

CANADIAN BUILDING MAINTENANCE CODES AND STANDARDS WITH EXAMPLE CITY OF CALGARY

Amr Abbass¹

Received 21.02.2024.

Revised 01.04.2024.

Accepted 12.06.2024.

Keywords:

ABSTRACT

Canadian Buildings, Maintenance codes, standards, Example, City of Calgary.

This paper rigorously explores the multifaceted standards and procedures for building management and maintenance as prescribed by Alberta's governmental regulations. Through an examination of various sectors, from window cleaning to electrical system maintenance, it highlights the essential practices and innovative strategies employed to ensure structural integrity, safety, and operational efficiency across public facilities. By integrating preventative maintenance schedules, stringent safety protocols, and compliance with environmental regulations, the paper underscores the significance of comprehensive building management systems. These systems not only enhance the lifespan and functionality of building infrastructures but also promote sustainability and safety, thus reflecting a proactive approach in the stewardship of public assets. The discussion extends to the implications of these practices on future policy development and the evolution of building management standards, advocating for continuous improvement in maintenance protocols to meet the dynamic demands of public safety and environmental conservation.

Original research



© 2025 Journal of Engineering, Management and Information Technology

1. INTRODUCTION

The focus of this paper is a detailed analysis of the maintenance specifications set forth by the Alberta government, covering a broad spectrum of services essential for the upkeep of public buildings (Mirza, 2006). The narrative is structured around the delineation of standards across multiple sectors, illustrating how regulatory frameworks shape the maintenance practices of various building components (Jardine & Tsang 2005, Schweber & Harty 2010). From the meticulous care in mechanical systems to the precision required in fire safety maintenance, the paper discusses the integration of regulatory compliance with operational maintenance to forge systems that are not only efficient but also robust and reliable (Alliou & Mourdi 2023). This introductory exploration sets the stage for a deeper understanding of the strategic importance of these standards in maintaining public infrastructure, ensuring safety, and enhancing the operational longevity of facilities (Kwak et al., 2009).

2. LITERATURE REVIEW

Alberta Building Codes and Standards (Alberta Codes 2024, National Building Code 2019, National Fire Code 2019). The Alberta Codes website provides an authoritative resource on building codes and standards applicable in Alberta, Canada. This portal is crucial for understanding the regulatory framework that governs building construction, maintenance, and safety in the region. It outlines the latest versions of the Alberta Building Code (National Building Code 2019) and Alberta Fire Code (National Fire Code 2019), which are essential for ensuring compliance with safety, accessibility, and energy efficiency requirements (National Fire Protection Association (NFPA) (2024). The site is an invaluable tool for professionals in the construction and facility management sectors, offering updates and amendments that reflect the evolving needs of building safety and environmental considerations (Hodges & Sekula, 2013).

¹ Corresponding author: Amr Abbass
Email: Calgary732@hotmail.com

Building Codes Illustrated: A Guide to Understanding the 2015 International Building Code by Ching and Winkel (2021). This book serves as a visual interpretation of the 2015 International Building Code (IBC). Through detailed illustrations and clear narrative explanations by Ching and Winkel (2021), readers can better understand the complex provisions of the IBC, which impacts all aspects of building construction and regulation. This guide simplifies the understanding of the standards required for various building systems, facilitating easier compliance and enhancing the quality of construction projects (Bartlett et al., 2003).

Facilities Management: Towards Best Practice by Barrett and Baldry (2009). Barrett and Baldry (2009) explore the strategic role of facilities management in optimizing the effectiveness of built environments. This book discusses the alignment of facility management practices with organizational objectives to achieve best practices. It emphasizes the importance of understanding regulatory codes and standards to manage facilities effectively, ensuring that buildings not only meet legal requirements but also contribute to the organization's overall performance.

The Facility Management Handbook by Roper and Payant (2014) offer a comprehensive overview of the field of facility management. This handbook covers a broad spectrum of topics from strategic planning and space management to operations and maintenance. The authors highlight the critical role of adhering to building codes and standards to ensure facility safety, sustainability, and functionality (Nielsen et al., 2016). This resource is indispensable for facility managers who need to navigate the complexities of maintaining compliance with evolving building codes.

Maintenance, Replacement, and Reliability: Jardine and Tsang (2005). Jardine and Tsang (2005) delve into the methodologies of maintenance and reliability engineering as applied to building management. Their work includes a discussion on how building codes and standards influence maintenance strategies and decisions (Jordan, 2000; Levitt, 2009; Stanford, 2021). By applying reliability principles, facility managers can enhance the life expectancy of building components and ensure compliance with safety standards, thus avoiding costly failures and replacements.

3. METHODOLOGY

The Approach of this paper is to summarize the building maintenance codes and standards of the city of Calgary and represent a fast reference to engineers and technicians to get acquainted with the main points targets and schedules required in the standard.

4. CODE SECTIONS

A. Sector 08 01 90 - Major window cleaning services

This sector specifies comprehensive guidelines and standards for conducting major window cleaning operations that require the use of specialized equipment such as suspended platforms and scaffold towers. The document mandates strict adherence to Canadian Standards Association (CSA) (2024), CSA Z91-M1980, the Safety Code for Window Cleaning Operations, and CAN3-Z271-M84, the Safety Code for Suspended Powered Platforms to ensure the safety and efficiency of cleaning operations. It emphasizes the importance of following the Alberta Workers' Health Safety & Compensation Regulation, particularly regarding the use of scaffolding, work platforms, and temporary supporting structures to safeguard the personnel involved in the operations. Verification of conditions is a critical aspect, requiring operators to ensure all window cleaning equipment is operational and compliant with the specified standards, with a mandatory review of a 3-month inspection and test report to address any equipment deficiencies. The sector also focuses on the protection of the public, outlining measures to shield building users and bystanders from potential hazards associated with window cleaning activities, such as chemical exposure and equipment misuse. This includes ensuring safe passage for individuals around and below the operation areas, installing necessary barricades, and halting operations during adverse weather conditions that could pose risks. Additionally, the guidelines stipulate the protection of existing finishes on the building, requiring temporary safeguards against potential damage from cleaning chemicals and equipment. General cleaning guidelines are detailed, emphasizing thorough washing and polishing of all glass and window surfaces to remove a wide array of contaminants to maintain the aesthetic and integrity of the building. Overall, this sector provides a robust framework for managing major window cleaning operations, prioritizing safety, compliance, and thoroughness to ensure the operations are conducted without compromising the safety of workers and the public, or damaging property.

B. Sector 08 01 91 - Minor window cleaning services

The Sector 08 01 91 document establishes guidelines specifically for minor window cleaning services that are accomplished with straightforward access methods, such as using a ladder. It explicitly excludes the use of more complex setups like suspended platforms or scaffold towers, which are covered under separate, more detailed regulations for major window cleaning activities. The standards ensure adherence to CSA Z91-M1980, which is the Safety Code for Window Cleaning Operations, to uphold safety across all operations.

The sector mandates thorough verification of the conditions before beginning cleaning to identify any defects such as broken caulking or cracked glazing units,

ensuring that these are reported and addressed promptly. A significant emphasis is placed on public safety, requiring the implementation of measures to protect pedestrians and building occupants from potential hazards associated with the cleaning process. This includes securing the area with barricades, guardrails, and appropriate signage to ensure the safe passage of individuals around the cleaning sites.

Additionally, the guidelines require protection for existing finishes within the building. This involves covering adjacent surfaces, furnishings, and equipment to shield them from the potential negative impacts of cleaning chemicals and equipment. The procedure also includes the careful management of furniture and movable items to prevent any damage during the cleaning operations, stipulating that these items be returned to their original positions post-cleanup.

The cleaning process itself is described in detail, emphasizing the need for a meticulous approach to washing and polishing glass and window surfaces. This includes removing all forms of dirt, stains, and residues to maintain the aesthetic quality of the building. The document also outlines the cleanup process, which involves the removal of all used chemicals, supplies, and equipment, leaving the site in a pristine state.

In conclusion, Sector 08 01 91 provides a robust framework for managing minor window cleaning operations efficiently and safely, without the need for specialized equipment. It ensures that these activities are conducted with a high degree of professionalism, prioritizing the safety of the public and the preservation of the building's integrity. This sector not only facilitates the maintenance of the building's appearance but also ensures that the operations are seamlessly integrated into the daily activities of the building without disruption or hazard.

C. Sector 14 01 01 - Elevating device maintenance

Sector 14 01 01 - Elevating Device Maintenance thoroughly outlines the procedures and requirements for maintaining elevating devices, focusing on ensuring operational safety and compliance through detailed service specifications. This sector breaks down the types of maintenance contracts available—Full Maintenance, Limited Maintenance, and Oil and Grease—each catering to different levels of service needs and risk management.

Full Maintenance encompasses a comprehensive service package where the contractor assumes responsibility for both scheduled and unscheduled maintenance tasks, including all necessary repairs and parts replacements that arise during the contract period. This contract type places the entirety of maintenance risk on the contractor, making it a worry-free solution for the building owner but typically comes at a higher cost due to the extensive coverage.

Limited Maintenance includes routine scheduled maintenance and limited unscheduled maintenance. It does not cover major repairs or replacements of

significant components such as elevator motors or hydraulic cylinders, which remain the financial responsibility of the building owner. This contract limits the contractor's risk to smaller, more predictable tasks and is often chosen to balance service coverage with cost-effectiveness.

Oil and Grease Maintenance is the most basic maintenance contract, focusing solely on the necessary lubrication and minor adjustments required during regular service visits. It excludes all parts and significant repairs, placing most of the financial risk for unscheduled maintenance on the building owner. This type of contract is often suitable for newer installations or where minimal usage reduces the likelihood of major repairs.

Scope of Maintenance Services details the responsibilities and services provided under each contract type, ensuring that all elevating devices are maintained according to regulatory standards and operational needs. This includes everything from routine inspections to the emergency repair of critical components.

Scheduled Preventive Maintenance Services are a core component of all contract types, designed to maintain the operational integrity and safety of the elevating devices through regular inspections, adjustments, and replacements as needed to prevent failures and extend the equipment's lifespan.

Unscheduled Maintenance Services – Contractor's Risk and Unscheduled Maintenance Services – Minister's Risk differentiate the financial responsibilities associated with unexpected repairs or failures. The contractor covers some unscheduled services under their risk, generally minor components or issues arising from normal wear and tear, while the minister (or building owner) takes on the risk for more significant and less predictable problems, often related to core mechanical failures or external damages.

Replacement Parts must meet or exceed original manufacturer specifications to ensure compatibility and reliability. The type of maintenance contract will dictate who bears the cost of these parts, which significantly impacts the overall maintenance budget.

Safety Tests and Safety Devices involve regular checks and updates to ensure that all safety-related components of the elevating devices function correctly. These tests are crucial for compliance with safety regulations and to protect the users and maintenance personnel.

Regulatory Requirements ensure that all maintenance services comply with current laws and standards, such as the Safety Codes Act and CSA safety standards. Compliance is critical not only for operational safety but also for legal protection and to avoid penalties.

Work Site Safety addresses the need to maintain a safe environment during maintenance operations. This includes securing the work area, properly marking and isolating it, and ensuring all personnel are equipped with necessary safety gear and are trained in safe work practices.

In summary, Sector 14 01 01 establishes a rigorous framework for maintaining elevating devices across

various contract types, emphasizing preventive maintenance and systematic checks while balancing risk between the contractor and the building owner. This detailed approach ensures that elevating devices operate reliably and safely, adhering to stringent regulatory standards and adapting to the specific needs and financial considerations of the property management.

D. Sector 14 01 22 - Elevator task and frequency schedule

Sets forth a structured and detailed schedule for the routine and periodic maintenance tasks required to ensure the safe and efficient operation of elevators. This sector categorizes tasks based on their required frequency, ranging from every visit to every five years, ensuring that all aspects of elevator maintenance are thoroughly addressed to minimize downtime and extend the lifespan of the equipment.

Every Scheduled Visit: At every maintenance appointment, technicians meet with the Minister's representative to identify and address any immediate concerns. They inspect the condition of hoistways, pits, and machine rooms to ensure cleanliness and dryness, ride the car to detect any unusual noises or operational issues, and perform all scheduled tasks within the stipulated time frame. All findings and actions are recorded in the Minister's 52-week Work Schedule System Log Sheets.

Monthly Tasks: Monthly maintenance includes inspecting and maintaining machinery parts requiring lubrication, checking and maintaining the general operation of the elevator, testing door reopening devices, ensuring that indicators, lights, and gongs are functioning properly, and testing communication and emergency systems. Monthly checks also cover the inspection and operation of the governor and completing oil loss monitoring for hydraulic elevators.

Quarterly Tasks: Every three months, tasks expand to include thorough inspections and maintenance of all machinery and equipment parts, especially focusing on landing and car door components to ensure their safe and proper operation. This includes checks on interlocks, door reopening devices, door operators, and various safety mechanisms like car and counterweight safety devices, oil buffers, and hydraulic cylinders. Electrical components such as controller contactors, relays, and motor brushes are also inspected and maintained.

Annually: Annual maintenance tasks are critical and involve cleaning, lubricating, and inspecting moving parts like chains, tracks, and sheaves in bi-parting doors, as well as dismantling and cleaning driving machine brakes to ensure their proper operation. This also includes performance tests like deceleration tests under no-load conditions, an inspection of generator brushes, lubrication of car fan motors, and detailed inspection and maintenance of hoisting ropes and elevator machinery located over the hoistway.

Every Two Years: Biennial tasks focus on hoisting ropes of elevators that have winding drum driving machines, requiring resocketing of babitted rope sockets and

replacement or adjustment of fastenings to ensure safety and reliability.

Every Five Years: Every five years, a comprehensive buffer return test as per code requirements is performed on all car and counterweight buffers to verify their performance and compliance with safety standards.

In conclusion, Sector 14 01 22 meticulously outlines a comprehensive schedule of maintenance tasks that are essential for the upkeep of elevators, categorizing them based on frequency to ensure all components are kept in optimal condition. This sector emphasizes safety, efficiency, and compliance with regulatory standards through a well-organized approach to maintenance, ensuring elevators are reliable and safe for users and minimizing potential risks and failures

E. Section 14 01 24 - Hydraulic elevator oil loss monitoring

Section 14 01 24 - Hydraulic Elevator Oil Loss Monitoring outlines stringent requirements for monitoring and managing hydraulic oil levels in elevators with buried cylinders. This section aims to prevent and mitigate oil loss, which is crucial for maintaining the efficiency and safety of hydraulic elevators. It establishes a comprehensive set of protocols that must be adhered to rigorously to ensure the longevity and reliable operation of the hydraulic systems.

Requirements Overview:

System Cleanliness: All components of the hydraulic system, including cylinder heads, platen plates, piping, valves, pumps, motors, and tanks, must be kept clean and dry at all times. This helps in preventing contamination and leaks.

Oil Leak Management: Any hydraulic oil that leaks from the system must be collected immediately. Steps should be taken to seal any excessive leaks to maintain system integrity and minimize environmental impact.

Oil Recirculation and Replacement: Collected oil should be filtered and returned to the hydraulic system. If the oil is found to be contaminated, it must be replaced with new oil in the exact quantity to maintain proper system functioning.

Accurate Oil Level Measurement: A reliable method for measuring the oil level in the tank must be provided, and the oil level must be measured monthly with the car in the same position each time to ensure consistency.

Record Keeping: Monthly checks must be diligently recorded in a logbook. These records should include the date, oil level, description of any losses (including amount and location), and the name and signature of the mechanic performing the check.

Procedure Documentation: The logbook should also include detailed instructions on how to perform oil loss monitoring tests for each specific elevator, ensuring that all personnel can follow the same standards and methods.

Management of Added Oil: Any addition of oil to the system, outside of replacing unaccountable losses, must be recorded in the logbook along with a new reference point for future oil level measurements.

Response to Oil Loss: In cases where unaccountable oil loss is detected or suspected, the Minister must be notified immediately, and a full load leak-down test should be arranged. If this test confirms the unaccountable oil loss, the elevator unit must be taken out of service until the necessary repairs have been completed.

Conclusion: This sector provides a robust framework for the ongoing maintenance and safety of hydraulic elevators by emphasizing the importance of oil loss monitoring. Through detailed requirements for cleanliness, oil collection and recirculation, precise measurement, and meticulous record-keeping, Section 14 01 24 ensures that all hydraulic elevators operate efficiently and safely. The prescribed measures not only enhance the reliability of the elevators but also ensure compliance with environmental standards and reduce the risk of operational failures due to hydraulic issues.

F. Section 14 01 30 - Escalator task and frequency schedule

Section 14 01 30 details a comprehensive maintenance schedule for escalators, designed to ensure safe and reliable operation through systematic maintenance and inspection tasks categorized by frequency from every visit to annual checks.

Every Scheduled Visit: Maintenance teams are required to meet with the Minister's representative to address any immediate concerns and ensure all escalator components are in optimal condition. This includes completing all scheduled tasks as outlined in the Minister's 52-week Work Schedule System Log Sheets, ensuring documentation is thoroughly updated.

Monthly Tasks: These include removing pit covers and landing plates to inspect, clean, maintain, and lubricate essential machinery parts such as step chains, rollers, machine brakes, and automatic chain oilers. Maintenance personnel must check the general operation, inspect step skirts for wear, adjust step treads, balustrades, and landing plates for damage, and ensure that handrails are free from damage and operating at the correct temperature and speed. Testing of emergency stop buttons and key switches is also required.

Quarterly Tasks: The focus expands to testing all safety devices like skirt and complete switches, handrail inlet, and missing step devices. Maintenance of handrail speeds, chain tensions, drive mechanisms, and proper skirt clearances are also critical. Additional tasks include inspecting step treads, risers, and performing detailed inspections of the interior truss space by removing at least one step. This is complemented by maintenance of step obstruction devices, speed governors, and brakes, among others.

Semi-Annually: This involves greasing the main drive shaft, bull gear bearings, and maintaining seals to ensure the mechanical components operate smoothly without excessive wear or failure.

Annually: Annual tasks include a thorough cleaning and adjustment of step chain novatex curves to note any excessive or uneven wear, cleaning of dirt deposits from

step bands, and checking the operation of controllers. This period also involves extensive cleaning of the interior truss and pit areas, changing oil in the gearbox, lubricating motor bearings, and inspecting, monitoring, and possibly replacing cracked step frames according to manufacturer's standards. A detailed logbook record of all steps inspected, repaired, or replaced is maintained for accountability and tracking.

In conclusion, Sector 14 01 30 establishes a detailed and structured approach to escalator maintenance, emphasizing the importance of regular and thorough inspections, cleaning, and lubrication to prevent malfunction and ensure safety. The defined tasks across various frequencies aim to maintain escalators in peak condition, reducing downtime and extending the lifespan of the equipment while ensuring compliance with safety standards and operational efficiency.

G. Section 14 01 42 - Lifts for persons with physical disabilities

Section 14 01 42 outlines a comprehensive maintenance schedule for lifts designed for persons with physical disabilities, emphasizing the importance of safety and reliability. The section provides detailed guidelines for routine checks and maintenance to ensure these essential devices continue to operate efficiently and safely, accommodating the specific needs of users with physical disabilities.

Scheduled Visit and Semi-Annual Tasks: Every scheduled maintenance visit involves a meeting with the Minister's representative to address and rectify any concerns immediately. It includes a thorough examination of the equipment to maintain it in a safe and reliable operating condition. The detailed tasks are documented in the Minister's 52-week Work Schedule System Log Sheets.

Semi-Annually, the maintenance tasks become more intensive:

Cleaning and Inspection: Runways, pit areas, machine areas, and the tops of carriages must be kept clean and dry. Stairway runways should also be clear of obstructions to ensure safe operation.

Mechanical Maintenance: This includes lubricating and maintaining all machinery parts, especially those related to carriage safety mechanisms and hydraulic systems. Components such as valve seals, packing glands, couplings, piping, hoses, pumps, and tanks are inspected for integrity and function.

Hydraulic Systems: For lifts with hydraulic systems, tasks include monitoring and recording oil leakage, maintaining oil reservoir levels, and testing relief valve settings. A no-load leak-down test is performed for units with unexposed hydraulic cylinders, with results recorded in the logbook.

Electrical and Controller Components: Inspection and maintenance cover all controller components and other mechanical and electrical devices to adjust for proper operation. This includes testing circuits related to protection in the event of a failure and ensuring all seals in the governor are intact.

Operational Checks: Functional tests are conducted on emergency lights, audiovisual warning signals, emergency battery backup systems, and power-assisted swing doors and gates. Additional checks include testing sensitive edges and surfaces, chair carriage rotation, foldable seat mechanisms, automatic leveling, and alarm and warning signals.

Safety and Compliance: Inspect and maintain all landing and carriage doors or gates, ensuring interlocks, locks, and contacts are functioning correctly. The force required to open doors is tested, and all devices are examined for compliance with safety and operational standards.

Structural Integrity: This includes inspecting wire ropes, chains, sprockets, and ensuring that all mechanical linkages like acme thread drive screws and rack and pinion drives are in good working condition.

In conclusion, Section 14 01 42 ensures that lifts for persons with physical disabilities are maintained to the highest standards of safety and functionality. The section mandates regular and detailed maintenance routines that address both mechanical and electrical aspects of lift operation, ensuring that these critical mobility aids continue to provide safe and reliable service. The comprehensive task list and maintenance frequency schedule are designed to preempt failures and address any issues proactively, thereby extending the life of the equipment and ensuring it remains compliant with all relevant safety regulations.

H. Section 10 44 30 - Portable fire extinguisher inspection testing and maintenance

Section 10 44 30 is dedicated to establishing rigorous protocols for the inspection, testing, and maintenance of portable fire extinguishers, ensuring they meet safety standards and are ready for use in emergencies. This section comprehensively outlines the tasks and requirements necessary to maintain fire extinguishers within the safety and operational guidelines mandated by regulatory authorities.

Reference Documents: This sector adheres to the Alberta Fire Code 1997 and NFPA 10 1998, which provides standardized procedures for the maintenance and operation of portable fire extinguishers. It also relies on manufacturers' service manuals to ensure specific product requirements are met.

Definitions: The section defines crucial terms to clarify the scope of work:

Inspection: A monthly quick check to ensure the extinguisher is charged, operable, and undamaged.

Maintenance: An annual thorough examination to assess the condition of the extinguisher and determine if any repairs, replacements, or hydrostatic testing are necessary.

Recharging: Refers to the refilling of extinguishers with extinguishing agent and excellent, ensuring readiness for operation.

Regulatory Requirements: Compliance with the latest edition of all applicable codes is required, and contractor facilities and equipment must be certified by relevant authorities.

Inspections: Monthly inspections are mandated to check that extinguishers are in their proper location and free from apparent defects. Any issues identified during inspections must be reported immediately for corrective action.

Maintenance: Includes a detailed examination of the extinguisher's mechanical parts, agent, and expelling means, adhering to NFPA standards. Maintenance findings and actions must be documented and reported to ensure accountability and traceability.

Recharging: Must comply with NFPA and manufacturer recommendations. The process includes thorough testing and verification, especially after recharging, to prevent leaks and ensure the extinguisher's efficacy.

Hydrostatic Testing: Carried out only by trained personnel using proper equipment and procedures. The testing frequency and requirements are dictated by NFPA standards, with successful tests leading to the extinguisher being stamped and tagged as proof of compliance.

Maintenance Records and Safety: Detailed records of maintenance, recharging, and testing are maintained on tags attached to each extinguisher and in logbooks, which include dates, descriptions of work performed, and identifiers for personnel carrying out the service. These records are essential for tracking the history of each unit and ensuring compliance with safety regulations.

In summary, Section 10 44 30 provides a detailed framework for the ongoing inspection, testing, and maintenance of portable fire extinguishers, emphasizing adherence to regulatory standards and ensuring that these critical safety devices are always ready for use. The section ensures that all aspects of fire extinguisher upkeep are managed systematically and transparently, enhancing safety protocols within facilities and ensuring compliance with both provincial and national standards.

I. Section 21 01 90 - Sprinkler system inspection testing and maintenance

Section 21 01 90 outlines comprehensive protocols for the inspection, testing, and maintenance of sprinkler systems, ensuring they meet stringent safety standards and function reliably in case of fire emergencies. This section is integral for maintaining the operational integrity and compliance of fire suppression systems within buildings.

Related Requirements: This sector ties into general requirements detailed in Section 01 00 15 and specific fire alarm system requirements in Section 28 31 01, emphasizing a coordinated approach to fire safety systems maintenance.

Regulatory Requirements: Compliance with the latest editions of all applicable codes, such as the National Plumbing Code of Canada 1995 and NFPA 25-1998 for Water-Based Fire Protection Systems, is mandatory. The maintenance work must be performed by qualified personnel who are experienced and fully trained in sprinkler system maintenance. Any operational downtimes, especially when a system or part thereof is shut off, must be reported to the Minister immediately.

System Components: Detailed maintenance protocols are specified for various system components:

Fire Pumps: Checking operational conditions including pressures and levels, and conducting flow tests to confirm proper function.

Control Valves: Testing for operational freedom and proper signaling through supervisory switches.

Water Flow Alarms: Verifying that water flow triggers the correct audible and visual alarms.

Wet and Dry Systems: Performing tests to ensure that these systems respond appropriately under simulated demand conditions.

Preaction Systems: Testing according to manufacturers' instructions to verify the correct operational response and resetting the systems post-test.

Sprinklers: Inspecting for physical and functional integrity, ensuring they are free from obstructions or damages.

Inspection Report and Test Record: All inspection and testing activities must be thoroughly documented, and results recorded in the appended Section 21 01 90B. This ensures that every action taken during the maintenance processes is logged and can be reviewed by regulatory authorities or during audits.

Maintenance and Recharging: Includes routine procedures to maintain and, when necessary, recharge the system to ensure it is always ready for operation. This involves checking and replacing parts like seals and excellent and ensuring all mechanical parts are in good working order.

Hydrostatic Testing: Conducted to test the strength and leak resistance of the system under pressure. This test is critical for validating the long-term integrity of the system components, particularly the piping and storage vessels.

Work Site Safety: Ensuring safety at the work site during maintenance activities is paramount. This includes adhering to all prescribed safety protocols to protect maintenance personnel and the building occupants.

In conclusion, Section 21 01 90 provides a detailed framework for the regular upkeep and stringent testing of sprinkler systems to ensure they meet safety standards and are always ready to perform in emergency situations. The section emphasizes the importance of systematic inspections, maintenance, and compliance with regulatory requirements, ensuring that all components of the sprinkler system are regularly evaluated and maintained to uphold safety and functionality.

J. Section 26 13 90 - Medium voltage power system maintenance

Section 26 13 90 provides comprehensive guidelines for the maintenance of medium voltage power systems to ensure safety, reliability, and compliance with regulatory standards. This document is crucial for maintaining the operational integrity of power systems handling voltages above 750 volts.

Regulatory Requirements: Maintenance operations must adhere to the Electrical Protection Act of Alberta and the Canadian Electrical Code (CEC), incorporating specific

regional amendments. All electrical products used must either bear a CSA label or be approved in writing by the authority having jurisdiction. Before commencing work, necessary drawings and specifications must be submitted for approval to relevant authorities, including local utility companies.

Reference Documents: The section mandates compliance with standards from organizations such as the Electrical and Electronic Manufacturers Association of Canada (EEMAC), National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronic Engineers (IEEE), Insulated Power Cable Engineers Association (IPCEA), and American Society for Testing and Materials (ASTM).

Safety Procedures: Detailed safety procedures are outlined to ensure the safety of personnel during maintenance. These include de-energizing equipment, performing proper system isolation, locking and tagging out equipment, discharging capacitive energy, and applying safety grounds.

Power Cables: Maintenance includes strict adherence to procedures for system switching operations, dielectric strength testing using the step voltage method, and careful handling and testing of cables to ensure their integrity and insulation quality.

Power Transformers, Dry Type: Involves visual inspections, cleaning, insulation power factor tests, ratio tests, insulation resistance measurements, dielectric strength testing, and core ground testing. All transformers must be isolated from power sources during these procedures.

Power Transformers, Liquid Filled: Similar maintenance tasks as dry type but also includes additional tests such as dielectric strength of the insulating liquid, dissolved gas analysis, and moisture content evaluation to monitor the condition of the insulating liquid.

Maintenance of Switchgear Enclosures: This includes cleaning, mechanical inspections of the enclosure and its components, electrical tests to ensure operational integrity, and applying protective measures to ensure the longevity and reliability of the switchgear.

Maintenance of Medium Voltage Air/Oil Circuit Breakers: Encompasses both air and oil-type breakers and includes mechanical and electrical inspections, cleaning, testing for dielectric strength, and ensuring all moving parts are adequately lubricated and operational.

Fused or Unfused LB and NLB Disconnect Switchgear: Inspection and maintenance focus on mechanical and electrical integrity, cleaning, and ensuring proper operation of all disconnects and fuses.

Maintenance of Protection Relays: Testing and setting adjustments to ensure that protection relays operate correctly under fault conditions, including calibration and functional testing.

Maintenance of Overhead Radial Power Lines: Includes inspection of poles, insulators, and conductors, ensuring secure and reliable connections, and checking for physical and environmental damage that might affect operation.

Surge Arrestors: Testing of surge arrestors involves inspecting their condition, cleaning, and conducting electrical tests to ensure they function correctly and protect the system from voltage surges.

Deficiency List and Cost Estimate: Any deficiencies identified during inspections or maintenance must be documented, and a detailed cost estimate for the repair or replacement of faulty components must be provided.

In summary, Section 26 13 90 ensures thorough and regular maintenance of medium voltage power systems, emphasizing strict adherence to safety protocols, regulatory compliance, and detailed record-keeping to support ongoing system integrity and safety. This comprehensive approach helps mitigate risks associated with medium voltage power systems, ensuring they operate efficiently and reliably.

K. Section 26 29 90 - Low voltage power system maintenance

Section 26 29 90 sets forth a comprehensive framework for the maintenance of low voltage power systems (under 750 Volts), ensuring operational safety, reliability, and compliance with regulatory standards. This detailed guideline covers everything from routine inspections to specific maintenance procedures for various system components, emphasizing the critical nature of maintaining these systems to prevent electrical failures and ensure continuous operation.

Regulatory Requirements: Maintenance operations must comply with the Electrical Protection Act of Alberta, incorporating rules and regulations, including the Canadian Electrical Code (CEC). The section specifies that all electrical products used must either bear a CSA label or be approved in writing by the authority having jurisdiction. Before any work begins, necessary drawings and specifications must be submitted for examination and approval to the relevant authorities, with associated fees paid by the contractor.

Reference Documents: The maintenance practices must align with standards set by reputable organizations such as the Electrical and Electronic Manufacturers Association of Canada (EEMAC), the National Electrical Manufacturers Association (NEMA), the Institute of Electrical and Electronics Engineers (IEEE), the Insulated Power Cable Engineers Association (IPCEA), and the American Society for Testing and Materials (ASTM).

Power Transformers, Dry Type: Maintenance includes visual inspections, cleaning, and several tests such as insulation power factor tests, ratio tests, and core ground tests. These transformers are isolated from power sources during inspections to ensure safety and accuracy in testing.

Maintenance of Switchgear Enclosures: Involves cleaning, inspections of mechanical and electrical components, and testing for operational integrity. The procedure ensures that switchgear enclosures are free from contaminants that could impair their functionality.

Maintenance of Low Voltage Air Circuit Breakers: Focuses on ensuring that these critical components

operate reliably through inspections, mechanical tests, and cleaning. Specific attention is paid to the condition of contacts, insulators, and the overall mechanical operation.

Fused or Unfused LB and NLB Disconnect Switchgear: Regular maintenance checks include inspecting for mechanical and electrical integrity, cleaning, and operational testing to ensure all disconnects function correctly.

Maintenance of Protective Relays: Involves setting, testing, and calibration to ensure that these devices operate correctly under fault conditions. Maintenance is critical for the safety and functionality of the overall power system.

Maintenance of Overhead Radial Power Lines: Includes inspections of poles, insulators, and conductors, ensuring secure and reliable connections and checking for physical and environmental damage that might affect operation.

Surge Arrestors: Maintenance includes inspecting for physical damage, cleaning, and conducting electrical tests to ensure functionality and reliability.

Deficiency List and Cost Estimate: After maintenance, any deficiencies found are to be listed with an estimated cost for repair or replacement provided. This ensures that all potential issues are addressed promptly and efficiently, maintaining the system's integrity and safety. In summary, Section 26 29 90 provides a detailed and systematic approach to maintaining low voltage power systems, emphasizing the importance of compliance with regulatory requirements, thorough documentation, and precise maintenance procedures. This section ensures that all components of the system are regularly checked and maintained to prevent failures, enhance safety, and ensure continuous and reliable power supply within the facility.

L. Section 28 31 91 - Fire alarm system maintenance

Section 28 31 91 focuses on the comprehensive maintenance and testing protocols for fire alarm systems, ensuring their reliability and compliance with regulatory standards. This detailed section emphasizes the critical importance of maintaining fire alarm systems to safeguard buildings and their occupants.

Regulatory Requirements: Maintenance must adhere to the latest editions of all applicable codes, including the Alberta Building Code 1985. The work should only be conducted by personnel approved by the Fire Commissioner, as stipulated in the Alberta Labour Fire Prevention Branch Bulletin 86-003. The procedures are also required to comply with electrical work regulations under the Certification of Electrical Workers Regulation. If a system or part of it is shut off for more than two hours, local fire authorities must be notified, and appropriate safety measures, like watchmen, must be deployed until the system is operational again.

Reference Documents: Testing and maintenance should align with standards such as ULC-S536-97 for the inspection and testing of fire alarm systems, along with other relevant ULC and CSA Standards. Additional

guidelines are provided by the Alberta Fire Code and manufacturer's instructions, ensuring that all practices meet or exceed regulatory expectations.

Test Equipment: The section specifies the need for specific test equipment including smoke generators and portable communication devices to conduct comprehensive testing as prescribed. This equipment ensures that each component of the fire alarm system is tested under conditions that closely simulate actual fire scenarios.

Execution: Detailed execution protocols are laid out for:

System Components: Includes testing manually actuated signaling devices, heat detectors (resettable/self-restoring and non-resettable), smoke detectors (area and duct types), ultraviolet and infrared detectors, audible and visual alarm signals, annunciators, and voice communication systems.

Power Supplies: Ensures both normal and emergency power supplies are tested, including generator standby power and battery systems, to verify that they operate within the required ranges and can sustain the alarm system during power outages.

Control Units: Requires a thorough inspection and testing of all control unit functions, ensuring they communicate correctly with all system components and respond appropriately during tests.

Safety Procedures: The document mandates strict safety procedures to protect maintenance personnel and building occupants during testing. This includes ensuring all electrical connections are secure, testing devices for proper operation without causing false alarms or disruptions, and confirming that all system components are accessible and correctly located to respond to fire conditions.

In conclusion, Section 28 31 91 provides a meticulous framework for the maintenance and testing of fire alarm systems, underscoring the necessity of strict adherence to safety standards and regulatory requirements. Through detailed testing schedules, the use of specific equipment, and rigorous safety procedures, this section ensures that fire alarm systems are maintained in a state of readiness to effectively protect property and lives.

M. Section 09 68 91 - Carpet cleaning

Section 09 68 91 outlines comprehensive procedures for maintaining and cleaning carpeted areas within facilities, emphasizing the importance of maintaining appearance and extending the lifespan of the carpeting. This section details various cleaning methods tailored to the traffic and soiling levels of different areas, ensuring all carpets receive appropriate care.

Performance Requirements: The section stipulates that dry vacuuming should effectively remove all loose dirt and debris. Spot cleaning is expected to eliminate isolated stains, providing a consistent texture, color, and pattern across carpeted areas. For high-traffic areas, the spin bonnet method must remove visible stains and soil, ensuring uniform appearance and texture. The steam clean/extraction method, used across all carpeted areas,

should eliminate all forms of soil and stains, resulting in a uniformly clean appearance throughout.

Testing: Prior to widespread cleaning, a field test must be conducted by cleaning a 1 square meter area to demonstrate the effectiveness of the chosen method. This test area must be inspected and approved by the Minister before full-scale cleaning proceeds, ensuring the method is suitable for the carpet type and installation.

Field Test of Cleaning Method: The initial field test involves assessing the carpet and underpad, identifying the material and installation method, and recommending a cleaning strategy that optimizes carpet life. A report of this assessment, along with any observed deterioration or damage, must be provided to the Minister.

Spin Bonnet Method: This method is designated for high-traffic areas and includes pre-vacuuming, spot removal, and application of a cleaning solution followed by scrubbing without over-wetting the carpet or underpad. The area is then wet vacuumed in two directions to minimize pile distortion and ensure deep cleaning.

Steam Clean/Extraction Method: Applied to all carpet areas, this method involves relocating furniture and thoroughly vacuuming the floor. After spot cleaning, steam, shampoo, and detergents are applied. The carpet is then cleaned with an extraction machine that also performs wet vacuuming in two directions. This method emphasizes minimal pile distortion and thorough removal of cleaning residues.

Maintenance of System Components: Ensures all equipment used in carpet cleaning, such as vacuums and extractors, is properly maintained and does not damage the carpet fibers, backing, or underpad.

Safety Procedures: Includes deploying warning signs in areas with wet or damp carpets to prevent slips and falls. It also involves proper cleanup post-cleaning, removing all equipment and materials, and ensuring furniture is returned to its original position with protectors under metal feet to avoid damage to the damp carpet.

Regulatory Requirements: All operations must adhere to the guidelines specified by the Alberta Fire Code 1997 to ensure safety during cleaning operations, particularly when handling electrical equipment in wet environments. In conclusion, Section 09 68 91 provides a detailed framework for the proper cleaning and maintenance of carpets in various traffic areas, ensuring techniques and products used do not harm the carpet while achieving the highest cleaning standards. This structured approach ensures the longevity of carpet materials, enhances the appearance of facilities, and upholds safety and cleanliness standards.

N. Section 23 09 98 - Building management control systems inspection and maintenance

Section 23 09 98 provides an exhaustive framework for the inspection and maintenance of Building Management Control Systems (BMCS), focusing on ensuring operational reliability and efficiency while complying with safety standards. This section emphasizes systematic procedures for the initial and subsequent

maintenance phases to extend the lifespan and functionality of BMCS components.

Maintenance Overview: The document prescribes detailed annual and semi-annual maintenance tasks tailored to different components of the BMCS. Maintenance includes the inspection and calibration of analog inputs and outputs, cleaning of hardware, and verification of software backups.

First Year Maintenance Procedures:

The first year of maintenance is crucial for establishing baseline functionality and performance of all system components. This includes:

Submitting all inspection results as part of the comprehensive Building Management Control Systems Inspection Report.

Calibration to manufacturer's specifications of all analog airflow points, with detailed reporting on adjustments and findings.

Striking and ranging all analog output points including transducers, gauges, actuators, and positioning devices followed by calibration and submission of a detailed report.

A third of all other analog input, digital input, and digital output points are calibrated and tested for relay and contactor operations.

Making complete paper copies of all software for backup and recovery purposes.

Cleaning and maintenance of hardware components like hard copy devices, screens, keyboards, modems, control units, and uninterruptible power supplies (UPS), which includes checking cable connections and operational tests.

Subsequent Maintenance Procedures:

In the years following the initial maintenance, the focus shifts to maintaining the reliability and accuracy of the system components through:

Repeating calibration processes for the remaining two-thirds of all analog and digital points over the second and third years.

Biannual checks of all outside air temperature sensors and relative humidity sensors, ensuring their calibration aligns with manufacturer's specifications.

Regular backups of the current software to safeguard against data loss.

Continued cleaning and maintenance of all personal computers or head ends involved in BMCS, including fan operation checks and real-time clock settings.

Safety and Compliance:

All maintenance tasks are to be performed in compliance with the Alberta Fire Code and the Canadian Electrical Code, ensuring all practices meet safety regulations and standards.

The section also mandates cleanliness and organization during maintenance operations, requiring areas to be kept free of waste material, and equipment to be clean upon completion of work.

Regulatory Requirements and Reference Documents:

Adherence to guidelines from the Alberta Building Code and manufacturer's service manuals is mandatory,

ensuring all maintenance activities align with legal and operational standards.

Reference documents such as ULC standards for safety and operations provide a baseline for all testing and maintenance protocols.

In summary, Section 23 09 98 sets out comprehensive maintenance strategies for building management control systems, ensuring they are maintained at peak efficiency and reliability. The detailed protocols for initial and subsequent maintenance ensure that the systems are calibrated, clean, and compliant with regulatory requirements, ultimately ensuring their optimal function and longevity. This careful attention to detail and structured approach to maintenance helps prevent system failures and extends the operational life of the BMCS components.

O. Section 23 69 20 - Centrifugal liquid chillers inspection and maintenance

Section 23 69 20 outlines the meticulous processes for the inspection and maintenance of centrifugal liquid chillers, ensuring their operational reliability and compliance with safety regulations. This comprehensive approach is crucial for maintaining system efficiency and prolonging the lifespan of these essential cooling units.

Inspection and Maintenance Schedule: The section provides a detailed annual cycle of inspections and maintenance, divided into specific periods to optimize chiller performance throughout the year:

1. **Spring Start-Up and Inspection:**

Begins with a review of the maintenance log and the operation of the purge unit to remove non-condensable gases, achieve a vacuum, and ensure the unit functions properly.

The chiller is started, ensuring the oil temperature is appropriate prior to start-up.

Operating conditions such as refrigerant and lubrication levels, temperatures, and pressures are checked.

The system is tested for leaks in the refrigerant, oil, and water loops, and minor leaks are repaired.

All operating and safety controls are calibrated and recorded.

The operator is instructed on proper or unusual operating conditions and troubleshooting techniques.

The process concludes with a report on any recommendations or deficiencies.

Mid-Season Inspections:

Conducted twice; operations involve recording operating pressures, temperatures, voltages, and amperages, and ensuring refrigerant and oil levels are correct.

All gauges and thermometers are verified for accuracy, and the purge unit is checked for operation and canister depletion.

The system is inspected for leaks, and any issues are documented in the maintenance report.

The last mid-season check includes taking an oil sample for laboratory analysis to assess acid content, moisture content, and wear metals content.

Fall Inspection and Shutdown:

Involves another review of the log and recording of operational metrics.

The system is prepared for winter shutdown, with detailed instructions provided to the operator regarding shutdown responsibilities.

A leak check is performed, the purge unit canister is replaced if depleted, and any concerns or repairs needed before the next season are documented.

Annual Inspection and Maintenance:

Comprehensive checks and calibrations are carried out on all safety and operating controls.

The starter and its components are inspected, lubrication systems are checked, and electrical connections are verified.

The purge unit is serviced, oil levels are managed, and condenser tubes are cleaned, with chemical cleaning requiring prior approval.

Any deficiencies and recommendations are reported, ensuring readiness for the next operational season.

This structured schedule ensures that each aspect of the centrifugal liquid chiller's function is inspected and maintained at optimal intervals, reducing the likelihood of unexpected breakdowns and ensuring efficient operation. The detailed documentation and adherence to safety and operational standards help in maintaining system integrity, thus safeguarding the investments in these critical cooling systems. This approach not only ensures the chillers' reliability but also aligns with environmental and energy efficiency goals by maintaining the system at peak performance.

P. Section 23 69 30 - Mechanical draft cooling towers inspection and maintenance

Section 23 69 30 delineates the comprehensive procedures for maintaining mechanical draft cooling towers, focusing on ensuring their efficient operation and longevity. The section is instrumental in guiding maintenance teams through systematic checks and service tasks tailored to the unique needs of cooling towers, which are crucial for large-scale HVAC systems. **Maintenance Procedure Overview:** The maintenance of mechanical draft cooling towers is segmented into three critical phases: Seasonal Start-Up, Mid-Season Inspection, and Seasonal Shut-Down, each designed to address specific operational needs and potential issues that could affect the performance and structural integrity of the cooling towers.

Seasonal Start-Up:

Begin by checking and removing debris from critical areas such as screens, fans, eliminators, heat transfer sections, and the sump to ensure unobstructed airflow and water flow.

Flush and clean the sump to prevent sediment build-up which can affect water quality and system efficiency.

Inspect the protective finishes for signs of deterioration or damage that might compromise the tower's structural integrity.

Ensure the free movement of fans, inspect belt conditions, and adjust or replace them as necessary to maintain optimal operational efficiency.

Lubricate shaft and motor bearings and ensure that all set screws and locking collars are secure.

Inspect and clean spray nozzles and the heat transfer section to ensure effective cooling.

Adjust the make-up valve and bleed rate to optimize water usage and concentration cycles.

Conduct operational checks on pumps, including lubrication and recording voltage and current draws of pump and fan motors.

Report any recommendations or deficiencies using Section 23 69 30A for documentation and further action.

Mid-Season Inspections:

Periodic checks to remove debris from fans and inlet screens which can accumulate and hinder performance.

Inspect and clean the sump as needed, along with sump strainers, to maintain water quality.

Re-assess and adjust the belt conditions, shaft and motor bearings, and lubrication to ensure continued efficient operation.

Regular cleaning of spray nozzles to prevent blockages that could affect the cooling process.

Verify and adjust the make-up valve and bleed rate as necessary to maintain water efficiency.

Document any findings and make recommendations for any corrective actions on Section 23 69 30A.

Seasonal Shut-Down:

Drain parts of the system that are susceptible to freezing to prevent damage during the cold months.

Conduct a thorough inspection of the entire system, noting any deficiencies that must be addressed before the next season.

Report and document these findings and recommendations using Section 23 69 30A to ensure issues are resolved prior to reactivation.

In summary, Section 23 69 30 provides a meticulous framework for the regular maintenance of mechanical draft cooling towers, emphasizing a proactive approach to inspection and service. This structured maintenance ensures that cooling towers operate efficiently throughout their service life, minimizing breakdowns and optimizing performance. The detailed procedures for start-up, mid-season, and shut-down phases ensure that every component is carefully maintained, leading to enhanced system reliability and effectiveness.

Q. Section 32 93 90 - Integrated pest management

Section 32 93 90 meticulously outlines the procedures for an Integrated Pest Management (IPM) program, focusing on minimizing the use of chemicals while effectively controlling pests in infrastructural settings. This section is critical for ensuring the health and safety of occupants and the longevity of the building by managing pests through environmentally sound practices.

Pest Control Plan of Work:

The pest control plan includes detailed descriptions of structural or operational changes that facilitate the pest

control effort. It requires the contractor to outline site-specific solutions that eliminate pest access to food, water, and harborage, employing a building floor plan as a permanent record.

Monitoring methods involve the use of biological traps and other devices to assess pest presence, activity, and harborage locations.

The plan also lists all materials and equipment to be used, including pesticides and their safety data sheets (MSDS), brand names of application equipment, rodent bait boxes, and other control equipment.

A service schedule is provided, detailing the routine pest control inspections for each building, including the frequency of inspections and the specific areas that will receive special attention.

Chemical Control Methods:

Pesticides are applied only as needed, based on visual inspections or monitoring device indications of pest activity, and after non-chemical control methods have been tried unsuccessfully.

The application of chemical control products is designed to minimize risk by using the least hazardous materials, most precise application techniques, and only the necessary quantity of pesticide to achieve effective control.

Detailed records of pesticide applications, including types of chemicals used, amounts, and locations of application, are maintained and submitted to the regulatory authorities.

Insect Control:

Emphasizes non-chemical methods such as the use of HEPA vacuums for initial cleanouts of infestations and trapping devices for indoor fly control.

Biological traps are utilized to monitor indoor insect populations and evaluate the effectiveness of control efforts.

Bait formulations are employed strategically for managing ants, cockroaches, and other crawling insects.

Rodent Control:

Indoor rodent control is achieved using trapping devices only, which are checked regularly and placed in concealed, protected areas within buildings.

Outdoors, bait boxes are used discreetly, securely anchored, and labeled with essential contact information and service dates to ensure safety and compliance with regulations.

Structural Modifications and Recommendations:

The contractor advises on potential structural, sanitary, or procedural modifications that could reduce pest access, food, water, and harborage, although actual structural changes are not part of the contractor's responsibilities.

Program Evaluation:

The effectiveness and safety of the IPM program are continually evaluated by the Province, with required changes implemented promptly to address any identified deficiencies.

In conclusion, Section 32 93 90 advocates for a strategic and environmentally responsible approach to pest management that prioritizes safety and efficacy. The detailed guidelines for monitoring, chemical use, and

pest control methods ensure that pest management efforts are comprehensive, minimally invasive, and aligned with sustainable practices. This approach not only addresses immediate pest issues but also contributes to long-term prevention and control strategies essential for maintaining the integrity and safety of the infrastructure.

R. Section 32 93 98 - Interior plant maintenance

Section 32 93 98 emphasizes detailed care for indoor plants within institutional settings, ensuring healthy growth and aesthetic appeal. Key aspects include:

Regulatory Compliance and Documentation: Ensures adherence to all required permits and licenses, particularly for pesticide application, enhancing plant safety and maintenance efficiency.

Detailed Maintenance Logs: Maintenance activities are meticulously logged daily, including plant care specifics and any issues encountered, providing transparency and ongoing evaluation of the service quality.

Fertilization and Watering: The section outlines specific requirements for the application of fertilizers and water, ensuring plants receive necessary nutrients and hydration according to their individual needs.

Pest Management: Implements integrated pest management strategies to minimize chemical use, focusing on preventative measures and biological controls which align with environmental and health standards.

Plant Maintenance Procedures: Includes regular watering, pruning, cleaning of foliage, and specific soil care, ensuring optimal growth conditions and plant health.

This holistic approach ensures that interior plant maintenance is conducted with a focus on sustainability, efficiency, and aesthetic upkeep, contributing to the overall well-being and ambiance of the indoor environments.

S. Section 32 01 30 - Snow and ice removal services

Section 32 01 30 focuses on maintaining safe and accessible walkways during winter by detailing procedures for effective snow and ice removal. Key components include:

Performance Standards: Establishes that all pedestrian and vehicular pathways must be kept clear of snow and ice to ensure safety and accessibility.

Detailed Service Logs: Contractors are required to maintain accurate logs of all clearing activities, which include detailed information on the timing, extent of services, and conditions during operations.

Equipment and Safety Measures: Specifies the use of appropriate, well-maintained equipment to efficiently clear snow and ice without damaging surfaces. Safety measures for both workers and pedestrians are emphasized to prevent accidents.

Environmental Considerations: The use of environmentally friendly deicing materials is mandated

to minimize harm to adjacent vegetation and infrastructure.

Priority and Quality Assurance: Sets clear priorities for the order in which areas must be cleared and establishes rigorous quality assurance practices to maintain high standards of service.

This comprehensive approach ensures that pathways remain safe and functional throughout the winter, reducing hazards for all property users and maintaining compliance with local safety regulations.

T. Section 32 99 05 - Exterior landscape maintenance

Section 32 99 05 outlines the requirements for comprehensive exterior landscape maintenance to ensure visually pleasing and healthy outdoor environments. Highlights include:

Scope of Maintenance: Covers all aspects of landscape upkeep, from lawn care and tree maintenance to pest control and seasonal preparations.

Quality and Regulatory Compliance: Emphasizes adherence to the highest horticultural standards and local regulations, ensuring that all activities are conducted safely and effectively.

Integrated Pest Management: Focuses on minimizing chemical interventions by prioritizing biological and mechanical pest controls, aligning with environmental best practices.

Soil and Plant Health Management: Includes regular soil testing and tailored fertilization to maintain optimal soil conditions and plant health.

Detailed Record-Keeping and Inspections: Requires meticulous logging of all maintenance activities and regular inspections to ensure ongoing quality and address any issues promptly.

This detailed maintenance strategy ensures that outdoor spaces are not only aesthetically pleasing but also sustainable and conducive to the well-being of both the plant life and the community that enjoys these spaces.

U. SECTION 32 99 06 - MODIFIED EXTERIOR GROUNDS MAINTENANCE

Section 32 99 06 sets comprehensive standards for maintaining exterior grounds with an emphasis on sustainable practices, aiming to enhance aesthetic appeal and ensure environmental responsibility. The section covers various aspects of grounds maintenance, integrating advanced horticultural practices with

meticulous site management to maintain high-quality landscapes.

Scope of Work: The maintenance work includes a variety of tasks such as lawn care, planting, fertilization, pest control, and seasonal clean-up activities. All services are performed according to the best horticultural practices to ensure grounds are visually appealing and healthy.

Reference Standards: The section references several Alberta Agriculture publications that provide guidelines on plant growth, pest management, and pruning techniques, ensuring that all maintenance activities are scientifically grounded and effective.

Maintenance Procedures: Detailed maintenance logs are required, and payments are structured to ensure quality and accountability. The contractor is expected to maintain daily logs that detail every aspect of the work performed, which are critical for evaluating service quality and compliance with the specifications.

Chemical Use and Pest Control: The use of chemicals is minimized, reflecting a commitment to environmental stewardship. Integrated Pest Management (IPM) strategies are employed to manage pests with the least possible hazard to people, property, and the environment.

5. CONCLUSIONS

The comprehensive analysis presented throughout this paper illustrates the critical importance of adhering to stringent maintenance protocols and standards across various sectors of building management. The findings suggest that a systematic approach to maintenance not only ensures the functional reliability and safety of building infrastructures but also significantly contributes to their sustainability. By adhering to detailed maintenance schedules, conducting regular inspections, and ensuring compliance with regulatory standards, facility managers can enhance the operational lifespan of building components, reduce the likelihood of system failures, and ensure a safe environment for all occupants. This holistic view of building management underscores the need for ongoing evaluations and adaptations of maintenance practices to meet evolving standards and technological advancements, ultimately contributing to more sustainable and resilient public infrastructure management.

References:

- Alberta Codes (2024). Building Codes and Standards. Accessed on 01.05.2024, <https://www.alberta.ca/building-codes-and-standards>
- Allioui, H., & Mourdi, Y. (2023). Exploring the full potentials of IoT for better financial growth and stability: A comprehensive survey. *Sensors*, 23(19), 8015.
- Barrett, P., & Baldry, D. (2009). Facilities management: Towards best practice. John Wiley & Sons.
- Bartlett, R., Halverson, M. A., & Shankle, D. L. (2003). Understanding building energy codes and standards (No. PNNL-14235). Pacific Northwest National Lab.(PNNL), Richland, WA (United States).

- Canadian Standards Association (CSA) (2024). Guidelines for Building Maintenance. Accessed on 01.05.2024, <https://ipac-canada.org/canadian-standards-association-csa>
- Ching, F. D., & Winkel, S. R. (2021). Building codes illustrated: a guide to understanding the 2021 international building code. John Wiley & Sons.
- Hodges, C., & Sekula, M. (2013). Sustainable Facility Management: The Facility Manager's Guide to Optimizing Building Performance. Vision Spots Publishing.
- Jardine, A. K., & Tsang, A. H. (2005). Maintenance, replacement, and reliability: theory and applications. CRC press.
- Jordan, J. K. (2000). Maintenance management for water utilities. American Water Works Association.
- Kwak, Y. H., Chih, Y., & Ibbs, C. W. (2009). Towards a comprehensive understanding of public private partnerships for infrastructure development. *California management review*, 51(2), 51-78.
- Levitt, J. (2009). The handbook of maintenance management. Industrial Press Inc.
- Mirza, S. (2006). Durability and sustainability of infrastructure—A state-of-the-art report. *Canadian journal of civil*
- National Building Code (2019). Alberta Edition, NBC(AE) Accessed on 01.05.2024, <https://nrc.canada.ca/en/certifications-evaluations-standards/codes-canada/codes-canada-publications/national-building-code-2019-alberta-edition-nbcae>
- National Fire Code (2019). Alberta Edition, NFC(AE) Accessed on 01.05.2024, <https://nrc.canada.ca/en/certifications-evaluations-standards/codes-canada/codes-canada-publications/national-fire-code-2019-alberta-edition-nfcae>
- National Fire Protection Association (NFPA) (2024). Guidelines and Standards. Accessed on 01.05.2024, <https://www.nfpa.org/en>
- Nielsen, S. B., Sarasoja, A-L., & Ramskov Galamba, K. (2016). Sustainability in facilities management: an overview of current research. *Facilities*, 34(9/10), 535 - 563. DOI: 10.1108/F-07-2014-0060
- Roper, K., & Payant, R. (2014). The facility management handbook. Amacom.
- Schweber, L., & Harty, C. (2010). Actors and objects: a socio-technical networks approach to technology uptake in the construction sector. *Construction management and economics*, 28(6), 657-674.
- Stanford, H. (2021). Effective building maintenance: Protection of capital assets. River Publishers.

Amr Abbass

University of Idaho

Canada

calgary732@outlook.com

ORCID 0009-0007-9376-266X
