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SAFETY, RESPECT AND DIGNITY FOR ALL

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Technical Criteria for

Correctional Institutions

SECTION M – MECHANICAL

Canada

M-1 MECHANICAL – GENERAL MECHANICAL REQUIREMENTS

1. SCOPE

This section outlines the basic mechanical engineering design criteria related to the special requirements of Correctional Service Canada (CSC).

2. RELATED DOCUMENTS

2.1 Technical Criteria Document (TCD)

M–2 to M–4 inclusive
SU–1 – Storm & Sanitary Sewers
SU–2 – Wastewater (Sewage) Treatment
SU–3 – Water Utility

2.2 Correctional Service of Canada - Commissioner's Directives

318-2 - Energy Measurement and Conservation
318-4 - Management of Halocarbons

3. GENERAL REQUIREMENTS

3.1 The mechanical technical criteria provided under this section describes special Correctional Service Canada (CSC) requirements and are intended to supplement the most current version of the National Building Code, National Plumbing Code, and National Fire Code of Canada.

3.2 Health care facilities construction, renovation and design shall meet the requirements of the CSA Z317 Health Care Codes: CAN/CSA Z317.13 Infection control during construction, renovation and maintenance of health care facilities, CAN/CSA Z317.1 Special requirements for plumbing installations in health care facilities, CAN/CSA Z317.2 Special requirements for heating, ventilating and air-conditioning systems in health care facilities, and CSA Z8000 Canadian health care facilities.

3.3 Any departure from these technical criteria shall be supported by explanation and back-up data, and shall receive approval by CSC NHQ-Technical Services and all Authorities Having Jurisdiction before proceeding with the design.

4. DESIGN GUIDELINES

4.1 General

4.1.1 Design systems to minimize opportunities for system sabotage, the concealment of contraband and to facilitate the task of staff in maintaining and controlling the institution.

4.1.2 Mechanical equipment shall generally be located in specially-designated buildings or rooms for mechanical equipment. Building mechanical rooms shall be located, laid out and designed so that major equipment items such as boiler, air handlers and hot water tanks can be efficiently serviced, removed or replaced. For example, allow adequate room for filter and coil replacement. Arrange to provide suitable wall opening(s) to replace equipment. For example, a mechanical room located on a 2nd floor or higher shall be accessible from a

high level exterior access door to avoid the use of interior stairwells when replacing large equipment. Layout of mechanical rooms shall be designed to allow for replacement of equipment without the need to remove other major equipment, piping or ducting.

4.1.3 Arrange location of controls, alarm accessories, indicators, valves, traps, cleanouts, etc., to prevent access by inmates.

4.1.4 Where a complex is served with connecting security walkways, tunnels or galleries, consider using these areas for running heating and plumbing pipes.

4.2 Central Control

The mechanical central control station shall be located in a room controlled by maintenance staff. Selected alarms shall be relayed to the 24 hour manned Main Communication Control Post (MCCP). The capability to change set points or programs shall not be available from the MCCP.

4.3 Service Chases

Design cell service chases for ease of maintenance and economy of space and provide large scale sectional drawings across critical points of chase. Provide a “mock up” of service chase with all services installed. The “mock up” shall be provided either by the consultant, through PWGSC, before tender, or specified to be provided by the successful contractor before commencing the installation of services. Mock-up shall demonstrate reasonable access to all components in the chase that may require adjustment, servicing or replacement. Access to chases shall be from corridor through secured doors as described in the Technical Criteria section A-5 Architecture-Doors and frames.

5. ENERGY CONSERVATION

5.1 General

5.1.1 The level of quality of systems provided in the institution is to be consistent with achieving the lowest possible energy consumption based on life cycle cost principles. New constructions of facilities and renovated portions of facilities shall be designed so that energy use will not exceed 1 400 MJ/m2/year, based on a national average of 4,700 Heating Degree-Days (HDD), or to meet the requirements of the National Energy Code for Buildings (2011), whichever is the lower.

5.1.2 Prepare an energy consumption analysis during the conceptual phase of design. All modelling shall adhere to the National Energy Code or another approved CSC method.

6. METERING

6.1 Provide permanent recording energy or steam flow meters in each major boiler plant, and oil or gas meters to measure fuel to the boilers.

6.2 Provide permanent meter to measure heating energy used in each major building.

6.3 Provide meters for CORCAN buildings or processes when energy usage is significant (paint baking ovens, laundry, etc.).

6.4 All meters shall be connected to the building automation system and provide both instantaneous and cumulative values.

6.5 Locate natural gas meters outside the secure perimeter for easier access by the utility.

7. FUELS

7.1 Natural gas and propane lines generally shall not be located in areas accessible to inmates. However gas may be installed where required, in kitchens, industrial areas, shops, etc.

7.2 Unless specifically requested by the project brief or project manager:

7.2.1 Propane and gasoline storage tanks shall not be installed within the perimeter security fence.

7.2.2 Vehicle fuelling stations shall not be installed within the perimeter security fence.

M-2 MECHANICAL – PLUMBING REQUIREMENTS

1. SCOPE

This section outlines the special requirements for plumbing systems associated with Correctional Service Canada (CSC) institutions. In general, this Section covers the following:

- Drainage systems
- Domestic water
- Plumbing fixtures and trim
- Plumbing in health care facilities must meet the requirements of the CSA Z317 health care codes. See M-1 Mechanical: General Mechanical Requirements.

2. RELATED DOCUMENTS

2.1 Technical Criteria Document (TCD)

SP–1 – Site Development
SU–1 – Storm and Sanitary Sewers
SU–2 – Waste Water (Sewage) Treatment
SU–3 – Water Utility

2.2 Correctional Service of Canada - Commissioner's Directives

318-9 - Water Measurement and Conservation

3. DRAINAGE SYSTEMS

3.1 Pumped Sewage

Sewage pumps should be considered only if gravity flow cannot be employed. Where such pumps are required, only the floors which cannot drain by gravity shall be pumped.

Provide duplex sewage pumps with an automatic transfer switch to alternate the unit operation, emergency power supply and high level alarm.

3.2 Blockages

In order to minimize the problem of drainage system blockage by inmates, either intentionally or in the attempt to dispose of unauthorized clothing by flushing down water closets:

3.2.1 The number and location of cleanouts in soil and waste runs and risers shall be selected to facilitate the easy removal of blockage material.

3.2.2 Where practical, locate cleanouts in areas inaccessible to inmates such as janitor closets, pipe chases, mechanical rooms, etc. Any cleanouts in inmate areas shall be secured with tamper-proof screws.

3.2.3 In inmate housing units, below-grade or concealed drain lines from water closets shall be a minimum of 150 mm in diameter.

3.2.4 Consideration shall be given to provide a screen or a sewage grinder to remove large objects, i.e., clothing, from sewage before it enters the sewage treatment system.

3.3 Floor Drains

3.3.1 Provide floor drains in corridors and cell runways, normally one per housing wing, located away from traffic areas.

3.3.2 Floor drains in areas occupied by inmates shall have grates secured with vandal-proof screws.

3.3.3 To reduce the possibility of inmates hiding or disposing of contraband, grate openings in inmate areas shall consist of multiple holes approximately 10 mm in diameter.

3.4 Traps

Exposed traps are not permitted in inmate areas.

3.5 Chases

Where two (2) cells share a common service chase, water closet connections to main stack in chase must be designed with a "Y" in order to prevent "fishing" of contraband from a cell to another.

4. DOMESTIC WATER QUANTITIES

Refer to Technical Criteria section SU-3 Water Utility.

General note: an electrically-operated valve must be provided to shut off domestic water supply in case of a disturbance in a unit. This valve is to be operable from the control post.

5. HOT WATER GENERATION

5.1 Temperature Requirements

5.1.1 Water shall be delivered at the following temperatures:

5.1.1.1 Lavatories and janitors service sinks: 38°C.
5.1.1.2 Clinical areas: 43°C.
5.1.1.3 Food Services; general use 60°C, with booster to 82°C where required by health regulations.
5.1.1.4 Washing machines: No hot water
5.1.1.5 Showers: 43°C for shower with hot and cold supplies
40.5°C maximum for showers with tempered supply only.

5.1.2 Temperature control and mixing valves shall not be accessible to inmates and shall be provided with temperature-adjusting knob and dial thermometer to measure discharge temperature.

6. FIXTURE AND FITTINGS

6.1 General

6.1.1 . Do not specify "pop-up" drain fitting within the institution fence including in the administration washrooms.

6.1.2 Flush valves must be provided for all fixtures. Reservoirs are not acceptable.

6.2 Health Care Centre (all levels)

6.2.1 Dispensary and dental operating – General purpose 302 stainless steel sink 1.0 mm thick nominal 530 x 530 x 175 mm self rimming, ledge back with undercoating and swing spout aerator tip supply with indexed hooded handles and basket strainer. (Aerators not to be used in Class A and B facilities.)

6.2.2 Dental laboratory; general purpose sink as above but with plaster interceptor.

6.2.3 Examination room; hospital type lavatory and general purpose sink.

6.2.4 Treatment room; scrub up sink. V.T. wall hung 559 mm x 483 mm lavatory with integral back, wall carriers, rigid gooseneck spout, aerator and 100 mm indexed blade handles, drain plug and perforated strainer. (Aerators not to be used in Class A and B facilities.)

6.2.5 Washrooms; vitreous china prison type WC complete with seat and prison type lavatory.

6.2.6 Cells; vitreous china prison type WC complete with seat and cover and prison type lavatory.

6.2.7 Bathtubs may be provided with lift assist devices in designated Health Care tub rooms.

6.2.8 Fit one (1) WC in the area, but not in a cell, with bed pan washer and lugs.

6.3 Maximum Institution at S-6 & S-7 Levels

6.3.1 Maximum Cells: stainless steel WC and lavatory with pushbutton valves.

6.3.2 Segregation cells: stainless steel WC and lavatory with pushbutton valves.

6.3.3 Inmate washrooms in dining areas, gymnasiums, visiting area, work spaces, library, etc.: stainless steel prison type fixtures with concealed water supplies, pushbutton operated concealed flush valves, and pushbutton hot and cold water supplies for lavatories. Access for maintenance shall preferably be from pipe chase, but if this is not practical, access shall be from security type access box.

6.3.4 Showers: Stainless steel shower panel with chrome plated 12 1/2° tamper-proof shower head with 9 litres/min maximum flow and pneumatically-activated pushbutton valve. Single temperature tempered water shall be supplied to showers, thermostatically-controlled from remote position in non-inmate area. Thermostatic mixing valve shall compensate for both temperature and pressure.

6.4 Medium Institution at S-3, S-4 & S-5 Levels

6.4.1 S-3 Unit Bedrooms: no plumbing; Common washrooms: commercial vitreous china type WC with seat and cover and vitreous china lavatory.

6.4.2 S-4 & S-5 Unit Cells: vitreous china institutional type WC with seat and institutional type vitreous china lavatory.

6.4.3 Segregation cells: stainless steel WC and lavatory.

6.4.4 Inmate washrooms in dining areas, gymnasiums, visiting areas, work spaces, library, etc.: vitreous china prison type fixtures. Water closet with seat. Water supplies and flush valves shall be as specified in 6.3.3.

6.4.5 S-3 Unit Showers: hot and cold water supplied to commercial type showers. Thermostatic mixing valve shall compensate for both temperature and pressure.

6.4.6 S-4 & S-5 Unit Showers: see 6.3.4.

6.5 Minimum Institution

Provide commercial grade fixtures. WC's shall be flush valve type

6.6 Drinking Fountains

6.6.1 Fully or semi-recessed type in all areas.

6.6.2 Do not provide refrigerated drinking fountains in inmate-occupied areas.

6.7 Urinals

6.7.1 Urinals in inmate areas where stainless steel W.C's are specified shall be wall hung with concealed flush valve if backing on pipe chase, or with exposed flush valve if not backing onto pipe chase.

6.7.2 Urinals in inmate areas where vitreous china W.C's are specified shall be wall hung with concealed flush valve. If a pipe space is not available in which to install the flush valve, provide security access box as specified in 6.11.

6.8 Service Sinks

6.8.1 Since floor receptor type service sinks are less subject to damage through inmate use, they shall normally be specified.

6.8.2 Where it is architecturally impractical to design floor receptors, specify standard mop or service sinks with rim guard and wall mounted fittings.

6.8.3 All mop and service sink faucets shall be provided with a built-in vacuum breaker.

6.9 Pushbutton valves (showers and lavatories)

Other than in an S-2 or S-3, pushbutton valves shall be vandal-resistant metering type valves. Duration of flow shall be adjustable from five (5) to sixty (60) seconds, by a control located in pipe chase. Metering cartridge shall be serviceable from pipe chase without disconnecting inlet supply. No inlet water shall flow through the timing mechanism.

6.10 Access box

Security type access box shall have 1.9 mm type 304 stainless steel cover secured with vandal-resistant screws.

Frame shall be 0.90 mm galvanized steel frame with back mounting flange and front reinforcing hemmed edge.

M-3 MECHANICAL – FIRE PROTECTION REQUIREMENTS

1. SCOPE

This section outlines the special requirements for fire protection associated with Correctional Service Canada (CSC) institutions.

2. RELATED DOCUMENTS

2.1 This section should be read in conjunction with the following Technical Criteria Document (TCD) sections as applicable:

G-2 – Fire Authorities and Classification
A-13 – Control Posts
E-6 – Emergency Electrical
E-9 – Fire Alarm

2.2 In addition the following standards and guidelines shall be observed as applicable:

- National Building Code of Canada
- National Fire Code of Canada
- National Fire Protection Association (NFPA) 13 – Standard for the Installation of Sprinkler Systems
- National Fire Protection Association (NFPA) 14 – Standard for the Installation of Standpipe and Hose Systems
- PWGSC Standard and Guideline MD 15500 – Fire Protection National Master Specification (NMS) Division 15.

3. GENERAL DESIGN REQUIREMENTS

3.1 Firefighting equipment in living unit and inmate circulation areas shall be designed for maximum control by staff. Design systems to minimize opportunities for vandalism, sabotage, the hiding of contraband and the use of the system or system components as weapons.

3.2 The fire standpipe system should be combined with the automatic sprinkler system in order to economize on the distribution piping. Piping and valving shall be such that the sprinklers on a range or portion can be shut off after a fire or vandalism to permit repair yet still permit operation of the fire standpipe and hose cabinets in the area.

4. SPRINKLER SYSTEM

4.1 Location

Sprinkler systems shall be installed in all Living Units; in all new buildings and in buildings receiving major renovations except:

4.1.1 Unless otherwise required by code, sprinklers may be omitted from small detached buildings having free-egress, in which there are no sleeping units and which do not constitute an exposure hazard to the principal functional areas of the institution, where such buildings are:

4.1.2.1 Not more than two storeys in height and less than 500 m^2 in area, or

4.1.2.2 One storey in height and less than 1000 m^2 in area.

4.2 Type

Sprinkler systems shall be generally of the wet type with the following exceptions:

4.2.1 Dry type system is to be used in areas subject to freezing.

4.2.2 Pre-action type as used in meeting the requirements of clause 7 for the protection of the Main Communication and Control Post (MCCP).

4.3 Zone Shut Off Valves

It is known that sprinklers located in inmate occupied areas are more likely to be activated, either because of vandalism or purposely set fires, than in a standard building. For this reason, provide electrically supervised manually operated control valves to aid in quickly shutting off the water without disrupting sprinkler protection to other areas of the building after it has been determined that sprinkler fire suppression in the immediate area is not required. These control valves shall be capable of quickly restoring water to the system if a fire is started in the affected area.

4.3.1 The zone valves shall be located in secured areas.

4.3.2 Each zone valve shall be clearly identified using a metallic tag as to what it controls. Cell numbers and/or range identification are to be clearly indicated.

4.3.3 Each zone controlled by a shut off valve shall have an alarm and flow switch.

4.3.4 Provide a minimum of one shut off valve for each cell block wing. Further subdivision of zoning to each side of the range and upper and lower floors is desirable if feasible.

4.4 Sprinkler Heads

4.4.1 Sprinkler heads in cells must be of the type which cannot be used to secure or anchor a rope like object to be used by the inmate for self destruction by hanging. If a rope or string can be secured to the head it shall not support a weight of more than 50 kg without breaking or operating the sprinkler system.

4.4.2 While not exclusive, the following list of sprinklers meets the CSC Standard of Acceptance:

- *Pendant Type*
  - Tyco Raven Quick Response Pendant Institutional Sprinkler.
  - Viking HQR-2 Institutional Quick Response Pendant.
  - Reliable - RASCO PEND ZX-SR-INST
  - Viking Horizon Model H Residential/Extended Coverage Pendant Sprinkler.
- *Side wall Type*
  - Tyco Raven Quick Response Horizontal Sidewall Institutional Sprinkler.
  - Reliable – RASCO HSW ZX-SR-INST
  - Viking - HQR-2 Institutional Quick Response Pendant

4.4.3

4.4.4 Provide protective guards on heads in MCCP, Janitor Closets and electrical and mechanical rooms to prevent the accidental impact of objects with the heads causing unwanted sprinkler operation.

4.4.5 Dry pendant type sprinklers may be used on a wet system in areas subject to cold temperatures such as walk-in refrigeration/freezer units.

5. STANDPIPE AND HOSE SYSTEM

5.1 Where Required

Standpipe and hose systems shall be installed in all locked Living Units and in all buildings of more than 3 storeys or 14 m in height and of 3 storeys or 14 m or less in height when the building area exceeds the following with no exemption to sprinklered buildings:

Height (Storeys)	Area (m^2)
1	2000
2	1500
3	1000

5.2 Non-Inmate Locations

Fire hose and cabinets, not in inmate housing units or other inmate oriented spaces, shall be unlocked standard type as required by National Building Code of Canada (NBC) except door shall be solid steel without a glazed viewing panel.

5.3 Minimum Institutions

Fire hose cabinets in housing units shall generally be standard type to meet National Building Code of Canada. However, since standard type soft hose must be fully extended before water will flow, consideration should be given to installing hard rubber hose on continuous flow reels if building configuration will not readily allow this full extension. Cabinets shall be unlocked. Hose length shall depend on the distance required to travel to meet the most remote location and shall conform to NFPA 14.

5.4 Medium and Maximum Institutions

In institution living areas, inmate circulating corridors and other inmate oriented spaces such as gymnasium, classrooms, library, vocational shops industries etc. provide standpipe and hose system as follows:

5.4.1 Fire hose cabinet shall be of steel, recessed where possible, with solid steel door without viewing window and shall be equipped with a 65 mm hose connection for fire department use and a 38 mm connection with adapter to 25 mm hose. Cabinet shall not contain a hose wrench as it may be used as a weapon.

5.4.2 The hose shall be 25 mm inside diameter rubber not exceeding 30 m in length and shall be mounted on a continuous flow hose reel. Water shall be admitted to the hose reel by a manually operated valve in the cabinet or in the line feeding the cabinet. Use of an automatically operated valve admitting water to the hose reel is not permitted as they can inadvertently shut off the water if several metres of hose is re-racked. The hard rubber hose is required because, unlike the standard soft hose, it cannot be easily slashed and if it is damaged it can be readily detected by visual inspection.

5.4.3 Fire hose nozzle shall be 25 mm size constructed of brass and shall be easily adjusted under all pressures through the complete range of; off, fog straight stream, and wash-down stream.

5.4.4 Fire hose cabinets at S-3 and S-4 Levels shall be unlocked.

5.4.5 At S-5 to S-7 Levels, to prevent inmate misuse of the hoses, the following features are required:

4.1.5.1 Provide means to shut off the water to the living unit hose cabinets from within the security control post. This is to be accomplished by either having electrically supervised manual shut off valves in the post or by ULC certified electrically controlled valves installed in a secure area, with switch in the control post.

4.1.5.2 Provide means to shut off the water to the cabinets in the inmate circulating corridor and inmate oriented spaces from a secure area, without disrupting the water supply to sprinklers or fire hose cabinets in other areas. Shut off to be either electrically supervised manual valve or ULC certified electrically controlled valve.

4.1.5.3 The cabinets shall be specially designed of heavy steel so that inmates cannot force open the door for unauthorized use. The doors shall either be secured with padlock or preferable, if cabinet can be recessed into security control post, a locking latch operable only from within the control post. If padlocks are used all doors shall be keyed alike. Padlocks and hasps are to be used on cabinet doors rather than cylinder locks or security type locks, since they can be broken off to gain access if the key slot is plugged with foreign matter or key is misplaced. The padlocks shall be provided by the owner.

5.2 Identification

Cabinet doors shall be painted red and be identified with graphic symbols or bilingual signs reading FIRE HOSE.

6. FIRE EXTINGUISHERS

5.1 General

Fire extinguishers shall be installed in accordance with National Fire Code of Canada requirements except as required in this section.

5.2 Water Type

5.2.1 Shall be pressurized type of 9 ℓ capacity.

5.2.2 For Maximum Institution and Medium Institution at S-5 Level, extinguishers required in living units, inmate circulating corridor and gymnasiums shall be in locked cabinets. Locks shall be as for fire hose cabinets and all keyed alike.

5.3 Water extinguisher

A water extinguisher shall be provided in every hose cabinet and generally shall be located so that the travel distance to an extinguisher does not exceed 23 m. However in areas requiring locked cabinets, permission may be given to increase the distance between extinguishers so that they will only be required in each fire hose cabinet. Dry Chemical Type

5.3.1 A 5 kg or equivalent multipurpose dry chemical extinguisher shall be installed in workshops or similar areas where flammable or combustible liquids are stored or handled. They shall be located so that at least 1 extinguisher is within 15 m of hazardous areas.

5.3.2 Dry chemical extinguishers must be of the stored pressure type. Cartridge operated extinguishers are not permitted as the cartridge could be used a weapon.

***5.4 Carbon* Dioxide Type**

Carbon dioxide extinguishers of 5 kg or equivalent capacity shall be provided for the protection of electrical and electronic equipment. They shall be located so that at least 1 extinguisher is within 7.5 m of such equipment.

5.5 Class K Wet Chemical

5.5.1 Class K fire extinguishers shall be provided for hazards where there is a potential for fires involving combustible cooking media (vegetable or animal oils and fats). A Class "K" wet chemical portable extinguisher of 6 L capacity shall be installed within 10 m of all commercial cooking appliances producing grease laden vapours.

5.5.2 A sign shall be posted next to the Class K extinguisher stating the "Fixed extinguishing system shall be operated prior to the use of the Class K portable extinguisher." This is required to isolate the fuel or energy source associated with the cooking appliance.

5.6 Clean Agent

Listed special purpose clean agent portable extinguishers shall be provided for the protection of areas involving fine electronic equipment such as in central computer rooms in RHQ and NHQ and in MCCP/CER's. Dry chemical extinguishers shall not be used for protection of MCCP/CER's.

5.7 *Supplier*

The location of all fire extinguishers shall be shown on the contract drawings. However, CSC shall supply and install all hand extinguishers that are not required to be located in a cabinet.

7. MAIN COMMUNICATION CONTROL POST (MCCP)

7.1 Except as otherwise noted in this Section, where the building containing the Main Communication and Control Post (MCCP) and Communication Equipment Room (CER) is required to be sprinkled, the sprinkler system in these rooms shall be of the single-interlock pre-action type, activated by heat detectors (no cross zoning) installed at ceiling level. An easily accessible, electrically supervised manual sprinkler control valve shall be located near the exit from the MCCP.

7.2 15 lb CO_2 fire extinguishers shall be provided at the exit from the MCCP and CER rooms.

7.3 Ventilation for the UPS battery units shall be provided in accordance with Canadian Electric Code C22.1[1]

7.4 In lieu of a pre-action sprinkler system, institutions may consider the use of a listed clean agent (or similar) fire suppression system. All systems so installed to comply with this sentence shall be submitted via a formal project submission to CSC Technical Services, Engineering & Maintenance at National Headquarters.

8. WATER SUPPLIES

8.1 The water supply in litres per second for correctional institutions shall be not less than two times the square root of the largest single floor area in square metres, to a maximum of 130 ℓ/s. Floor area means the space on any storey of a building between exterior walls and required firewalls.

8.2 The water supply stipulated in (.1) shall be available for a period of not less than 2 h.

8.3 Every hydrant shall be capable of flowing not less than 30 ℓ/s of water at a residual pressure of not less than 450 kPa (gauge).

8.4 Water supply capacity for buildings shall be sufficient to meet the requirements for sprinkler systems and standpipe and hose systems.

8.5 Fire protection water supply entry into buildings shall be controlled with an above ground post indicator valve (PIV).

8.6 When available, the water supply shall consist of 2 separate connections from a municipal water works system.

8.7 When a municipal water works system is not adequate to meet the requirements stipulated in the previous clause, it shall be augmented by on site water supply from tanks or reservoirs with at least 2 fire pumps. Each fire pump shall be capable of supplying the water supply requirements based upon 120 percent of its rated capacity.

9. FIRE PUMPS

9.1 Fire pumps shall be automatic in operation and arranged to remain in operation until manually shut down.

9.2 Fire pumps shall be electrically interconnected with the fire alarm system such that their operation is indicated at the central alarm and control facility.

9.3 Where adequate standby power is available the two fire pumps shall be driven by electric motors with at least one of them connected to the emergency power supply.

9.4 Where it is not feasible to provide reliable standby power, one pump shall be electrically driven and the other shall be driven by an internal combustion engine.

M-4 MECHANICAL – HEATING, VENTILATING & AIR CONDITIONING REQUIREMENTS

1 SCOPE

This section outlines the basic HVAC criteria for Correctional Institutions and provides design guidelines for these systems.

Heating, ventilating and air-conditioning in health care facilities must meet the requirements of the CSA Z317 health care codes. See M-1 Mechanical: General Mechanical Requirements.

2 RELATED DOCUMENTS

2.1 This section should be read in conjunction with the following TCD sections as applicable:

A–3 – Architecture – Grilles, Mesh and Screens
A–8 – Architecture – Building Acoustics
M–1 – Mechanical – General Mechanical Requirements, and
E–6 – Electrical – Emergency Electrical

2.2 In addition the National Master Specification (NMS) for HVAC, Division 15000 shall be observed as applicable.

3 ENVIRONMENTAL COMFORT LEVELS

Ventilation systems shall be designed as per ASHRAE guidelines and ASHRAE standards 55[1] and 62[2].

4 AIR CONDITIONING

4.1 Mechanical cooling shall be provided in the following areas:

4.1.1 Office areas
4.1.2 Security control posts, duty rooms, etc.
4.1.3 Food services supervisor and general offices
4.1.4 Computer equipment and telecommunication rooms. Computer room air conditioning systems shall be to ASHRAE latest recommended standards and to CSC “Computer Facility Guidelines”

4.2 Except as provided in 4.3, air conditioning shall not be provided in inmate-occupied areas unless special approval has been obtained from NHQ – Technical Services.

4.3 Exceptions

4.1.5 Hospitals and health care centres including related cells.
4.1.6 Industrial areas where processes performed require temperatures which cannot be maintained without mechanical cooling.

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[1] ANSI/ASHRAE Standard 55-2010 – Thermal Environmental Conditions for Human Occupancy (ANSI approved) – American Society of Heating, Refrigerating and Air-Conditioning Engineers including Errata

[2] ANSI/ASHRAE Standard 62.1-2010 – Ventilation for Acceptable Indoor Air Quality (ANSI Approved) American Society of Heating, Refrigerating and Air-Conditioning Engineers Including Errata
ANSI/ASHRAE Standard 62.2-2010 – Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings (ANSI/ASHRAE Approved) American Society of Heating, Refrigerating and Air-Conditioning Engineers Including Errata

5 HEATING PLANT

5.1 Guidelines

Investigate and provide cost study of alternative heating methods, heating media and fuels, and recommend specific systems at the conceptual design stage, giving sufficient supporting data to justify recommendations, taking the following items into consideration.

5.1.1 For ease of operation and maintenance, preference is to be given to low or medium temperature hot water heating systems. Steam or high temperature hot water systems shall be avoided.

5.1.2 Plant economic design evaluation shall take into account the level of operator certification and length of time of mandatory supervision required by the Provincial boiler and pressure vessel regulations.

5.1.3 To facilitate maintenance, especially in plants not requiring 24 hour supervision and to eliminate or shorten underground distribution lines, the preferred location of the boiler plant is within the institution fence adjacent to the Works and Engineering Section of the complex.

5.1.4 In campus-style institutions, consider designing the heating system with separate boilers for individual buildings or small groups of adjacent buildings. CSC promotes the installation of geothermal systems, solar panels, direct contact heat exchangers, etc.

5.1.5 Buried underground heat distribution systems:

5.1.5.1 Consideration should be given to installing insulated heating pipes on a continuous concrete pad slightly below grade covered with inverted “U” precast concrete box, polyethylene and 300 mm of earth. Consider using summer boilers where the summer load is low compared to the winter load and avoid systems requiring long heat distribution lines to be kept energized to provide for a small summer load.

5.2 Boiler Standby

5.2.1 For Medium and Maximum institutions, boilers shall be sized so that if one boiler fails, comfort conditions in the critical spaces can be maintained and other areas of the complex can be kept above freezing under winter design conditions.

5.2.2 If separate boilers in the same boiler room are used for space heating, process heating, and domestic hot water, review the possibilities and cost of interconnecting the boilers to allow for maintenance and repairs while still providing all services.

If electrical heating is used, standby heating to satisfy conditions outlined in 6.2 shall be provided in the event of a main power failure.

5.3 Fuel

5.3.1 Investigate the availability and reliability of alternate fuels and prepare a comparison of heating costs and recommendations.

5.3.1.1 Investigation to include possibility of using combination of fuels such as oil and gas to obtain interruptible gas rates, off peak electrical use with oil or gas. etc.

5.3.1.2 Cost comparison to include total owning and operating costs including capital, maintenance, staffing, and fuel costs.

5.3.2 Where local fuel delivery is readily available provide a minimum fuel storage capacity of seven (7) days based on the period having the maximum continuous heating load. Use a fourteen (14) day period minimum where local fuel delivery may not be reliable.

6. HEATING AND VENTILATION

6.1 General

6.1.1 Ceiling Access

Keep to a minimum the installation of equipment such as mixing boxes, dampers, forced flow heaters etc., in ceiling spaces in inmate-oriented areas. If equipment must be installed in ceiling spaces of these areas:

5.1.1.1 Access panel must be secured so that special tools are required for removal.

5.1.1.2 Where possible, equipment shall be located so it can be serviced from below, with the equipment directly over the access panel, preventing access into the ceiling space.

6.1.2 Rooftop Units

Because of operating and maintenance difficulties, rooftop units without heated service spaces normally shall not be installed in locations with severe winter climate.

6.2 *Cells*

6.2.1 Comfort Condition

5.1.1.1 To ensure comfort levels are maintained in the cells: provide sufficient zoning so that cells with different exposures have separate temperature controls.

5.1.1.2 Design air supply to eliminate drafts in occupied space, taking into consideration that the cells are small, the occupant spends considerable time in the cell, is not able to rearrange the furniture to avoid a draft, and that the grilles must meet security requirements, which limits adjustability and air diffusion patterns.

5.1.1.3 Temperature control must be designed so that one occupant cannot upset the temperature of adjacent cells by opening his window, closing off his return air grille, providing heat source to a thermostat, etc.

5.1.1.4 The system shall be designed to keep the temperature in the cells between 21°C and 23°C during the heating season.

6.2.2 Ventilation in wet cells

5.1.2.1 Exhaust rates as per ASHRAE Standard 62 [3]

5.1.2.2 Cells shall be maintained at a negative pressure with respect to the corridor.

[3] ANSI/ASHRAE Standard 62.1-2010 – Ventilation for Acceptable Indoor Air Quality (ANSI Approved) American Society of Heating, Refrigerating and Air-Conditioning Engineers– Including Errata

5.1.2.3 Heat exchangers shall be provided in order to recover heat from exhaust air.

6.2.3 Security

In Medium and Maximum Institutions, since inmates spend much of their time in the cells unsupervised, cell heating and ventilation systems shall meet the following requirements:

6.2.3.1 Supply and exhaust grilles in Maximum Institutions must not be removable from within the cell. In Medium Institution, if it is not practical to design systems so that grilles are not removable from inside the cell, use security fasteners so that special equipment is required to remove the grilles.

6.2.3.2 For cells with combination stainless steel fixtures, consider using an integral punched grille for return, exhaust or supply air.

6.2.3.3 Installation shall minimize the possibility for occupant to anchor a string or rope to use for self-destruction by hanging. Grilles with bars or heavy screens installed in the ceiling will not be acceptable. The installation of S-vents or a similar type of grill shall be used for Segregation and Maximum cells.

6.2.3.4 Limit the opportunity for inmates to hide contraband in grilles or heating units. No access panels or cleanouts shall be installed in cells.

6.2.3.5 Valves, thermostats, air vents etc. shall be adjustable and serviceable from outside the cells.

6.2.3.6 Grilles or heating units must be ruggedly constructed to resist abuse and to minimize possibility of them being used as weapons. Grilles to have closely-spaced grid openings to discourage hiding of contraband. Check with project manager to determine whether grilles will be part of the contract or whether they will be manufactured by CSC Industries and supplied by the owner.

6.2.3.7 Ductwork to adjacent cells shall be divided so that there is a minimum of four 90° elbows between cells to impede verbal communication and the exchange of contraband. If service chase is used as return air plenum, provide stub duct from each cell with 90° elbow and minimum 400 mm length of duct.

6.2.3.8 Floor grilles shall not be specified as they can be used to aide in fermentation to produce wine or conceal and pass contraband. Floor grilles also collect dust and dirt, and will collect water if sprinkler system is activated.

6.2.4 Heating

6.2.4.1 In many of our existing institutions cell temperature control is accomplished by thermostatic sensors in the return air ducts from one or more cells, controlling zone values or mixing dampers. This has not been fully satisfactory for the following reasons:

a) An occupant may purposely change the temperature of neighbouring cells by opening his window, hanging a wet towel on his return air or adding a heat source, i.e., hair dryer, to the return air.

b) Occupants have a habit of covering their supply and exhaust grilles, upsetting the temperature control.
c) Not all occupants wish to have their cells at the same temperature and may wish changes from day to night. If one occupant opens a window to cool his cell the system will provide more heat to all cells thus causing others to overheat and open windows.

6.2.4.2 One method of overcoming these cell temperature control problems is to install a radiant floor heating system.

6.2.4.3 To minimize inmate hiding of contraband, the grilles in the convector cabinet shall have round holes not more than 6 mm in diameter.

6.2.4.4 Convector damper shall be sliding type that can be manually adjusted from fully open to complete closure to convector top openings and shall have a small knob not removable from cell side of cabinets. Design of the knob shall be such to make it impossible to secure a rope for self-destruction by hanging.

6.2.4.5 Convector cabinet shall be constructed of minimum 2.6 mm steel, and shall run wall to wall. Top shall be supported by wall strip hangers, and bottom shall be secured with security screws or pop rivets to floor mounted angle iron. The angle iron shall run the total length of the cabinet and shall be secured to the floor inside the cabinet.

6.2.4.6 No valves, air vents or any other fittings that may require maintenance shall be installed in the cell cabinets.

6.2.4.7 Cabinets must be secured in place so that they can only be removed by service personnel with special tools, drills, etc.

6.2.4.8 It is recommended that the amount of cell radiation installed be based on lower water temperatures than used for designing the rest of the building, as cleaning of fins will be very difficult, and if fins do become dirty over time, cell temperature could still be maintained.

7. CONTROLS

7.1 Thermostats and sensors

Since occupants will attempt to sabotage the heating system operation, thermostat and sensor type and location, in inmate oriented areas, must be carefully chosen using the following guidelines:

7.1.1 Thermostats shall not be located in cells.

7.1.2 Any type of standard guard is likely to be breeched.

7.1.3 Consider installing temperature sensors in return air ducts.

7.1.4 For forced flow units consider installing sensor within the cabinet.

7.1.5 Locating sensors above the reach of inmates may be acceptable.

7.1.6 Sensors shall not be located so that one inmate in his cell can affect the temperature of a neighbouring cell.

7.2 Building automation system (BAS)

Controls for HVAC systems shall be connected to a CSC building automation network (BAS) that is accessible to technical personnel. The BAS may be connected to CSC's Corporate Network via a managed connection for administrative, technical and vendor access as necessary.

The controllers and command posts shall not be accessible to inmates.

The BAS specification shall require BAC net. Systems shall be sourced from established manufacturers with a track record of long-term system support.

8. SECURITY GRIDS

8.1 Location

8.1.1 Steel security grids are required in Medium and Maximum Institutions to prevent inmate movement through ducts which have a minimum dimension larger than 125 mm and a total cross sectional area greater than 54 000 mm^2 if the ducts pass from:

8.1.1.1 One major inmate department to another.

8.1.1.2 Inmate area to non-inmate area.

8.1.1.3 Inmate area to outside.

8.1.1.4 Outside to MCCP or Guard House.

8.1.2 The duct work design shall minimize the number of openings requiring security grids and there shall be no duct openings larger than 54 000 mm^2 through control post walls or ceilings.

8.2 Construction

The security grids shall be as follows:

8.2.1 Structural quality steel bars not less than 12 mm diameter on 137 mm centers (2 bars of radius 6 mm plus a 125-mm gap = 137 mm), except that where the opening is between an inmate area and a security corridor the bars shall be of Tool Resistant Homogenous Steel.

8.2.2 Maximum bar length without cross bars not to exceed 610 mm and all bars shall be welded together where they intersect.

8.2.3 Bars to be welded to a flat steel frame secured to masonry/concrete. Acceptable method: bolts set a minimum of 50 mm into expansion shields. Bolt spacing not exceeding 400 mm on centers. No less than 4 bolts per grille.

8.2.4 Refer to Technical Criteria Section A–3 – Architecture – Grilles, Mesh and Screens for steel specifications.

8.3 Mechanical Room Openings

Exterior Openings in mechanical rooms for air intake, exhaust, etc., in Maximum Institutions and Medium Institutions at S-5 Level, which are less than 3.5 m above grade or above an accessible roof, shall be protected with security grids to prevent inmate entry. Exterior openings in mechanical room in Medium Institutions at S-3 or S-4 Level, and those more than 3.5 m above grade in Maximum Institutions and Medium Institutions at S-5 Level shall have louvers securely fastened in place with fastenings removable only from the interior, but need not have security grids.

8.4 Security Corridor

Locate ducts to minimize the number of openings larger than 54 000 mm^2 required through the security corridor walls.

8.5 Grilles

8.5.1 Aluminum bars from ventilation grilles have been used by inmates to fabricate contraband knives. These aluminum knives are not detected by the metal detector.

8.5.2 To reduce the chance of this occurring, all grilles in inmate-oriented areas such as kitchens, dining areas, workshop, inmate corridors, recreation areas, library, chapel, etc., that are less than 3.4 meters above the floor shall be made of steel or iron in all Medium or higher level institutions.

9. AIR SYSTEMS CONTROL

9.1 General

Chemical agent (tear gas) may be used for riot control in inmate-occupied areas and corridors with inmate movement. The ventilation systems should be designed to minimize the spread of tear gas-laden air to non-inmate areas remote from the source.

9.2 MCCP

Special attention should be given to the design of the ventilation system in the main communication control post as this post must stay in operation at all times. Tear gas will have an adverse affect on equipment, and systems should be designed so that the MCCP will not become contaminated by gas or smoke from inmate areas. The room should have a positive pressure compared to the surrounding spaces.

9.3 Health Care Unit

The health care unit shall have a separate ventilation system to ensure that neither the cells nor the operations area will be contaminated if tear gas is used in other areas of the institution.

9.4 Control Post

Design of the Security Control Posts ventilation system in Maximum Institutions and Medium Institutions at S-5 Level shall prevent the control posts from being contaminated by smoke or tear gas from inmate-oriented areas of the Institution. Secure refuge areas behind D Level posts must also meet this standard. The control post shall be maintained with positive pressure to avoid any contamination.

9.5 Living Unit System Design

For “protecting in place” during a fire and to facilitate tear gas use and purging, Medium and Maximum living units (excluding S-3 units) shall be designed with the following features: a ventilation system for normal use (including supply and exhaust/return air fans) and one separate end-of-range emergency exhaust fan per level of the living unit. The emergency exhaust fans shall be capable of providing four (4) air changes per hour.

9.5.1 Under normal conditions, the living unit ventilation system alone shall operate.

9.5.2 If there is tear gas use or a fire occurrence, to prevent cross contamination or the need to shut down ventilation systems serving a number of ranges, the end of unit exhaust fan shall be used.

9.5.3 Consideration shall be given to provision of a separate ventilating system for each living unit wing. Submit cost and design implications of this requirement at preliminary design submission stage.

9.5.4 For each living unit ventilation system, provide two (2)-three (3) position (“OFF”-“AUTO”-“ON”) manual switches in the control post to control the ventilation system supply and return fans separately. .

9.5.4.1 In the “AUTO” position, the ventilation system shall operate normally, controlled by the building control system.

9.5.4.2 The "OFF" position shall over-ride all other controls and shut the ventilation system down.

9.5.4.3

9.5.4.4 When return fan is in "ON" position it shall exhaust 100% to outside.

9.5.4.5 When supply fan is in "ON" position it shall supply air to the living unit but shall not re-circulate air from the wing being controlled.

9.5.4.6 Red indicator light shall be on when switch is not in "AUTO" position, to indicate abnormal system status.

9.5.4.7 Since these controls are for emergency use only and will seldom be used:

a) Design the ventilation supply system to minimize possibility of coil freeze- up, but size the supply air heating coil for normal operation, not for 100% outdoor air at winter design conditions.
b) Consider re-circulating air from other areas of the building when supply fan is in "ON" position.
c) Freeze protection shall override "ON" position of supply fan to prevent coil freeze-up.

9.6 Living Unit. System Operation

During tear gas use

9.6.1 Before using tear gas, turn the living unit ventilation system supply and return fan switches to "OFF".

9.6.2 To purge area after gas use, turn both switches to ON.

9.6.3 After the area has been purged, turn the living unit ventilation system switch to "AUTO".

9.6.4 If quick exhaust is required, the end-of-range emergency exhaust fans may be turned ON. However these fans must be turned off before turning the ventilation system to "ON" or "AUTO". The end-of-range fans are not provided with heated makeup air so they will cool down the range considerably in cold weather and should be used with caution to prevent possible occupant discomfort or freezing of piping or equipment.

10. SPECIAL VENTILATION

10.1 Smudging

This section provides guidelines for dedicated air exhaust in designated group rooms used for smudging in accordance with applicable CD's[2]

10.1.1 Locations where smudging may take place

10.1.1.1 The following locations will be supported with a dedicated air exhaust system as described below:

a) Designated Sacred Space within the Spirituality, Chaplaincy or Aboriginal Services area of an institution.
b) Designated room in a standalone Aboriginal Cultural Centre or building.
c) Parole Hearing rooms.
d) Designated program room in a standalone program building or/and isolated wing of a building used for programs.

10.1.1.2 The following locations used for smudging as outlined in CD 259 and as directed by the Institutional Head, shall not be supported with a dedicated air exhaust system:

a) Inmate cells or bedrooms, including in segregation.
b) Private Family Visits space;
c) Any other space not noted above.

10.1.2 Requirements for ventilation related to smudging:

In the above-noted group rooms where smudging may take place shall have an exhaust system that vents directly to the exterior of the building. This is to prevent the transfer of smoke to other areas of the building.

The rooms used for smudging should, if possible, be located on the perimeter of the building.

10.1.2.1 Technical Requirements:

The minimum supplemental exhaust shall increase the normal air changes supplied by the existing ventilation system by two (2) air changes per hour. The maximum increase shall not be more than four (4) air changes per hour.

This can be achieved by:

- An insulated wall fan unit installed on the exterior of an outside wall of the room so that the unit can exhaust directly to the outdoors.
- A duct system with an internal fan that is ducted directly to the outdoors.

The following applies to either approach:

10.1.2.2 There shall be a manual switch with a sixty (60) minute timer.

10.1.2.3 There shall be a controlled damper on the return vent(s) for the room. The switch should be set up so that when the fan is turned on, the damper on the return vent(s) is closed. This will prevent the smoke from returning into the building ventilation system.

10.1.2.4 The supply vent(s) to the room will remain active. This may cause the ventilation system to be out of balance for a short time.

10.1.2.5 Care must be given to the placement of the exhaust vent so that it is not near operable windows, doors, or ventilation intakes to adjacent areas, in order to prevent the transfer of smoke back into the building.

10.1.2.6 There is no need to weatherstrip the room door.

10.2 Airborne isolation rooms within Health Care Centres

Airborne isolation rooms (negative pressure rooms) shall be designed as per *CSA Z317.2.*

10.3 Other

10.3.1 Provide special ventilation systems as required for carpenters shop, paint shop, Corcan laundry room, welding shops, automotive repair areas, hobby shop etc. Design shall be to ASHRAE standards and shall be designed taking into account that users will attempt to sabotage the systems:

10.3.1.1 Underfloor exhaust systems for carbon monoxide removal should be avoided, as they are easily plugged and made ineffective.

10.3.1.2 Providing appropriate portable equipment may be the most suitable solution for some ventilation requirements.

11. ARMOURY

11.1 Environment control

11.1.1 Temperature must be controlled in the armoury within the range of 1°C to 27°C.

11.1.2 Relative humidity shall be maintained below 50% within the armoury.

11.1.3 The armoury shall be cooled during summer.

11.1.4 Make-up air shall come from adjoining rooms by transfer grilles.

11.1.5 A slot exhauster type fume hood and ventilated cabinet (storage closet) shall be installed in the armoury. As solvents are used to clean the firearms, they shall be stored in the ventilated cabinets and used under the fume hood. Fume hood to be designed as per ACGIH standards.

11.1.6 Total evacuation airflow shall be 160 litres/second, including that of the fume hood, storage closet, and main room.

11.1.7 When beneficial, recover heat from exhaust air with heat exchanger.