1.1 **GENERAL**

1.2 Related Technical Requirements

1.3 Coordination Requirements

2.1 **MATERIAL AND DESIGN REQUIREMENTS**

2.2 General

.1 All interior building lighting shall be supplied from 120/277 volt power systems.

.2 Lighting design shall incorporate the principles of sustainability and its products and systems shall be energy conserving, long life, have a low cost of ownership and be accessible for service and maintenance.

.3 For interior building lighting solutions, preference shall be given to (LED) light sources.

.4 Daylight harvesting opportunities shall be implemented in areas where natural daylight is available.

.5 Uniformity and low brightness contrast shall be achieved by judicious use of luminaires and their locations.

.6 All lighting shall be designed to suit the task and task location rather than the general lighting. Latest versions of ASHRAE 90.1, IESNA and WorkSafeBC guidelines shall be taken into consideration and calculations submitted where requested.

.7 As a general rule, the following task lighting levels shall be used:

   .1 Offices 500 lux maintained.
   .2 Classrooms and Seminar Rooms 500 lux maintained.
   .3 Corridors 100 lux maintained.
   .4 Washrooms 150 lux maintained.
   .5 Special areas such as laboratories, Audio/Video rooms, drafting rooms, etc., in accordance with the user’s task requirements and IESNA recommendations.

.8 When mounting luminaires in high ceiling spaces, consideration must be given to ensure access for maintenance such as lamp and ballast changing. The use of scaffolding is discouraged. Indoor lighting shall be accessible either from ladders on flat surfaces such as floors or stair landings or from powered lifts with a maximum lift of 6.1 m. Building access, floor construction, and elevators shall permit entry and use of existing SFU lift equipment for proper and safe maintenance. Lift can pass through a standard 3’x7’ door opening. If special equipment is required for lighting maintenance, then the consultant shall, prior to tender, prepare and submit maintenance plan to SFU for review and approval and it shall contain documentation describing the special equipment and a maintenance schedule and spare parts list.
The lighting design proposed for all public areas such as corridors and stairways shall ensure the life safety of building occupants at all times and shall also minimize lighting energy required to zero, if possible, when the building is un-occupied. (i.e. lights off until occupancy has been detected or an emergency has occurred). A portion of the lighting fixtures shall be wired to an emergency power panel if an emergency generator is available. Lighting circuits fed from emergency power panels shall be arranged so that they may be switched or dimmed during normal operation.

Non-linear specialty fixtures such as pot lights, cylinders, wall sconces, wall washers and other decorative lighting shall be minimized and shall not exceed 10% of the total quantity of fixtures in the building project. When used, these luminaires shall not be enclosed and shall incorporate vertically aligned medium base screw-in LED lamps.

In general, Metal Halide (MH) lighting solutions are not acceptable. In exceptional circumstances where MH is required to achieve the lighting design requirements then Ceramic Metal Halide lamps shall be used and shall be consistent with ANSI standards, and shall be equipped with compatible 120 volt ANSI compliant ballasts.

Banks of multiple switches shall be labeled to avoid confusion.

2.3 Lamps

Lamps shall be the longest life available.

Use of LED lamps is encouraged and as substitutes for traditional applications. LED lamps shall be Energy Star rated.

2.4 Ballasts

All fluorescent lighting ballasts shall operate from 120 volt input voltage and shall be instant start electronic type with standard ballast factor. Ballasts shall have parallel lamp operation.

Ballast output frequency shall be greater than 42 kHz.

Dimming ballasts shall be instant start with 0-10 volt control.

Ballasts shall have lamp end-of-life detection and shutdown circuitry that meets ANSI standards.

2.5 Lighting Controls

Lighting controls will follow ASHRAE 90.1 requirements, as well as the Technical Requirements in this section.

All interior lighting shall have controls such that when the lighting is not needed, it will automatically be either turned off or dimmed to a low output condition.

For new building projects, addressable devices and systems form the control structure for lighting. These systems are to operate independently of the BAS.

Occupancy sensors using microphonic technology are preferred, and may be either line voltage or low voltage types. Low voltage occupancy sensors with 1 or 2 poles and local power packs are preferred. Slave power packs are not acceptable. The occupancy sensor time delay settings shall be adjusted to 10 minutes for offices, classrooms or theaters and 20 minutes for washrooms.
.5 Offices, classrooms, and lecture theatres shall have light control switches at all entrances, exits and vestibules. These interior spaces shall also have occupancy sensors, mounted at a high level in a corner and arranged for semi-automatic operation such that manual operation of the local switches is required to energize the lighting while occupancy sensors and local switches will de-energize the lighting. Large spaces may need more than one sensor.

.6 Corridors, lobbies, atria and similar public spaces shall be controlled by the BMS system and shall also have occupancy sensors, mounted at high levels, and arranged for full automatic operation. The BMS system shall energize lighting in these areas in the early morning and will also disable the occupancy sensors in these areas during the daytime occupied condition. Late at night when the building is un-occupied, the BMS system will energize the occupancy sensors and lighting in these areas will be turned off automatically once the un-occupied sensor time-out period has expired. The occupancy sensor time delay settings shall be adjusted to 20 minutes for corridors and public spaces. Large spaces may need more than one sensor.

.7 Occupancy sensors are not permitted in interior spaces that may be or may become hazardous, such as electrical and mechanical service rooms.

.8 Mechanical and Electrical services rooms must have illuminated light switch.

.9 All classrooms and lecture theatres shall have LV lighting control switches at all entrances and exits to the space. In addition, LV switching controls shall be installed at the instructor’s end of the space. Classroom and lecture theatre lighting control shall include zoning and separate zone control. Zone 1 comprises the white board area; zone 2 comprises the front of the room; zone 3 deals with lighting in the front seating area; and zone 4 deals with back seating area lighting. The extent of zoning and multi-level of control within zones will vary depending upon size of the teaching space.

.10 Where applicable, all classrooms, lecture theatres, offices, corridors, stairways and other public spaces shall incorporate daylight harvesting via use of interior mounted photocells and arranged to take advantage of free illumination while maintaining acceptable minimum illumination levels within the space.

.11 LED dimmers shall be compatible with the LED lamps used and their drivers.

.12 New dimmable CFL lamps shall be left on at full power for 3 days (72 hours) before engaging dimmers.

2.6 Exit Signage

.1 Exit lighting shall be provided in accordance with the BC Building Code and the Canadian Electrical Code as amended by BC Electrical Safety regulations.

.2 All exit signs shall be illuminated by LED light sources.

.3 Exit signs shall be powered at 120 volts from emergency power panels, if available.

2.7 Emergency Lighting

.1 Emergency lighting must be installed in accordance with the B.C. Building Code.

.2 Individual light fixtures shall not contain batteries.

.3 The battery packs shall be long life type and either 12 volts DC or 24 volts DC and shall be in accordance with CSA C22.2 No. 141.
.4 All battery packs shall be mounted and secured on an appropriately sized shelf.

.5 Generator and Electrical rooms and washrooms shall be provided with an emergency battery lighting pack.

.6 If 12 volt DC is used they shall be the 36 watt or 360 watt units only and should not be self-testing as clients do not understand the self-test and call in a trouble call unnecessarily.

.7 If 24 volts DC are used they shall be either a 360 watt unit or a 720 watt unit only. They shall also be a basic model without meters or self-testing.

.8 For both 12 volt DC and 24 volt DC systems, the heads and remote heads shall be 9 watts each.

.9 Battery packs that are fed from a 120 volt AC source shall have a 120 volt duplex receptacle mounted adjacent so that the battery pack can be plugged into the receptacle.

2.8 Lighting Power Density

.1 The installed lighting power shall not exceed the lighting power allowance developed in accordance with the latest version of ASHRAE 90.1

2.9 Approved Lighting Fixture Products Standard

<table>
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<td>Cooper Encounter</td>
<td>22-EN-LD2-39</td>
<td>Recessed</td>
<td>120/277</td>
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<tr>
<td>Classrooms, Student Lounges open ceiling</td>
<td>LED linear</td>
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<tr>
<td>Public area T-bar ceiling</td>
<td>LED 2X2 or 1X4</td>
<td>Cooper Encounter</td>
<td>22-EN-LD2-39 or</td>
<td>Recessed Pot</td>
<td>120/277</td>
</tr>
<tr>
<td>Classroom, Office T-bar with occupancy and daylight control</td>
<td>LED 2X2</td>
<td>Philips Clear Appeal</td>
<td>2CAG30L835-2-DS-UNV-DIM-SWZG2</td>
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Alternates may be approved, coordinate with SFU Facilities.

***END OF SECTION***