domestic Cold Water		Safety Green	White	DOMESTIC COLD WATER	
Domestic Hot Water		Safety Green	White	DOMESTIC HOT WATER	
Domestic Hot Water Recirculation		Safety Green	White	DOMESTIC HOT WATER RECIRC.	
Heating Hot Water Supply		Yellow	Black	*[]°C HOT WATER HEATING SUPPLY	
Heating Hot Water Return		Safety Green	Black	*[]°C HOT WATER HEATING RETURN	
Heating Glycol Supply		Yellow	Black	*[]°C HEATING GLYCOL SUPPLY	
Heating Glycol Return		Yellow	Black	*[]°C HEATING GLYCOL RETURN	
Chilled Glycol Supply		Green	White	CHILLED GLYCOL SUPPLY	
Chilled Glycol Return		Green	White	CHILLED GLYCOL RETURN	
Chilled Water Supply		Safety Green	White	CHILLER WATER SUPPLY	
Chilled Water Return		Safety Green	White	CHILLER WATER RETURN	
Condenser Water Supply		Safety Green	White	CONDENSER WATER SUPPLY	
Condenser Water Return		Safety Green	White	CONDENSER WATER RETURN	
Plug Load Cooling Water		Safety Green	White	PLUG COOLING WATER SUPPLY	
Plug Load Cooling Water		Safety Green	White	PLUG COOLING WATER RETURN	



Return					
Steam - Low Pressure		Yellow	Black	[100]kPa LP STEAM	
Steam - High Pressure		Yellow	Black	*[]kPa HP STEAM	
Steam Condensate		Yellow	Black	*[]kPa HOT STEAM CONDENSATE	
Dry Mop	-	Aluminum	Green	DRY MOP	
Refrigerant - Ammonia (R-717)	Safety Grey	Safety Orange	Black	AMMONIA	Per IIAR Bulletin 114
Vent - Ammonia (R-717)	Red	Safety Orange	Black	AMMONIA	Per IIAR Bulletin 114
Refrigerant - Carbon Dioxide	Safety Grey	Safety Grey	White	*[]kPa CO2	
Refrigerant - Other - Liquid	Safety Grey	See ASME A13.1	White	FREON (LIQ)	Label should be fluid specific.
Refrigerant - Other - Gas	Safety Grey	See ASME A13.1	White	FREON (VAP)	Label should be fluid specific
Fuel Oil	-	Safety Brown	White	FUEL OIL	
Lubricating Oil	-	Safety Brown	White	LUBE OIL	
Engine Exhaust	-	Aluminum	Black	ENGINE EXHAUST	
Boiler Feed Water		Yellow	Black	BOILER FEED WATER	
Strong Acid	Safety Purple	Safety Purple	White	*ACID [SYMBOL]	Use WHMIS Symbol
Nitrogen		Safety Orange	White	*[]kPa N2	
Brine		Green	White	BRINE	
Chemical Feed Line		Green	Black	*CHEMICAL FEED [SYMBOL]	Use WHMIS Symbol
Drains	-	Aluminum	Green	DRAIN	
Vent (Except Ammonia Vents)	-	Aluminum	Green	VENT	

Blown Down	-	Aluminum	Green	HOT BLOW DOWN	
Acetylene		Orange	Black	*[]kPa ACETYLENE	
Hydrogen		Safety Orange	Black	*[]kPa H2	
Carbon Monoxide		Safety Orange	Black	*[]kPa CO	
Propane		Safety Yellow	Black	*[]kPa PROPANE	
Methane		Safety Yellow	Black	*[]kPa METHANE	
Butane		Safety Yellow	Black	*[]kPa BUTANE	
Ethane		Safety Yellow	Black	*[]kPa ETHANE	
Combined Methane Argon		Orange	Black	*[]kPa METHANE/ARGON	
Argon (Gas)		Orange	White	*[]kPa ARGON	
Helium		Safety Orange	Black	*[]kPa HELIUM	

1.5. Ductwork

- 1.5.1. All ductwork shall be identified with Identification Labels complete with directional flow arrows.
- 1.5.2. Labels shall be applied exterior to insulation and jacketing when used.
- 1.5.3. All Identification Labels shall be as identified below:

Service	Background Colour	Lettering Colour	Label Legend
Supply Air	Blue	White	SUPPLY AIR
Return Air	Blue	White	RETURN AIR
Mixed Air	Blue	White	MIXED AIR
Combustion Air	Blue	White	COMBUSTION AIR
Relief Air	Blue	White	RELIEF AIR
Exhaust Air - General	Blue	White	GENERAL EXHAUST AIR
Exhaust Air - Toilet	Blue	White	TOILET EXHAUST AIR



1.5.4. Ductwork access panels shall be identified with Identification Labels conforming to the following table:

Access Type	Background Colour	Lettering Colour
Cleaning and Service Access	Yellow	Black
Controls (including Heater Sensor)	Black	White
Dampers - Backdraft, Balance and Control	Blue	White
Fire Damper	Red	White
Smoke Damper & Detectors	Red	White

2. Electrical Equipment

- 2.1. All pull boxes, junction boxes, covers, and conduit fittings shall be enamel finished in the colour indicated in Table A-2. All cover markings to be in black lettering.
- 2.2. All switchgear, distribution centers, panelboards, motor control centers, motor starter cabinets, motor control cabinets, disconnect switches, contactor cabinets, relay cabinets, transformers, termination cabinets, splitter boxes, bus duct, cable duct, etc are to be colour coded as indicated in Table A-2.

Table A-2, Electrical Colour Coding Requirements

System	Description	Conduit Banding/ Colour Coding	Cover Marking
Distribution	High Voltage (>750V)	Orange (RAL 2011)	
	347/600V Distribution	Sand (RAL 1001)	
	277/480V Distribution	Maroon (RAL 3011)	
	230/400V Distribution	Cream (RAL 9001)	
	120/208V Distribution	Grey (RAL 7001)	
	Emergency Power Systems	As Per Voltage + Black Striping	"EM"
	Isolated Ground Systems	As Per Voltage + Orange Striping	"IG"
	Solar PV DC Power (various Voltage)	Gold (RAL 1003)	
Fire and Emergency	Fire Alarm and Fire Phone	Red (RAL 3001)	"FA"
Security	Card Access	Yellow (RAL 1003)	"CA"
	Electrical Door Lock System	Yellow (RAL 1003)	
	Security Control Systems	Yellow (RAL 1003)	
Gas Detection	Gas Detection	Yellow (RAL 1003) + Black Striping	"GD"
Communication	Audio Visual TV Systems	Green (RAL 6032)	"AVTV"
	Computer and Data Systems	Blue (RAL 5005)	"C"
	Intercom Systems	Yellow (RAL 1003)	"I"
	Telephone System	Blue (RAL 5005)	"T"
	Television Distribution	Green (RAL 6032)	"TV"
Miscellaneous	Low Voltage Control for Lighting	Black (RAL 9004)	
	Lighting LV DC Power (<50V)	Lt Blue (RAL 5012)	



APPENDIX B - IT INFRASTRUCTURE DESIGN GUIDELINES

1. General

1.1. Overview

- 1.1.1. This document is intended to guide the consultant when designing the structured wiring and associated infrastructure for a new building, building addition, or building renovation for the City of Edmonton.
- 1.1.2. These guidelines are to be used in conjunction with building program requirements to design the IT infrastructure to meet the needs of the facility.
- 1.1.3. The technical information contained in this document is to be used as a guide only. The consultant is expected to follow his or her professional judgment as well as all applicable codes and regulations. Building projects may have specific requirements that supersede material presented in this document. When a deviation from these guidelines is either required or requested by the consultant or the City, it is to be documented in writing.
- 1.1.4. Prior to the Design Development phase, a meeting with the City of Edmonton Project Manager and Open City & Technology (OCT) Design Advisor will be arranged to discuss the IT design. For projects with minimal IT requirements, email or telephone correspondence may be adequate, at the discretion of the City.

1.2. References

- 1.2.1. Design is to comply with the latest adopted edition of all applicable codes and standards, including the Alberta Building Code, Canadian Electrical Code, and this guideline.
- 1.2.2. ANSI/TIA/EIA-568-C.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
- 1.2.3. ANSI/TIA/EIA-568-C.2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components
- 1.2.4. ANSI/TIA/EIA-568-C.3 Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components Standard
- 1.2.5. ANSI/TIA/EIA-569 Commercial Building Telecommunications Pathways and Spaces
- 1.2.6. ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- 1.2.7. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications

1.3. Responsibilities of the City of Edmonton

- 1.3.1. Provide these guidelines and building program requirements to the Prime Consultant prior to the start of design.
- 1.3.2. Supply, install and configure client IT equipment, such as hubs, switches and routers in Network Access Rooms (NAR).
- 1.3.3. Commission the overall IT system. This does not include performance testing of the structured wiring and terminations.

- 1.3.4. The assigned City of Edmonton Project Manager will be the primary point of contact, and will facilitate communication between the Prime Consultant and City Information Technology personnel, as required.

1.4. Responsibilities of the Design Consultant

- 1.4.1. Design the IT infrastructure and structured wiring system to ensure all program requirements are met. This includes:
 - 1.4.1.1. Identifying all locations where structured wiring is to be run, based on program and building requirements.
 - 1.4.1.2. Locating Network Access Room(s).
 - 1.4.1.3. Laying-out and coordinating equipment within Network Access Room(s), including equipment racks and backboards, ensuring adequate space for identified City-supplied equipment.
 - 1.4.1.4. Specifying required connections to other building systems. This may include mechanical/BAS systems, security equipment, etc.
- 1.4.2. Coordinate required communication services to the building. Coordinate with City of Edmonton IT Design Advisor, through the Project Manager, to ensure the building is on the City-wide IT network and also to confirm requirements. Connection requirements will vary from site to site depending on various factors such as facility capacity, function, growth and service ability.
- 1.4.3. Prepare the IT infrastructure drawings and specifications. Refer to Submission Requirements section.
- 1.4.4. Attend construction meetings, inspect installations and perform contract administration relating to the IT infrastructure.

1.5. Submission Requirements:

- 1.5.1. The consultant is responsible for preparing all drawings and specifications necessary to convey the entire scope of the IT infrastructure to bidding contractors.
- 1.5.2. All progress review submissions are to include information on the IT infrastructure system.
- 1.5.3. Refer to Vol. 1 for submission requirements.
- 1.5.4. Subsequent submissions are to indicate the locations of all end devices, and refine the details, diagrams and plans presented in previous submissions.
- 1.5.5. Where possible, provide a separate drawing for low tension system plans and details.
- 1.5.6. If a submission is not sufficiently detailed to review, it will be returned for resubmission.
 - 1.5.6.1. Provide required specification sections for the non-City provided infrastructure associated with the structured wiring system and IT infrastructure. Specifications to address communication services, structured wiring (horizontal, backbone, etc), patch panels & racks, conduit and cable tray. Specifications are to include: Structured wiring testing requirements and procedures.

2. Technical

2.1. Utility Services

- 2.1.1. Determine what communication services are required for the building, based on program

requirements and consultations with Open City & Technology (OCT). The building may require service connections for telephone, television, City network, Supernet, emergency communications and remote monitoring of building systems such as fire alarm, security, CCTV, or BAS. Connection requirements will vary from site to site depending on various factors such as facility capacity, function, growth and service availability.

- 2.1.2. Consult with the Project Manager and OCT Network Analyst to determine the necessity of providing a fiber service to the site. The supply of a fiber service will be based on the requirements of the building user and the cost to supply and maintain the service.
 - 2.1.2.1. Consult with the City to determine if it is feasible for a City-owned fiber service to be brought to the project site. Typically, the provision of a new City-owned fiber service will be a separate project. Coordinate with that project to ensure appropriate infrastructure, such as service conduit to the site boundary, is provided.
 - 2.1.2.2. If a City-owned fiber service is not available or cost-effective to supply, determine through consultation with the utility provider if a managed fiber service is available. Coordinate with the utility provider to ensure appropriate infrastructure, such as service conduit to the utility pedestal, is provided.
 - 2.1.2.3. For sites connected to the City network or with security and/or CCTV equipment, present or future, it is the recommendation of this guideline to provide a fiber service, where economically viable.
 - 2.1.2.4. When a fiber service is not installed, consider providing an empty conduit to the property line to facilitate a future fiber service. Indicate pull-box locations on long runs, and where conduit changes direction, as required.
- 2.1.3. Many installations require a limited number of analog phone lines for emergency phones and auto-dialers (ie. Fire Alarm). Determine requirements through consultation with the Service Provider and indicate required equipment and additional backboard configuration in NAR on drawings. Refer to Consultant Manual section [Life Safety, Emergency, and Security Systems](#) for additional requirements.
- 2.1.4. All incoming service conductors are to be terminated in a rack-mounted patch panel in the main Network Access Room.
- 2.1.5. All required utility services are to be identified no later than the Design Development submission. A site plan showing the location of the utility service box(es) and the preliminary route of the underground service conductors to the main incoming service room should be included with the submission.

2.2. Horizontal and Backbone Cabling

- 2.2.1. For horizontal cabling, specify 4-pair Category 6 UTP (blue) for all data and voice cables between patch panels and end devices. All components to meet the technical performance requirements for Cat 6 installation. Refer to the Section for [Inspection, Testing, Commissioning and Training](#) for additional information. Cabling shall have end to end Cat 6 products and shall be of one manufacturer. Cable length (Ethernet over UTP) is not to exceed 90m including patch cables.
- 2.2.2. For data backbone cabling, specify multi-strand single-mode fiber optic cable, terminated in a rack mount enclosure mounting in the rack using LC connectors at each end. Determine the number of strands based on design requirements. The number of strands will determine the size of the rack

mount enclosure for terminating the fibre.

- 2.2.3. Provide two (2) Cat 6 cables to each identified workstation.
- 2.2.4. Network cabling to be terminated with a standard network jack compatible with industry standard keystones for mounting such as Hubbell HXJ6. Jacks to be installed into an unloaded patch panel that accepts industry standard keystone mounted jacks such as Hubbell UDX24E.
- 2.2.5. Specify cabling suited for the environment it is being installed in. This may include areas with extreme temperatures, high humidity, excessive “noise”/RF interference, etc. Where possible, avoid extreme environments.
- 2.2.6. Cables are to be specified as ULC rated for risers or plenums where appropriate.
- 2.2.7. All cables are to be uniquely labeled at the patch panel. Cable origin needs to be indicated at the end of the cable not terminated in the patch panel. Ensure cable labeling standards are included in the specifications. A copy of the City labeling standard is included as an appendix to this document.
- 2.2.8. Consult with the OCT Network Analyst, through the Project Manager, should an alternate cable type be required or recommended for a specific application.
- 2.2.9. Under no circumstances are horizontal or backbone cable runs to be spliced between origin and destination.
- 2.2.10. All cabling communications lines, copper or fiber optic must be terminated on patch panels mounted in the rack.

2.3. Horizontal Cabling Raceways

- 2.3.1. Do not run horizontal cabling and backbone cabling in the same conduit.
- 2.3.2. Do not run horizontal cabling for data and voice in the same conduit as Security or CCTV.
- 2.3.3. Do not run communication and power cables in close proximity to each other. In no circumstances are they to be run in the same conduit or non-barriered cable tray.
- 2.3.4. Structured wiring in walls is to be run in minimum 21mm conduit to ceiling.
- 2.3.5. Structured wiring may be run in conduit or cable tray (basket or ladder types acceptable) in ceiling space as appropriate. For accessible ceiling areas (T-Bar), branch distribution from tray to individual rooms may be supported by J-hook with permission from the Project Manager. In no circumstances are structured wiring cables allowed to be laid directly on a building surface such as on a T-bar ceiling.
- 2.3.6. Size conduit and cable tray on drawings to ensure maximum fill allowance is not exceeded and provide min 25% spare capacity for future growth.

2.4. Existing Data Cable Installation

- 2.4.1. All redundant materials to be removed from ceiling space including conduit, boxes, cables and patch cables.
- 2.4.2. Existing cables may be relocated and/or reconnected as required for renovations and expansions; however, inspection and recertification of reused data lines is required.

2.5. Network Access Rooms (NARs)

- 2.5.1. All horizontal cabling from end devices throughout the facility is to be run to the nearest NAR and terminated in patch panels located in free-standing racks. Backbone cabling is to be run between NARs and terminated in patch panels.
- 2.5.2. NARs are to be located throughout the facility to ensure maximum allowable run lengths of horizontal cabling are not exceeded. Where possible, locate NAR rooms near locations with a high density of IT equipment to minimize the amount of structured wiring cable run throughout the facility.
- 2.5.3. In multi-level buildings, provide a NAR on each storey, stacked where possible.
- 2.5.4. In facilities with multiple NARs, connect racks in a star topology, where each NAR is directly connected via backbone cabling to the main NAR (typically where the service conductors are terminated). Where this is impractical due to physical or cost limitations, remote NARs may be connected to the nearest NAR where backbone cables can be “jumpered” to connect to the main NAR.
- 2.5.5. Minimum size 1800 mm x 4800 mm. For EPS facilities, minimum size to be 2115 mm x 3200 mm.
- 2.5.6. Backboards and equipment required for items such as service terminations, analog telephone equipment, fire alarm panels, etc are to be located in NAR rooms.
- 2.5.7. Confirm with the Project Manager before locating Security and Video Surveillance System equipment in the NAR. Be aware that the Video Surveillance recording equipment (Head-end) must be located in a separate rack than other IT equipment. This rack must be housed in a secure cabinet refer to Video Surveillance System Guideline. Cables associated with Video Surveillance are to run in dedicated conduit to the closest IT network rack.
- 2.5.8. NAR not to contain power and distribution equipment, mechanical equipment, ducts, pipes, shafts or water mains unless the equipment is serving the room.
- 2.5.9. In buildings with electronic security, NARs are to be secured with card access control to restrict access and monitor usage. Where electronic security is not provided, discuss alternate forms of security such as a lock or keypunch with the Project Manager.
- 2.5.10. Provide emergency lighting.
- 2.5.11. Equipment in NARs:
 - 2.5.11.1. Racks are to be free-standing 19” type (steel) without cable management guides, equipment mounting rails fabricated, drilled and tapped for No. 10-32 screws, with provision to attach grounding and designed to accept EIA standard 483 mm (19”) wide panels. The rack should be tapped on both sides. Provide minimum 915mm clearance on front, back and one side of all floor-mounted racks, remaining side requires minimum 610mm clearance. Refer to Detail.
 - 2.5.11.2. Wall-mount racks may be approved by OCT for small installations with minimal IT requirements where there is insufficient space for a floor-mounted rack. Close coupled racks are permitted. In such instances, a horizontal basket cable tray must be installed across the top of the close coupled racks.
 - 2.5.11.3. Patch panels are to be 24 or 48 port, designed for Category 6 RJ-45 jacks.
 - 2.5.11.4. Horizontal and vertical cable management and all patch cords will be provided by the City.

- 2.5.11.5. Rack-mount equipment other than patch panels, such as network switches, will be provided by the City. Ensure adequate space is available in racks for City-supplied equipment.
- 2.5.11.6. Provide a second rack if the cabling equals or exceeds 20 RU (Rack Units) in horizontal copper data cabling.
- 2.5.11.7. Sites with multiple NAR: provide one NAR with an additional rack for FOC (Fiber Optic Cable) aggregation.
- 2.5.11.8. Provide 1.0 m working clearance in front of all backboards.
- 2.5.12. Indicate all grounding and bonding for equipment installed in NARs, including incoming conduit and cable tray. Cable trays to be continuously grounded. Show on elevation drawing(s) discussed in submission requirements.
- 2.5.13. The NAR must be adequately lit and be subject to standard interior environmental conditions. Provide HVAC services as required to ensure environment maintains optimum operating requirements for the equipment housed therein.
- 2.5.14. Provide a minimum of two dedicated circuit 208/240V, 30A L6-30R “Twist lock” receptacles to serve each rack, utilize UPS power where available. Provide a minimum of two dedicated circuit 120V, 20A 5-20R “T-Slot” duplex receptacles to serve each rack, utilize UPS power where available. Consult with OCT Network Analyst to ensure additional receptacles are not required. Receptacles are to be mounted on the wall directly behind the rack. Provide one dedicated circuit 120V, 20A 5-20R “T-Slot” duplex receptacle on the bottom right corner of each backboard. Refer to City of Edmonton Security Guidelines for additional requirements for security backboards. Quad receptacles are not acceptable due to clearance conflicts.

2.6. WiFi (Internal Wireless Access)

- 2.6.1. Consult with the Project Manager and OCT Network Analyst to determine the WiFi requirements.
- 2.6.2. Access Point (AP) equipment will be provided by the OCT Network Analyst. AP map will be generated by the OCT Network Analyst using Consultant provided floorplans.
- 2.6.3. Provide one (1) Cat 6 cable to each identified WAP location. Cable to run from patch panel in NAR to AP location. Provide minimum 3m of excess cable with female termination connector neatly coiled in ceiling space at AP location. Cable to be clearly labeled at rack and at AP location (i.e. AP1 etc.) along with tag on the ceiling T-bar, tile or connection box to identify the AP location.

2.7. Telephone and Fax Equipment

- 2.7.1. Most new installations in the City will utilize Voice Over Internet Protocol (VOIP) technology for telephone services. Confirm with the Project Manager prior to commencing design. Consultation with OCT Network Analyst required for all VOIP systems to determine requirements.
 - 2.7.1.1. There is no requirement for backboard or rack space to mount VOIP telephone equipment, as this equipment is server based and located off-site.
- 2.7.2. In a building using VOIP technology, fax equipment does not require an independent analog phone line. The OCT department will install a fax analog to digital converter in the NAR room for each fax station identified on the drawings. This converter allows faxes to utilize the VOIP system.
- 2.7.3. All cabling to be Cat 6. Specify appropriate terminations for structured wiring identified for VOIP

(data) and analog (voice) telephones.

- 2.7.4. For renovations and additions to existing buildings with analog phone systems, provide minimum Category 5e voice cabling to all identified new analog phone locations. Provide additional backboard space in NARs as necessary to accommodate voice backbone terminations and telephone equipment.

2.8. Emergency Phones and Auto-dialers

- 2.8.1. Emergency phones and auto-dialers are to be identified on drawings and must be connected to a dedicated analog line. This equipment must remain operational during a power interruption and therefore cannot be serviced by the VOIP system.
- 2.8.2. Where an analog line to the facility is not available from the Service Provider, fiber may be used provided that the line is from a managed modem/switch supplied by the Service Provider, and that the system is set up to test the line every 6 hours. City Fiber does not comply and cannot be used for this purpose.

2.9. Inspection, Testing, Commissioning and Training

- 2.9.1. The consultant is responsible for inspection of the IT infrastructure installation and is to issue contemplated changes or instructions to the Project Manager as required, during construction.
- 2.9.2. Ensure the specification indicates the contractor's responsibility to do performance testing of the horizontal and backbone cables and terminations to ensure they meet minimum industry-defined performance criteria and certified. Describe testing procedures and submittal requirements in the specification. Review submissions and performance tests to ensure the installed system meets all requirements.
- 2.9.3. Certification Testing of Final Installation using ANSI/TIA/EIA-568 Series compliant, UL verified Class IIe, III, or IV field certification instruments are required for testing the Category rated copper infrastructure. The installation must be tested in accordance with approved certification procedures as detailed in ANSI/TIA/EIA-568 Series standards and the Telecommunications Distribution Methods Manual.
- 2.9.4. All fiber optic installations to be certified must be tested with optical loss test sets (power meters or field testers), capable of reporting Insertion Loss and Length, or an appropriate OTDR capable of reporting link loss measurements. These test results will be submitted with a link loss budget corresponding to the installation.
- 2.9.5. Fibre Optic Test results must include:
 - 2.9.5.1. The calculation of the loss budget at 1550nm and 1310nm
 - Maximum loss budget @1550nm = **(Length in Km X 0.3dB/Km) + (# Connectors X 0.5dB/connector) + (# of splices X 0.3dB/splice)**
 - Maximum loss budget @ 1310nm = **(Length in Km X 0.4dB/Km) + (# Connectors X 0.5dB/connector) + (# of splices X 0.3dB/splice)**
 - 2.9.5.2. The power meter test report
 - 2.9.5.3. The OTDR test results
 - The pulse length for automatic OTDR is often not adequate.

- 2.9.5.4. The CFOT (Certified Fibre Optics Technician) Ticket of the operator for each of the submissions.
- 2.9.6. Testing to be completed on 100% of all installed copper and fiber optic Links and Channels that comprise both the horizontal and backbone portions of the structured cabling system. An exception is made for factory pre-terminated copper and fiber optic cable assemblies.
- 2.9.7. After the project has been granted substantial completion and is handed over to the City for occupancy, the City will install all City-supplied IT equipment.
- 2.9.8. The City will conduct training on the IT system, where required.

2.10. Warranty

- 2.10.1. Installer must supply an end to end 15 year manufacturer warranty covering all passive copper and fiber optic connectivity products including connectors, patch panels, pre-terminated cable assemblies, patch cords, equipment cords, and enclosures. Includes associated replacement parts and labour.

2.11. Labeling Standard

- 2.11.1. General
 - 2.11.1.1. This section details labeling standards for library, police, and all other types of City buildings.
 - 2.11.1.2. Ensure the applicable labeling standard is clearly described in the construction specifications.
 - 2.11.1.3. Cables serving VOIP telephones are data cables, not voice cables, and should be labeled accordingly.
 - 2.11.1.4. Network patch panels and wall plates to be mechanically labeled.

2.12. Edmonton Public Library IT Labeling Standard

- 2.12.1. The following labeling standard is to be used when working on a library building:

TF-RRR-P

where: T = type (D or V)

F = floor

RRR = three digit room number

P = port letter (NOT number)

Examples: V3-101-A, D3-101-A, D3-101-B

2.13. Edmonton Police Service IT Labeling Standard

- 2.13.1. This standard will be added in a future edition of this document. When writing the specifications, confirm labeling requirements with Project Manager.

2.14. City of Edmonton IT Labeling Standard

- 2.14.1. For all other building types, the following labeling standard is to be used:

AT-PP

where: A = NAR Room identifier. This is not required in buildings with only one NAR.

T = type. This will always be "D". No labels to be labeled "V"

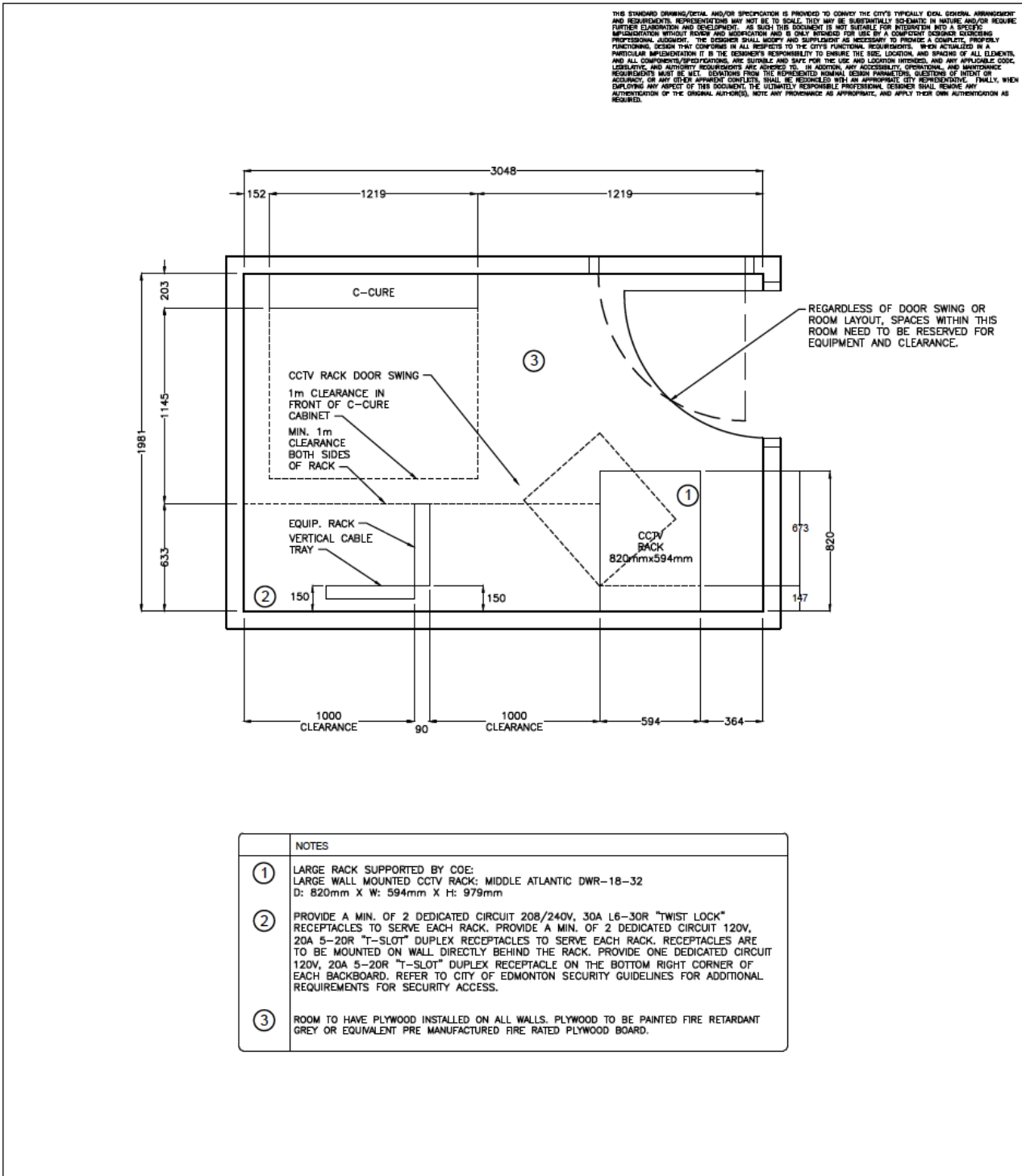


PP = cable number

Examples: D-01, D-02, 2D-01



APPENDIX B1 - STANDARD NETWORK ACCESS ROOM LAYOUT



SCALE: 1:30



LARGE SWIVEL CCTV RACK LAYOUT	Description		CONSULTANT MANUAL STANDARD DETAIL
	Location ID	Project #	N/A
IT ROOM LAYOUT (WITH APPROPRIATE CLEARANCES)	Discipline	ELECTRICAL	Drawn
	Volume	01	Drawing Number
	Sheet	1 OF 2	
	File	Security_STD_CCTV_Box (1).dwg	

Drawn	KW
E-01	



APPENDIX C - SECURITY AND CARD ACCESS SYSTEM DESIGN GUIDELINES

1. GENERAL

1.1. Overview

- 1.1.1. This guideline is to be used in conjunction with project program requirements to design a security system that meets the needs of the facility and is compatible with the City of Edmonton's requirements.
- 1.1.2. For the purposes of this guideline, the term 'Security System' refers to the access control and intrusion detection system, inclusive of card access and motion sensors.

1.2. References

- 1.2.1. "Safety Audit Guide for Crime Prevention", City of Edmonton, Jan 2000. This document can be found on the City of Edmonton website.
- 1.2.2. CSA C22.1, Canadian Electrical Code, Part 1
- 1.2.3. Software House - CCURE - iStar Edge - Installation and Configuration Guide, REV E0 or higher
- 1.2.4. Software House - CCURE - iStar Ultra - Installation and Configuration Guide, REV A0 or higher
- 1.2.5. City of Edmonton - CCURE 9000 - Element Naming Convention Rev A7 or higher
- 1.2.6. City Of Edmonton - Corporate Security Charter

1.3. Responsibilities of the Prime Consultant

- 1.3.1. Incorporate the requirements described in the Functional Security Program, provided by the City's Project Manager, using a combination of electronic and non-electronic security measures. Incorporate Crime Prevention through Environmental Design (CPTED) principles in design. Consider security when determining site layout, sightlines, interior & exterior lighting, landscaping, program relationships, etc. Effective security design will seek to minimize the amount of electronic security devices needed through the use of intelligent design.
- 1.3.2. Where electronic security equipment is used:
 - 1.3.2.1. Specify and locate all detection and access control equipment such as control panels, motion sensors, glass break sensors, card readers, etc.
 - 1.3.2.2. Specify connections between security equipment and other building systems requiring audible and remote alarm annunciation. This includes ensuring an appropriate communication service is provided.
 - 1.3.2.3. Coordinate security design across disciplines, including architecture, door hardware, and electrical.
 - 1.3.2.4. Prepare the security system drawings and specifications, and perform contract administration relating to the security system.

1.4. Submission Requirements:

- 1.4.1. All progress review submissions are to include security information.
 - 1.4.1.1. Refer to the Professional Service Agreement and the latest edition of “Consultant Manual Volume 1, Design Process and Guidelines” for a complete list of submission requirements.
 - 1.4.1.2. If a submission is not sufficiently detailed to review, it will be returned for resubmission.
- 1.4.2. Standard security drawing details and a Security Specification Template are included in the appendices to this guideline. These documents do not account for all possible scenarios, and are provided for reference only. It is the responsibility of the Consultant to make modifications and add new details or information as necessary to accurately convey project requirements.

2. TECHNICAL

2.1. General

2.1.1. Security System Selection:

- 2.1.1.1. The City of Edmonton uses two types of security systems, selected based on specific project requirements. Refer to the table below and consult with the City to determine the appropriate system for your project:

System	Card Access & Intrusion Detection (C-Cure)	Intrusion Detection (Honeywell ADEMCO)
Arming:	Pre-Programmed or Manual	Manual
Max # of intrusion devices:	See Section 2.3	128 (Typical)
Communication Service:	IP Network with CoE Domain	POTS
Cost:	Higher	Lower
Product:	See Section 2.3	See Section 2.2

2.1.2. Field Device Input/Output Point Allocation:

- 2.1.2.1. Refer to Cable Schedule table on drawing E-08 for the number of points required on a security panel for typical field devices. This information is not dependant on the type of security system selected.

2.1.3. Communication Service and Alarm Annunciation:

- 2.1.3.1. All security systems are to be remotely monitored for status and building alarms at the City’s central monitoring station.
- 2.1.3.2. Provide CoE Domain using IP Ethernet Networks using the following media types:

- .1 Fiber – City Owned or Leased.
- .2 Copper – Managed ADSL or POTS
- 2.1.3.3. Depending on program requirements, building alarms such as mechanical alarms and generator status may be annunciated through the security system.
- 2.1.3.4. Do not remotely annunciate fire alarms through the security system. Provide a separate fire alarm dialer, compliant with City requirements. Refer to Fire Alarm Communication Design Guidelines in [Appendix F](#) for additional information.

2.2. Intrusion Detection Systems (Non-Card Access)

- 2.2.1. This section discusses intrusion detection systems where card access is not required. Refer to the next section when designing a security system requiring card access.
- 2.2.2. Intrusion detection systems are to be one of the following approved products:
 - 2.2.2.1. Honeywell Ademco Vista (model 128 BPT or higher) or approved equal.
- 2.2.3. When designing an intrusion alarm system without card-readers:
 - 2.2.3.1. Design to accommodate 25% future expansion. If more than one panel is required, use a C-Cure IStar System.
 - 2.2.3.2. Connect to communication service for remote alarm annunciation. A dedicated copper analog telephone service is preferred, CoE approval required for any alternative.
 - 2.2.3.3. Refer to manufacturer documentation when choosing a product and designing the system.
- 2.2.4. Intrusion detection alarm panels are to be installed in a secure location, on a plywood backboard.
- 2.2.5. Provide two(2) individual dedicated 15A/120V circuits(emergency circuits are preferred when available) to panel and to duplex receptacle (located adjacent to each intrusion detection alarm panel).
- 2.2.6. Refer to the Non-Card Access Security Specification Template, and manufacturer's guidelines.

2.3. Card Access & Intrusion Detection Systems (C-Cure 9000/IStar)

*VERSION OF SOFTWARE HOUSE SOFTWARE (9000) TO BE CONFIRMED WITH COE.

- 2.3.1. Card Access Security Systems are to be C-Cure 9000/IStar-based, and have strict design and installation requirements, described in this guideline. Refer to the previous section when designing an intrusion detection system without card access.
- 2.3.2. Contractor must be "C-Cure 9000 system installer/maintainer with IStar" certified by Software House to purchase, install and program C-Cure 9000 components. Contractor responsible for programming must already have pre-approved access to the City's C-Cure 9000 system. City to provide a list of Contractors with access. Ensure the specification clearly identifies this requirement.
- 2.3.3. Security backboard are to be located throughout the facility to ensure maximum allowable run lengths are not exceeded.

2.3.4. In multi-level buildings, provide a Security backboard on each storey, stacked where possible.

2.3.5. Security Zoning:

2.3.5.1. Ensure that system design is consistent with CoE - Security Charter. Request document from CoE Project Manager.

2.3.5.2. All devices on a single zone are to run to the same IStar panel. One (1) IStar panel may serve multiple zones (Zone Type 1 and 2 Only).

- .1 Zone Type 1 - Manual Arming/Disarming: Where intrusion devices(glass breaks, door contacts and/or motion sensors) and/or card readers are armed and/or disarmed manually with an arming reader.
- .2 Zone Type 2 - Scheduled Arming/Disarming: Where intrusion devices (glass breaks and door contacts) and/or card readers are armed and disarmed on a preprogrammed schedule, or remain armed at all times. Assign different zones to areas that are armed and disarmed on different schedules.

2.3.6. Control Panel:

2.3.6.1. There are two types of control panels approved for use in a C-Cure 9000 compatible security system installed in a City of Edmonton building, IStar Ultra, and IStar Edge. The IStar Edge may only be used upon explicit approval by CoE Engineering Services and PRT. Consider the following criteria when determining the type, number, and location of IStar security control panels:

- .1 The following table indicates the maximum number of field devices that one security control panel can accommodate.

	# of Readers per ACM	# of Inputs per ACM	# of Outputs per ACM
iStar Ultra	8	24 expandable to 128	16 expandable to 128
iStar Edge	2 expandable to 4	8 expandable to 64	4 expandable to 64

- .2 Provide eight (8) additional inputs in CCure panel closest to BMS panel for BMS alarms. Wire, as per Cable Schedule drawing E-08, to be provided in conduit sized as per Appendix C2 - Security Specifications Template Card Access.
- .3 Design to accommodate 25% future expansion spare input/outputs and readers. Add additional CCure system equipment as required.

2.3.7. Communication between security control panels:

2.3.7.1. At each security backboard location, provide two (2) structured wiring cable (Cat 6 minimum) with certified terminations between each IStar control panel and a network patch panel or ADSL box. Panels communicate on CoE Network.

2.3.7.2. Additionally, provide one (1) spare structured wiring cable at each security backboard location to facilitate local programming with a laptop.

2.3.8. Security Room & Backboards

2.3.8.1. The security backboard must be adequately lit and be subject to standard interior environmental

conditions.

2.3.8.2. At each security panel location, specify:

- .1 A 1219 mm x 2438 mm x 19 mm plywood backboard, dedicated for security equipment. Plywood to be painted fire retardant grey or equivalent pre manufactured fire rated plywood board.
- .2 A 1219 mm wide x 254 mm high x 203 mm deep gutter box with internal backpan, hinged down and lockable, to collect wiring to and from field devices. All conduits must enter gutter box to the rear (ie. close to backboard).
- .3 LifeSafety E8S enclosure (or equivalent) containing the IStar Ultra GCM and ACM boards, relay boards, distribution boards, and power supplies with separate battery enclosures mounted below the E8S enclosure. Any deviations from this setup to be approved by CoE Engineering Services and PRT.
- .4 Provide two(2) individual dedicated 15A/120V circuits(emergency circuits are preferred when available), one for the power supply and one for the convenience duplex receptacle).

2.3.8.3. Refer to the Card Access Security Specification Template, included as an appendix to this document.

2.4. Wire and Conduit

- 2.4.1. Install a separate dedicated conduit system for all security (intrusion and card access) system components, do not share with any other building systems. All security wiring is to be run in conduit.
- 2.4.2. Conduit is to be concealed where possible. Where conduit is exposed, it is to be installed on the secure side of the wall.
- 2.4.3. Conduit home-runs to the security backboard are to be minimum 21 mm. Conduit home-runs for card reader equipped doors are to be a minimum 27 mm.
- 2.4.4. Composite and “Banana” cables are not permitted, see cable schedule E-08 for full requirements.
- 2.4.5. Wires are to be adequately rated for the application (i.e. underground run, wet rated, temperature, etc.).
- 2.4.6. Provide an individual wire home-run from each field device to the security backboard. Do not splice wiring between the field device and security backboard.
- 2.4.7. All wires are to be mechanically labeled with the unique field device number at both ends.
- 2.4.8. Typical wire types and sizes are indicated in the standard details, included as an appendix to this document. Increase wire size as necessary for distant devices.

2.5. Field Devices

2.5.1. General

- 2.5.1.1. For product information and installation requirements for typical field devices, refer to the Security Specification Template, included as an appendix to this document,

- 2.5.1.2. Where possible, locate all devices where they can be easily accessed for maintenance (Maximum height of 2500 mm from finished grade).
- 2.5.1.3. All security field devices must be powered from the security control panel. Most existing installations and all new installations are 12VDC. When working on an existing building, consult with the City to determine if the building has 24VDC devices.
- 2.5.1.4. All powered door hardware components (i.e. retractable panic bars, delayed egress) must be powered from a separate power supply (by others). On secured doors & gates with electric door hardware, specify a relay, powered from the security control panel to support the typical operations outlined in detail E-04 and E-05.
- 2.5.1.5. Indicate each field device's intrusion zone adjacent to its symbol on the drawing(s). Provide an intrusion zone schedule on the drawing(s) indicating the area protected, arming method (manual, scheduled, special user access) and that zone's security panel location.

2.5.2. Card Readers

- 2.5.2.1. Install card readers where access is limited to authorized personnel or where the City has identified a requirement to log door use for auditing purposes in compliance with the Security Charter consider the application when specifying card reader type. One reader type may not be suitable for all locations.
 - .1 Specify readers designed to operate in the intended environment. This may include outdoors, extreme temperatures, condensation/frost, and wet, dirty or hazardous environments.
 - .2 Provide long read range readers for applications where the user may be further from the reader, such as parking garage entries. Consult with the City prior to specifying long read range readers.
 - .3 Ensure specified readers are able to physically mount where required. Specify flush mount (preferred), surface mount or mullion mount as required.
- 2.5.2.2. Refer to accessibility guidelines for recommended mounting heights for barrier-free entrances.
- 2.5.2.3. Flush mount device box where possible. For surface installations, use a weatherproof device box.
- 2.5.2.4. Specify card readers compatible with the C-Cure 9000/IStar system. Refer to the Security Specification Template, included as an appendix to this document, for further information.
- 2.5.2.5. Where possible, limit cable distance between card readers and security control panel to 125 meters. If distance exceeds 125 meters, consult CoE Engineering Services and PRT for approved options.

2.5.3. Arming Readers and Keypads

- 2.5.3.1. For facilities using a C-Cure 9000/IStar system, Software House RM2L-SE readers are required for zones that will be armed or disarmed manually.
- 2.5.3.2. For facilities using an non-card access intrusion system, a keypad is required to arm and disarm the system and must be installed inside.
- 2.5.3.3. Locate arming readers and keypads at location(s) where staff will be arming the system or

intrusion zone, preferably inside the building.

2.5.4. Request to Exit Sensors and Door Release Buttons

- 2.5.4.1. Install request to exit (RTE) sensors at all card-reader doors that have intrusion detection (ie. door contacts) to disable the contact while exiting from the secured side.

2.5.5. Door and Window Contacts

- 2.5.5.1. Install contacts in all doors entering an intrusion zone.
- 2.5.5.2. Contacts may be required in operable windows entering an intrusion zone, depending on the project requirements.
- 2.5.5.3. Where possible, conceal contact and wiring in door/window frame.
- 2.5.5.4. On double doors, contacts at each door may be wired in series and therefore only use one input point per pair at the security control panel.
- 2.5.5.5. On sliding doors, monitor the door open and break away status with a door position switch.

2.5.6. Motion Sensors and Glass-Break Sensors

- 2.5.6.1. Select the appropriate form of detection and sensor based on the environmental and physical limitations of the space.
 - .1 Install glass-break sensors where occupants may be present while the system is armed and in areas that are prone to nuisance alarms.
- 2.5.6.2. Locate sensors to minimize the quantity needed. If not obvious on the drawings, indicate the area to be covered to facilitate calibration by the contractor.
- 2.5.6.3. Mount sensors as per the manufacturer's specifications. Sensors must remain accessible for maintenance.

2.5.7. Electric Door Strikes

- 2.5.7.1. Electric door strikes are the preferred method for electronically securing card-access doors.
- 2.5.7.2. Coordinate electric door strikes with automatic door operators to ensure attempted unauthorized operation of the automatic door does not damage the door motor.
- 2.5.7.3. Electric door strikes are to fail-secure, except where fail-safe strikes are required to satisfy building code and safety requirements.
- 2.5.7.4. Electric door strikes are to be 12VDC and powered from the relay panel at the security backboard. Do not power strikes directly from the IStar security panel ACM outputs.

2.5.8. Magnetic Locks

- 2.5.8.1. To be used by explicit exemption only, please contact CoE Engineering Services for approval.

2.5.9. Sirens and Signaling Equipment

- 2.5.9.1. Provide an audible alert to annunciate security alarms within the facility.
- 2.5.9.2. Sound level (dB) is to be designed appropriate to the application.
- 2.5.9.3. Signaling equipment is to be 12VDC and powered from the relay panel at the security

backboard.

2.5.10. LED Indicators

- 2.5.10.1. Use LED indicators when it is required to have visual indication that an intrusion zone is armed.

2.6. Programming, Testing and Training

2.6.1. Card Access Security System (C-Cure 9000/IStar)

- 2.6.1.1. To facilitate programming, the security drawings and/or specifications are to indicate all intrusion zones and arming methods. Zone/room naming methodology to be submitted to CoE for approval prior to start of programming.
- 2.6.1.2. Installation and programming of the C-Cure 9000 system must be completed by a certified Software House contractor. Contractor must also have pre-approved access to the City's C-Cure system. City to provide a list of contractors with access.
- 2.6.1.3. System to be ULC Certified.
- 2.6.1.4. Contractor to provide CoE with verification reports and as-builts.
- 2.6.1.5. Refer to the Security Specification Template, included as an appendix to this document, for typical testing and training requirements.

2.6.2. Intrusion Detection Systems (No Card Access)

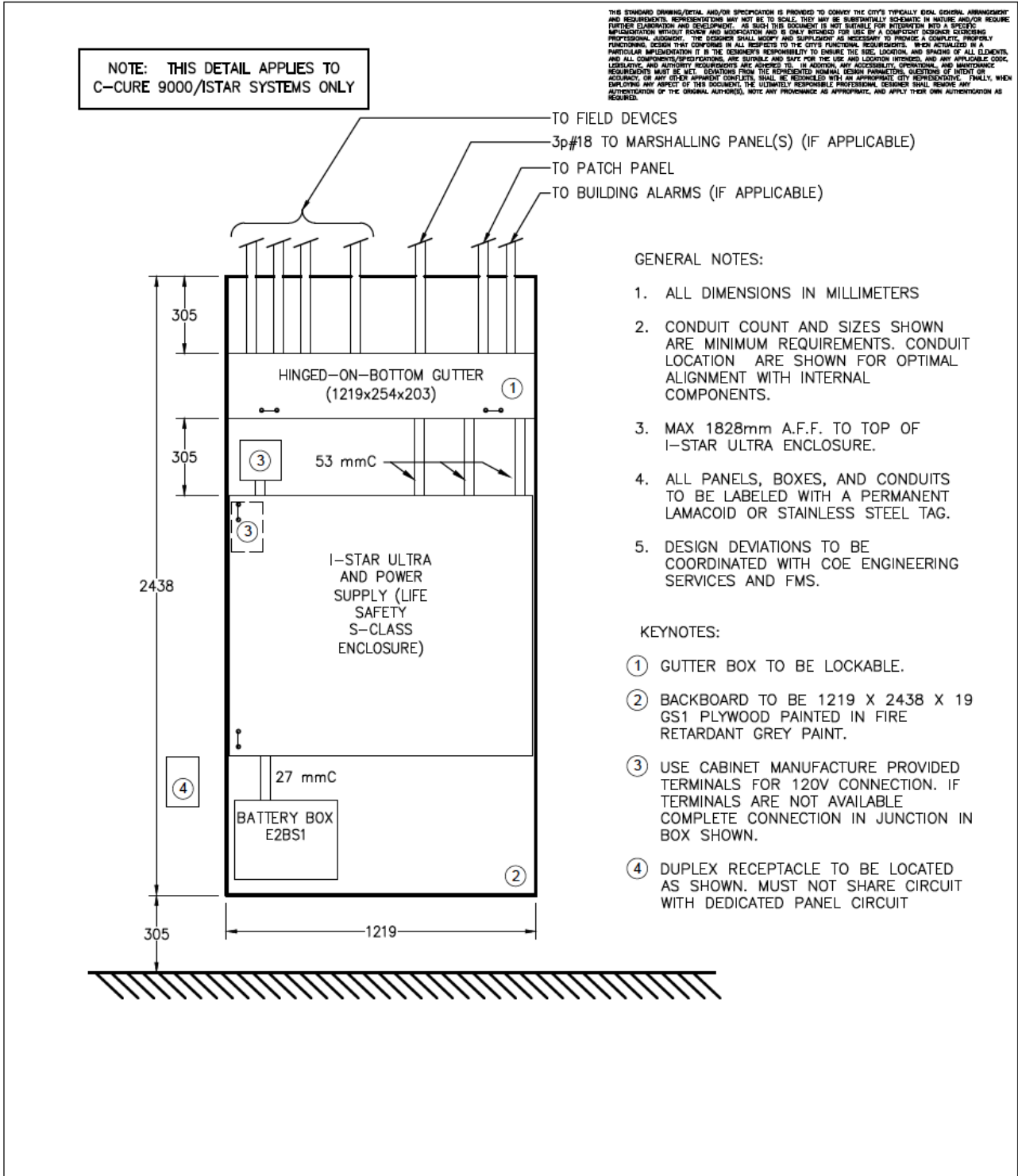
- 2.6.2.1. Installation and programming of the C-Cure 9000 system must be completed by a certified Software House contractor. Contractor must also have pre-approved access to the City's C-Cure system. City to provide contact information of contractors with access.
- 2.6.2.2. Contractor to install and program system. To facilitate programming, the security drawings and/or specifications are to indicate all intrusion zones and arming methods. Zone/room naming methodology to be submitted to CoE for approval prior to start of programming.
- 2.6.2.3. Contractor to provide CoE with defaulted installer code, verification reports and as-builts.
- 2.6.2.4. System to be ULC Certified.

2.7. Design & Specifications

- 2.7.1. Standard Security Drawings and Specification templates, for card and non-card access scenarios, included in Appendix [C1](#) and [C2](#).

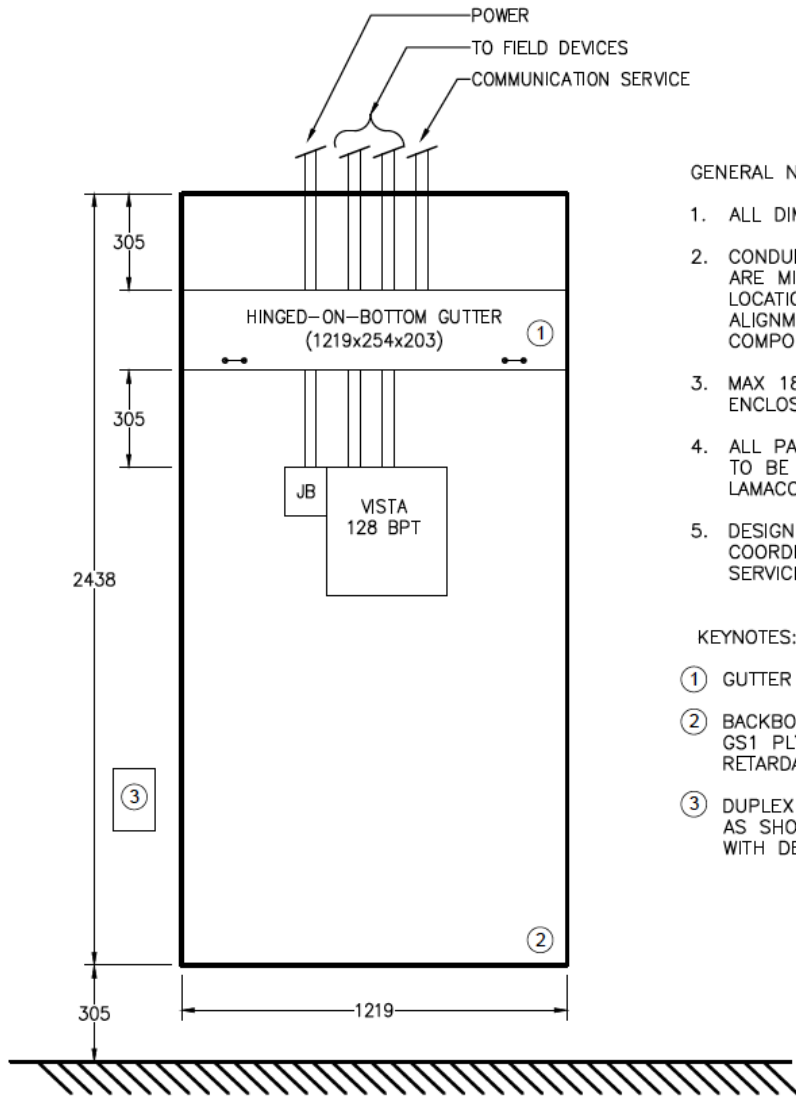


APPENDIX C1 - STANDARD SECURITY DRAWINGS



	SECURITY SYSTEM DESIGN GUIDELINES		Description CONSULTANT MANUAL STANDARD DRAWING	
			Location ID	Project # N/A
			Discipline ELECTRICAL	Drawn KW
			Volume 01	E-01
			Sheet 1 OF 8	
	SECURITY BACKBOARD WITH ISTAR ULTRA (TYPICAL)		File Security_STD_20171025_V4.0.dwg	

THIS STANDARD DRAWING/DETAIL AND/OR SPECIFICATION IS PROVIDED TO CONVEY THE CITY'S TYPICAL GOAL, GENERAL ARRANGEMENT AND REQUIREMENTS. REPRESENTATIONS MAY NOT BE TO SCALE. THEY MAY BE SUBSTANTIALLY SCHEMATIC IN NATURE AND/OR REQUIRE FURTHER ELABORATION AND DEVELOPMENT. AS SUCH THIS DOCUMENT IS NOT SUITABLE FOR INTERPRETATION INTO A SPECIFIC APPLICATION WITHOUT REVIEW AND MODIFICATION AND IS ONLY INTENDED FOR USE BY A COMPETENT DESIGNER EXERCISING PROFESSIONAL JUDGEMENT. THE DESIGNER SHALL VERIFY AND SUPPLEMENT AS NECESSARY TO PROVIDE A COMPLETE, PROPERLY FUNCTIONING DESIGN THAT CONFORMS IN ALL RESPECTS TO THE CITY'S FUNCTIONAL REQUIREMENTS. WHEN ACTUALIZED IN A PARTICULAR IMPLEMENTATION IT IS THE DESIGNER'S RESPONSIBILITY TO ENSURE THE FIT, LOCATION AND FINISH OF ALL ELEMENTS AND ALL COMPONENTS/SPECIFICATIONS ARE SUITABLE AND SAFE FOR THE USE AND LOCATION INTENDED, AND ANY APPLICABLE CODE, LEGISLATIVE, AND AUTHORITY REQUIREMENTS ARE ADHERED TO. IN ADDITION, ANY ACCESSIBILITY, OPERATIONAL, AND MAINTENANCE REQUIREMENTS MUST BE MET. DEVIATIONS FROM THE REPRESENTED NORMAL DESIGN PARAMETERS, QUESTIONS OF INTENT OR ACCURACY, OR ANY OTHER APPARENT CONFLICTS, SHALL BE RESOLVED WITH AN APPROPRIATE CITY REPRESENTATIVE. FINALLY, WHEN EMPLOYING ANY ASPECT OF THIS DOCUMENT, THE ULTIMATELY RESPONSIBLE PROFESSIONAL DESIGNER SHALL REMAIN ANY AUTHORIZATION OF THE ORIGINAL AUTHOR(S). NOTE ANY PROVISIONS AS APPROPRIATE AND APPLY THEIR OWN AUTHORIZATION AS REQUIRED.



GENERAL NOTES:

1. ALL DIMENSIONS IN MILLIMETERS
2. CONDUIT COUNT AND SIZES SHOWN ARE MINIMUM REQUIREMENTS. CONDUIT LOCATION ARE SHOWN FOR OPTIMAL ALIGNMENT WITH INTERNAL COMPONENTS.
3. MAX 1828mm A.F.F. TO TOP OF VISTA ENCLOSURE.
4. ALL PANELS, BOXES, AND CONDUITS TO BE LABELED WITH A PERMANENT LAMACOID OR STAINLESS STEEL TAG.
5. DESIGN DEVIATIONS TO BE COORDINATED WITH COE ENGINEERING SERVICES AND FMS.

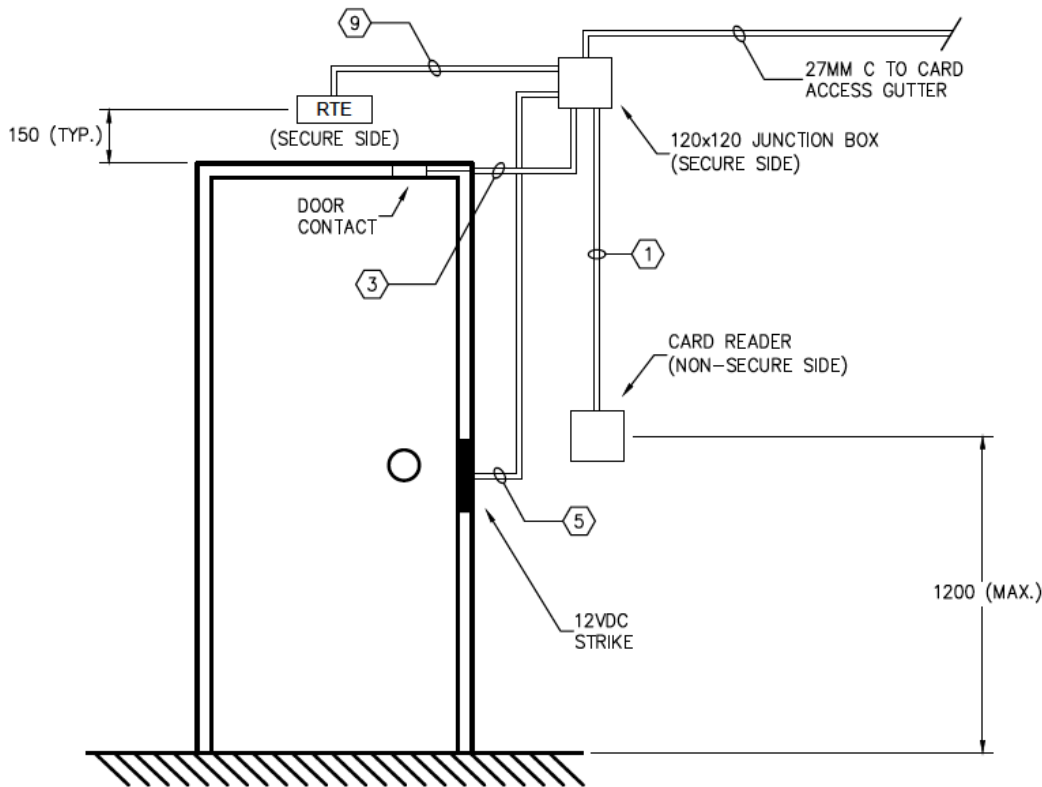
KEYNOTES:

- ① GUTTER BOX TO BE LOCKABLE.
- ② BACKBOARD TO BE 1219 X 2438 X 19 GS1 PLYWOOD PAINTED IN FIRE RETARDANT GREY PAINT.
- ③ DUPLEX RECEPTACLE TO BE LOCATED AS SHOWN. MUST NOT SHARE CIRCUIT WITH DEDICATED PANEL CIRCUIT

	SECURITY SYSTEM DESIGN GUIDELINES	Description CONSULTANT MANUAL STANDARD DRAWING		
	SECURITY BACKBOARD WITH ADEMCO PANEL (TYPICAL)	Location ID	Project #	N/A
		Discipline	Drawn	KW
		Volume	Drawing Number	
		Sheet	E-03	
		File	Security_STD_20171025_V4.0.dwg	

NOTE: THIS DETAIL APPLIES TO
 C-CURE 9000/ISTAR SYSTEMS ONLY

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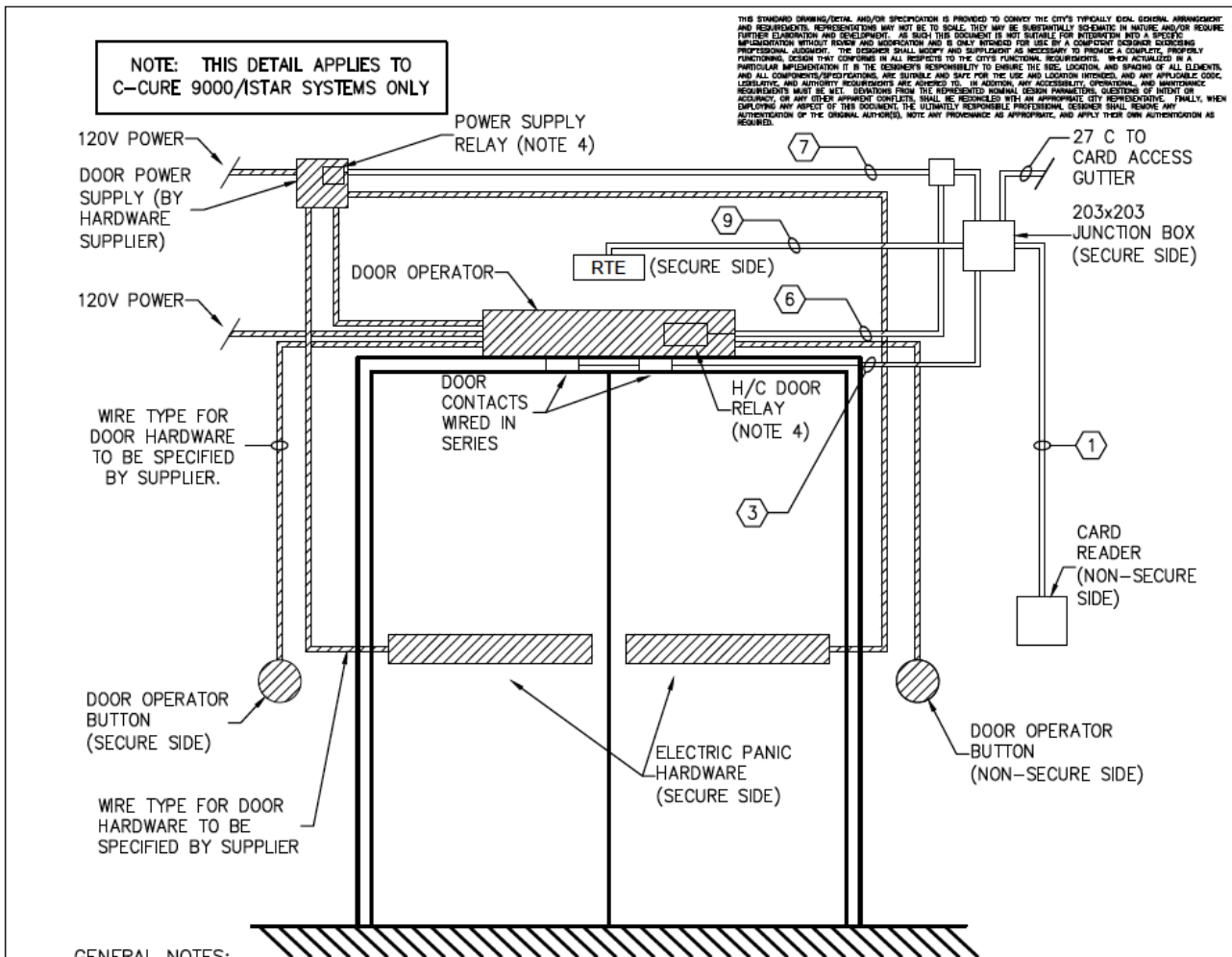
GENERAL NOTES:

- DRAWING SHOWS TYPICAL NON-POWERED DOOR, SECURED WITH AN ELECTRIC STRIKE. MODIFY TO SUIT SPECIFIC CONDITIONS, INDICATING ANY ADDITIONAL REQUIREMENTS, DIMENSIONS/MOUNTING HEIGHTS, ETC
- REFER CABLE SCHEDULE ON E-08 FOR WIRING REQUIREMENTS.
- TYPICAL OPERATION:

ENTRY: WHEN A VALID CARD IS SWIPED, DOOR CONTACT IS DISABLED FOR A SHORT TIME, AND STRIKE IS RELEASED, ALLOWING USER TO PUSH OPEN DOOR.

EXIT: USER MANUALLY OPERATES DOOR HARDWARE TO OPEN DOOR WHILE THE REQUEST-TO-EXIT SENSOR TELLS THE SECURITY PANEL TO DISABLE THE DOOR CONTACT FOR A SHORT TIME, ALLOWING USER TO PASS THROUGH DOOR WITHOUT SETTING OFF AN INTRUSION ALARM.

Edmonton	SECURITY SYSTEM DESIGN GUIDELINES		Description CONSULTANT MANUAL STANDARD DRAWING	
			Location ID	Project # N/A
			Discipline ELECTRICAL	Drawn KW
	CARD ACCESS DOOR WITHOUT POWERED HARDWARE (TYPICAL)		Volume 01	E-04
			Sheet 4 OF 8	
			File Security_STD_20171025_V4.0.dwg	



GENERAL NOTES:

1. THIS DRAWING AND OPERATION DESCRIPTION BELOW IS ONE OF MANY POSSIBLE POWERED DOOR AND GATE CONFIGURATIONS AND IS SHOWN ONLY TO ILLUSTRATE HOW TYPICAL POWERED DOOR HARDWARE COMPONENTS MAY INTERACT WITH SECURITY EQUIPMENT. PROVIDE A SEPARATE DETAIL FOR EACH UNIQUE TYPE OF POWERED DOOR THAT HAS SECURITY.
2. HATCHED AREAS DENOTE TYPICAL POWERED DOOR HARDWARE EQUIPMENT. UNHATCHED AREAS DENOTE TYPICAL SECURITY EQUIPMENT.
3. REFER CABLE SCHEDULE ON E-08 FOR WIRING REQUIREMENTS.
4. TYPICAL OPERATION:

ENTRY: WHEN A VALID CARD IS SWIPED, DOOR CONTACTS ARE TEMPORARILY SHUNTED, AND THE CARD ACCESS PANEL SENDS A SIGNAL TO THE 12VDC RELAY LOCATED IN THE DOOR OPERATOR. IF THERE IS NO DOOR OPERATOR THE 12VDC RELAY WILL BE LOCATED IN THE POWER SUPPLY. 12VDC RELAY AND BASE TO BE INSTALLED BY SECURITY CONTRACTOR. THE DOOR MAY THEN BE OPENED MANUALLY USING THE DOOR HARDWARE, OR AUTOMATICALLY BY PRESSING THE DOOR OPERATOR BUTTON.

EXIT: USER MANUALLY OPERATES PANIC HARDWARE OR PRESSES DOOR OPERATOR BUTTON TO ACTIVATE UNLOCK FUNCTION AND OPEN DOOR. WHILE THE REQUEST-TO-EXIT SENSOR SIGNALS THE SECURITY PANEL TO TEMPORARILY SHUNT THE DOOR CONTACTS, ALLOWING USER TO PASS THROUGH DOOR WITHOUT SETTING OFF AN INTRUSION ALARM.

	SECURITY SYSTEM DESIGN GUIDELINES	
	Description	CONSULTANT MANUAL STANDARD DRAWING
	Location ID	Project# N/A
	Discipline	ELETRICAL
	Volume	01
	Sheet	5 OF 8
CARD ACCESS DOOR WITH POWERED HARDWARE (TYPICAL)		E-05 Drawing Number
File	Security_STD_20171025_V4.0.dwg	



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No.	DEVICE	TYPE	NO. OF POINTS	NOTES	CABLE
1	CARD READER	CARD READER	DIRECT WIEGAND		3P #18 AWG SHIELDED TWISTED PAIRS
2	ARMING CARD READER	CARD READER	RS485 PORT	CARD ACCESS SYSTEMS ONLY	3P #18 AWG SHIELDED TWISTED PAIRS
3	DOOR CONTACT CARD READER DOOR	DOOR INPUT	1	CARD ACCESS SYSTEMS ONLY	6C #22 AWG STRANDED
4	DOOR CONTACT NON CARD READER DOOR	DOOR INPUT	1	DOUBLE DOORS CAN BE WIRED IN SERIES 1 PT PER 2 DOORS	6C #22 AWG STRANDED
5	ELECTRIC STRIKE	DOOR OUTPUT	1	CARD ACCESS SYSTEMS ONLY	1P #16 AWG SHIELDED STRANDED
6	DOOR OPERATOR H/C ACTIVATION RELAY	DOOR OUTPUT	1	CARD ACCESS SYSTEMS ONLY	1P #16 AWG SHIELDED STRANDED
7	DOOR CONTROL RELAY	DOOR OUTPUT	1	CARD ACCESS SYSTEMS ONLY	1P #16 AWG SHIELDED STRANDED
8	SLIDING DOOR ACTIVATION RELAY	DOOR OUTPUT	1	CARD ACCESS SYSTEMS ONLY	1P #16 AWG SHIELDED STRANDED
9	REQUEST TO EXIT	INPUT	1	CARD ACCESS SYSTEM ONLY	6C #22 AWG STRANDED
10	SIREN	OUTPUT	1		2C #16 AWG SHIELDED STRANDED
11	STROBE	OUTPUT	1		4C #18 AWG SHIELDED STRANDED
12	SIREN STROBE COMBO	OUTPUT	1		4C #18 AWG SHIELDED STRANDED
13	LED INDICATOR	OUTPUT	1		2C #16 AWG SHIELDED STRANDED
14	KEYPAD	NON READER		NON CARD ACCESS SYSTEM ONLY	6C #22 AWG STRANDED
15	WINDOW CONTACT	INPUT	1		6C #22 AWG STRANDED
16	GLASS BREAK DETECTOR	INPUT	2	1 ALARM POINT, 1 TAMPER POINT	6C #22 AWG STRANDED
17	MOTION DETECTOR	INPUT	2	1 ALARM POINT, 1 TAMPER POINT	6C #22 AWG STRANDED
18	LOW TEMP SENSOR	INPUT	1	1 ALARM POINT	6C #22 AWG STRANDED
19	PANIC BUTTON	INPUT	1	1 ALARM POINT	6C #22 AWG STRANDED
20	WIRELESS PANIC RECEIVER	INPUT	1	1 ALARM POINT	6C #22 AWG STRANDED
21	BMS ALARM MONITORING	INPUT	1	1 ALARM POINT	6C #22 AWG STRANDED
22	WATER SENSOR	INPUT	1	1 ALARM POINT	6C #22 AWG STRANDED
23	GATE READER	INPUT	1	TO BE LONG RANGE HID MAXIPROX	3P #18 AWG SHIELDED STRANDED TWISTED PAIR
24	WATER GAS DETECTION	INPUT	1	MONITORING CABLES	6C #22 AWG STRANDED

	SECURITY SYSTEM DESIGN GUIDELINES		Description CONSULTANT MANUAL STANDARD DRAWING	
			Location ID	Project # N/A
			Discipline ELECTRICAL	Drawn KW
	CABLE SCHEDULE (TYPICAL)		Volume 01	E-08 Drawing Number
			Sheet 8 OF 8	
			File Security_STD_20171025_V4.0.dwg	



APPENDIX C2 - SECURITY SPECIFICATIONS TEMPLATE CARD ACCESS (SPEC SECTION 28 13 00)

1. General

1.1. Related Sections

- 1.1.1. Section 08 71 00 – Door Hardware – General.
- 1.1.2. Section 14 21 23 – Elevators.
- 1.1.3. Section 26 05 21 – Wires and Cables.

1.2. System Description

- 1.2.1. Security System: Control access to building and selected areas and detect unauthorized movement within building using card access readers, motion sensors, and glass-break sensors.
 - 1.2.1.1. Selected Exterior Doors: Control access into [and out of] building.
 - 1.2.1.2. Selected Building Areas: Control access into [mechanical room,] [electrical room,] [IT room,] [staff area,] [cash handling room/safe,] [_____].
 - 1.2.1.3. Selected Building Areas: Detect unauthorized access in [exterior offices,] [hallways,] [_____].
 - 1.2.1.4. System Arming: By [arming reader].
 - 1.2.1.5. Refer to the Intrusion Zone Schedule on drawings.
 - 1.2.1.6. Signaling: By local siren(s) and remote annunciation to City monitoring facility.
- 1.2.2. Security Access System is to be fully compatible with the CCure 9000 security management system.

1.3. Submittals

- 1.3.1. Refer to Section 01 33 00: Submittal Procedures.
- 1.3.2. Product Data: Provide electrical characteristics and connection requirements.
- 1.3.3. Shop Drawings: Provide system wiring diagram showing each device and wiring connection required.
- 1.3.4. Security system submittals are to be coordinated with Door Hardware submittals, specified in Section [_____].

1.4. Closeout Submittals

- 1.4.1. Refer to Section 01 78 10: Closeout Submittals.
- 1.4.2. Test Reports: Indicate satisfactory completion of required tests and inspections.
- 1.4.3. Record Documents: Record actual locations of Security equipment. Record field device number designation.

1.5. Quality Assurance

- 1.5.1. Installer Qualifications: Certified to purchase, install and program CCure 9000 systems and components. To also include any site specific requirements(Example: Police clearance).

2. Products

2.1. Manufacturers

2.1.1. All products must be compatible with the CCure 9000 security management system.

2.2. Control Panels

2.2.1. Software House IStar Ultra with two ACM's:

- 2.2.1.1. 16 card readers.
- 2.2.1.2. 48 supervised inputs, expandable to 256.
- 2.2.1.3. 32 form C relay outputs, expandable to 256.
- 2.2.1.4. 2 GB memory.
- 2.2.1.5. Local ethernet port.
- 2.2.1.6. Support static IP addressing.
- 2.2.1.7. Panel Tamper.
- 2.2.1.8. Alternate products (including Ultra SE) will not be accepted.

2.2.2. Software House IStar Edge:

- 2.2.2.1. 2 card readers.
- 2.2.2.2. 8 supervised inputs, expandable to 32.
- 2.2.2.3. 4 form C relay outputs, expandable to 32.
- 2.2.2.4. 64 MB memory.
- 2.2.2.5. One Ethernet port, optional power-over-ethernet module.
- 2.2.2.6. Panel Tamper
- 2.2.2.7. Alternate products will not be accepted.

2.2.3. Powered Relay Boards:

- 2.2.3.1. Isolating relays for security device outputs, such as door strikes.
- 2.2.3.2. 8 fused outputs, configurable to NO or NC.
- 2.2.3.3. LED relay indicators.
- 2.2.3.4. Fire Alarm disconnect feature, where required.(Example: Maglocks - Fire Alarm requires interconnect contact to open doors)
- 2.2.3.5. Auxiliary contact for monitoring of disconnect feature with LED indicator for arm/disarming.

2.2.4. Power Supply (door control):

- .1 115VAC input(typical), 12VDC 20A output(typical).Coordinate ULC approved device with Door Hardware prior to supply/install.
- .2 Filtered and electronically regulated outputs.
- .3 Short circuit and thermal overload protection.

- .4 Battery backup: One 12VDC 18AH Batteries
- .5 LED indication of AC input and DC output.
- .6 Class 2 limited fused to be used.

2.3. Input Devices

2.3.1. Card Readers

- 2.3.1.1. Multiclass SE type.
- 2.3.1.2. Transmit frequency: 125 kHz.
- 2.3.1.3. Read range: [63.5mm (2.5") - 76mm (3")]
- 2.3.1.4. LED indicator light and beeper.
- 2.3.1.5. Operating Voltage: 5-12VDC.
- 2.3.1.6. Color: [black].
- 2.3.1.7. Enclosure/housing: Polycarbonate.
- 2.3.1.8. Mounting: Flush, surface, or mullion as indicated on drawings.(For vehicles, please contact CoE Corporate Security)
- 2.3.1.9. Communication: Weigand compatible.
- 2.3.1.10. HID RP40SE/RP15SE or approved equal.
- 2.3.1.11. Software House RM2L-SE Multiclass Arming Readers: Where indicated on drawings.

2.3.2. Request-to-Exit Sensors

- 2.3.2.1. Two Form C outputs.
- 2.3.2.2. Adjustable relay time of 0.5s to 60s.
- 2.3.2.3. Swivel optics for aiming.
- 2.3.2.4. 12VDC I/P voltage.
- 2.3.2.5. Color: [White] [Black].
- 2.3.2.6. Honeywell IS310 with IS-310WHTP trim plate or approved equal.

2.3.3. Door and Window Contacts

- 2.3.3.1. Closed loop type.
- 2.3.3.2. Wide gap 19 mm (3/4") or 23 mm (7/8") diameter recessed mount: GE 1078C or approved equal.
- 2.3.3.3. Surface mount: GRI 29AWGW or approved equal.
- 2.3.3.4. Overhead door rail mount: Sentrol SR-2325AL or approved equal.
- 2.3.3.5. Overhead door floor mount: Amseco AS-ODC-59A or approved equal.

2.3.4. Motion Sensors

- 2.3.4.1. Dual technology: PIR, Microwave.

- 2.3.4.2. Form C output.
- 2.3.4.3. Cover tamper.
- 2.3.4.4. Animal immunity.
- 2.3.4.5. Fluorescent light interference filter.
- 2.3.4.6. 12VDC I/P voltage.
- 2.3.4.7. Optics for long, medium or curtain applications, as required.
- 2.3.4.8. Bosch ISC-CDL-W15G or approved equal.
- 2.3.5. Glass Break Sensors
 - 2.3.5.1. Form C output.
 - 2.3.5.2. Cover tamper.
 - 2.3.5.3. Omni-directional microphone.
 - 2.3.5.4. RF Immunity.
 - 2.3.5.5. 12VDC I/P voltage.
 - 2.3.5.6. Residio FG-1625T or approved equal.
- 2.3.6. Panic Alarm
 - 2.3.6.1. Closed loop type.
 - 2.3.6.2. 12VDC I/P voltage.
 - 2.3.6.3. Sentrol 3045 (w/ panic switch) or approved equal.
 - 2.3.6.4. Inovonics wireless panic EN4204 or approved equal.
- 2.3.7. Intercom
 - 2.3.7.1. Please contact CoE Corporate Security for information.

2.4. Output Devices

- 2.4.1. Electric Door Strikes
 - 2.4.1.1. 12VDC
 - 2.4.1.2. Install blocking diode as per Softwarehouse Installation guide.
 - 2.4.1.3. [As specified in Section 08 71 00 – Door Hardware – General.]
- 2.4.2. LED
 - 2.4.2.1. 12VDC
 - 2.4.2.2. Provide LED to indicate system is armed
- 2.4.3. Relays
 - 2.4.3.1. 12VDC coil, 10A removable Ice Cube with base
 - 2.4.3.2. [Single] [Double] pole.

2.4.3.3. [As specified in Section 08 71 00 – Door Hardware – General.]

2.4.4. Sirens

2.4.4.1. 12VDC.

2.4.4.2. [100dB at 1.0m.]

2.4.4.3. Honeywell Wave 2 or approved equal.

3. Execution

3.1. Installation

3.1.1. Install to manufacturer’s instructions and this specification.

3.1.2. All alarm inputs must have a supervisory/End of Line Resistor installed. **Factory manufactured resistor packs to be used as field devices, no bare resistors permitted.**

3.1.3. Ferrule connectors to be used for all headend terminations.

3.1.4. **12VDC Ice Cube relays and bases to be installed at door operators (i.e. barrier free doors, sliding doors, and gate operators).**

3.1.5. Make conduit and wiring connections to door hardware devices provided and installed under Section 08 71 00. Power for all security devices, including door strikes and field relays, must be supplied from the security panel. Electronic hardware other than electric strikes will require a separate power supply designed for the hardware intended and supplied by the door hardware supplier. Power supply to be mounted on the secure side of the door and easily accessible. A 12VDC relay controlled by the card access system to be installed inside the power supply to activate function.

3.1.6. Security System Wiring and Conduit:

3.1.6.1. Install all security wiring, including wiring on security backboard, in conduit.

3.1.6.2. Composite cable and “Banana” cables not permitted, refer to cable schedule provided by consultant for requirements.

3.1.6.3. Install security conduit on secure side of the wall.

3.1.6.4. Provide minimum 21 mm conduit home-runs from field devices to security panel.

3.1.6.5. Provide minimum 27 mm conduit home-runs from card reader equipped doors to security panel.

3.1.6.6. Do not splice wiring between field devices and security panel.

3.1.6.7. Mechanically label all wiring with the field device number at both the device and panel ends. Record field device number on record drawings.

3.1.7. Security Backboard:

3.1.7.1. Plywood or pre manufactured Backboard: 1219 mm x 2438 mm x 19 mm G1S plywood backboard, painted grey with fire retardant paint or equivalent pre manufactured fire rated plywood board. Mount at 305 mm above finished floor.

3.1.7.2. Gutter Box: **A 1219 mm wide x 254 mm high x 203 mm deep gutter box, with internal metal backpan.** Mount horizontally on backboard, [305 mm from the top,] hinged side on bottom.

- 3.1.7.3. Provide #6 insulated ground wire from [communications room] ground bus to security backboard and bond equipment.
 - 3.1.7.4. Install all conduits from field devices to the [top] and to the back of the gutter box. Run all field wiring to security backboard through the gutter.
 - 3.1.7.5. Provide two(2) individual dedicated 15A/120V circuits(emergency circuits are preferred when available), one for the power supply and one for the convenience duplex receptacle.
 - 3.1.7.6. Provide tamper contacts on the gutter and relay boxes, and wire to the IStar control panel.
 - 3.1.7.7. Do not install equipment not specified in this section on the security backboard.
 - 3.1.7.8. Refer to the standard backboard wiring diagrams at the end of this specification. These diagrams are provided for reference and do not represent specific project requirements.
- 3.1.8. Security Panels:
- 3.1.8.1. Provide expansion modules for card readers, inputs, and outputs based on the number of devices indicated on drawings and [25 percent] future capacity.
 - 3.1.8.2. To be installed in LifeSafety E8S enclosure or equivalent Software House ULC approved enclosure.
 - 3.1.8.3. Provide two(2) Cat [5e] [6] structured wiring cables in conduit between nearest CoE network rack and each IStar control panel.
 - 3.1.8.4. Provide connection between security control panel and building systems requiring remote annunciation:
 - .1 [BMS.]
 - .2 [Gas Detection.]
 - .3 [_____.]
 - 3.1.8.5. Do not monitor fire alarm system through security control panel. Refer to Section [_____] for fire alarm dialer specification.
- 3.1.9. Field Devices:
- 3.1.9.1. Card Access Doors:
 - .1 Mount card reader on non-hinged side of door at 1320 mm above finished floor, or as shown on drawings. Use single gang, vertically mounted device box.
 - .2 Where wire distance between card reader and security backboard exceeds 125 m, [_____]
 - .3 Mount request-to-exit sensor 300 mm above center of door, or as recommended by manufacturer. Adjust sensor for optimum coverage.
 - .4 Conceal door contacts in door frame. Mount on top of door, or non-hinged side, approximately 75 mm from edge.
 - .5 Fire-rated doors: Provide doors with pre-drilled hole for contact. Field-drilling fire-rated doors will not be accepted.

.6 Arming Readers: Provide 2-gang device box.

3.1.9.2. Intrusion Detection:

.1 Mount devices at elevation and spacing indicated on drawing and calibrate based on installation conditions. Confirm device quantities and locations for optimum coverage prior to installation.

3.1.9.3. Specialty Doors:

.1 [_____.]

3.2. System Programming

3.2.1. Programming MUST be completed Software House certified personnel with pre-approved access to the City's C-Cure 9000 system. All points are to report to monitoring through CCURE 9000.

3.2.2. Installer to program security system leaving the default CSID and installer code.

3.3. Field Quality Control

3.3.1. Intent

3.3.1.1. Arrange and pay for security system testing. Confirm system programming and operation, field device operation and calibration, alarms, and annunciation. Record all results.

3.3.1.2. If test results do not conform with applicable requirements, repair, replace, or adjust equipment. Repeat testing as necessary until acceptable results are achieved.

3.3.1.3. Provide all labor, materials, instruments and equipment necessary to perform the tests specified.

3.3.1.4. All tests are to be witnessed and approved by the City or City's designate.

3.3.1.5. Do not perform security system testing before IT network is configured and building communication service is established.

3.3.2. Reports

3.3.2.1. Log and tabulate test results on appropriate test report forms.

3.3.2.2. Submit completed test report forms for inclusion in Operations and Maintenance Manual.

3.3.3. Security System Testing Procedure

3.3.3.1. Verify and inspect installation of Card Access controller panel.

3.3.3.2. Verify and inspect DC power supplies. Record DC volts output of supply(s) and batteries.

3.3.3.3. Inspect and record all installed card access door components.

3.3.3.4. Verify and record operation of all card access doors:

- .1 Admit Entry.
- .2 Exit (Request-to-exit).
- .3 Forced open/held.
- .4 LED operation.

- .5 Door Latch Release (DLR) operation.
- .6 Provide copy of report to Project Manager for review and approval.
- 3.3.3.5. Inspect and record non-card access door components.
- 3.3.3.6. Verify alarm operation.
- 3.3.3.7. Verify strike operation.
- 3.3.3.8. Verify scheduled unlock operations.
- 3.3.3.9. Verify programmed event operations:
 - .1 Sirens.
 - .2 LEDs.
 - .3 Unlock schedules.
 - .4 [Relay outputs.]
- 3.3.3.10. Verify remote monitoring station alarms.
- 3.3.3.11. Verify remote monitoring station operations:
 - .1 Lock-unlock (if applicable).
- 3.3.3.12. Verify and record operation of all additional intrusion devices: Motion sensors, glass break sensors, device tampers, panel tamper.
- 3.3.3.13. Verify and record operation of all building alarm devices annunciated through the security system: Temperature sensors, BMS interconnection.
- 3.3.3.14. Verify security panel communication fail alarm.

3.4. Closeout Activities

- 3.4.1. Demonstrate Security System operation. Refer to Section 01 79 00 – Demonstration and Training.



APPENDIX C3 - SECURITY SPECIFICATIONS TEMPLATE NON-CARD ACCESS (SPEC SECTION 28 13 00)

1. General

1.1. Related Sections

- 1.1.1. Section 08 71 00 – Door Hardware – General.
- 1.1.2. Section 26 05 21 – Wires and Cables.

1.2. SYSTEM DESCRIPTION

- 1.2.1. Security System: Protect building perimeter by means of door contacts and glass-break detectors.
- 1.2.2. Detect unauthorized movement within building using motion sensors.
 - 1.2.2.1. System Arming: By [arming keypad].
 - 1.2.2.2. Refer to the Partition Zone Schedule on drawings.
 - 1.2.2.3. Signaling: By local siren(s) and remote annunciation to City monitoring facility.

1.3. SUBMITTALS

- 1.3.1. Refer to Section 01 33 00: Submittal Procedures.
- 1.3.2. Product Data: Provide electrical characteristics and connection requirements.
- 1.3.3. Shop Drawings: Provide system wiring diagram showing each device and wiring connection required.

1.4. Closeout Submittals

- 1.4.1. Refer to Section 01 78 10: Closeout Submittals.
- 1.4.2. Test Reports: Indicate satisfactory completion of required tests and inspections.
- 1.4.3. Record Documents: Record actual locations of Security equipment. Record field device number designation.

1.5. Quality Assurance

- 1.5.1. Installer Qualifications: Certified to purchase, install and program Honeywell Ademco Vista or approved equal.

2. Products

2.1. Manufacturers

- 2.1.1. Honeywell or approved equal

2.2. Control Panels

- 2.2.1. Honeywell Ademco Vista (model 128 BPT or higher):
 - 2.2.1.1. Nine style B hardwired zones, with support for up to 119 additional zones and 127 wireless zones.
 - 2.2.1.2. 150 user codes with seven authority levels
 - 2.2.1.3. Logging for 512 events.

- 2.2.1.4. 96 programmable outputs
- 2.2.2. Power Supply:
 - 2.2.2.1. 115VAC input, 12VDC 10A output. Coordinate ULC approved device with Door Hardware prior to supply/install.
 - 2.2.2.2. Filtered and electronically regulated outputs.
 - 2.2.2.3. Short circuit and thermal overload protection.
 - 2.2.2.4. Battery backup: Two 12VDC 7AH Batteries
 - 2.2.2.5. LED indication of AC input and DC output.
 - 2.2.2.6. Four (4) class 2 limited fused or PTC outputs.
 - 2.2.2.7. Lifesafety Flex or ULC approved equal

2.3. Input Devices

- 2.3.1. Arm/Disarm Keypads
 - 2.3.1.1. .Alpha numeric 32 character display keypad.
 - 2.3.1.2. Honeywell 6160 or approved equal.
- 2.3.2. Door and Window Contacts
 - 2.3.2.1. Closed loop type.
 - 2.3.2.2. Wide gap 19 mm (3/4") or 23 mm (7/8") diameter recessed mount: GE 1078C or approved equal.
 - 2.3.2.3. Surface mount: GRI 29AWGW or approved equal.
 - 2.3.2.4. Surface mount with armoured cable: GRI 4460A or approved equal.
 - 2.3.2.5. Overhead door rail mount: Sentrol SR-2325AL or approved equal.
 - 2.3.2.6. Overhead door floor mount: Amseco AS-ODC-59A or approved equal.
- 2.3.3. Motion Sensors
 - 2.3.3.1. Dual technology: PIR, Microwave.
 - 2.3.3.2. Form C output.
 - 2.3.3.3. Cover tamper.
 - 2.3.3.4. Animal immunity.
 - 2.3.3.5. Fluorescent light interference filter.
 - 2.3.3.6. 12VDC I/P voltage.
 - 2.3.3.7. Optics for long, medium or curtain applications, as required.
 - 2.3.3.8. Bosch ISC-CDL-W15G or approved equal.
- 2.3.4. Glass Break Sensors
 - 2.3.4.1. Form C output.
 - 2.3.4.2. Cover tamper.
 - 2.3.4.3. Omni-directional microphone.
 - 2.3.4.4. RF Immunity.

- 2.3.4.5. 12VDC I/P voltage.
- 2.3.4.6. GE Shatter Pro3 5815NT or approved equal.
- 2.3.4.7. Closed loop type.
- 2.3.5. Panic Alarm (hard wired)
 - 2.3.5.1. Lever type
 - 2.3.5.2. Normally closed
 - 2.3.5.3. Sentrol 3045 (w/ panic switch) or approved equal
- 2.3.6. Wireless Panic Alarm
 - 2.3.6.1. Pendant single button activation
 - 2.3.6.2. Inovonics EN4204R or higher as needed or approved equal
 - 2.3.6.3. 12VDC I/P voltage
- 2.3.7. Low Temperature Sensors
 - 2.3.7.1. 40 degrees Fahrenheit (4.4 degrees Celsius)
 - 2.3.7.2. Normally closed, opens at 40 degrees Fahrenheit (4.4 degrees Celsius)
 - 2.3.7.3. Temp Alert TA-40 or approved equal

2.4. OUTPUT DEVICES

- 2.4.1. Sirens
 - 2.4.1.1. 12VDC.
 - 2.4.1.2. [100dB at 1.0 m.]
 - 2.4.1.3. Honeywell Wave 2 or approved equal.

3. Execution

3.1. Installation

- 3.1.1. Install to manufacturer's instructions and this specification.
- 3.1.2. Make conduit and wiring connections to door hardware devices provided and installed under Section 08 71 00.
- 3.1.3. All security devices shall be in a separate conduit system from device to panel from all other electrical systems (fire alarm, lighting, IT, etc). Similar security devices may be combined in the same conduit for example door contacts, glass break, motion detectors, keypads, etc.
- 3.1.4. There shall be no splices between the security control panel and the end security devices.
- 3.1.5. All materials supplied must be new and approved for their intended use.
- 3.1.6. For retrofit and renovation work, open wiring installed within existing wall cavities will be considered as acceptable, subject to all authorities listed below.
- 3.1.7. Flexible conduit may be used for device drops on T-Bar ceilings.
- 3.1.8. All conduit, fittings and wiring must be installed in accordance with the most current edition of the Canadian Electrical Code and Alberta Building Code, in accordance with all authorities having

jurisdiction.

- 3.1.9. Installation of any holes through the building roofing materials must be coordinated through a roofer designated by the City. All roof penetrations need to meet the requirements listed in [Section - Roofs](#).
- 3.1.10. Upon completion of the work all penetrations in building surfaces must be properly sealed, prepared and primed ready for finish paint.
- 3.1.11. The contractor must implement good housekeeping practices and provide a safe work environment for all employees at the work site.
- 3.1.12. An approved electrical inspection authority permit number is required for all electrical work completed and must be submitted to Facility and Landscape Infrastructure.
- 3.1.13. Security System Wiring and Conduit:
 - 3.1.13.1. Install all security wiring, including wiring on security backboard, in conduit.
 - 3.1.13.2. Install security conduit on secure side of the wall.
 - 3.1.13.3. Conduit to be sized at 40% fill to allow for future expansion.
 - 3.1.13.4. Conduit runs to be concealed as best as possible.
 - 3.1.13.5. Provide minimum 21mm conduit home runs from field devices to security panel.
 - 3.1.13.6. Do not splice wiring between field devices and security panel.
 - 3.1.13.7. Mechanically label all wiring with the field device number at both the device and panel ends. Record field device number on record drawings.
- 3.1.14. Security Backboard:
 - 3.1.14.1. Plywood or pre manufactured Backboard: 1219 mm x 2438 mm x 19 mm G1S plywood backboard, painted grey with fire retardant paint or equivalent pre manufactured fire rated plywood board. Mount at 305 mm above finished floor.
 - 3.1.14.2. Gutter Box: A 1219 mm wide x 254 mm high x 203 mm deep hinged bottom, lockable gutter box, with internal metal backpan. Mount horizontally on backboard, [305mm from the top,] hinged side on bottom.
 - 3.1.14.3. Provide insulated bond wire from [communications room] ground bus to security backboard and bond equipment.
 - 3.1.14.4. Provide two(2) individual dedicated 15A/120V circuits(emergency circuits are preferred when available) for panel and to duplex receptacle (located adjacent to each intrusion detection alarm panel).
 - 3.1.14.5. Do not install equipment not specified in this section on the security backboard.
- 3.1.15. Security Panels:
 - 3.1.15.1. Provide expansion module inputs, and outputs based on the number of devices indicated on drawings and [25 percent] future capacity. Output expansion modules may be required if strobes, LED indicators or additional sirens are used. Expansion modules to be installed at the panel in a separate lockable cabinet unless otherwise specified.

- 3.1.15.2. Security Control Panel area requires a minimum of 1 m of clearance in front of the cabinets.
- 3.1.15.3. Provide one (1) Cat [5e] [6] structured wiring cable in 21 mm conduit between nearest telephone board and Security Control Panel backboard.
- 3.1.15.4. Provide two (2) 3P #22 in 21mm conduit between Security Control Panel and BMS panel.
- 3.1.15.5. Provide connection between security control panel and building systems requiring remote annunciation:
 - .1 [BMS.]
 - .2 [Gas Detection.]
 - .3 [____.]
- 3.1.15.6. Do not monitor fire alarm system through security control panel. Refer to Section [_____] for fire alarm dialer specification.
- 3.1.16. Field Devices:
 - 3.1.16.1. Motion Sensors
 - .1 Wall mounted motion sensor conduits and wiring shall terminate in a standard single gang device box vertically mounted, a minimum of 300 mm below finished ceiling with a max. height of 2440 mm above finished floor. Locate all devices where they can be easily accessed for maintenance.
 - .2 Ceiling mount 360 motion sensor conduits and wiring shall terminate in a ceiling mounted octagon device box and located as marked on the drawings. Device boxes must be securely mounted using T-Bar support bracket.
 - 3.1.16.2. Glass Break Sensors
 - .1 Conduits and wiring shall terminate in a standard, single gang device box, within 1828 mm (6'), of the window being monitored; preferably on the ceiling or facing window as per the manufacturer's instructions. Devices boxes must be securely mounted using T-Bar support bracket.
 - .2 One (1) glass break device shall be placed every 6096 mm (20') along exterior glass walls or as identified on drawings.
 - 3.1.16.3. Door Contacts
 - .1 Conduit and wiring to be installed on the top of door, non-hinged secure side of door, three inches from the outside edge of the non-hinged side of door frame. Install one (1) deep 100 mm x 100 mm box face down on top of frame approx. 75 mm from edge of frame of center of box if frame is going into block wall and is not pre-prepped.
 - .2 Conduit to be concealed within wall and wiring to contact location to be concealed within door frame.
 - .3 Where not possible to conceal conduits and wiring, terminate conduit and wiring in a standard single gang electrical device box, surface mount horizontally on the top of the non-hinged side of the door frame approx.. 75 mm from edge.
 - .4 Surface mount contacts may be used if recessing is not possible.

.5 Double doors, the two contacts shall be wired in series.

3.1.16.4. Arming Keypad

.1 Provide 2-gang device box and locate near the main staff entry or as indicated on drawings. Mounting height to be 1400 mm above finished floor. Keypad to have LCD display

3.1.16.5. Intrusion Detection:

.1 Mount devices at elevation and spacing indicated on drawing and calibrate based on installation conditions. Confirm device quantities and locations for optimum coverage prior to installation.

3.1.16.6. Specialty Overhead/Rolling Shutter Doors:

.1 Overhead Doors:

.1 Overhead door contact conduit and wiring to terminate in a vertically mounted surface or flush device box, 300 mm above finished grade, within 300 mm of the overhead door track. On the non-chain side of door. Depending on the type of door a rail mount or floor mounted contact is required.

.2 Roll up type doors will require a floor mounted contact.

.2 [_____.]

3.1.16.7. End of Line Resistors:

.1 All alarm inputs must have a supervisory resistor installed as per the manufacturer's equipment.

3.2. System Programming

3.2.1. System programming must be coordinated with Facility Infrastructure Delivery. Notify appropriate CoE Corporate Security [2 weeks] prior to programming to arrange for access.

3.3. Field Quality Control

3.3.1. Intent

3.3.1.1. Arrange and pay for security system testing. Confirm system programming and operation, field device operation and calibration, alarms, and annunciation. Record all results.

3.3.1.2. If test results do not conform with applicable requirements, repair, replace, or adjust equipment. Repeat testing as necessary until acceptable results are achieved.

3.3.1.3. Provide all labor, materials, instruments and equipment necessary to perform the tests specified.

3.3.1.4. All tests are to be witnessed and approved by the City or City's designate.

3.3.2. Reports

3.3.2.1. Log and tabulate test results on appropriate test report forms.

3.3.2.2. Submit completed test report forms for inclusion in Operations and Maintenance Manual.

3.3.2.3. Provide Red Line drawings of the complete security system layout.

3.3.2.4. Provide Report to Project Manager For review and approval.

3.3.3. Security System Testing Procedure

3.3.3.1. Verify and inspect installation of security panel.

3.3.3.2. Verify and inspect DC power supplies. Record DC volts output of supply(s) and batteries.

3.3.3.3. Inspect and record all installed components.

3.3.3.4. Verify and record operation of all devices:

3.3.3.5. Verify alarm operation.

3.3.3.6. Verify Alarm Signaling:

.1 Sirens.

.2 LEDs/Strobes

3.3.3.7. Verify remote monitoring station alarms.

3.3.3.8. Verify and record operation of all additional intrusion devices: Motion sensors, glass break sensors, device tampers, panel tamper.

3.3.3.9. Verify and record operation of all building alarm devices annunciated through the security system: Temperature sensors, BMS interconnection.

3.4. CLOSEOUT ACTIVITIES

3.4.1. Demonstrate Security System operation. Refer to Section 01 79 00 – Demonstration and Training.



APPENDIX D - VIDEO SURVEILLANCE SYSTEM DESIGN GUIDELINES

1. GENERAL

1.1. Overview

- 1.1.1. This guideline is to be used in conjunction with project program requirements to design a Video Surveillance System that meets the needs of the facility and is compatible with the City of Edmonton's requirements.
- 1.1.2. This guideline assumes a new digital IP-based Video Surveillance System is being installed. When working in a facility with an existing Video Surveillance System, consult with the Project Manager.

1.2. References

- 1.2.1. "Safety Audit Guide for Crime Prevention", City of Edmonton, Jan 2000. This document can be found on the City of Edmonton website.
- 1.2.2. CSA C22.1, Canadian Electrical Code, Part 1

1.3. Responsibilities of the Prime Consultant

- 1.3.1. Incorporate the requirements described in the Functional Security Program, provided by the City's Project Manager. Incorporate Crime Prevention through Environmental Design (CPTED) principles in design. Consider video surveillance when determining site layout, sightlines, interior & exterior lighting, landscaping, program relationships, etc. Effective video surveillance system design will seek to minimize the amount of video surveillance devices needed through the use of coordinated design.
- 1.3.2. Where video surveillance equipment is used:
 - 1.3.2.1. Specify and locate all cameras, wiring and head-end equipment.
 - 1.3.2.2. Coordinate video surveillance design across disciplines, including architecture, landscape design, and electrical.
 - 1.3.2.3. Prepare the video surveillance system drawings and specifications, and perform contract administration relating to the video surveillance system.

1.4. Submission Requirements:

- 1.4.1. All progress review submissions are to include video surveillance system information.
 - 1.4.1.1. Refer to the Professional Service Agreement and the latest edition of "Consultant Manual Volume 1, Design Process and Guidelines" for a complete list of submission requirements.
 - 1.4.1.2. If a submission is not sufficiently detailed to review, it will be returned for resubmission.

2. TECHNICAL

2.1. System Architecture

- 2.1.1. The system architecture consists of various cameras, each of which are connected via dedicated home run data cables (Cat-6 or fiber optic) to termination/patch panels in the nearest IT network

rack located in a secure Network Access Room (NAR). The Video Surveillance recording equipment shall be located in a separate wall mounted lockable equipment rack as per Corporate Security directive A1435.

2.2. Raceway/Cable Infrastructure

- 2.2.1. Contractor shall provide all raceway infrastructures necessary for a complete and fully functioning IP Video Surveillance System.
- 2.2.2. Dedicated raceway required and shall be continuous from Head-end equipment rack to field end devices. Ensure compliance where cameras are mounted to light poles or other equipment that may have both line and low voltage.
- 2.2.3. Minimum 21 mm trade size conduit shall be used for Cat-6.
- 2.2.4. Minimum 27 mm trade size conduit shall be used for Fiber.
- 2.2.5. Accepted raceways are EMT, flexible metal conduit, metal liquid tight and rigid conduit. Poly based forms of raceways such as rigid PVC may only be used underground.
- 2.2.6. All boxes and fittings shall adhere to minimum cable bend radius specifications.
- 2.2.7. PVC bushings are to be used on all connectors
- 2.2.8. The use of LB, LL or LR conduit fittings are prohibited.
- 2.2.9. Cable fill standards shall comply with the Canadian Electrical Code
- 2.2.10. Provide a minimum of 1 meter extra cable at all camera locations and minimum of 3 meters extra cable at all rack locations.
- 2.2.11. Provide a minimum of three (3) Cat-6 network drops between the head-end equipment rack and the nearest CoE domain network switch.
- 2.2.12. Wire and conduit is to be concealed where possible. Where conduit is exposed, it should be run in non-public secure areas where possible.
- 2.2.13. All cables are to be labeled at both ends using permanent mechanical labels. Cables to cameras are to use the format xx-yy, where xx is the floor number and yy is the camera number. This unique label number is to appear next to each camera on the record drawings.

2.3. Cable

- 2.3.1. Less than 90 meters:
 - 2.3.1.1. Above ground: Camera runs shall have one Cat-6 cable with the following specs: Cat-6: Solid Copper, Unshielded Cable, 350 MHz Rated, FT6 as required (Yellow Jacket).
 - 2.3.1.2. Underground: Camera runs shall have one Cat-6 with the following specs: Cat-6 - Solid Copper, Flooded, Shielded Cable, 350 MHz Rated. Rated for wet locations
- 2.3.2. Greater than 90 Meters. Require fiber with approved fiber modules

2.4. Termination/Certification

- 2.4.1. Network lines at cameras are to be terminated with approved RJ-45 modular plug (Crystal), such as

Paladin PA-9655. NOTE: Platinum Tools EZ-RJ45 modular plugs are NOT approved for use.

- 2.4.2. Camera jacks at Network head end equipment are to be terminated using standard TIA/EIA T568A with Category 6 Yellow jacks such as the Hubbell HXJ6Y or approved equal.
- 2.4.3. Certification of Cat-6 lines to be done with an approved Network Certifier such as the Fluke DTX-1800, and all certification reports to be included in O&M Manuals (Note: Partial Pass test results will not be accepted).
- 2.4.4. Fiber to be terminated in Fiber Trays with LC Duplex Connectors.
- 2.4.5. Certification of Fiber lines to be done with an approved Network Certifier such as the Fluke DTX-1800, and all certification reports to be included in Operations and Maintenance Manuals.

2.5. Head End Equipment

- 2.5.1. All equipment to be mounted to a 1219 mm x 2438 mm x 19 mm G1S plywood backboard, painted grey with fire retardant paint or equivalent pre manufactured fire rated plywood board mounted at 305mm above finished floor.
- 2.5.2. Field conduits are to terminate at the City network rack.
- 2.5.3. Ensure that gutter door opens down and is supplied with ventilation slots and a lockable door .
- 2.5.4. Equipment rack requires one 120V/20 Amp dedicated circuit, provide a 120V, 20A 5-20R "T-Slot" duplex receptacle in a surface mount device box positioned at the bottom right corner of the racks interior.
- 2.5.5. Provide one #6 bonding conductor from Video Surveillance Rack to electrical system ground buss as per CEC.

2.6. Camera Mounting

- 2.6.1. Electrical Box Mount – 2 Gang and 100 mm x 100 mm electrical box mounting is acceptable.
- 2.6.2. Hanging Cameras - Minimum 21 mm grade size rigid metal conduit. Mounted on approved box only (Example: MOOG CA15) with explicit approval from COE Corporate Security
- 2.6.3. Exterior Pendant Mount Cameras – Cameras to be hung from factory pendant mounts.
- 2.6.4. Exterior Surface Wall Mount - Require 21 mm liquid tight flex with 27 mm slack through wall and factory weather shield.
- 2.6.5. T-Bar Ceiling Mount - Require a 100 mm x 100 mm Box and T-Bar support bracket.
- 2.6.6. Pole Mount - Refer to Section Exterior Lighting.

2.7. Equipment Specifications

2.7.1. Camera Rack Equipment

2.7.1.1. Large Equipment Rack

- .1 Rack: wall mount 12U minimum rack with 813 mm depth. Middle Atlantic DWR-18-32 or approved equal. If larger racks are required, floor mount rack models can be provided upon request, please contact CoE Engineering Services and PRT.

- 2.7.1.2. Fans: 2 x 50 CFM, 30dBA, 114mm per Rack. Middle Atlantic QFAN or approved equal.
- 2.7.2. UPS Equipment
 - 2.7.2.1. Rackmount 1U 1kVA Line Interactive Sine Wave UPS. Tripp Lite SMART1500RM1U or approved equal.
- 2.7.3. Video Surveillance System Recording Equipment
 - 2.7.3.1. Rack mountable in a standard 482 mm rack mounting frame
 - 2.7.3.2. Linux Operating System.
 - 2.7.3.3. Video Recording Devices shall record IP based video streams. The number of video streams managed and recorded by a server shall be determined in accordance with the selected manufacturers' recommendations.
 - 2.7.3.4. Storage capacity is to meet a minimum retention requirement of 21 days or as specified by Corporate Security.
 - 2.7.3.5. Appliance to be licensed through ExacqVision for a duration of 6 years.
 - 2.7.3.6. Hardware must have a three year manufacturer warranty on parts and labor.
 - 2.7.3.7. ExacqVision Pro VMS with Enterprise License or approved equal.
- 2.7.4. Cameras
 - 2.7.4.1. Fixed Dome Camera
 - .1 The camera input power shall be Power over Ethernet (PoE) (IEEE 802.3af/IEEE 802.3at compliant, Class 3).
 - .2 Cameras shall have a composite analog MONITOR output in addition to streaming video via Ethernet. The composite analog video output can be used for monitoring while installing the camera to adjust the field of view and focus.
 - .3 Cameras shall have an Easy Focus function, which adjusts the camera focus by using the Easy Focus button on the camera unit or remotely via the GUI. When the camera is switched between day and night modes, the Easy Focus function is automatically activated to keep the camera focused.
 - .4 Shall also have a zoom/focus adjustment capability via the ZOOM/FOCUS switch on the camera unit or remotely via the GUI.
 - .5 Simultaneously encoding up to 3 of the following streams in any combination, including multiple instances of the same compression format: JPEG and/or H.264 (High/Main/Baseline Profile)
 - .6 IP66-rated waterproof and dust-tight feature: The camera shall be IP66 rated in accordance with the IEC 605292 standard for outdoor surveillance, or indoor where water ingress may pose an issue.
 - .7 IK10-rated vandal-resistant feature: The camera shall be IK10 rated in accordance with the IEC 62262 standard to vandal-resistant feature for protecting the camera from destructive behaviors.

- .8 The camera shall utilize a 1/2.8-type progressive scan Exmor CMOS sensor.
- .9 The camera shall have an equivalent Forensic 120 dB wide dynamic range capability.
- .10 The video signal-to-noise ratio shall be more than 50 dB (Auto gain control maximum rate 0 dB).
- .11 The electronic shutter speed shall be set from 2 to 1/65,500 second.
- .12 The camera shall have an integrated 3X IR compensated DC auto-iris type Varifocal lens as a standard equipment.
- .13 The ranges (typical) shall be: Pan: 360°, Tilt: -80° to +80°, Rotate: -175° to +175°.
- .14 The focal length shall be 9mm to 22mm with horizontal field of view coverage of 105° to 36°.
- .15 The aperture range for the lens (F number) shall be F 1.3 (Wide) to F 1.6 (Tele).
- .16 The camera operating temperature shall be within the following range:
 - .1 Indoor Application: -14 °F to +122 °F (-10 °C to +50 °C)
 - .2 Outdoor Application: -58 °F to +140 °F (-50 °C to +60 °C)
- .17 Cold start temperature must be greater than:
 - .1 -40 °F (-40 °C).
- .18 Axis Q3515-LV/Axis Q3515-LVE or approved equal

2.7.4.2. 360 Degree Dome Camera

- .1 The camera input power shall be a power voltage of IEEE 802.3af/802.3 at Type 1 Class 3 Typical 738W, Max 12.95W compliant (PoE system), DC 12V ± 10%.
- .2 IP66-rated waterproof and dust-tight feature: The camera shall be IP66 rated in accordance with the IEC 605292 standard for outdoor surveillance or indoor where water ingress may pose an issue.
- .3 IK10-rated vandal-resistant feature: The camera shall be IK10 rated in accordance with the IEC 62262 standard to vandal-resistant feature for protecting the camera from destructive behaviors.
- .4 The camera shall utilize a 1/1.7"-type progressive scan RGB CMOS sensor.
- .5 The number of effective pixels shall be approx. 12 Megapixels.
- .6 The camera shall have up to 120 dB wide dynamic range capability.
- .7 The electronic shutter speed shall be set from 2 to 1/22,500 second.
- .8 The viewing angle shall be: Horizontal: 181°. Vertical: 181°.
- .9 The focal length shall be 1.3 mm
- .10 The aperture range for the lens (F number) shall be F 2.2.
- .11 The camera operating temperature shall be within the following range:

.1 -40 °F to +122 °F (-40 °C to +50 °C)

.12 Cold start temperature must be greater than:

.1 -40 °F (-40 °C)

.13 Axis M3058-PLVE or approved equal

.14 All other Cameras to be approved by CoE prior to use.

.15 Recording Appliance Settings and Camera Settings are to be configured to Building Facility Maintenance requirements.

2.7.4.3. Pan, Tilt, Zoom Camera

.1 The camera input power shall be Power over Ethernet (PoE) (IEEE 802.3af compliant, Class 0) or Power over Ethernet + (PoE+) (IEEE 802.3at compliant, Class 4).

.2 Cameras shall have a composite analog MONITOR output in addition to streaming video via Ethernet. The composite analog video output can be used for monitoring while installing the camera to adjust the field of view and focus.

.3 The camera shall utilize a 1/2.8-type progressive scan CMOS sensor.

.4 The number of effective pixels shall be approx. 2.38 Megapixels.

.5 The camera shall have an equivalent 120 dB wide dynamic range capability.

.6 The electronic shutter speed shall be set from 2 to 1/66,500 second.

.7 The camera shall be capable of 360° endless pan rotation.

.8 The focal length shall be 4.3 mm to 137.6 mm with horizontal field of view coverage of 58.3° to 2.4° and a vertical field of view coverage of 34.9° to 1.3°

.9 The aperture range for the lens (F number) shall be F 1.4 (Wide) to F 4.0 (Tele).

.10 IP66-rated waterproof and dust-tight feature: The camera shall be IP66 rated in accordance with the IEC 605292 standard for outdoor surveillance, or indoor where water ingress may pose an issue.

.11 IK10-rated vandal-resistant feature: The camera shall be IK10 rated in accordance with the IEC 62262 standard to vandal-resistant feature for protecting the camera from destructive behaviors.

.12 Streams in any combination, including multiple instances of the same compression format: JPEG and/or H.264 (MPEG-4 Part 10/AVC) and/or H.265 (MPEG-H Part 2/HEVC)

.13 The camera operating temperature shall be within the following range:

.1 -22°F to +122°F (-30°C to +50°C) (30W)

.2 -58°F to +122°F (-50°C to +50°C) (60W)

.14 Cold start temperature must be greater than

.1 -40°F (-40°C) (AC 24 V)

.15 Axis Q6135-LE or approved equal

.16 All other Cameras to be approved by CoE prior to use.

.17 Recording Appliance Settings and Camera Settings are to be configured to Building Facility Maintenance requirements.

2.8. Commissioning

2.8.1. Commissioning of the entire system including all camera views to be completed in the presence of a Corporate Security Advisor

2.8.2. Report shall be provided to advisor, shall include but not limited to

2.8.2.1. All camera views,

2.8.2.2. Camera IP addresses,

2.8.2.3. Make and model of camera,

2.8.2.4. Confirmation of recording,

2.8.2.5. Minimum retention time,

2.8.2.6. NVR IP address,

2.8.2.7. UPS ip ADDRESS,

2.8.2.8. Make and model of NVR.,

2.8.2.9. Name of camera

2.8.3. Naming convention for all cameras to be:

2.8.3.1. DIRECTION - AREA - VIEW (ex: NW - ARENA - CORRIDOR)

2.8.3.2. NVR Server to be named by building I.D. (ex: TER101 - NVR SERVER)

2.9. Documentation and Training

2.9.1. Documentation: A detailed report with the following information shall be provided to Project Manager in an acceptable electronic form.

2.9.1.1. Equipment Location

2.9.1.2. Equipment Type

2.9.1.3. Equipment Number

2.9.1.4. IP Address

2.9.1.5. MAC Address

2.9.1.6. Cable ID

2.9.1.7. Camera Screen Shot

2.9.2. Training

2.9.2.1. Training shall be provided to the end users.



APPENDIX E - ARC FLASH DESIGN GUIDELINES

1. General

1.1. Overview

- 1.1.1. All electrical equipment installed in buildings maintained by the City of Edmonton must be labelled with an Arc Flash and Electrical Shock warning label. This document describes the consultant's responsibilities to ensure these requirements are met when designing a new or existing facility.
- 1.1.2. The technical information contained in this document is to be used as a guide only. The consultant is expected to follow his or her professional judgment as well as all applicable codes and regulations. When a deviation from these guidelines is either required or requested by the consultant or the City, it is to be documented in writing.

1.2. Responsibilities of the City of Edmonton

- 1.2.1. Provide these guidelines to the Prime Consultant prior to the start of design.
- 1.2.2. The assigned City of Edmonton Project Manager will be the primary point of contact, and will facilitate communication between the Prime Consultant and City, as required

1.3. Submission Requirements

- 1.3.1. The Consultant responsible for the design of the electrical system is to prepare a Short Circuit, Coordination, and Arc Flash Study.
- 1.3.2. A preliminary study is to be submitted prior to tender. This study will be reviewed to ensure equipment ratings are properly specified, proper coordination is possible, and the distribution is designed to minimize available incident energy as much as is practicable. This includes the incorporation of mitigating techniques and technologies where high incident energy levels are anticipated. The target maximum incident energy level for all CoE facilities is 8 cal/cm². Where the incident energy is greater than 8 cal/cm², the Consultant is to include additional measures that mitigate the risk to Electrical Workers as per Z462, Annex O.
- 1.3.3. It is understood that some information affecting study results is not finalized (or in some cases known) prior to construction. Consultants are to use professional judgement to ensure preliminary assumptions are reasonable, and ensure high-risk assumptions and their consequences are explained to the City project manager.
- 1.3.4. A final study is to be submitted at the conclusion of the project. The computer model developed for the preliminary study is to be updated with as-built conditions, including Utility transformer data. Where final incident energy values differ substantially from the preliminary report (ie. higher incident energy) and exceeds 12 cal/cm², provide an explanation and propose modifications to rectify the issue. Refer to Submission Requirements for Arc Flash Study format.
- 1.3.5. The construction specifications are to indicate the Contractor's responsibility to provide as-built information necessary for the design Consultant to prepare the final study, and instructions to prepare and affix all labels. The final study is to indicate all information to be printed on each label. Refer to Arc Flash and Shock Label Requirements for format and content to be included on each label.

2. References

- 2.1. CSA-C22.1, Canadian Electrical Code (latest adopted edition)
- 2.2. CSA-Z462, Workplace Electrical Safety (latest published edition)

3. Criteria

- 3.1. The Incident Energy Method must be used for:
 - 3.1.1. A new facility with a secondary utility voltage exceeding 240V, and with greater than 25KA short circuit current available; or,
 - 3.1.2. A new facility where there are extraordinarily long clearing times leading to available incident energy exceeding 8 cal/cm²; or,
 - 3.1.3. Additions or renovations to an existing facility that has previously had an Arc Flash Study performed. The City will inform the consultant when this is the case and provide documentation and computer model of the existing distribution. Existing model may be in either SKM or ETAP and may be updated using same program or regenerated in the other; or,
 - 3.1.4. Addition or replacement of significant components of the electrical distribution within an existing facility that has not had an Arc Flash Study performed and that also has a secondary utility voltage exceeding 240V, and greater than 25KA short circuit current available; or, where there are extraordinarily long clearing times leading to available incident energy exceeding 8 cal/cm².
- 3.2. A general Arc Flash Hazard label may be used in all other circumstances. Refer to the sample “Label Requirements” below for a complete description of all information to be printed on each label.

4. Submission Requirements

- 4.1. Short Circuit, Coordination and Arc Flash Study, is to follow the format described in the document, ‘Engineering Report Guidelines’, included as Appendix A of “City of Edmonton Consultant Manual Volume 1 – Design Process and Guidelines”.
- 4.2. As a minimum, include in the report the following information:
 - 4.2.1. Short Circuit/Fault Current Study:
 - 4.2.1.1. Maximum available short circuit current in amperes RMS symmetrical at each point of the electrical distribution system, including utility supply termination point, switchgear, MCC’s, and panelboards.
 - 4.2.1.2. Maximum fault conditions are to be determined by studying the distribution under normal (utility) and alternate power sources, and all possible switching configurations.
 - 4.2.2. Coordination Study:
 - 4.2.2.1. In tabular format, show settings for overcurrent protective devices. Indicate circuit breaker sensor rating, as well as long time, short time and instantaneous settings. Indicate ground-fault relay pickup and time delay settings. Indicate fuse current rating and type.
 - 4.2.2.2. Using coordination curves for overcurrent protective devices, graphically illustrate that adequate time separation exists between devices installed in series, for all possible

switching configurations.

4.2.3. Demonstrate that equipment and cables withstand the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or tripping time of the fuse.

4.2.4. Arc Flash Study:

4.2.4.1. Calculate incident energy in calories per square centimeter (cal/cm²).

4.2.4.2. Analyse scenarios for both minimum and maximum available fault contribution from the utility and determine which provides the highest available incident energy. Where only one fault level is published by the utility, assume +/-15% of that value for the maximum and minimum contribution.

4.2.4.3. Where multiple sources exist (i.e. utility, generator), document and base calculations on the source that provides the highest possible incident energy.

4.2.4.4. Use the “two second rule” for maximum fault clearing time. Do not locate devices where workers cannot easily move away from a hazard within two (2) seconds.

4.2.4.5. Prove 8 cal/cm² is not exceeded at any point in the distribution. In tabular format, indicate information to be printed on each piece of equipment. This will include incident energy, PPE level, flash hazard boundary, flash protection boundary, shock hazard boundaries (limited approach, restricted approach, prohibited approach), and study date. Refer to Label Requirements section below for a complete description of all information to be printed on each label and samples.

4.2.4.6. Provide a Single Line Diagram and include cal/cm² for all overcurrent devices on both the line and load side of all transformers, including the Utility transformer.

4.3. Studies are to be performed using ETAP or SKM software. The report must include an appendix showing the single line diagram, as modelled in the software. The Preliminary and Final Arc Flash study and model are to be submitted to the City via file sharing system.

5. Arc Flash and Shock Label Requirements

5.1. Arc Flash and Shock Labels to be generated by the design Consultant using as-built information provided by the Contractor. Labels to be affixed to the front of equipment and be readily visible to the approaching worker.

5.2. Size and construction:

5.2.1. Label to be 89 mm x 127 mm thermal transfer type warning label of high adhesion polyester

5.3. Colours:

5.3.1. Warning Label: word WARNING to be safety black letters on a safety orange background

5.3.2. Danger Label: word DANGER to be safety white letters on a safety red background

5.4. The label shall include the following information, at a minimum:

5.4.1. Breaker/Disconnect Designation

5.4.2. Location designation

- 5.4.3. Nominal voltage
- 5.4.4. Flash protection boundary
- 5.4.5. Hazard risk category
- 5.4.6. Incident energy
- 5.4.7. Working distance
- 5.4.8. PPE category and description including glove rating
- 5.4.9. Limited approach distance
- 5.4.10. Restricted approach distance
- 5.4.11. Prohibited approach distance
- 5.5. Sample Labels



Figure H1 – Simple Arc Flash & Shock Warning Label Sample

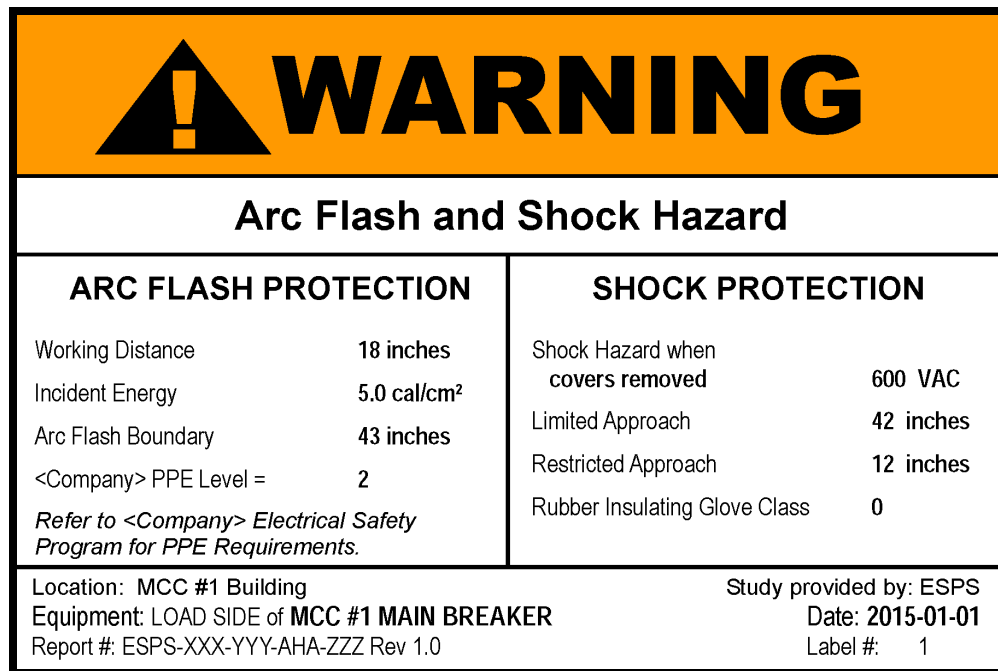


Figure H-2 – Detailed Arc Flash & Shock Warning Label for SWGR/MCC/ Electrical Distribution Equipment where Incident Energy is 40 cal/cm² or less



Figure H-3 – Detailed Arc Flash & Shock Danger Label for MCC/SWGR and other distribution equipment where Incident Energy is above 40 cal/cm²



APPENDIX F - FIRE ALARM COMMUNICATION DESIGN GUIDELINES

1. General

1.1. Overview

- 1.1.1. This document describes the City of Edmonton’s requirements when installing and verifying Fire Alarm Communications Equipment (Dialer). All City of Edmonton facilities require a monitored Fire Alarm System, unless specifically stated otherwise. Dialers are to be provided for both ULC compliant systems and non-ULC compliant systems.
- 1.1.2. Questions related to this document are to be directed to Engineering Services/Project Review Team (PRT) through the City of Edmonton project manager.

1.2. References

- 1.2.1. National Building Code (Alberta Edition), latest edition
- 1.2.2. Alberta Fire Code, latest edition
- 1.2.3. CSA C22.1, Canadian Electrical Code, Part 1, latest edition
- 1.2.4. CAN/ULC-S537 - Standard for the Verification of Fire Alarm Systems, latest edition
- 1.2.5. CAN/ULC-S561 - Installation and Services for Fire Signal Receiving Centres and Systems, latest edition

2. TECHNICAL

2.1. List of Approved Equipment

ULC Compliant Install	Non-ULC Compliant Install
Honeywell Vista 32FBT – 9 Communicator UL864 Rev 9 Version (or higher)	Honeywell Vista 32FBT – 9 Communicator UL864 Rev 9 Version (or higher)
Honeywell 6160CR-2 – Commercial Fire Alpha Keypad	Honeywell 6160CR-2 – Commercial Fire Alpha Keypad
Honeywell 7845GSMCN – Digital Cellular Communicator	Honeywell 7845GSMCN – Digital Cellular Communicator (only when no copper/fiber line)
Honeywell Battery Sense Module (BSM)	One (1) - 7 AH 12VDC battery
Two (2) - 7 AH 12VDC batteries	6 pin telephone single port jack
6 pin telephone single port jack	
GSM – ANT 3DB Cellular Antenna	

2.2. Installation Instructions

- 2.2.1. Install equipment on a 1200 mm x 2400 mm plywood backboard painted with fire retardant grey paint in a secure room, and mount equipment between 1000 mm and 2000 mm above finished floor. Provide 1.0 m working clearance in front of all equipment.
- 2.2.2. Mount keypad to the cover of a RED junction box (200x200x100 mm) with Keypad to be mounted to box using machine screws. Box to be labelled indicating phone jack inside.
- 2.2.3. Provide one (1) 6 pin telephone single port jack within 100x100 mm junction box (no cover) mounted above dialer panel (see detail).
- 2.2.4. Mount digital cellular communicator to the cover of a RED junction box (250x250x100 mm) using machine screws.
- 2.2.5. Wire the Vista 32FBT with a tamper alarm. Alarm to sound when door of dialer is opened, in accordance with CAN/ULC-S537.
- 2.2.6. Wiring specifications:
 - 2.2.6.1. Cat 6 cable between the fire alarm communication panel and single jack in item 3 above. Terminate and test cable.
 - 2.2.6.2. 6c#18 FAS cable between the main fire alarm panel and fire alarm communication panel.
 - 2.2.6.3. All other wiring to be #18 AWG FAS cable and labelled appropriately. All wiring to be run direct without breaks or splices
- 2.2.7. All wire to be mechanically protected in conduit; flex conduit is not permitted. Do not pull into conduit any other wire than fire alarm communication cable. Paint RED all conduit fittings and junction boxes carrying fire alarm monitoring cable.

2.3. Vista 32FBT

- 2.3.1. Provide 120VAC 15 amp power from a dedicated circuit. Where available, provide power from an emergency power source. Paint the circuit breaker RED to signify it is part of the Fire Alarm system and install a position lock. Provide label on the fire alarm monitoring panel indicating the panel name and circuit number, in accordance with CAN/ULC-S537. Terminate on the panel as follows:

Terminal No.	ULC Compliant	Non-ULC Compliant
1	Power from Transformer	Power from Transformer
2	Power from Transformer	Power from Transformer
3	Lead A of 2K resistor provided with package	Lead A of 2K resistor provided with package



4	Lead B of 2K resistor on Terminal 3	Lead B of 2K resistor on Terminal 3
5	Lead A of 2K resistor	Lead A of 2K resistor
6	Lead B of 2K resistor on Terminal 5	Lead B of 2K resistor on Terminal 5
7	Left Open	Left Open
8	Left Open	Left Open
9	Left Open	Left Open
10	Left Open	Left Open
11	Positive (red) wire from both 6160CR keypad and 7845GSM Cellular Communicator	Positive (red) wire from both 6160CR keypad and 7845GSM Cellular Communicator
12	Negative (black) wire from both 6160CR and 7845GSM Cellular Communicator	Negative (black) wire from both 6160CR and 7845GSM Cellular Communicator
13	Data In (green) wire from both 6160CR and 7845GSM Cellular Communicator	Data In (green) wire from both 6160CR and 7845GSM Cellular Communicator
14	Data Out (yellow/blue) wire from both 6160CR and 7845GSM Cellular Communicator	Data Out (yellow/blue) wire from both 6160CR and 7845GSM Cellular Communicator
15	Left Open	Left Open
16	Left Open	Left Open
17	Left Open	Left Open
18	Left Open	Left Open
19	Left Open	Left Open
20	Zone 4 (red) wire from the fire alarm panel for a Normally Open input 'Fire Alarm' point	Zone 4 (red) wire from the fire alarm panel for a Normally Open input 'Fire Alarm' point
21	Zone 4 (black) other half of the Normally Open input 'Fire Alarm' point	Zone 4 (black) other half of the Normally Open input 'Fire Alarm' point
22	Zone 5 (blue) wire from the fire alarm panel for a Normally Open input 'Fire Trouble Alarm' point	Zone 5 (blue) wire from the fire alarm panel for a Normally Open input 'Fire Trouble Alarm' point
23	Zone 5 (orange) other half of the	Zone 5 (orange) other half of the Normally

	Normally Open input 'Fire Trouble Alarm' point. As well as Zone 6 (brown) wire from the fire alarm panel for a Normally Open input "Fire Supervisory Alarm"	Open input 'Fire Trouble Alarm' point. As well as Zone 6 (brown) wire from the fire alarm panel for a Normally Open input "Fire Supervisory Alarm"
24	Zone 6 (green) other half of Normally Open input 'Fire Supervisory Alarm' point	Left Open
25	Left Open	Left Open
26	Zone 8 from the fire alarm panel for a Normally Closed input 'Fire Tamper Alarm' point	Zone 8 from the fire alarm panel for a Normally Closed input 'Fire Tamper Alarm' point
27	Zone 8 other half of the Normally Open input 'Fire Tamper Alarm' point	Zone 8 other half of the Normally Open input 'Fire Tamper Alarm' point
28	Left Open	Left Open
29	Left Open	Left Open
30	Ground wire provided from transformer case	Ground wire provided from transformer case

2.4. BSM and Two (2) 7AH 12VDC batteries [ULC Compliant Only]

2.4.1. All leads are provided in the package. **Do not use** the set of leads provided with two wires going to one terminal end. Terminate as follows:

Terminal No.	Item
1	Positive (red) from battery A to positive post of BSM marked battery A
2	Negative (black) from battery A to negative of BSM marked battery A
3	Positive (red) from battery B to positive post of BSM marked battery B
4	Negative (black) from battery B to negative of BSM marked battery B
5	Positive post of Vista 32FBT to positive post of BSM marked panel
6	Negative post of Vista 32FBT to negative post of BSM marked panel

*Non-ULC installation requires only one (1) battery. Refer to section 2.5 for terminations.

2.5. One (1) 7AH 12VDC battery [Non-ULC Compliant Only]

2.5.1. All leads are provided in the package. **Do not use** the set of leads provided with two wires going to one terminal end. Terminate as follows:

Terminal No.	Item
1	Positive post of Vista 32FBT to positive post of 7AH battery
2	Negative post of Vista 32FBT to negative post of 7AH battery

2.6. 6160 CR Keypad

2.6.1. Supply keypad with 4c#18 FAS cable from Vista 32FBT. Terminate as follows:

Terminal No.	Item
1	Y Terminal (blue/yellow wire) from terminal 14 of Vista 32FBT
2	+ Terminal (red wire) from terminal 11 of Vista 32FBT
3	- Terminal (black wire) from terminal 12 of Vista 32FBT
4	G Terminal (green wire) from terminal 13 of Vista 32FBT

2.7. 7845GSMCN Cellular Communicator [ULC compliant install or non-ULC compliant install with no copper/fiber connection available]

2.7.1. Supply Cellular Communicator with 4c#18 FAS cable from Vista 32FBT. Terminate as follows:

Terminal No.	Item
1	Left open
2	Red jumper wire to terminal 3
3	(Red wire) from terminal 11 of Vista 32FBT
4	(Black wire) from terminal 12 of Vista 32FBT
5	(Blue/yellow wire) from terminal 14 of Vista 32FBT
6	(Green wire) from terminal 13 of Vista 32FBT
7	Left open
8	Left open

2.8. GSM Antenna

2.8.1. Required for all sites with 7845GSMCN Cellular Communicator.

2.8.2. **Antenna to be provided on all installations.**

2.8.3. Note: No part of the Antenna may be grounded or bonded to the boxes or pipes that are installed with Vista 32FBT as this will result in earth ground issues with the panel.

2.9. Fire Alarm Panel

2.9.1. Set all alarm point relays as Normally Open with a supervisory 2K resistor placed in parallel with wires coming from Zones of Vista 32FBT. Do not twist or solder resistor to wires coming from Vista 32FBT, in accordance with CAN/ULC-S561.

Contact	Item
Fire Alarm Contact	Wired to terminals 20 and 21 for Zone 4 from Vista 32FBT
Fire Trouble Contact	Wired to terminals 22 and 23 for Zone 5 from Vista 32FBT
Fire Supervisory Contact	Wired to terminals 23 and 24 for Zone 6 from Vista 32FBT

*Non-ULC installation does not require Fire Supervisory contact

2.10. Programming and Verification

2.10.1. City requires **minimum 14** days notification for creation of monitoring account and programming/commissioning of Dialers. Programming of Dialer must occur prior to Fire Alarm Verification and after the following:

2.10.1.1. All equipment is installed,

2.10.1.2. Communication services have been verified as active,

2.10.1.3. Monitoring Account is active and dedicated phone number assigned.

2.10.2. Dialer testing to be completed in conjunction with the main fire alarm system verification, and to verify compliance with CAN/ULC-S537 – Standard for the Verification of Fire Alarm Systems.



APPENDIX F1 - STANDARD FIRE ALARM DIALER DRAWINGS



APPENDIX G - GUIDELINES FOR GAS DETECTION SYSTEMS

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7. Chlorine (Cl₂)
8. Hydrocarbons – i.e. natural gas and methane (CH₄), propane (C₃H₈), acetylene (C₂H₂)
9. Refrigerants (i.e. Ammonia [NH₃], R-22, R-422B, R-410A, R-134a)
10. Ozone (O₃)
11. Carbon dioxide (CO₂)

Table 1 – Alarm and ventilation activation concentrations

Table 2 – Visual alarm, label, and sign colours

Table 3 – Occupational exposure limits and lower explosive limits

1. Background

- 1.1. The City of Edmonton has established guidelines for all permanent gas detection systems installed in its facilities. These guidelines are designed to:
 - 1.1.1. Achieve high quality and reliability in gas detection systems
 - 1.1.2. Eliminate failed and improper gas detection system installations
 - 1.1.3. Optimize for occupant safety and operational efficiency
 - 1.1.4. Achieve consistency across gas detection systems
- 1.2. The following gases are included in these guidelines:
 - 1.2.1. Carbon monoxide (CO)
 - 1.2.2. Nitrogen dioxide (NO₂)
 - 1.2.3. Chlorine (Cl₂)
 - 1.2.4. Hydrocarbons – i.e. natural gas and methane (CH₄), propane (C₃H₈), acetylene (C₂H₂)
 - 1.2.5. Refrigerants (i.e. R-22, R-422B, R-410A, R-134a)
 - 1.2.6. Ammonia (NH₃)
 - 1.2.7. Ozone (O₃)
 - 1.2.8. Carbon dioxide (CO₂)
- 1.3. These guidelines cover the following concepts, in order of appearance in the document:
 - 1.3.1. General requirements to which all gas detection systems must adhere
 - 1.3.2. Additional detailed requirements specific to each gas
 - 1.3.3. Tables containing requirements specific to each gas
- 1.4. The requirements under this document are sourced, in part, from the following codes and standards:
 - 1.4.1. Alberta Building Code
 - 1.4.2. Alberta Fire Code
 - 1.4.3. NFPA 52
 - 1.4.4. NFPA 55
 - 1.4.5. CSA B52
 - 1.4.6. CSA B149
 - 1.4.7. ASHRAE 15 & 34
 - 1.4.8. OH&S Code
 - 1.4.9. ASHRAE Handbook – Refrigeration
 - 1.4.10. Industrial Ventilation Manual – Appendix A
 - 1.4.11. International Programme on Chemical Safety – Data Sheets

- 1.4.12. WCB Alberta – Chlorine and ammonia
- 1.4.13. WorkSafeBC – Chlorine, ammonia, and ozone
- 1.4.14. Health and Safety Laboratory – Review of alarm setting for toxic gas and oxygen detectors – Research Report
- 1.5. This document has been developed in collaboration with the following City of Edmonton groups:
 - 1.5.1. Facility Engineering
 - 1.5.2. Facility Maintenance
 - 1.5.3. Corporate Safety and Employee Health
 - 1.5.4. Fire Rescue Services
 - 1.5.5. Community and Recreation Facilities

2. General

- 2.1. Application of this document
 - 2.1.1. The general guidelines contained in this section (section 2) shall be applied to all gas detection systems included in subsequent sections (sections 3, 4, etc.).
 - 2.1.2. In addition to the requirements described in 2.1.1, the guidelines contained in sections 3, 4, etc. shall apply to the gas detection systems corresponding to each respective section's title.
 - 2.1.3. New gas detection systems and existing systems that are modified shall conform to this document in its entirety.
- 2.2. Alarm concentration thresholds
 - 2.2.1. The following definitions shall apply:
 - 2.2.1.1. **8-hour exposure limit:** Maximum time-weighted average concentration to which nearly all persons may be repeatedly exposed for 8 hours per day and 40 hours per week without adverse effect.⁴
 - 2.2.1.2. **15-minute exposure limit:** Maximum time-weighted concentration to which nearly all persons may be exposed over any 15 minute period, occurring a maximum of four times separated by a 60-minute period within an 8-hour period, without suffering from irritation, chronic or irreversible tissue damage, or narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency, and provided the 8-hour exposure limit is not otherwise exceeded.
 - 2.2.1.3. **Ventilation activation concentration:** The measured gas concentration at which the gas shall be mitigated using an engineered ventilation system. The ventilation system shall be activated or increased to high flow in order to exhaust the gas and replace it with outdoor air.
 - 2.2.1.4. **Low alarm activation concentration:** The concentration at which the gas concentration is not harmful but would become harmful if it increases to higher concentrations. The visual alarms shall be activated to indicate the low concentration and a notification of low concentration shall be sent to City of Edmonton Corporate Security for non-emergency response (local or

⁴ Industrial Ventilation Manual – 23rd edition – 1998 – Appendix A: Threshold Limit Values for Chemical Substances in the Work Environment

maintenance personnel). It is not necessary for occupants to vacate the space—the low alarm serves as a notification to occupants that there is some gas concentration in the space, which should be mitigated by the local or maintenance personnel.

- 2.2.1.5. **High alarm activation concentration:** The minimum concentration at which the gas concentration is harmful. The visual and audible alarms shall be activated to indicate the high concentration and a notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services. Occupants are expected to vacate any space in which an audible alarm can be heard—the high alarm serves as a means to evacuate the occupants of a harmful space.
- 2.2.2. All gas detection systems shall employ the concentration thresholds listed in Table 1 according to the guidelines set for each gas as outlined in the rest of this document:
 - 2.2.2.1. Ventilation activation concentration
 - 2.2.2.2. Low alarm activation concentration
 - 2.2.2.3. High alarm activation concentration
- 2.3. System performance criteria
 - 2.3.1. The City's basis of design is Honeywell 301-C controller with compatible Honeywell sensors. Other alternative manufacturers and models shall be vetted by the City of Edmonton before being specified.
 - 2.3.2. All gas detection components shall be pre-manufactured, pre-assembled, CSA-approved devices. No custom, one-off, field-assembled, or contractor-assembled equipment shall be specified or installed as any part of a gas detection system.
 - 2.3.3. All gas detection controllers shall have the capability of achieving call-outs to external monitoring agencies (such as security services, dispatch services, etc.).
 - 2.3.4. All gas detection controllers shall have the capability of achieving call outs to Corporate Security Monitoring on a fault/trouble condition. If required, contact Facility Engineering for further discussion.
 - 2.3.5. The controller shall visually indicate low and high concentration status. The controller shall display the current measured concentration or percent of lower explosive limit. Use the same units (e.g. PPM or %) as shown in Table 1 for the gas in question.
 - 2.3.6. All sensors, controllers, wiring, systems, etc. shall be properly shielded and resistant to all common environmental sources of electromagnetic interference or radio-frequency interference. This includes, but is not limited to, cell phones, radios, other electronics, motor drives, and appliances. To this effect, internal communication protocol (i.e. from sensors to controllers, shall be digital, not analog.
 - 2.3.7. All gas detection system components shall be robust and of sufficient quality to resist all foreseeable interaction with users and moderate human-powered impact. All devices shall have a NEMA rating that is appropriate for their environment (i.e. NEMA 3).
 - 2.3.8. For gas detection systems installed in the following locations, all devices shall be NEMA 4X rated as a minimum, or as determined by the Hazardous Classification Study if the NEMA 4X rating is insufficient for the space:

- 2.3.8.1. Natatoriums
- 2.3.8.2. Chlorine rooms
- 2.3.8.3. Ice-resurfacing-machine rooms
- 2.3.8.4. Parking garages
- 2.3.8.5. Any space where water will be sprayed
- 2.3.9. All gas detection systems shall record and log the instantaneous gas concentration measured by the systems. The data shall be stored in the controller. The data-logging shall occur at every gas concentration change (with appropriate concentration change threshold).
- 2.3.10. No permanent gas detection system shall employ time-weighted averaging gas concentration measurement.
- 2.3.11. All gas detection controllers shall allow a specified time delay to be set with a maximum resolution of 10 seconds. Manufacturer–pre-set time delays will not be accepted (i.e. controllers only providing a set number of delay periods, such as 10, 30, or 60 seconds, are not acceptable).
- 2.3.12. No gas detection system, nor any of its components, shall have any mechanism to allow a low or high alarm to be deactivated while the system is in alarm status (i.e. while the conditions at which a low or high alarm would normally activate are in place or satisfied). This means no “mute” or “silence” features.
- 2.3.13. The gas detection system designer shall include a requirement in the specifications that lubricants or sealants used for threaded conduit connections contain no substance that might adversely affect the gas detection system sensors.
- 2.3.14. All gas detection system components shall be installed such that their exposure to vibration is minimized.
- 2.3.15. All gas detection system components shall be installed such that their exposure to water is minimized, and their design shall drain water effectively.
- 2.3.16. When interconnecting ancillary devices, maximum current and voltage ratings of the instruments’ outputs (i.e. interposing relay contacts) shall be observed. This includes barriers, isolation devices, and other intrinsically safe components.
- 2.3.17. All circuits exceeding 30 V RMS or 42.4 V peak-to- peak and all circuits 30 V RMS or less that are not Class 2 power-limited—as defined by the Canadian Electrical Code (CSA 22.1)—shall be protected from accidental contact through appropriate mechanical guards or barriers.
- 2.3.18. If gas detection system components or ancillary components are installed in a hazardous (classified) location, these instruments or components shall be approved for the area in which they are installed and shall be clearly marked.⁵ Hazardous (classified) locations are defined by the Canadian Electrical Code (CSA 22.1).
- 2.3.19. All gas detection equipment shall be installed as per their manufacturer’s specifications.
- 2.3.20. Each gas detection zone shall have two points out to the applicable City of Edmonton Corporate Security panel—one point for low alarm, and one point for high alarm.

⁵ ISA RP92.0.02, Part II-1998 and CSA 22.1

E.g. For refrigerants, wherever there are two zones—machinery room and adjacent public area—each zone shall have two points out to the security panel: machinery room low, machinery room high, public area low, and public area high.

2.4. System design process

- 2.4.1. All gas detection systems shall be authenticated by a professional engineer. The engineer shall have relevant experience designing gas detection systems, including ancillary systems, such as ventilation, control interlock with mechanical refrigeration or combustion equipment, sensor layouts, call-outs to external monitoring, etc. The engineering consulting services shall be procured by the City of Edmonton or by the prime contractor—not by the gas detection system vendor or contractor. All gas detection design contract documents shall be reviewed by the City of Edmonton.
- 2.4.2. The engineer's design process shall include the following:
 - 2.4.2.1. Gas hazard assessment
 - 2.4.2.2. Identify location and severity of potential gas sources, gas accumulation, and contact with occupants
 - 2.4.2.3. Consider airflow patterns within the space
- 2.4.3. Sensor layouts shall be designed such that sensor range radii overlap one-another to cover the gas detection zone's complete horizontal plane.
- 2.4.4. A sensor layout plan indicating the sensing radii and the sensors' specific and dimensioned locations—on plan and in section—shall be submitted as part of the project contract documents.
- 2.4.5. All gas detection system components shall be specified in the contract documents, including the manufacturer and model number.
- 2.4.6. All gas detection system sequences of operation shall be explicitly specified by the engineer, with appropriate interdisciplinary coordination. The sequence shall be included in the mechanical controls specification section.
- 2.4.7. Hazardous location designation for fire protection:
 - 2.4.7.1. The designer shall determine each space's hazardous location designation (i.e. Class I Zone 1). The hazardous location designation for each project shall be reviewed by the City of Edmonton.
 - 2.4.7.2. The gas detection system, including all its components, shall conform to the requirements of this classification.

2.5. Location

- 2.5.1. All gas detection system components shall be installed in clearly visible locations.
- 2.5.2. Any components that requires access or interaction (controllers, switches, display screens) shall be mounted in highly accessible locations.
- 2.5.3. All points of access for periodic testing and calibration shall be located and installed such that they are highly accessible by trades.
- 2.5.4. All visual and audible alarms shall be installed in highly visible locations. All relevant occupants in the zone should be able to see and hear the alarms whenever they are in the space.
- 2.5.5. All gas detection sensing components shall be installed in locations and elevations as prescribed by

the manufacturer and taking into account the gas being detected, the sensor's sensing radius, any effect of air currents in the space, or interference from architectural features.

- 2.5.6. Do not locate sensors where they will be impacted by erroneous locally-high concentrations of gas, where the application does not warrant detection of such high concentrations before being diluted into the space. For example, do not locate carbon monoxide or nitrogen dioxide in front of a vehicle exhaust pipe.
- 2.5.7. Sensors and controllers shall be located such that they are free from any environmental factors that could damage them, such as dust, debris, water, aerosols, and physical impacts.
- 2.5.8. Whenever practicable, stand-alone sensors (i.e. separate from other components such as a controller) shall be mounted facing downward (preferred) or horizontally (acceptable).
- 2.5.9. Sensors shall not be located near supply air outlets.
- 2.5.10. Sensors shall not be located where contaminated air will short-circuit around the sensor to an exhaust inlet.
- 2.5.11. Consideration shall be given to spaces that are immediately adjacent to spaces that are gas detection zones, where leaked gas from the gas-detection- zone-space could infiltrate the adjacent space. If such a risk exists, the adjacent space shall have a permanent gas detection system similar to the one used in the gas detection zone space and shall be on a separate zone from the gas detection zone space.
- 2.5.12. Elevations:
 - 2.5.12.1. Definition of *low elevation*: 150 mm above the finished floor.
 - 2.5.12.2. Definition of *occupant breathing elevation*: 1,500 mm above the finished floor.
 - 2.5.12.3. Definition of *high elevation*: Minimum 2,000 mm and maximum 2,500 mm above the finished floor or above an accessible platform. Must be accessible from an 8 ft step ladder.

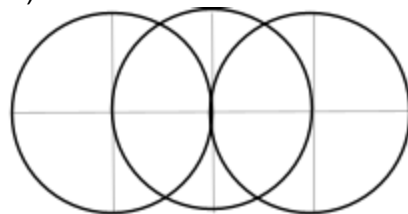
2.6. Preventing false alarms

- 2.6.1. All gas detection system alarms shall have a delay function (referred-to herein as "alarm delay"). The delay period (i.e. magnitude, in seconds) for each gas shall be set according to the "alarm delay period" specification in the section corresponding to the gas in question (section 3, 4, etc.).
 - 2.6.1.1. **Low alarm:** If a sensor measures a concentration exceeding the low alarm activation concentration stated in Table 1, the low alarm shall only activate if, after the prescribed delay period, the measured concentration has not, at any point during the prescribed delay period, fallen below the low alarm activation concentration
 - 2.6.1.2. **High alarm:** If a sensor measures a concentration exceeding the high alarm activation concentration stated in Table 1, the high alarm shall only activate if, after the prescribed delay period, the measured concentration has not, at any point during the prescribed delay period, fallen below the high alarm activation concentration
- 2.6.2. If a gas detection zone requires prevention of false alarms, a voting scheme may be employed. Sensors may employ a voting scheme if all of the conditions, below, are satisfied:
 - 2.6.2.1. The sensors are located in the same single physical space
 - 2.6.2.2. There are 3 or more sensors

2.6.2.3. The sensors achieve the same function:

- .1 Example—sensors that *do* achieve the same function: Three sensors are located in a single space. All sensors are at the same elevation, are dispersed roughly equally throughout the space, and are located roughly at the same distance from the probable source of a gas leak and from the probable location of gas accumulation.
- .2 Example—sensors that *do not* achieve the same function: Three sensors are located in a single space. One sensor is located near the probable source of a gas leak; one sensor is located near an exhaust fan inlet; one sensor is located in the probable location of gas accumulation.

2.6.2.4. Range of each sensor shall overlap the adjacent sensor's range up to, at minimum, its midpoint (see figure, below).



Minimum overlap of sensor ranges
employed in a voting scheme

2.6.3. The voting scheme shall have the following sequence:

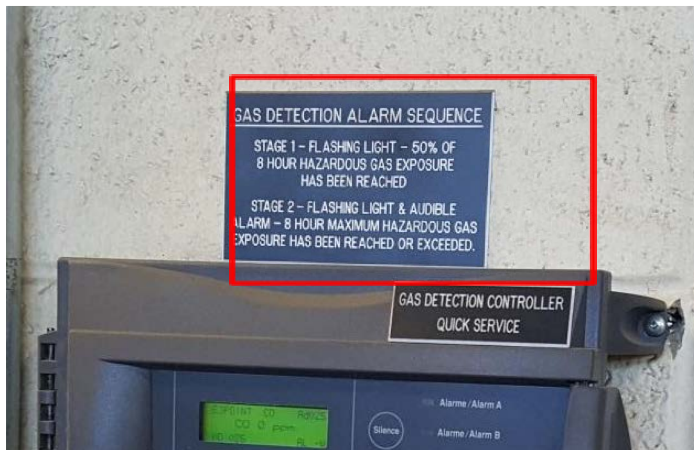
- 2.6.3.1. **Low alarm:** If at least one of the sensors in the voting scheme measures a concentration exceeding the low alarm activation concentration stated in Table 1 and at least one other sensor in the voting scheme whose range overlaps with the first sensor measures any non-zero concentration, then the low alarm shall be activated
- 2.6.3.2. **High alarm:** If at least one of the sensors in the voting scheme measures a concentration exceeding the high alarm activation concentration stated in Table 1 and at least one other sensor in the voting scheme whose range overlaps with the first sensor measures a concentration exceeding the low alarm activation concentration stated in Table 1, then the high alarm shall be activated.

2.7. Labels

2.7.1. All gas detection devices (sensors, controllers, and manual push buttons) shall be identified using small or medium engraved plastic plate tags⁶ mounted on or near the device on the wall, as shown in the annotated pictures below:



2.7.2. The controller label shall be medium engraved plastic plate tags⁷ mounted near the controller on the wall, as shown in the annotated picture below.



2.7.3. The controller label shall include the following content:

- 2.7.3.1. The name and chemical formula of the gas being detected
- 2.7.3.2. The source of the gas (i.e. “gasoline combustion” for some cases of CO, “diesel combustion” for some cases of NO₂)
- 2.7.3.3. The stages of gas detection: low and high gas concentration levels (defined in Table 1) and the corresponding control sequence actions

⁶ Also known as “lamacoids”

⁷ Also known as “lamacoids”

2.7.3.4. Where its associated sensors are located.

2.7.3.5. A statement that the gas is remotely monitored.

2.7.4. All label colours shall conform to the specifications listed in Table 2.

2.8. Signs

2.8.1. In general, all visual alarms shall be identified using large engraved plastic plate tags⁸ mounted near the visual alarm, as shown in the pictures below.



2.8.2. In maintenance spaces, such as vehicle maintenance garages, all visual alarms shall be identified using large signs mounted near the visual alarm, as shown in the picture, below.



⁸ Also known as “lamacoids”

2.8.3. All signs shall include the following content:

2.8.3.1. The name of the gas being detected

2.8.4. All sign colours shall conform to the specifications listed in Table 2.

2.9. Visual alarms

2.9.1. Visual alarms shall be strobe lights.

2.9.2. Visual alarms shall be located at an elevation where it is clearly visible from all areas of the space containing the gas and out of reach of occupants. As many visual alarms as needed shall be installed for at least one visual alarm to be visible from every point within the space.

2.9.3. For closed gas-monitored spaces, a visual alarm shall be located immediately outside the space such that it clearly indicates the detection of a gas from outside the space without needing to enter the space.

2.9.4. For gas-monitored spaces with direct access to the outdoors, a visual alarm shall be located outside the space, on the outside of the building, such that it clearly indicates the detection of a gas from outside the space without needing to enter the space.

2.9.5. All visual alarm colours shall conform to the specifications listed in Table 2.

2.10. Audible alarms

2.10.1. Audible alarms shall be horns or speakers specifically designed and manufactured for use as audible alarm annunciation.

2.10.2. The sound made by the audible alarm shall be unique. It shall not be similar to a fire alarm, or any other alarm common to the facility, or to facilities in general.

2.10.3. In general, audible alarms shall generate a sound pressure of minimum 100 dB at 3 m and shall be clearly audible from all areas of the space containing the gas.

2.10.3.1. Audible alarms at non-mechanical spaces such as guest services counters and rink attendant offices shall create a sound pressure of between 50 dB and 60 dB at 3 m.

2.10.3.2. Audible alarms in chlorine rooms and other similar-sized small rooms shall create a sound pressure of between 50 dB and 60 dB at 3 m.

2.10.4. If a gas detection zone is contained within a closed space (i.e. a mechanical room) and the system has no audible alarm outside the space, then the audible alarm shall be loud enough that it is clearly audible from outside the space containing the zone.

2.11. Ventilation systems in gas detection zones

2.11.1. Ventilation systems shall be installed in any space where detection or ventilation of a hazardous gas is required, for the purpose of removing hazardous gases. This ventilation system shall:

2.11.1.1. Follow all relevant standards, including:

- .1 OSHA Technical Manual – Section III – Chapter 3: Ventilation Investigation – Appendix III: 3-1. Ventilation Primer
- .2 ASHRAE Handbook – Fundamentals – Chapter 11. Air Contaminants
- .3 Industrial Ventilation Manual

- 2.11.2. Conform to all gas-specific ventilation requirements, including:
 - 2.11.2.1. CSA B52 (2013) – 6.2 and 6.3
 - 2.11.2.2. ASHRAE 15 & 34 – 8.11
 - 2.11.2.3. CSA B149 (2010) – 10.1
 - 2.11.2.4. Alberta Building Code (2014) – including:
 - .1 3.3.1
 - .2 6.2.2
 - .3 6.2.3
 - .4 7.2.3
 - 2.11.2.5. Occupational Health and Safety Code (2009) – Part 26
 - 2.11.2.6. NFPA 55 – Chapter 3
 - 2.11.2.7. WorkSafeBC – Chlorine Safe Work Practices – Ventilation
 - 2.11.2.8. BSR/IIAR 2-201x – 6.14
- 2.11.3. Be designed according to best practices specific to:
 - 2.11.3.1. The gas in question
 - 2.11.3.2. The systems and equipment containing the gas in question
- 2.11.4. Employ control sequences designed to interlock with the gas detection system
- 2.11.5. Ensure adequate outdoor air flow to make-up exhaust air flow
- 2.11.6. Be engineered to achieve sufficient dilution of the gas, accounting for the following:
 - 2.11.6.1. Density of the gas relative to that of the ambient air
 - 2.11.6.2. Location of exhaust inlets
 - 2.11.6.3. Location of make-up or supply air outlets relative to exhaust inlet locations to avoid short-circuiting of ventilation
 - 2.11.6.4. Location in the space where the gas is most likely to accumulate
- 2.11.7. Installation and commissioning
- 2.11.8. All gas detection systems shall be installed by either of the following:
 - 2.11.8.1. Red seal journeyman electrician
 - 2.11.8.2. Certified factory installer
- 2.11.9. Sensors must be kept clean, and clear of any dust or debris, throughout construction.
- 2.11.10. All gas detection systems shall be commissioned. The City of Edmonton commissioning manual shall be followed, in addition to the commissioning guidelines listed below.
- 2.11.11. Commissioning shall be verified by an independent commissioning agent, and not by the controls contractor.

- 2.11.12. The commissioning process must confirm that all gas detection systems:
 - 2.11.12.1. Are properly installed in conformance to the guidelines stated herein
 - 2.11.12.2. Measure the correct concentration of gases, as tested by an independent calibrated gas
 - 2.11.12.3. Activate correct ventilation equipment as per the design control sequence according to the corresponding gas concentration stages
 - 2.11.12.4. Engage correct audible and visual alarms according to the corresponding gas concentration stages
 - 2.11.12.5. Signal to correct external monitoring parties (i.e. City of Edmonton Corporate Security for response from Facility Maintenance and Fire Rescue Services) according to the corresponding gas concentration stages
- 2.11.13. The commissioning process shall include static and functional check sheets that confirm, in writing, all points listed under 2.12.5.
- 2.11.14. The ventilation system shall be balanced to confirm proper flow is achieved through each supply inlet and exhaust outlet.
- 2.11.15. A separate verification sheet is to be completed for each sensor and each input and output point on all controllers. Each verification sheet is to be dated and signed by the commissioning agent. Each sheet shall include the expected value for the point being tested and the actual value measured with an independent portable device at the time of the commissioning dynamic test.
- 2.11.16. Each sequence shall be recorded in a separate verification sheet. The sheet shall be dated and signed by the commissioning agent and include a description of the sequence.
- 2.11.17. If the gas detection system has building automation system connection capability, the system's integration with the building automation system shall be verified in the commissioning process.
- 2.12. System configuration
 - 2.12.1. All gas detection system components (i.e. sensors, controllers, visual and audible alarms) shall have hard-wired power and control connections and to each other. No wireless. No digital communication from the controller to any other components (i.e. fans, alarms, etc.)—use relays only. Only digital communication allowed is from a sensor to controller and from controller to a remote display.
 - 2.12.2. All gas detection system components (i.e. sensors, controllers, visual and audible alarms) shall have hard-wired connections to each other.
 - 2.12.3. All gas detection systems shall use dedicated gas detection controllers to control dependent components, such as visual and audible signaling devices, and exhaust and supply fans. The gas detection system shall be a standalone control system. Sensors shall not be routed directly to a building automation system.
 - 2.12.4. Gas detection system outputs for control of mechanical equipment, such as ventilation, shall be made through dry contact connections. There shall be a separate status signal using a current transducer for all mechanical equipment to the building automation system. Where the BAS is needed to control equipment under regular circumstances, the gas detection controller command shall override the BAS control signal.

- 2.12.5. Gas detection system shall, to the extent practical, have the capability to output data for trending to the building automation system through analog outputs (4–20 mA or 0–10 V) or binary outputs (relay).
- 2.12.6. All gas detection systems shall be monitored for status by the building automation system (where it exists). The following points (application-dependent) shall be monitored:
 - 2.12.6.1. Measured gas concentration
 - 2.12.6.2. Low concentration gas detection status
 - 2.12.6.3. High concentration gas detection status
 - 2.12.6.4. Call for low ventilation rate
 - 2.12.6.5. Call for high ventilation rate
- 2.12.7. All gas detection system-related wiring shall be installed in conduit. The system shall not have any exposed wiring. All conduits shall have colour indication (painted in a contrasting colour or with coloured banding) to distinguish it as a safety system. All gas detection system-related wiring shall be protected by means appropriate for the area classification.
- 2.12.8. Gas detection call-outs to City of Edmonton Corporate Security shall be achieved by a dry contact connection from the gas detection system to the security system, and not through the building automation system.
- 2.12.9. A single gas detection system controller shall not be used to detect two or more different gas types. Exception: Carbon monoxide and nitrogen dioxide will be allowed to be detected by a single, combined gas detection system comprised of one controller, provided it is designed for that purpose. In this case, all outputs shall be independent for each gas.
- 2.12.10. Please ensure that the 120V power source for the gas detection is on a dedicated circuit with a lockable breaker. If feasible, place it on an emergency power source. Contact FES for further discussion, if required.
- 2.12.11. Please ensure to use manufacturer approved 24VDC power supply. CoE basis of design is the Honeywell M600400 or approved equal.

3. Carbon monoxide (CO) - Bulk Storage, repair garages, specified mechanical rooms

- 3.1. Application
 - 3.1.1. A gas detection system shall be installed in any location where the concentrations of the gas is plausible in a concentration exceeding the low alarm point stated in Table 1.⁹
 - 3.1.2. A carbon monoxide gas detection system is required in all arenas and associated mechanical spaces where ice resurfacing machines are operated and stored.
 - 3.1.3. All mechanical/electrical rooms in recreational facilities housing non-sealed-combustion gas burning equipment shall include carbon monoxide (CO) monitoring.

⁹ Occupational Health & Safety Code – Part 4: An employer must ensure that a worker's exposure to any substance [...] does not exceed its occupational exposure limits [...]. The high alarm point is set to indicate that the gas concentration has reached a potentially harmful level.

3.2. System performance criteria

3.2.1. No additional specific requirements.

3.3. System configuration

3.3.1. Sensors shall be mounted at occupant breathing elevation or low elevation, at the engineer's discretion, according to the following considerations:

3.3.1.1. Location of the gas source

3.3.1.2. Airflow patterns in the space

3.3.1.3. Location where the gas is most likely to accumulate

3.4. Alarm delay period

3.4.1. The alarm delay period, as specified in 2.6.1, shall be 60 seconds, unless otherwise determined by the design engineer.

3.5. Visual and audible alarm specifications

3.5.1. Visual and audible alarms shall be located at each of the following locations:

3.5.1.1. Inside the space containing the gas

3.5.1.2. Any other location required to provide warning of the hazardous gas concentration

3.6. Label and sign specifications

3.6.1. No additional specific requirements.

3.7. Control sequence of operation requirements

3.7.1. Upon exceeding a concentration equal to the ventilation activation concentration (stated in Table 1), the mechanical ventilation system complying with 2.11 shall be activated or increased to high speed to exhaust air from the space and introduce outdoor air to the space.

3.7.2. Upon exceeding a concentration equal to the low alarm activation concentration (stated in Table 1), the visual alarms shall be activated. A notification of low concentration shall be sent to City of Edmonton Corporate Security for response from Facility Maintenance and the Facility Supervisor.

3.7.3. Upon exceeding a concentration equal to the high alarm activation concentration (stated in Table 1), the audible alarms shall be activated. A notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services and notification to Facility Maintenance.

4. Carbon monoxide (CO) - Storage garages / parking garages

4.1. Application

4.1.1. Storage garages (as defined by the Alberta Building Code) require gas detection systems to monitor and control the gas concentration.¹⁰

4.2. System performance criteria

4.2.1. No additional specific requirements.

¹⁰ Alberta Building Code – 3.3.5.4 & 6.2.2.3

4.3. System configuration

- 4.3.1. Sensors shall be mounted at an elevation conforming to the Alberta Building Code for storage garages.

4.4. Alarm delay period

- 4.4.1. The alarm delay period, as specified in 2.6.1, shall be 60 seconds, unless otherwise determined by the design engineer.

4.5. Visual and audible alarm specifications

- 4.5.1. No visual or audible alarms required.

4.6. Label and sign specifications

- 4.6.1. No additional specific requirements.

4.7. Control sequence of operation requirements

- 4.7.1. Meet Alberta Building Code requirements under 6.3.1.4—Ventilation of Storage Garages

5. **Nitrogen dioxide (NO₂) - Bulk Storage, repair garages, specified mechanical rooms**

5.1. Application

- 5.1.1. A gas detection system shall be installed in any location where the concentrations of the gas corresponding to this section is plausible in a concentration exceeding the low alarm point stated in Table 1.¹¹
- 5.1.2. System performance criteria
- 5.1.3. No additional specific requirements.

5.2. System configuration

- 5.2.1. Sensors shall be mounted at occupant breathing elevation or low elevation, at the engineer's discretion, according to the following considerations:
 - 5.2.1.1. Location of the gas source
 - 5.2.1.2. Airflow patterns in the space
- 5.2.2. Location where the gas is most likely to accumulate

5.3. Alarm delay period

- 5.3.1. The alarm delay period, as specified in 2.6.1, shall be 60 seconds, unless otherwise determined by the design engineer.

5.4. Visual and audible alarm specifications

- 5.4.1. Visual and audible alarms shall be located at each of the following locations:
 - 5.4.1.1. Inside the space containing the gas

¹¹ Occupational Health & Safety Code – Part 4: An employer must ensure that a worker's exposure to any substance [...] does not exceed its occupational exposure limits [...]. The high alarm point is set to indicate that the gas concentration has reached a potentially harmful level.

- 5.4.1.2. Any other location required to provide warning of the hazardous gas concentration
- 5.5. Label and sign specifications
 - 5.5.1. No additional specific requirements
- 5.6. Control sequence of operation requirements
 - 5.6.1. Upon exceeding a concentration equal to the ventilation activation concentration (stated in Table 1), the mechanical ventilation system complying with 2.11.1 shall be activated or increased to high speed to exhaust air from the space and introduce outdoor air to the space.
 - 5.6.2. Upon exceeding a concentration equal to the low alarm activation concentration (stated in Table 1), the visual alarms shall be activated. A notification of low concentration shall be sent to City of Edmonton Corporate Security for response from Facility Maintenance and the Facility Supervisor.
 - 5.6.3. Upon exceeding a concentration equal to the high alarm activation concentration (stated in Table 1), the audible alarms shall be activated. A notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services and notification to Facility Maintenance.

6. Nitrogen dioxide (NO₂) - Storage garages / parking garages

- 6.1. Application
 - 6.1.1. Storage garages (as defined by the Alberta Building Code) require gas detection systems to monitor and control the gas concentration (“where the majority of the vehicles stored are powered by diesel-fuelled engines”).¹²
- 6.2. System performance criteria
 - 6.2.1. No additional specific requirements.
- 6.3. System configuration
 - 6.3.1. Sensors shall be mounted at an elevation conforming to the Alberta Building Code.
- 6.4. Alarm delay period
 - 6.4.1. The alarm delay period, as specified in 2.6.1, shall be 60 seconds, unless otherwise determined by the design engineer.
- 6.5. Visual and audible alarm specifications
 - 6.5.1. No visual and audible alarms required.
- 6.6. Label and sign specifications
 - 6.6.1. No additional specific requirements
- 6.7. Control sequence of operation requirements
 - 6.7.1. Meet Alberta Building Code requirements under 6.3.1.4—Ventilation of Storage Garages

¹² Alberta Building Code – 3.3.5.4 & 6.2.2.3

7. Chlorine (Cl₂)

7.1. Application

- 7.1.1. A gas detection system shall be installed in any location where the concentrations of the gas corresponding to this section is plausible in a concentration exceeding the low alarm point stated in Table 1.¹³
- 7.1.2. A gas detection system shall be installed in any pool chlorine room.

7.2. System performance criteria

- 7.2.1. No specific requirements.

7.3. System configuration

- 7.3.1. Sensor(s) shall be located at low elevation.
- 7.3.2. A minimum of one sensor shall be installed at an optimal location for sensing a gas leak from the most probable source and where the gas is most likely to accumulate. The sensor(s) shall be installed as close as practical to the chlorine cylinders and their associated tubing, valves, regulators, etc., without impeding the movements necessary to change chlorine bottles.
- 7.3.3. An additional gas detection sensor shall be installed at occupant breathing elevation if the room is large enough that the sensor at low elevation does not have sufficient range for detecting chlorine gas at occupant breathing elevation where occupants will most probably be located while inside the chlorine room. Within that elevation's horizontal plane, the sensor(s) shall be located where the gas is most likely to accumulate, and where occupants will most probably be located whilst inside the chlorine room.
- 7.3.4. The gas detection controller shall be located immediately outside the chlorine room, inside the building. The controller shall be clearly visible before entering the chlorine room. The controller shall be located adjacent to the viewing window.
- 7.3.5. All requirements under the Alberta Building Code 7.2.3.45 with respect to the chlorine gas detection system and the associated ventilation system shall be followed.¹⁴

7.4. Alarm delay period

- 7.4.1. There shall be no alarm delay.

7.5. Visual and audible alarm specifications

- 7.5.1. Visual and audible alarms shall be located at each of the following locations:
 - 7.5.1.1. Outside the building near the chlorine room door
 - 7.5.1.2. Inside the building but outside the chlorine room near the chlorine room's viewing window
 - 7.5.1.3. Inside the chlorine room
 - 7.5.1.4. On the pool deck in a clearly visible location
 - 7.5.1.5. At the guest services counter

¹³ Occupational Health & Safety Code – Part 4: An employer must ensure that a worker's exposure to any substance [...] does not exceed its occupational exposure limits [...]. The high alarm point is set to indicate that the gas concentration has reached a potentially harmful level.

¹⁴ Alberta Building Code (2014)

7.5.2. Audible alarms shall be located such that the complete natatorium and its related spaces (locker room, pool mechanical room) are covered by the audible range of the alarms.

7.6. Label and sign specifications

7.6.1. No additional specific requirements.

7.7. Control sequence of operation requirements

7.7.1. The exhaust ventilation system shall be turned on only manually by the chlorine room ventilation wall switch. The chlorine detection system shall not activate the exhaust ventilation system.

7.7.2. Upon exceeding a concentration equal to the low alarm activation concentration (stated in Table 1), the visual alarms shall be activated.

7.7.3. Upon exceeding a concentration equal to the high alarm activation concentration (stated in Table 1), the audible alarms shall be activated. A notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services and notification to Facility Maintenance.

8. Hydrocarbons – i.e. natural gas and methane (CH₄), propane (C₃H₈), acetylene (C₂H₂)

8.1. Application

8.1.1. A gas detection system shall be installed in any location where the concentrations of the gas corresponding to this section is plausible in a concentration exceeding the low alarm point stated in Table 1.¹⁵

8.1.2. A natural gas detection system is required in all arenas and associated mechanical spaces where ice resurfacing machines are operated.

8.2. System performance criteria

8.2.1. No specific requirements.

8.3. System configuration

8.3.1. Any gas with sufficiently low density to require a sensor or sensors to be installed at high elevation (i.e. natural gas and methane, as stated in 6.4.7), the sensor or sensors shall be capable of being calibrated without using a ladder.

8.3.2. If the gas is less dense than air, the sensor(s) shall be located at high elevation.

8.3.3. If the gas's density is similar to air, the sensor(s) shall be mounted at occupant breathing elevation.

8.3.4. If the gas is more dense than air, the sensor(s) shall be mounted at low elevation.

8.3.5. The gas detection sensor shall be located in the same space as the hydrocarbon gas equipment and source. The specific location must be designed according to the gas type, room configurations, and manufacturer's recommendations.

8.3.6. The gas detection controller shall be located immediately outside the space containing the natural gas appliance. If this is not possible, then the controller shall be located a safe distance away from

¹⁵ Occupational Health & Safety Code – Part 4: An employer must ensure that a worker's exposure to any substance [...] does not exceed its occupational exposure limits [...]. The high alarm point is set to indicate that the gas concentration has reached a potentially harmful level.

the natural gas equipment and source, and be rated for the location in which it is installed.

8.3.7. Where a vehicle is fuelled indoors:

8.3.7.1. The gas detection sensors shall:¹⁶

.1 Be interlocked to shut off the vehicle refuelling appliance

8.3.7.2. The mechanical ventilation system serving the fuelling area shall:¹⁷

.1 Vent the fuelling area to the outdoors at a flow rate of 25 times the flow rate of the vehicle refuelling appliance

.2 Provide for minimum clearances from the discharge as specified in Table 5.2 in CSA B149.1 (see the table directly in the CSA standard)

8.4. Alarm delay period

8.4.1. The alarm delay period, as specified in 2.6.1, shall be 10 seconds, unless otherwise determined by the design engineer.

8.5. Visual and audible alarm specifications

8.5.1. A visual and audible alarm shall be located outside the building near the space containing the gas equipment and source, near the outside door.

8.5.2. Visual and audible alarms shall be located at each of the following locations:

8.5.2.1. Inside the building but outside the space containing the gas equipment and source, near the door to the space

8.5.2.2. Inside the space containing the gas equipment and source

8.5.2.3. In all adjacent arenas (if applicable), in a location that is clearly visible and audible by staff and patrons

8.5.2.4. Inside the rink attendant office.

8.5.2.5. If the arena facility has a pool, at the guest services counter.

8.6. Label and sign specifications

8.6.1. No additional specific requirements.

8.7. Control sequence of operation requirements

8.7.1. The ventilation system shall be turned on automatically any time the ice resurfacing machine fuelling station is active.

8.7.2. Upon exceeding a concentration equal to the ventilation activation concentration (stated in Table 1), the mechanical ventilation system complying with 2.11.1 shall be activated to exhaust air from the space and introduce outdoor air to the space. The vehicle refuelling appliance shall be switched off automatically.

8.7.3. Upon exceeding a concentration equal to the low alarm activation concentration (stated in Table 1), the visual alarms shall be activated. A notification of low concentration shall be sent to City of Edmonton Corporate Security for response from Facility Maintenance and the Facility Supervisor.

¹⁶ CSA B149.1 – 10.1.6

¹⁷ CSA B149.1 – 10.1.7

The vehicle refuelling appliance shall be switched off automatically.

- 8.7.4. Upon exceeding a concentration equal to the high alarm activation concentration (stated in Table 1), the audible alarms shall be activated. A notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services and notification to Facility Maintenance. The vehicle refuelling appliance shall be switched off automatically.

9. Refrigerants (i.e. Ammonia [NH₃], R-22, R-422B, R-410A, R-134a)

9.1. Application

- 9.1.1. A gas detection system shall be installed in any location where the concentrations of the gas corresponding to this section is plausible in a concentration exceeding the low alarm point stated in Table 1.¹⁸
- 9.1.2. A refrigerant vapour detection system shall be installed in any corresponding refrigeration machinery room.¹⁹
- 9.1.3. A gas detection system shall be installed wherever one is required by CSA B52.

9.2. System performance criteria

- 9.2.1. Follow all gas detection requirements in CSA B52 for machinery rooms and Class T machinery rooms (where applicable).
- 9.2.2. For ammonia detection in small spaces with potential for ammonia leaks, the gas detection system shall employ a combination of low and high concentration sensors such that the gas detection system accurately detects both toxic concentrations (low) and explosive concentrations (high) of ammonia. This is so that the gas detection system will continue to measure and display concentrations if the concentration is approaching explosive levels. For all other ammonia detection applications, where the risk of an explosive concentration of ammonia are sufficiently low, a low concentration sensor shall be employed.
- 9.2.3. The gas detection system shall include a means of manual reset. The gas detection system shall require a manual reset following a detection of gas.²⁰ The controller shall not allow a manual reset to be completed whenever the alarm low or high status is active.
- 9.2.4. The ventilation exhaust system serving the room containing the refrigeration machinery shall be designed including the full requirements of CSA B52 and ASHRAE 15 and 34. For example, see section 6.3 in CSA B52 and section 8.11.3 in ASHRAE 15 and 34.

9.3. System configuration

9.3.1. Gas detection zones

- 9.3.1.1. If the refrigeration machinery is located in a Class T machinery room: A minimum of two zones shall be established: one inside the refrigeration machinery room and one in any adjacent public area connected by an interior door.

- .1 A gas detection event in a zone shall only activate ventilation and visual and audible alarms for that zone, and not for any other zone.

¹⁸ Occupational Health & Safety Code – Part 4: An employer must ensure that a worker's exposure to any substance [...] does not exceed its occupational exposure limits [...]. The high alarm point is set to indicate that the gas concentration has reached a potentially harmful level.

¹⁹ CSA B52 – 6.2.3

²⁰ In accordance with ASHRAE 15 and 34 – 8.11.2.1

E.g. If a leak is detected in the machinery room zone, then the visual and audible alarms associated with the machinery room zone shall be activated. The visual and audible alarms associated with the other zones shall not be activated.

9.3.1.2. If existing refrigeration machinery is not located in a Class T machinery room: The machinery room and all adjacent public spaces shall be considered part of the same zone. A single refrigerant gas detection zone shall encompass all areas at risk of exposure to a refrigeration system leak.

- .1 A gas detection event in the single zone shall activate ventilation and visual and audible alarms for that zone.

E.g. If a leak is detected in the machinery room, then the visual and audible alarms associated with the single zone shall be activated.

9.3.2. Controller location

9.3.2.1. If the refrigeration machinery is located in a Class T machinery room:

- .1 If the refrigeration machinery room has a door to the interior of the building: the gas detection controller or controllers shall be located inside the building, inside the machinery room vestibule.
- .2 If the refrigeration machinery room does not have a door to the interior of the building: the gas detection controller shall be located inside the machinery room, near the door. There shall be a weather-proof, tamper-proof, heated enclosure located immediately outside the exterior door containing a secondary visual display, displaying the measured concentration and the alarm status (low or high).

9.3.2.2. If the refrigeration machinery is not located in a Class T machinery room:

- .1 If the refrigeration machinery room has a door to the interior of the building: the gas detection controller shall be located inside the building, immediately outside the door to the machinery room.
- .2 If the refrigeration machinery room does not have a door to the interior of the building: the gas detection controller shall be located inside the machinery room, near the door. There shall be a weather-proof, tamper-proof, heated enclosure located immediately outside the exterior door containing a secondary visual display, displaying the measured concentration and the alarm status (low or high).

9.3.3. Sensor location

9.3.3.1. Machinery room zone:

- .1 For refrigerants other than ammonia: In the machinery room, a minimum of one gas detection sensor shall be located where leaked refrigerant will concentrate.²¹ If the gas is more dense than air, the sensor(s) shall be mounted at *low elevation*.
- .2 For ammonia: In the machinery room, a minimum of two gas detection sensors shall be installed in rooms of up to 370 m² of floor area and an additional sensor shall be installed for every 185 m² of additional floor area. Both sensors shall be located in a location where, under continuous low ventilation, a leak will concentrate. Normally, the location where a

²¹ In accordance with ASHRAE 15 and 34

leak will concentrate shall be between the refrigeration equipment and the nearest exhaust intake, unless determined otherwise by the design professional.

- A minimum of one sensor shall be installed at high elevation (for initial leaked ammonia vapour—lighter than air).²²

- A minimum of one sensor shall be installed at *low elevation* (for humidified leaked ammonia—potentially heavier than air).

9.3.3.2. **Adjacent public area zone:**

- .1 If the machinery room has an interior door, a minimum of one gas detection sensor shall be located inside the building, immediately outside the door to the machinery room door (and vestibule). Sensors shall be located for the purpose of protecting occupants. If the gas is more dense than air, the sensor(s) shall be mounted at *low elevation*. In the case of ammonia, the sensor shall be mounted at high elevation.

9.3.3.3. For ammonia, a sensor shall be installed in the emergency discharge pipe. This is so that, if the refrigeration system's pressure-relief valves open and discharge ammonia to the outdoors, the gas detection system is alerted. This shall be on a third, separate zone.

9.3.4. The mechanical ventilation system (exhaust and make-up air) serving the machinery room shall be on a separate electrical circuit.²³

9.3.5. A fan ON switch controlling the machinery room ventilation shall be installed immediately outside each machinery room door. This fan switch shall only allow the ventilation to be turned 'on.'²⁴ The fan switch shall comply with CSA B52 (2013) – 6.2.5.4. For exterior doors, the fan switch shall be mounted outdoors and shall be rated for the outdoors. For interior doors, the fan switch shall be mounted outside the vestibule.

9.3.6. One fan ON switch and one fan OFF switch controlling the machinery room ventilation shall be installed immediately inside the machinery room, beside the door. These fan switches shall allow the ventilation to be turned on and off. The gas detection system fan control shall override the fan switch 'off' position whenever the gas detection system commands the ventilation to be activated. The fan switch shall comply with CSA B52 (2013) – 6.2.5.4.²⁵

9.3.7. The ventilation fan ON and OFF switches shall be separate push-button style (i.e. one push button for ON and one push button for OFF). The switches shall be mounted approximately at eye-level (i.e. 1,500 mm above the floor). Each switch shall have a label indicating whether it is 'ventilation ON' or 'ventilation OFF'.

9.3.8. Where the BAS is needed to control equipment under regular circumstances, the manual ON and OFF switches shall override the BAS control signal.

9.3.9. A display screen shall be installed immediately outside the main machinery room door, displaying the measured concentration in the machinery room zone. This shall allow a person to verify the concentration measured inside the machinery room before entering the vestibule.

9.4. **Alarm delay period**

9.4.1. The alarm delay period, as specified in 2.6.1, shall be 10 seconds, unless otherwise determined by

²² In accordance with ASHRAE 15 and 34

²³ In accordance with ASHRAE 15 and 34

²⁴ In accordance with CSA B52 – 6.2.5.4

²⁵ In accordance with ASHRAE 15 and 34 and CSA B52 – 6.2

the design engineer.

9.5. Visual and audible alarm specifications

9.5.1. A visual and audible alarm for each refrigerant gas detection zone shall be located inside the rink attendant office.

9.5.2. If the arena facility has a pool, a visual and audible alarm for each refrigerant gas detection zone shall be located at the guest services counter.

9.5.3. Visual and audible alarms serving machinery room and adjacent public area gas detection zones:

9.5.3.1. If the refrigeration machinery is located inside a Class T machinery room:

- .1 Alarms for the machinery room zone shall be located at each of the following locations:
 - Inside the machinery room
 - Outside any interior door to the machinery room, outside the vestibule, immediately above the door
 - Outside any exterior door to the machinery room, immediately above the door
- .2 If there is a door (and vestibule) connecting the machinery room to the building's interior: alarms for the adjacent public area zone shall be located in a location that is clearly visible by occupants of the adjacent public area

9.5.3.2. If the refrigeration machinery is not located inside a Class T machinery room:

- .1 Alarms shall be located at each of the following locations:
 - Inside the machinery room
 - Outside any interior door to the machinery room, immediately above the door
 - Outside any exterior door to the machinery room, immediately above the door
 - In the adjacent public area, in a location that is clearly visible by occupants of the adjacent public area

9.5.4. Wherever the alarms for two (or more) zones are located in the same room (i.e. the rink attendant office or the front desk), the alarms for each zone shall be separated by a minimum of 600 mm.

E.g. Within the rink attendant office, the visual and audible alarms for the machinery room zone shall be mounted together, and the visual and audible alarms for the adjacent public area zone shall be mounted together, but these two alarm sets shall be separated by a minimum of 600 mm.

This is so that the alarms from different zones are not confused.

9.6. Label and sign specifications

9.6.1. Visual alarms, audible alarms, controllers, and sensors, shall be labelled according to the following nomenclature:

9.6.1.1. If the refrigeration machinery is located inside a Class T machinery room:

- .1 Equipment related to the gas detection zone covering the machinery room: "Refrigerant Ice Plant Machinery Room" (for ammonia: "Ammonia Ice Plant Machinery Room")
- .2 Equipment related to the gas detection zone covering the adjacent public areas: "Refrigerant Arena Space"

9.6.1.2. If the refrigeration machinery is not located inside a Class T machinery room:

- .1 Equipment related to the gas detection zone covering the machinery room and adjacent public areas: “Refrigerant Ice Plant Machinery Room and Arena Space” (for ammonia: “Ammonia Ice Plant Machinery Room and Arena Space”)

9.7. Control sequence of operation requirements

- 9.7.1. If required under CSA B52,²⁶ in the event of a refrigerant leak at a level not exceeding the refrigerant threshold limit value or time-weighted average as measured by the gas detection system, any combustion equipment located in the space shall be shut down.
- 9.7.2. If any combustion equipment is located in the room containing refrigerant or refrigeration machinery, the gas detection system shall shut down the combustion process in the event of a refrigeration leak.²⁷
- 9.7.3. Upon exceeding a concentration equal to the ventilation activation concentration (stated in Table 1), the mechanical ventilation system shall be activated, or increased, to high flow to exhaust air from the space and introduce outdoor air to the space.
- 9.7.4. Upon exceeding a concentration equal to the low alarm activation concentration (stated in Table 1), the visual alarms shall be activated. A notification of low concentration shall be sent to City of Edmonton Corporate Security for response from Facility Maintenance and the Facility Supervisor.
- 9.7.5. Upon exceeding a concentration equal to the high alarm activation concentration (stated in Table 1), the audible alarms shall be activated. A notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services and notification to Facility Maintenance.

10. Ozone (O₃)

10.1. Application

- 10.1.1. A gas detection system shall be installed in any location where the concentrations of the gas corresponding to this section is plausible in a concentration exceeding the low alarm point stated in Table 1.²⁸
- 10.1.2. Gas detection is required in any ozone room, in accordance with WorkSafeBC’s Ozone Safe Work Practices guidelines.

10.2. System performance criteria

- 10.2.1. No additional specific requirements

10.3. System configuration

- 10.3.1. Sensor(s) shall be installed at low elevation.
- 10.3.2. The gas detection sensor shall be located inside the ozone generator room, near the ozone

²⁶ See CSA B52 – 6.2.4.3

²⁷ In accordance with ASHRAE 15 and 34

²⁸ Occupational Health & Safety Code – Part 4: An employer must ensure that a worker’s exposure to any substance [...] does not exceed its occupational exposure limits [...]. The high alarm point is set to indicate that the gas concentration has reached a potentially harmful level.

generator, between the generator and the destructor.²⁹

- 10.3.3. If the ozone generator system has a reaction tank or destructor further than 5 m away from the gas detection sensor described in 9.4.1, that reaction tank or destructor shall have an additional gas detection sensor.³⁰

10.4. Alarm delay period

- 10.4.1. The alarm delay period, as specified in 2.6.1, shall be 10 seconds, unless otherwise determined by the design engineer.

10.5. Visual and audible alarm specifications

- 10.5.1. Visual and audible alarms shall be located at each of the following locations:

- 10.5.1.1. Inside the space containing the gas
10.5.1.2. Outside the space near each door accessing the space

10.6. Label and sign specifications

- 10.6.1. No additional specific requirements.

10.7. Control sequence of operation requirements

- 10.7.1. The ventilation system shall be turned on any time the ozone generator is active.
- 10.7.2. Upon exceeding a concentration equal to the ventilation activation concentration (stated in Table 1), the mechanical ventilation system complying with 2.11.1 shall be activated to exhaust air from the space and introduce outdoor air to the space. The ozone generator shall be turned off.³¹
- 10.7.3. Upon exceeding a concentration equal to the low alarm activation concentration (stated in Table 1), the visual alarms shall be activated. A notification of low concentration shall be sent to City of Edmonton Corporate Security for response from Facility Maintenance.
- 10.7.4. Upon exceeding a concentration equal to the high alarm activation concentration (stated in Table 1), the audible alarms shall be activated. A notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services and notification to Facility Maintenance.

11. Carbon dioxide (CO₂)

11.1. Application

- 11.1.1. A gas detection system shall be installed in any location where the concentrations of the gas corresponding to this section is plausible in a concentration exceeding the low alarm point stated in Table 1.³²
- 11.1.2. A gas detection system shall be installed in any enclosed space containing a carbon dioxide storage tank or piping. This includes indoor spaces housing carbon dioxide bulk storage and distribution piping for pool pH control.

²⁹ WorkSafeBC – Ozone Safe Work Practices

³⁰ WorkSafeBC – Ozone Safe Work Practices

³¹ WorkSafeBC – Ozone Safe Work Practices

³² Occupational Health & Safety Code – Part 4: An employer must ensure that a worker's exposure to any substance [...] does not exceed its occupational exposure limits [...]. The high alarm point is set to indicate that the gas concentration has reached a potentially harmful level.

11.2. System performance criteria

- 11.2.1. No additional specific requirements.

11.3. System configuration

- 11.3.1. In occupied spaces, sensor(s) shall be mounted at occupant breathing elevation.
- 11.3.2. In mechanical spaces, sensor(s) shall be installed at low elevation. If the mechanical space has occupant traffic as part of normal operations (i.e. pool mechanical room), and the mechanical space is large enough for two sensors to be needed, then 10.4.1 shall also apply.
- 11.3.3. The gas detection sensor(s) shall be located in the same space as the carbon dioxide injection point into the pool water circulation system, in a location where the gas will accumulate. Gas detection sensors shall also be located in any space that contains carbon dioxide piping or a carbon dioxide bulk storage tank.

11.4. Alarm delay period

- 11.4.1. The alarm delay period, as specified in 2.6.1, shall be 10 seconds, unless otherwise determined by the design engineer.

11.5. Visual and audible alarm specifications

- 11.5.1. Visual and audible alarms shall be located at each of the following locations:
 - 11.5.1.1. In the space where the carbon dioxide injection equipment is located, in a clearly visible location
 - 11.5.1.2. On the pool deck in a clearly visible location
 - 11.5.1.3. At the guest services counter

11.6. Label and sign specifications

- 11.6.1. Display ventilation and alarm activation concentrations in percent, and display converted values to PPM as reference.

11.7. Control sequence of operation requirements

- 11.7.1. Upon exceeding a concentration equal to the ventilation activation concentration (stated in Table 1), the mechanical ventilation system complying with 2.11.1 shall be activated to exhaust air from the space and introduce outdoor air to the space.
- 11.7.2. Upon exceeding a concentration equal to the low alarm activation concentration (stated in Table 1), the visual alarms shall be activated. A notification of low concentration shall be sent to City of Edmonton Corporate Security for response from Facility Maintenance.
- 11.7.3. Upon exceeding a concentration equal to the high alarm activation concentration (stated in Table 1), the audible alarms shall be activated. A notification of high concentration shall be sent to City of Edmonton Corporate Security for response from Fire Rescue Services and notification to Facility Maintenance.

Table 1 – Alarm and ventilation activation concentrations

Section	Gas	Formula	Ventilation activation concentration	Low alarm activation concentration	High alarm activation concentration
Carbon monoxide - Bulk Storage, repair garages, specified mechanical rooms	Carbon monoxide	CO	2.5 ppm ¹	15 ppm	25 ppm
Carbon monoxide - Storage garages / parking garages	Carbon monoxide	CO	As required to meet Alberta Building Code	Not applicable	Not applicable
Nitrogen dioxide - Bulk Storage, repair garages, specified mechanical rooms	Nitrogen dioxide	NO ₂	0.75 ppm ¹	1.5 ppm	3.0 ppm
Nitrogen dioxide - Storage garages / parking garages	Nitrogen dioxide	NO ₂	As required to meet Alberta Building Code	Not applicable	Not applicable
Chlorine	Chlorine	Cl ₂	—	0.5 ppm	1.0 ppm
Hydrocarbons	Natural gas & methane	92% CH ₄ & 100% CH ₄	0.50% ²	0.50% ³	1.00% ⁴
	Propane	C ₃ H ₈	0.05% ²	0.05% ³	0.42% ⁴
	Acetylene	C ₂ H ₂	0.25% ²	0.25% ³	0.50% ⁴
Refrigerants	R-410A	CH ₂ F ₂ (50%) CHF ₂ CF ₃ (50%)	500 ppm ²	500 ppm	1,000 ppm
	R-134a	CH ₂ FCF ₃	500 ppm ²	500 ppm	1,000 ppm
	R-22	CHClF ₂	500 ppm ²	500 ppm	1,000 ppm
Ammonia (Class T machinery room zone)	Ammonia	NH ₃	15 ppm ²	15 ppm	25 ppm
Ammonia (Public areas zone)	Ammonia	NH ₃	15 ppm ²	15 ppm	15 ppm
Ozone	Ozone	O ₃	0.05 ppm ²	0.05 ppm	0.1 ppm
Carbon dioxide	Carbon dioxide	CO ₂	0.25% (2,500 ppm) ²	0.25% (2,500 ppm)	0.50% (5,000 ppm)

¹ Designed to mitigate undesirable gas concentrations as early as possible.

² Equal to the low alarm activation concentration; presence of gas is not expected, therefore must not be obscured by ventilation.

³ Equal to 10% of the lower explosive limit. Based on industrial gas detection standard.

⁴ Equal to 20% of the lower explosive limit. Based on industrial gas detection standard.

Table 2 – Visual alarm, label, and sign colours

Section	Gas	Formula	Visual alarm light colour	Label and sign colour
Carbon monoxide	Carbon monoxide	CO	Green	Green with white lettering
Nitrogen dioxide	Nitrogen dioxide	NO ₂	White	White with black lettering
Chlorine	Chlorine	Cl ₂	Amber	Amber with black lettering
Hydrocarbons	Natural gas & methane	92% CH ₄ & 100% CH ₄	Red	Red with white lettering
	Propane	C ₃ H ₈		
	Acetylene	C ₂ H ₂		
Refrigerants	R-410A	CH ₂ F ₂ (50%) CHF ₂ CF ₃ (50%)	Blue	Blue with white lettering
	R-134a	CH ₂ FCF ₃		
	R-22	CHClF ₂		
Ammonia	Ammonia	NH ₃	Blue	Blue with white lettering
Ozone	Ozone	O ₃	Amber	Amber with black lettering
Carbon dioxide	Carbon dioxide	CO ₂	Magenta	Magenta with white lettering

Table 3 – Occupational exposure limits and lower explosive limits

Section	Gas	Formula	Lower explosive limit ²	8-hour exposure limit ¹	15-minute exposure limit ¹	Ceiling limit
Carbon monoxide	Carbon monoxide	CO	—	25 ppm	75 ppm ³	125 ppm ⁴
Nitrogen dioxide	Nitrogen dioxide	NO ₂	—	3 ppm	5	20 ppm
Chlorine	Chlorine	Cl ₂	—	0.5 ppm	1.0	10 ppm
Hydrocarbons	Natural gas & methane	92% CH ₄ & 100% CH ₄	5%	—	—	—
	Propane	C ₃ H ₈	2.1%	—	—	2,100 ppm
	Acetylene	C ₂ H ₂	2.5%	—	—	—
Refrigerants	R-410A	CH ₂ F ₂ (50%) CHF ₂ CF ₃ (50%)	—	1,000 ppm	3,000 ppm ³	5,000 ppm ⁴
	R-134a	CH ₂ FCF ₃	—	1,000 ppm	3,000 ppm ³	5,000 ppm ⁴
	R-22	CHClF ₂	—	1,000 ppm	3,000 ppm ³	5,000 ppm ⁴
Ammonia	Ammonia	NH ₃	—	25 ppm (LEL=15%)	35 ppm	300 ppm
Ozone	Ozone	O ₃	—	0.1 ppm	0.3 ppm	5.0 ppm
Carbon dioxide	Carbon dioxide	CO ₂	—	0.50% (5,000 ppm)	3.00% (30,000 ppm)	4.00% (40,000 ppm)

¹ Time-weighted average gas concentration

² Instantaneous gas concentration

³ 15-minute exposure limit is not defined, therefore 15-minute exposure limit is set to 3 x the 8-hour exposure limit, except if that value is higher than the IDLH concentration; as per the Occupational Health & Safety Code – Part 4

⁴ 15-minute exposure limit is not defined, therefore ceiling limit set to 3 x the 8-hour exposure limit or the IDLH concentration, whichever is lower; as per the Occupational Health & Safety Code – Part 4



APPENDIX H - WATER SPRAY PARK DESIGN GUIDELINES

1. Technical Guidelines

1.1. Introduction

- 1.1.1. This document is the Water Spray Park Design Guideline. For design guidelines for buildings refer to the City of Edmonton Facility Design and Construction Consultant Manual Volume 1 and 2.
- 1.1.2. No content in this manual is designed for verbatim specification use and in general content should not be copied directly into a book spec for any project unless the consultant is explicitly so instructed.

1.2. Definitions

Spray Park or Water Spray Park

Per the Alberta Building Code a spray deck is a structure onto which water is sprayed or released without accumulating that is used for recreation or other similar purposes, and includes all buildings, equipment and facilities used in connection with it.

1.3. General

- 1.3.1. This section contains technical guidelines to follow when designing new spray parks for the City of Edmonton. These guidelines are to be used in conjunction with professional judgment to ensure that they are followed only to the extent they are appropriate. Consultants remain ultimately responsible for design.
- 1.3.2. More specifically, the intent of this document is to:
 - 1.3.2.1. Describe the minimum requirements for spray park components, assemblies, and systems that have an impact on serviceability and anticipated life cycle of the spray park.
 - 1.3.2.2. Alert consultants to design aspects that historically have been problematic.
 - 1.3.2.3. Provide solutions or problem avoidance techniques that have been developed through experience and have proven to be practical and effective.
 - 1.3.2.4. Provide a vehicle for communicating departmental design standards to consultants in an effective and expedient manner.
 - 1.3.2.5. Indirectly, provide a basis for evaluating designs.
- 1.3.3. No attempt is made to address every conceivable condition. Rather, common sense and best industry practice solutions are provided where experience has indicated that problems commonly arise. This experience can be applied to new designs as a preventative measure, and to existing spray parks to address problems that are attributable to design and/or execution that does not conform to these technical design requirements.
- 1.3.4. Where these guidelines do not address a technical design issue that arises on a project, it is the Consultant's responsibility to address it. When a requirement, though normally applicable, may not be appropriate for a specific project, the consultant should propose an alternative for consideration by the project team.
- 1.3.5. Include Open Spaces Planning and Design (OSPD) and Facility Engineering Services (FES) in the

review process of all spray parks.

- 1.3.6. Innovative designs or products are encouraged after thorough consideration of potential benefits and risks, value analysis and life cycle cost. Consult project team members and persons with expertise in spray park design, operation, and maintenance.
- 1.3.7. Designs are required to comply with most current versions of all applicable codes and regulations. Where the technical design requirements contained herein differ from building codes and other applicable codes and standards, apply the more stringent requirements.
- 1.3.8. All design drawings shall be drafted 11x17 size or larger as appropriate for content and be legible when printed. All design drawing pdf submissions shall be provided in black and white.

1.4. Spray Deck Equipment

1.4.1. References

- 1.4.1.1. National Building Code(NBC) - Alberta Edition
- 1.4.1.2. Canadian Electrical Code(CEC) - Current Edition
- 1.4.1.3. Alberta Health Pool Standards

1.4.2. General

- 1.4.2.1. Consultant to confirm with the City of Edmonton project manager if the consultant is managing the spray deck equipment selection or if this scope of work will be performed internally to the City.
- 1.4.2.2. The consultant is responsible for confirmation of the items below regardless of the party responsible for the spray toy selection.

1.4.3. Bonding

- 1.4.3.1. The below grade component of the water spray deck equipment is to include two (2) redundant manufacturer provided bonding lugs.
- 1.4.3.2. The above grade component of the water spray deck equipment is to include provisions for proper bonding:
 - .1 Bond must be electrically continuous, as defined by CEC, between the above grade and below grade components.

1.4.4. Equipment Selection and Delivery

- 1.4.4.1. Flow rate, water pressure, and power available for spray deck equipment must be determined prior to issuance of Request for Proposal and incorporated into the RFP documents.
- 1.4.4.2. The spray park equipment must include a programmable timer to allow the spray park operation to align with the operational hours of the park or plaza where it is installed.
- 1.4.4.3. The spray park equipment must include an activation device to allow users to activate the spray equipment for a defined period.

1.4.4.4. Consultant to review the spray deck equipment RFP prior to issuance.

1.4.4.5. Water Distribution Valve Vault

- .1 Water distribution cabinet to be designed to fit over an accessible vault.
- .2 Vault to be a minimum of 600mm back-to-front to allow access to water distribution drain valves.
- .3 Ensure all drain valves are accessible (within arms reach down into vault)

1.4.4.6. Shop drawings of spray equipment must be approved by the consultant team prior to acceptance.

1.4.4.7. The water spray equipment supplier must sign off on equipment received by the contractor.

1.5. Site Services

1.5.1. References

1.5.1.1. Alberta Environmental Protection:

- .1 Standards and Guidelines for Municipal Water Supply, Wastewater and Storm Drainage Facilities
- .2 Stormwater Management Guidelines

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

1.5.1.3. City of Edmonton Design and Construction Standards. These documents can be found on the City of Edmonton website.

1.5.1.4. Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE 38-02.

1.5.1.5. Geometric Design Standards for Canadian Roads and Streets, by the Roads and Transportation Association of Canada

1.5.2. Site Selection

1.5.2.1. Projects on City of Edmonton land or affecting City of Edmonton assets or maintenance requires coordination with Open Space Planning and Design (OSPD).

1.5.3. Site Survey Plan and Site Plan

1.5.3.1. An authenticated site survey and plan shall be obtained by a licenced Alberta Land Surveyor.

1.5.3.2. Include the following items on the site plan in the contract documents (CI/ASCE 38-02 or similar – Level D and C):

- .1 Legal description and address of the property, property lines and their legal dimensions, and legal pins.
- .2 Adjacent vegetation/trees, hard surfaces, site features, grading, roadways, utilities, easements and how the new development will tie to them.
- .3 Work of the contract and work by other forces and contracts.
- .4 All utilities, including power, water, storm and sanitary sewer.

1.5.4. Geotechnical

1.5.4.1. A geotechnical investigation report shall be obtained prior to all spray deck installations.

1.5.5. Roads, Walks and Parking

1.5.5.1. Follow City of Edmonton Design and Construction Standards for design of roads, walks and parking.

1.5.5.2. Lay out walkways and locate benches, bike racks, flower beds, etc to facilitate snow clearing and removal and to avoid damage from snow moving equipment. Provide adequate width and turning radii for snow moving equipment. Provide allowances for snow storage on site from snow clearing of walks and pathways and ensure drainage of these areas during melting.

1.5.5.3. Ensure separation of vehicular traffic from main pedestrian traffic.

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

1.5.6. Utilities

1.5.6.1. All utility service providers are to be contacted to obtain the following information:

- .1 Existing active and abandoned utilities that may affect or be affected by the construction.
- .2 Proposed utilities that may affect or be affected by the construction.
- .3 Determination of the responsibility for relocation and notice timeline requirements (as per existing agreements with the City).

1.5.6.2. Where utilities are to be connected to municipal systems, confirm with the City of Edmonton and utility companies the adequacies of their systems to service the site.

1.5.6.3. Ensure the specification instructs the contractor to provide horizontal and vertical GPS location of all utilities.

1.5.6.4. Early in the design, confirm with the City of Edmonton about any restrictions on stormwater discharge to the stormwater drainage system and confirm any impacts that the new development will have on the existing stormwater drainage system or stormwater management facilities. If applicable, provide on-site stormwater storage solutions in cases of limited stormwater drainage system capacity (e.g. storm water retention, bioswales, etc).

1.5.6.5. Contact the utility provider to confirm the municipal water pressure.

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

1.5.6.7. Coordinate provisions for future utilities with the City.

1.5.6.8. Utilities within integrated sites and park areas with multiple features are typically managed and maintained by the City. Assistance from utility companies and cadastral information may not be available. In the absence of information, perform CI/ASCE 38-02 or similar – Level D to Level A collection and depiction of existing subsurface utility data.

1.5.6.9. Perform a complete review of all utilities(including Exterior Lighting) when developing a site within an Integrated Site or park area. Necessary upgrades to existing utility distribution or

service connections are to be included as part of the new development.

1.5.6.10. Where possible, provide single service connections to each property or integrated site. Size service connections for anticipated future needs.

1.5.6.11. Where water service metering cannot be located within a building, a metering chamber or vault shall be provided. Access to chambers and vaults shall meet or exceed the EPCOR access requirements and shall have sufficient space to facilitate maintenance activities. Chambers requiring confined space entry procedures or fall protection to access will not be accepted. Alternatives to the standard Epcor meter chamber detail must be coordinated with and approved by Epcor.

1.6. Landscape Development

1.6.1. References

1.6.1.1. City of Edmonton landscape requirements as per Zoning Bylaw 12800.

1.6.1.2. City of Edmonton, Design and Construction Standards, Volume 5 – Landscaping. This document is available on the City of Edmonton website.

1.6.1.3. City of Edmonton Access Design Guide

1.6.2. Exterior Landscape Development

1.6.2.1. Refer to City of Edmonton Design and Construction Standards, Volume 5 – Landscaping.

1.6.2.2. Coordinate landscape development with Open Spaces Planning and Design (OSPD)

1.7. Civil

1.7.1. References

1.7.1.1. The City of Edmonton Playspace and Wheeled Sport Facility Design and Construction Standards

1.7.1.2. EPCOR Design and Construction Standards Volume 3 - Drainage

1.7.1.3. EPCOR Design and Construction Standards Volume 4 - Water

1.7.2. General

1.7.2.1. Consultant to confirm with the City of Edmonton project manager if the consultant is responsible for the spray deck slab and grading design or if this scope of work will be performed internally.

1.7.3. Spray Deck

1.7.3.1. Provide a 175mm depth concrete spray deck with a brushed finish

- .1 Deck to include 15M single mat rebar at 250mm on center for both spray deck and apron area.
- .2 Deck to have a minimum slope of 2% and maximum slope of 5%.
- .3 Consult with OSPD for spray deck surface finish. Typical finish is a concrete brushed finish.

.4 Provide a 1.5m wide 120mm depth concrete over spray apron around the deck. Consult OSPD for apron surface finish.

1.7.3.2. Dowel new concrete into existing concrete with chemical dowels and caulking. Chemical dowels to be Hilti Hit HY 200 or equivalent.

1.7.3.3. Fillcrete to be utilized to achieve compaction between closely spaced spray heads that can otherwise not achieve adequate compaction.

1.7.3.4. Survey points must be included with spray deck drawings to indicate the location of the spray deck equipment.

1.7.3.5. Spray deck location within the site to be reviewed with OSPD during design. Consideration must be given to adjacent infrastructure, vegetation, shade, etc.

1.8. Mechanical

1.8.1. References

1.8.1.1. Meet or exceed the following guidelines and standards:

- .1 Canadian Standards Association (CSA) Standards
- .2 National Building Code - Alberta Edition
- .3 National Plumbing Code of Canada
- .4 ASHRAE Handbooks
- .5 ASHRAE Standards
- .6 Alberta Health Pool Standards

1.8.2. General

1.8.2.1. Drawings

- .1 Prepare project drawings with schematic diagrams indicating the following:
 - .1 Mechanical equipment, components, and piping arranged to accurately reflect the physical (on-site) configuration including equipment connections and valves.
 - .2 Design parameters for inlet and outlet water flow rates and pressure.
 - .3 survey points for the water supply and drainage tie in locations.
- .2 Equipment schedules shall be located on drawings and not in the specifications.

1.8.2.2. Accessibility

- .1 Provide sufficient access space for servicing, maintaining and removal of equipment and components or portions thereof (i.e. drain valves, solenoids, etc.). Service access requirements shall be shown on drawings.
- .2 Indicate on the drawings, access space provided.
- .3 Ensure that all vaults and cabinets are specified to include latches for locking.

1.8.2.3. Winterization

- .1 Incorporate winterization requirements into design:
 - .1 Clearly identify blow out points and drain connections on design drawings
 - .2 Include a requirement for this section in the O&M manuals
 - .3 Ensure systems are commissioned and identified to maintenance staff
 - .4 Self-draining curb stops on main water feed are recommended

1.8.3. Design Criteria

1.8.3.1. General

- .1 Design water spray park mechanical systems according to the National Building Code - Alberta Edition and Alberta Health Pool Standards (current editions).
- .2 Recirculating water treatment systems are not to be designed unless discussed with Facility Engineering Services.

1.8.4. Water System

1.8.4.1. General

- .1 Refer to Spray Deck Equipment section above for consultant responsibilities regarding spray deck equipment selection and procurement
- .2 Contact EPCOR (wass.drainage@epcor.com) to determine the local system water pressure and for water meter queries.

1.8.4.2. Fixtures and Equipment

- .1 Provide backflow prevention that conforms to either the National Plumbing Code of Canada or the requirements of the municipality, whichever is more stringent.
 - .1 When spray park water feeds must have a dedicated backflow preventer independent of other services that share the same line to the main (i.e If one line from connecting to the City main serves a spray park and a community hall, both the hall and the spray park must have backflow preventers).
 - .2 Reduced pressure principle backflow preventers (RP) are not to be installed below grade.
- .2 Specify ball valves for isolation service up to 100 mm. Gate valves 100 mm and smaller will not be accepted.
- .3 Cleanouts shall be specified as 50 mm or larger.
- .4 Hose bibb to be provided to facilitate flushing and disinfecting.
- .5 All spray devices must be designed, constructed and installed so that they do not create a safety hazard. Nozzles that spray from the ground level must be flush with the ground, with openings no greater than 15 mm. Spray features that extend above the ground must be high enough to be clearly seen and are not a trip hazard.

.6 All vaults and chambers must be lockable.

.7 Water meter chamber

.1 Water meter chambers must be installed to EPCOR standards and match previous water spray park meter chamber installations at the City. Any alternative must be coordinated and approved by EPCOR.

.2 Water meter chamber basis of design to be equal to Alberta Wilbert Sales pre-manufactured '1600 Gallon Square City Sump' measuring 2615mm x 2615mm x 1220mm.

.8 Water Distribution Vault

.1 Vault to be a minimum of 600mm back-to-front to allow access to water distribution drain valves.

.2 Ensure all drain valves are accessible (within arms reach down into vault)

1.8.4.3. Drainage

.1 Water meter chamber and water distribution vault to be drained via french drains and not tied into the sanitary system

.1 Confirm water table height prior to installation of french drain

.2 Provide drainage sump as per standard City requirements to match previous water spray park installations at the City.

.1 Sump to be 900mm x 900mm with the depth determined by site conditions.

.2 Sump to include a backwater valve on the drainage pipe.

.3 Sump pipe to include a T-connection with a cleanout cover on the top of the fitting and a 300mm clearance between the bottom of the T-fitting and the bottom of the sump.

.4 Sump lid to be skid resistant stainless steel fastened down in all four corners with stainless steel screws fastened into nickel coated screw holes. Lid to include 19x125mm slots and 19mm holes. Drain slot/hole pattern to be approved by the City.

.5 Sump to be located at the lowest point of the spray park bowl with a secondary area drain located at a higher elevation

.6 Sump to drain the sanitary system.

1.9. Electrical

1.9.1. References

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

- .1 Canadian Standards Association
- .2 Illuminating Engineering Society of North America
- .3 Institute of Electrical and Electronics Engineers
- .4 Insulated Cable Engineers Association

1.9.1.2. EPCOR, *Customer Connection Guide*

1.9.2. Service and Power Distribution

1.9.2.1. Utility Service

- .1 Coordinate new and modified services with EPCOR. Refer to the latest EPCOR connection guide.

1.9.2.2. Load Calculation

- .1 Provide load calculations for Utility and on-site generation services as part of the Contract Documents.
 - .1 New Service: Provide calculation as per CEC Section 8. Discuss future load allowances with COE Engineering Services..
 - .2 Addition to existing service/feeder: Provide calculation as per CEC Section 8. City to provide maximum demand load for most recent 12-month period where available.

1.9.2.3. Single Line Drawing

- .1 Provide electrical single line diagram as part of the Contract Documents, indicating the following:
 - .1 Configuration, type, voltage and amperage ratings of electrical equipment including panelboards, transformers, etc.
 - .2 Type, size and amperage ratings of services and feeders.
 - .3 Type, frame size and trip rating of overcurrent protective devices.
 - .4 kAIC rating of switchgear, panelboards, transformer secondaries and overcurrent devices.
 - .5 Anticipated demand load at panelboards
 - .6 Arc flash incident energy levels at all points where specified labels are required.
 - .7 Service and distribution grounding/bonding.
 - .8 Renovation/Rehab: Provide complete site wide single line diagram; partial single line diagrams will not be accepted. City to provide existing master single line diagrams

where available.

- .2 Provide copies of single line diagrams from Record Drawings, recording actual construction, to:
 - .1 Incorporate into Operating and Maintenance Manuals.
 - .2 Display in clear pocket mounted to the inside of the Outdoor Pedestal door. This requirement is to be included in the electrical construction specifications.

1.9.2.4. Protection and Control

- .1 Ensure adequate fault interrupt ratings of all panelboards and overcurrent devices. Provide calculation results when requested by the City of Edmonton.
- .2 Use fully-rated overcurrent protective devices throughout the distribution system. Series-rated combinations may only be used with permission by the City of Edmonton.
- .3 Where ground fault protection is provided on services and feeders, ensure protection is also provided for downstream feeders and loads that are susceptible to nuisance ground faults. Ensure ground fault equipment is coordinated to prevent upstream devices tripping before downstream devices.

1.9.2.5. Panelboards Switching and Overcurrent Devices

- .1 Ensure that the panel is properly rated for application and environment.
- .2 Provide panel schedules indicating breaker size and wattage all connected loads. Panels to be a maximum of 50% filled at completion of design.
- .3 Hinged, door-in-door construction.
- .4 Lockable.
- .5 Single pole breakers with handle ties are not permitted in place of multi pole breakers.
- .6 Use bolt on molded case circuit breakers with thermal, magnetic trip for all circuit protective
- .7 devices.
- .8 Obtain the approval of the City of Edmonton for the use of fused equipment. Consideration will only be given where fault duties of equipment require a limitation of the available fault current.
- .9 Bussing
 - .1 Use solid copper only.
 - .2 Provide min. 25% spare capacity for future growth.
- .10 Control
 - .1 Consultant FES Mechanical to ensure to BAS interconnection is not required.
- .11 Working Clearances
 - .1 Provide all electrical equipment with minimum 1.5 m front clearance, and all free standing equipment with minimum 1.0 m back and side clearance.

.12 Outdoor Pedestals

- .1 Shall contain Service Entrance Rated main breaker, 200A meter socket (or as required by EPCOR), meter viewing window, recessed photocell for lighting circuits, one (1) GFCI receptacle mounted within the cabinet, panel board, 35A 4P lighting contactor(s) and Hand off Auto (HOA) switch.
- .2 Cabinet shall be fabricated from 5052-H32 sheet, marine grade aluminum of at least 1/8-inch thick. All materials shall be corrosion resistant for extended life.
- .3 All screws, bolts, washers, nuts, etc. shall be stainless steel. All screws shall be stainless steel pan-head machine screw type. Any bolts that are 1/4-20 or larger shall be stainless steel hex head type. No sheet metal or self tapping screws shall be used.
- .4 All exterior seams shall be of continuously welded construction . All welds shall be free of slag and spatter. All exterior welds shall be ground smooth.
- .5 Doors shall be designed for maximum strength and snug fit. Doors shall be fabricated out of a single sheet of aluminum and have a wrap around return for strength and fit. Doors shall also have an inner skin for additional strength. The bottom of each door shall have ventilation holes. Doors shall be fully gasketed against the cabinet.
- .6 Door hinges shall be positioned so they are hidden behind the door and cannot be accessed with the door closed. A minimum of 2 hinges are required per door. Each door shall have a pneumatic return device to control the rate of door open and close and prevent opening beyond 90 degrees. Door handles shall be 3 point contact stainless steel construction. The handles shall latch to the cabinet with minimum 16 gauge stainless steel rails and rollers which shall be fabricated to provide a secure and well sealed attachment to the cabinet. Cabinet to include stainless steel padlockable clasps on side.
- .7 The cabinet shall be mounted onto a concrete foundation and attached via suitable anchors. The cabinet shall be placed in such a way where it is unlikely to come in contact with motor vehicles. It shall be at least 1.25m away from roadways where behind curb and gutter and at least 3m off the roadway where no curb or gutter is present. The cabinet shall face away from the road to avoid water splashing on the door.
- .8 Conduits shall be located to suit the cabinet and components. Conduits shall be located to run straight into panels or cabinets with minimal bends.
- .9 Seal cabinet to concrete with suitable silicone sealant.
- .10 Type all circuits and device identifications onto panel schedules and locate on the panels.
- .11 Ensure that a grounding bar on standoffs is provided within the cabinet and accessible for maintenance.
- .12 Provide minimum temper heating to 5°C to facilitate proper operation of equipment and prevent condensation.

1.9.2.6. Transformers

- .1 Location

- .1 Utility Transformers: locate standard 600V, 208V or 240V outside with pads and rails as per EPCOR guide. Provide screens where required by project. Location to be serviceable as required by EPCOR standards and as close as possible to service entrance to reduce capital and operating costs (line losses)..

1.9.2.7. Feeders

- .1 Use copper conductors for feeders.
- .2 Provide a full capacity neutral and a bonding conductor with all feeders.
- .3 Other than main service feeder cables and/or raceway, feeders are not permitted to be located in slab or below slab-on-grade.

1.9.2.8. Arc Flash and Shock Hazard Labelling

- .1 Refer to Consultant Manual Appendix E – “Arc Flash Design Guideline”.

1.9.3. Lighting

1.9.3.1. General

- .1 Design to maximize the energy efficiency of lighting systems.

1.9.3.2. Exterior Lighting

- .1 All projects to adhere to the CoE ‘Light Efficient Community Policy’, latest edition.
- .2 Use LED for parking, roadway, area lighting, and building exterior. Acceptable voltages are 120V, 208V, 240V. 347V not permitted for new installations. In retrofit situations where only 347V is available and no conversion feasible, true integrated 347V drivers preferred (no external autotransformers) and confirm acceptability with CoE Engineering Services prior to specification.
- .3 Approved luminaire head manufacturers include “Philips Lumec”, “Cooper/Eaton”, or “Acuity Brands”. Preferentially recognized families already approved by Transportation for roadway or MUT or those otherwise previously used by CoE. Acceptable examples include “Philips Lumec” ‘Roadstar’, ‘Roadview’, ‘Streetview’, ‘Metroscape’, ‘Urbanscape’ & ‘Ancestra’; “Cooper/Eaton” ‘Ridgeview’. Explicitly confirm exceptions with CoE Engineering Services prior to specification.
- .4 Use cast in place or precast concrete piles with internal ducts and embedded bolts/rods. 280 mm (11”) BCD nominal standard. Top of pile shall be 150 mm above finished grade in soft landscaped areas, 150 mm if in sidewalk or other hard surfaced areas. Additionally, for parking lots and roadway areas where there is likely a risk of vehicular impact, top of pile shall be 1000 mm above finished grade.
- .5 Pile design & size to be coordinated with the structural consultant taking into account soil & grade conditions and final pole/head requirements. Acceptable examples for precast piles include Armtec ‘8-0082’, ‘8-0083-6’, & extended (3000 mm) ‘8-0079’ depending on application. Cast in place to be fully detailed.
- .6 Poles to be square or octagonal, galvanized steel and painted with 2 coats of enamel on primer or polyester powder coated. Approved manufacturers include Novapole & West

Coast Engineering. Any aluminum and/or custom poles to be explicitly approved by CoE Engineering Services. Pole supplier to confirm design suitability for luminaire head EPA and associated installation location parameters.

- .7 Ensure that lighting standards installed within the spray deck area meet current CEC standards, GFCI protection to be provided as required.
- .8 If cameras are to be pole mounted then please ensure that poles are specified with segregated raceways for different voltages and include manufacturer approved camera mounts. Custom poles to be explicitly approved by CoE Engineering Services.
- .9 Luminaires including emitter diode package & driver shall be explicitly rated to operate from -40°C to 40°C.
- .10 Exterior luminaires to have a minimum colour rendering index (CRI) of 60 and correlated colour temperature (CCT) of 3000 (± 200) K with a D_{UV} of -0.006 to 0.006. Optionally a CCT of 4000 (± 200) K with a D_{UV} of 0.005 to 0.007 will only be accepted with explicit approval from CoE Engineering Services.
- .11 A single head's emitter diode package/board should not exceed 12000 lumens for general purpose horizontal illumination. Consult with the City of Edmonton for project-specific details that may fall outside this limit.
- .12 Use UV resistant diffusers/lenses for exterior luminaires and consider vandal resistance.
- .13 Use full cutoff luminaires for all parking, roadway and area lighting. House side shielding to be specified on property perimeter luminaires unless there is otherwise lit road, or other adjacent city property, that could benefit from spill light. Wall mounted luminaires to be positioned or shielded to eliminate glare and light trespass to adjacent, non-city, properties.
- .14 Where multiple different architectural exterior luminaires are used (eg: pole mount, bollard, building mount), select luminaires to complement each other, possibly from the same manufacturer "family".
- .15 Bench and in ground lighting by explicit approval only, please contact CoE Engineer Services prior to specification.
- .16 Bollard, tube, saber style lighting by explicit exception approval only and used for decorative, architectural purposes only, not general area lighting. Follow above pole guidelines. Breakaway base design required except when not indicated due to security requirements.
- .17 Custom products are highly discouraged and not permitted without explicit approval from CoE Engineering Services. Eg. Architectural marquee luminaires, bollards, rail and rope light installations, etc.

1.9.3.3. Drivers and Ballasts

- .1 Use energy efficient electronic, solid state designs with built in inrush and surge suppression.
- .2 Total Harmonic Distortion of less than 12% and Power factor greater than 0.95.

1.9.3.4. Control

.1 General

.1 Provide single photocell, manual electro-mechanical time clock, or security device control or a combination thereof for exterior luminaires. Consider facility usage and security when determining the exterior lighting control scheme.

.2 Maintenance

.2 Commonly replaced components used in specified lighting products, such as LED arrays/lamps and ballasts/drivers, are to be available locally from wholesale supplies and/or distributors. Ensure the manufacturer guarantees compatible replacement parts for a minimum of 10 years.

.3 All LED arrays, lamps, lens, ballasts, drivers, etc shall be readily accessible for service and replacement without any requirement for architectural remediation Luminaires located in high areas (above 3 m) are to be positioned to allow for maintenance and replacement of parts with standard City of Edmonton maintenance equipment.

1.9.4. Branch Wiring

1.9.4.1. General

.1 Use copper conductors minimum #12 AWG conductor size.

.2 Provide a separate bonding conductor in all branch circuit raceways. Conduit shall not serve as bond.

.3 Branch circuit cable and/or raceway is not permitted to be located in slab or below slab-on-grade.

.4 Minimum raceway size to be 21 mm.

.5 Obtain approval of the City of Edmonton for the use of non-metallic sheathed cables.

.6 All receptacles to be specification grade.

.7 All branch circuits to be labelled with panel name & circuit designation.

.1 For circuits less than or equal to 20A and 240 volt, panel name and circuit designation to be indicated with a wrap around style label on faceplate and permanent marker inside the box.

.2 Otherwise, All higher voltage and ampacity circuits to have lamacoid style labels with panel name, circuit, and voltage/phase.

.8 For high humidity applications, ensure surface raceways are galvanized and painted (coordinate with Architectural).

1.9.4.2. Provisions for Mechanical

.1 Indicate location and circuiting of all mechanical control panels on drawings.

.2 Coordinate electrical equipment required for mechanical equipment with mechanical designer.

1.9.5. Miscellaneous

1.9.5.1. Maintenance & Sustainable Design of Electrical Equipment & Infrastructure

- .1 Common replacement components used in electrical equipment, such as lamps, ballasts, fuses and breakers, must be available through local distributors.
- .2 Where possible, specify electrical equipment and systems that have local service and support with 8 hr response time.

1.9.5.2. Bonding Study

- .1 List in specification that contractor is to:
 - .1 Perform visual inspection of existing bonding system, torque (and mark) all accessible hardware and inspect anchorage for tight connection
 - .2 Perform 4-Pole DC Resistance Test Bonding Study on all metal parts of the pool and of other non-electrical equipment located within 1.5 meters of the pool edge. Pool edge definition to follow applicable code. Bonding study is to be completed before and after concrete pour. Equipment to be tested shall include (but not be limited to):
 - Piping;
 - Pool Reinforcing Steel (including rebar or other steel structure exposed during work);
 - Grates (including non-metallic grates);
 - Fences;
 - Lighting;
 - Speakers;
 - Conduits;
 - Junction Boxes;
 - Control Cabinets;
 - Electrical Cabinets.
 - .3 Perform bonding study using method appropriate to site conditions and to the approval of the City of Edmonton and local authority having jurisdiction. Test back to the main ground connection point at the incoming electrical service. Coordinate main electrical service shutdown with the City of Edmonton and all associated parties.
 - Ensure test point locations are <20m apart.
 - Disconnect and test main ground to establish base point including test lead values.
 - Connect main ground and test each point bonding point.
 - Perform self-check prior to testing each point
 - .4 Where metallic equipment is covered with a coating (i.e. paint), expose base metal as required to perform test, using non-destructive methods. Patch and repair any removed coating to the satisfaction of the City of Edmonton.
 - .5 Submit tabular results to the Engineer of Record for review.
 - .6 Disconnect main power to any motors or electrical equipment (switches, outlets) prior to testing.

.7 Disconnect or bypass ground fault indicator during tests.

1.9.5.3. Lightning Protection:

- .1 Provide lightning arrestors on all services connected to overhead lines or elements/systems otherwise deemed to be exposed plant (eg. Roof mount antennas).
- .2 As a guideline, provide lightning protection for structures which are taller than adjacent structures within a 500 m radius.
- .3 Lightning protection requirements depend on a multitude of building design, construction, & location factors. On all projects the design professional of record shall positively confirm the requirement or exclusion of lightning protection.

1.9.5.4. Colour Coding Requirements:

- .1 Refer to *Appendix A – Colour Coding Requirements for Mechanical and Electrical Systems* for identification symbols and colours for electrical conduit and equipment.