

PART 1 - GENERAL

<u>1.1 RELATED SECTIONS</u>	.1	Section 26 05 00 - Common Work Results - for Electrical.
	.2	Appendix A - Lighting Fixture Schedule.
<u>1.2 WASTE MANAGEMENT AND DISPOSAL</u>	.1	Separate and recycle waste materials in accordance with Section 01 74 20.
<u>1.3 ADDITION OF ACCEPTABLE MANUFACTURERS</u>	.1	Refer to Section 26 05 00.
<u>1.4 SHOP DRAWINGS AND PRODUCT DATA</u>	.1	Submit shop drawings and product data in accordance with Sections 26 05 00 and 01 33 00.
	.2	Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.
	.3	Photometric data to include VCP Table and spacing criterion.
<u>1.5 SAMPLE LUMINAIRES</u>	.1	Submit sample luminaires for review prior to manufacturing when requested by the Departmental Representative.
	.2	Sample luminaires to be operable and complete with lamps, accessories and a plug-in power cord if requested by the Departmental Representative.
	.3	Deliver samples to the Departmental Representative's office or to another location as directed. Collect the sample(s) at the conclusion of the review.
<u>1.6 INTENTS</u>	.1	Provide lighting fixtures and accessories for all outlets as listed in the Lighting Fixture Schedule (Appendix A) and as shown on drawings.

1.6 INTENTS
(Cont'd)

- .2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.
- .3 Ground all lighting equipment to grounding system.
- .4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering fixtures.
- .5 Fixtures of the same or similar type shall be supplied by the same manufacturer.

1.7 MAINTENANCE
MATERIAL

- .1 Provide listed spare parts:
 - .1 Spare 1220 mm fluorescent lamps equal to 20% of the original number of lamps installed.
 - .2 5 spare of each other sizes of fluorescent lamps used.
 - .3 5 spare 2-lamp fluorescent ballast.
 - .4 2 spare 1-lamp fluorescent ballast.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Provide lighting fixtures new and complete with all mounting accessories, junction boxes, trims, frames, and lamps.
 - .2 All products of the same specified type are to be of the same manufacturer.
 - .3 Fixture type catalogue numbers do not necessarily denote required mounting equipment or accessories. Provide all appropriate mounting accessories for all mounting conditions.
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2.2 FLUORESCENT
ELECTRONIC
BALLASTS

- .1 The electronic ballast shall as a minimum meet the following characteristics:
 - .1 Ballast shall comply with CSA, UL 935, NEMA C82.11, and NFPA 70 unless specified otherwise. Ballast shall provide transient immunity as recommended by IEEE C62.41. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.
 - .2 Power factor shall be 0.95 (minimum).
 - .3 Ballast shall operate at a frequency of 20,000 Hertz (minimum).
 - .4 Ballast shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems.
 - .5 Provide ballasts operating at or above 40,000 Hertz where available.
 - .6 Ballast shall have light regulation of plus or minus 10 percent lumen output with a plus or minus 10 percent input voltage regulation.
 - .7 Ballast shall be normal light output 90% (minimum) or better.
 - .8 Ballast shall have 10 percent flicker (maximum) using any compatible lamp.
 - .9 Ballast shall be ULC listed with a sound rating of "A."
 - .10 Ballast shall have circuit diagrams and lamp connections displayed on the ballast.
- .2 Ballasts shall be instant start.
- .3 Instant start ballasts shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed. Programmed rapid start ballasts may operate lamps in a series circuit configuration. Provide series/parallel wiring for programmed start ballasts where available.
- .4 Ballasts for compact fluorescent fixtures shall be programmed rapid start.
- .5 Ballast shall be capable of starting and maintaining operation at a minimum of -17 degrees C (0 degrees F) unless otherwise indicated.
- .6 Electronic ballast shall have a full replacement warranty of 5 years from date of

2.2 FLUORESCENT
ELECTRONIC
BALLASTS
(Cont'd)

- .6 (Cont'd)
manufacture as specified in paragraph entitled
"Electronic Ballast Warranty" herein.
- .7 T-8 Lamp Ballast.
 - .1 Total harmonic distortion (THD): Shall be
10 percent maximum.
 - .2 Input wattage.
 - .1 32 watts (maximum) when operating one
F32T8 lamp.
 - .2 62 watts (maximum) when operating two
F32T8 lamps.
 - .3 92 watts (maximum) when operating
three F32T8 lamps.
 - .4 114 watts (maximum) when operating
four F32T8 lamps.
 - .3 Provide three and four lamp fixtures with
two ballasts per fixture where multilevel
switching is indicated.
 - .4 Single ballast may be used to serve
multiple fixtures if they are continuously
mounted and factory manufactured for that
installation with an integral wireway.
- .8 T-5 Lamp Ballasts.
 - .1 Total harmonic distortion (THD): Shall not
be greater than 25 percent when operating one
lamp, 15 percent when operating two lamps.
 - .2 Input wattage:
 - .1 28 watts (maximum) when operating one
T5 28W lamps.
 - .2 56 watts (maximum) when operating two
T5 28W lamps.
 - .3 Provide four lamp fixtures with two
ballasts per fixture where multilevel switching
is indicated.
 - .4 Single ballast may be used to serve
multiple fixtures if they are continuously
mounted and factory manufactured for that
installation with an integral wireway.
- .9 Electronic Dimming Ballasts.
 - .1 Ballast shall comply with CSA,
NEMA C82.11, UL 935, and NFPA 70, unless
specified otherwise. Ballast shall provide
transient immunity as recommended by
IEEE C62.41. Ballast dimming capability range
shall be from 100 to 1 percent (minimum range)
of light output, flicker free.
 - .2 Ballast shall start lamp at any pre-set
light output setting without first having to go
to full light output. Ballast shall be designed
for the wattage of the lamps used in the
indicated application. Ballasts shall be

2.2 FLUORESCENT
ELECTRONIC
BALLASTS
(Cont'd)

- .9 (Cont'd)
- .2 (Cont'd)
- designed to operate on the voltage system to which they are connected.
- .3 Power factor shall be 0.95 (minimum) at full light output and 0.90 (minimum) over the entire dimming range.
- .4 Ballast shall operate at a frequency of 20,000 Hertz (minimum).
- .5 Ballast shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems.
- .6 Provide ballasts operating at or above 40,000 Hertz where available.
- .7 Ballast factor at full light output shall be between 0.85 (minimum) and 1.00 (maximum). Current crest factor shall be 1.7 (maximum).
- .8 Ballast shall be ULC listed with a sound rating of "A".
- .9 Ballast shall have circuit diagrams and lamp connections displayed on the ballast.
- .10 Ballast shall be programmed start. Ballast may operate lamps in a series circuit configuration. Provide series/parallel wiring for programmed start ballasts where available.
- .11 Ballasts for compact fluorescent fixtures shall be programmed start.
- .12 Ballast shall be capable of starting and maintaining operation at a minimum of -17 degrees C (0 degrees F) unless otherwise indicated.
- .13 Total harmonic distortion (THD): Shall be 20 percent (maximum) over the entire dimming range.
- .14 Ballasts for T-5 and smaller lamps shall have end-of-life protection circuits as applicable.
- .10 Dimming Ballast Controls.
- .1 The dimming ballast controls shall be a slide dimmer with on/off control.
- .2 The slide dimmer shall be compatible with the ballast and control the ballast light output over the full dimming range. Dimming ballast controls shall be approved by the ballast manufacturer.
- .3 Light Level Sensor UL listed. Light level sensor shall be capable of detecting changes in ambient lighting levels, shall provide a dimming range of 10 percent to 100 percent, minimum, and shall be designed for use with dimming ballast and voltage system to which they are connected. Sensor shall be capable of controlling 40

2.2 FLUORESCENT
ELECTRONIC
BALLASTS
(Cont'd)

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electronic dimming ballast, minimum. Sensor light level shall be adjustable and have a set level range from 10 to 100 foot-candles 100 to 1000 lux, minimum. Sensor shall have a bypass function to electrically override sensor control.
- .11 All fluorescent ballasts shall be constructed by the same manufacturers.
- .12 Coordinate with Mechanical Division for compatibility between Mechanical Division supplied low voltage control and Electrical Division supplied ballasts.

2.3 LAMPS

- .1 All fluorescent lamps shall be low mercury lamps when available.
 - .2 T-8 lamp shall be rated 32 watts (maximum), nominal length of 1220 mm (48"), 3100 initial lumens (minimum), CRI of 85 (minimum), color temperature of 4100 K, and an average rated life of 20,000 hours.
 - .3 T-5 lamp shall be rated 28 watts (maximum), nominal length of 46 inches, 4100 K, 2900 initial lumens.
 - .4 Compact fluorescent lamps shall be: CRI 80, minimum, 3500 K, 10,000 hours average rated life, and as follows:
 - .1 T-4, twin tube, rated 5 watt, 250 initial lumens (minimum) 7 watts, 400 initial lumens (minimum), 9 watts, 600 initial lumens (minimum) and 13 watts, 825 initial lumens (minimum).
 - .2 T-4, double twin tube, rated 13 watts, 900 initial lumens (minimum), 18 watts, 1200 initial lumens (minimum), and 26 watts, 1800 initial lumens (minimum).
 - .3 T-4, Triple tube, rated 26 watts, 1800 initial lumens (minimum), 32 watts, 2400 initial lumens (minimum), and 42 watts, 3200 initial lumens (minimum).
 - .5 All fixtures shall be provided with proper, new, and operable lamps. Provide lamps indicated on the Light Fixture Schedule (Appendix A), or, if not indicated, as recommended by the fixture manufacturer.
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<u>2.3 LAMPS</u> (Cont'd)	.6	All fluorescent lamps of the same type and colour shall be by the same manufacturer.
	.7	Unless otherwise specified, all fluorescent lamps shall be 'premium' quality.
<u>2.4 SOCKETS</u>	.1	Sockets for fluorescent fixtures shall be standard medium bi-pin unless otherwise noted.
<u>2.5 FIXTURES</u>	.1	All fixtures shall comply with CSA Standard C22.2 No.9.0-96(R2011), General Requirements for Luminaires.
	.2	Except where otherwise noted in the Fixture Schedule, depth of recessed fluorescent fixtures shall not exceed 150 mm, including mounting yokes, or bridges and the distance from the back face of the diffuser or lens to the centre of the lamp shall be not less than 75 mm. Design of reflector and lamp position shall be to provide high efficiency, even brightness and lack of lamp lines.
	.3	Fluorescent fixtures shall be constructed of not less than code gauge steel. All metal parts shall be thoroughly cleaned and finished in high reflectance baked white enamel over corrosion-resistant primer. Reflecting surfaces and exposed surface shall have not less than two coats of baked white enamel with reflectance of not less than 85%.
	.4	All fixture diffusers, lens panels, lens frames, etc., shall be securely and adequately supported and shall be removable without the use of tools, unless otherwise noted.
	.5	Fixtures shall incorporate adequate gasketting, stops and barriers to form light traps and prevent light leaks.
	.6	Fixtures shall be designed for adequate dissipation of ballast and lamp heat to avoid short ballast life, nuisance thermal tripping and decreased lamp output. Heat test reports by independent laboratories shall be provided where required by the Department's Representative.
	.7	Construction of all fixtures shall be such as to provide a rigid well aligned fixture. Formed

- 2.5 FIXTURES
(Cont'd)
- .7 (Cont'd)
or ribbed backplates, end plates, reinforcing channel, heavy gauge sockets, straps, etc., shall be used where required to accomplish this.
 - .8 The construction and performance of all fluorescent fixtures shall be subject to the strict approval of the Departmental Representative's. Full photometric data from independent testing laboratory shall be provided where required by the Departmental Representative.

- 2.6 LIGHTING
FIXTURE SCHEDULE
- .1 Refer to Appendix A.
 - .2 It is the responsibility of the Contractor to ensure that all lighting fixtures provided include all features as specified in the Schedule.
 - .3 Submit sample luminaire complete with all specified options, mounting hardware and finishes for the Departmental Representative's review before ordering product. Contractor to carry the cost of sample submission and returning the luminaires.

PART 3 - EXECUTION

- 3.1 INSTALLATION
AND SUPPORTS
- .1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.
 - .2 Provide extra strong anchors and bolts for surface mounted fixtures in inmate areas.
 - .3 Support fixtures at locations shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.
 - .4 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to
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3.1 INSTALLATION
AND SUPPORTS
(Cont'd)

- .4 (Cont'd)
assure that insulation and corrosion protection is not damaged.
- .5 Self aligning seismically rated ball joint hangers shall be used for rod suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several fixtures in a row.
- .6 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Lighting Fixture Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.
- .7 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.
- .8 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.
- .9 Wiring from outlet boxes to fluorescent fixtures and wiring through fluorescent fixture channels shall be rated for 90 degrees C.
- .10 All recessed fixtures to be installed so that they are removable from below to gain access to outlet box or prewired fixture box. Connect all recessed fixtures to boxes with flexible conduit and approved fixture wire. Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with Electrical Code.
- .11 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental Representative.