SPECIFICATIONS FOR NEW UNDERGROUND RESIDENTIAL DISTRIBUTION SYSTEMS

1.0 PURPOSE AND INTRODUCTION

This document defines the minimum requirements and specifications for the installation of an underground residential electrical distribution system to be transferred to ATCO Electric ownership. It is intended for the specific use of Developers and their agents (Consultants and Contractors) who design and construct a new underground electrical distribution system within their subdivision.

ATCO Electric is an electric utility whose distribution facilities must be compliant with the provisions of the Alberta Electric Utility Code (AEUC) and is subject to all the regulations and standards described therein. All electrical facilities that are engineered, designed and constructed by a Developer and/or its agent(s) must comply with the same requirements and associated regulations of all local and provincial governing authorities, and any municipal, provincial or federal agencies or authorities having jurisdiction over the site or the installation. Where ATCO Electric's standards exceed regulatory and industry standards, ATCO Electric standards must be followed.

1.1 Definitions

Wherever used in these specifications, the following words and phrases shall have the meanings set forth below.

"Acceptance" means ATCO Electric's acknowledgement, through its formal reviews and processes, that the electrical design and installation, or any intermediate project deliverable, as presented and provided by the Developer and/or its agent(s), complies with the stated requirements, technical specifications and Contract documents, and the items presented for acceptance are satisfactory for ATCO Electric's purposes.


“AEUC” means the current and adopted Alberta Electric Utility Code and any amendments thereto, under the Alberta Safety Codes Act.
“Area Structure Plan” means a plan developed by a municipality which outlines all subdivision phases and zoning designations within an area or neighborhood.

“As-built” means a drawing which fully describes the actual, constructed Developed Distribution Facilities, in accordance with the drawing requirements identified within these specifications and authenticated by the Consulting Engineer.

"ATCO Electric's Engineering Representative" means ATCO Electric's Distribution Engineering Planning representative and/or the design representative for Distribution projects, or their designate(s), for any or all of the purposes of these specifications.

"ATCO Electric’s CSR (Customer Service Representative) means the ATCO Electric Distribution representative specifically assigned as the key contact for any Developer-initiated URD project.

"ATCO Electric’s Representative” means a representative from ATCO Electric's Distribution Operations group or their designate(s), for any or all of the purposes of these specifications (e.g., Inspectors).

"Authentication" means the application of the professional stamp of a responsible member of the Association of Professional Engineers and Geoscientists of Alberta (APEGA), signed and dated, and complete with the Permit to Practice Number (or signed and dated Permit Stamp).

“Bare Land Residential Development” means a multiple dwelling developed as a single entity on a single parcel of land on which the individual building lots and structures on those lots are privately owned and titled.

"Business day” means any day other than a Saturday, a Sunday or a Statutory holiday in Edmonton, Alberta.
**Civic address** means the street name and dwelling, lot, block and plan number assigned to a specific location and approved by the municipal authority.

“**Apartment and/or Commercial feeder**” means primary distribution cable whose main function is to provide power to the three phase transformers utilized in providing service within an URD boundary (see Appendix D, Drawing D.2.4). Services may include an apartment, gas station, grocery store, convenience store, etc., or any combination thereof. Recreation centres and schools shall be sourced from Apartment/Commercial feeders and must be identified to ATCO Electric’s Planning and Design Representative in the Preliminary Design stage of the project (Step 3, as per Appendix A).

“**Construction Completion Certificate (CCC)**” means the certificate issued to ATCO Electric by the Consulting Engineer stating that all the Developed Distribution Facilities provided by the Developer and/or its agent(s) have been constructed, installed and inspected in conformance with the Contract.

“**Construction Completion Inspection**” means an inspection of the Developed Distribution Facilities by ATCO Electric’s Representative prior to energization, for the purpose of identifying any defects, deficiencies and/or non-conformances.

“**Connected load**” means the sum of the capacities or ratings of all the electric energy-consuming apparatus connected to the supplying system.

“**Contract**” means any document related to the agreement between the Developer and/or its agent(s) and ATCO Electric. The Contract includes, but is not limited to, the Customer Proposal Letter, Notice of Disclaimer and the Underground Electrical Distribution Subdivision Service Agreement.

"**Consulting Engineer**" means a Professional Engineer, Professional Licensee (Engineering) or permit holder, registered and in good standing with APEGA, and entitled to engage in the practice of engineering in the province of Alberta under the Engineering and Geoscience Professions (EGP) Act retained by the Developer.
for the design, inspection and authentication of the construction and installation of the Electrical Distribution System pursuant to the Underground Electrical Distribution Subdivision Service Agreement as specified in these Specifications. The Consulting Engineer is considered to be an agent of the Developer.

"Contractor(s)" means the entities retained by the Developer in accordance with the terms and conditions of this Agreement for the construction and installation of the Electrical Distribution System including, without limitation, electrical construction contractors, site supervisors, excavation contractors and material suppliers. The Contractor is considered to be an agent of the Developer.

“Deep utility” means a utility which has facilities buried at a depth greater than 2.5 metres below surface grade. This includes water, storm water and sanitary sewer utilities.

“Developed Distribution Facilities” means the distribution facilities the Developer has engineered, procured and constructed which, after being commissioned, accepted and energized, will be transferred in ownership to ATCO Electric. These facilities must all be within an ATCO Electric franchise.

"Developer" means the registered owner of the lands and the developer of the lots on the lands in the Development on which the Electrical Distribution System shall be installed pursuant to the terms of the Underground Electrical Distribution Subdivision Service Agreement and these specifications.

"Distribution access service" means the service required to deliver electricity to customers by means of an electric distribution system.

“Diversity factor” means the ratio of the sum of the individual peak demands in a system to the peak demand of the whole system. In the context of these specifications, it means a group of transformers connected to a looped primary feeder. The diversity factor is greater than one or equal to one (for one customer).
"Distribution Tariff" means a document prepared by ATCO Electric which proposes terms and conditions for offering electric distribution service and charges for system access, in accordance with the Distribution Tariff Regulation, A.R. 162/2003, as amended from time to time.

“Single Family Dwelling” means a private residence, with sleeping and cooking facilities, intended for domestic use and in which the occupants live as a single housekeeping unit that is not part of a multiple family dwelling.

“Easement” is a right acquired by one party from another, permitting use of the other’s land for a purpose such as a utility right-of-way. An easement runs with the land.

“Express feeder” means a large, primary distribution cable (350 MCM or larger) utilized to provide the main power supply to and through a subdivision through switching cubicles or underground risers. ATCO Electric has sole responsibility for the planning and design of express feeders. See Appendix D, Drawing D.2.4.

"Facilities" means physical plant including, without limitation, primary and secondary conductor, pre-cast concrete bases, transformers, pedestals, terminations, street lights, street light bases, fault indicators and duct.

"Final Acceptance Certificate (FAC)" means the certificate issued to ATCO Electric by the Developer thirty (30) days prior to the end of the warranty period stating that the Developed Distribution Facilities meet all the requirements for final acceptance (see Appendix F, Form F.15); the FAC serves as a request to ATCO Electric to perform the final acceptance inspection.

“Final acceptance inspection” means an inspection of the Developed Distribution Facilities at the end of the warranty period, requested by the Developer in writing (i.e., the FAC) to ATCO Electric's CSR, to substantiate there
SPECIFICATIONS FOR NEW UNDERGROUND RESIDENTIAL DISTRIBUTION SYSTEMS

are no defects, deficiencies and/or non-conformances. If accepted, the Developer is released from all warranty obligations specified in the Contract.

“Final Inspection” means an inspection of the Developed Distribution Facilities by ATCO Electric’s Representative prior to energization, for the purpose of identifying any defects, deficiencies and/or non-conformances.

"Final record" means the most complete, accurate and up-to-date version of all drawings and documents related to the Developed Distribution Facilities, to be committed to ATCO Electric's records after acceptance of the CCC and energization.

"Governing authority" means any municipal, provincial or federal government official, agency or board which has legislative authority or jurisdiction over the work site.

"IFC" means Issued For Construction; IFC designation on a document must be authenticated by the Consulting Engineer. Within ATCO Electric, IFC is synonymous with Work Release Package. IFC drawings should be provided in both paper (colour) and electronic format (Micro Station or AutoCAD). See Section 4.2.8 and Appendix C for details.

“Independent Inspector” means a person or corporation retained and paid by the Developer in accordance with the Contract for the purpose of inspecting the electrical distribution system constructed by the Developer. This person or corporation must be not be affiliated with the Developer and/or its agent(s) and must be qualified to inspect the facilities.

“Joint-use” means shared, generally in relation to facilities such as trenches or secondary pedestals installed to allow several parties to service an area.

“kcmil” means a unit of measurement for conductor; specifically, an abbreviation for one thousand circular mils. Can be used interchangeably with MCM.
"Load" means the demand and energy delivered to or required at any Point of Service.

“Loop” means either:

a) The type of connection for a subdivision primary feeder supplying three phase padmount transformers or single phase transformers (i.e., the feeder is connected to two different source points and a normally open point is established somewhere in the middle of a loop); or

b) The type of connection for secondary conductors supplying secondary pedestals (i.e., the secondary supply to a pedestal can be sourced from two different single phase padmount transformers, and normally open points are established in the base of secondary pedestals).

"Luminaire" means an outside lighting unit fitted to a pole and consisting of a lamp and parts designed to distribute the light, including a reflector, bulb, lens, ballast and controls.

“Multiple Family Dwelling” means a building comprised of more than one unit or dwelling which share all or part of a service connection.

“Municipality or Municipal Authority" means the municipality, as defined in the Municipal Government Act (Alberta) within whose jurisdiction the Development lies.

"Point of Service" means the point at which ATCO Electric's service conductors are connected to the conductors or apparatus of a customer.

"Power cables" means primary, secondary, street light and service cables.

Compaction Characteristics of Soil Using Standard Effort. Standards commonly refer to a % Proctor. For example, a 95% Proctor means a particular soil (e.g., clay, loam or sand) has reached its maximum compaction at its optimum moisture content.

“Red-line” means distinctive markings, in red ink, on as-built and record drawings which indicate the alignments, descriptions and locations of equipment as actually constructed.

“Responsible member” means a registered, professional member of APEGA who satisfies the requirements of a responsible member, as defined in the regulations of the Engineering and Geoscience Professions Act of Alberta.

“Rough grade” means the approximate grade and slope of terrain established prior to the finishing of all landscape and related work in a subdivision. Rough grade is usually expressed in terms of final grade plus or minus a measurement amount (refer to ATCO Electric Terms and Conditions, Schedule C, for specific values).

"Service connection" means the apparatus required to physically connect a customer's facilities to ATCO Electric's distribution system to allow the customer to obtain distribution access service.

“Shallow utility” means a utility which has facilities buried at a depth less than 2.5 metres below surface grade. This includes power, gas, cable television and communication utilities.

"Site" means a unique end-use Point of Service.

"Site ID" means a unique identification number assigned by ATCO Electric to each unique end-use Point of Service on receipt of the municipally-approved civic address assignment from the Developer.
“Source primary feeder” means a system comprised of three separate, aluminum 14.4/24.94 kV underground cable jacketed – encapsulated concentric neutral cables which provide the source of power from ATCO Electric’s distribution substations to three phase cubicles located near or adjacent to a Subdivision Development Stage or Phase. See Appendix D, Drawing D.2.4.

“Subdivision Development Stage” means the combination of Phases completed within a subdivision. For example, a Subdivision Development Stage can include Phases 1, 2, 3, 4 and 5. It describes a larger area of development and is consistent with the meanings associated with overall municipal subdivision plans.

“Subdivision Development Phase” means a single, smaller area within a Subdivision Development Stage.

“Subdivision primary feeder” means a single phase primary cable which supplies a number of single phase padmount transformers within an URD. See Appendix D, Drawing D.2.4.

“Ultimate Underground Residential Development” means the underground distribution facilities within a subdivision have achieved a fully looped subdivision primary feeder design (i.e., each padmount transformer servicing load can be supplied from primary subdivision feeders, which are ideally supplied from two separately-sourced distribution feeders).

“Underground Residential Development (URD)” means any development as per ATCO Electric’s Distribution Tariff Schedule C, to meet the electric service requirements of individually-titled single family or duplex family lots and dwellings, in conjunction with other joint-use shallow utility requirements and/or deep utility requirements and/or vehicle roadway development requirements, as per an approved municipality’s development agreement. Single residential services are single phase 120/240V self-contained services to individual houses.
or units, designed and constructed in accordance with these specifications and ATCO Electric’s Service and Metering Guide.

“Utility right-of-way (URW)” means an easement acquired to allow the use of land owned by another party for utility purposes. A utility right-of-way remains with the grantee and may be transferred to other corporations or mortgaged.

"Work" means all the services to be performed and provided by the Developer and/or its agent(s) as contemplated within this document, including the professional design, procurement, construction, project management, commissioning and professional authentication of the underground residential distribution system, in conformance with the Underground Electrical Distribution Subdivision Service Agreement and the specifications provided herein.
2.0 GENERAL CONSIDERATIONS

2.1. Scope of the Specifications

These specifications apply to new front lot underground electrical facilities supplying single lot dwellings and multiple dwelling in a single parcel of private land (Bare Land Residential Development) within a new residential subdivision within the Municipality. In addition, these specifications apply to new underground facilities supplying three phase secondary service loads within the boundaries of the Developer’s residential subdivision. Information on three phase apartment and/or commercial loads is provided in Section 2.5.

2.2. Overall Process

The process steps from the initial request by a Developer to design and construct an underground residential distribution system within a new subdivision; through the drawing approval process, construction and inspection of the facilities, acceptance and energization; to the transfer of the Developed Distribution Facilities to ATCO Electric. This process is detailed in Section 4.0 and Appendix A.

2.2.1. Responsibilities

In accordance with the purpose stated in Section 1.0, the following describes the overall responsibilities of ATCO Electric and the Developer and/or its agent(s).

2.2.1.1. ATCO Electric

Has the responsibility to:

a) provide detailed technical requirements to the Developer for the distribution facilities the Developer will install;
b) review the Developer’s draft project schedule and negotiate with the objective of achieving a mutually agreed schedule for the entire project;

c) plan the source primary and express feeders supplying the subdivision and provide detailed information to the Developer on the supply connection points and proposed switch cubicle locations, and indicate whether or not the Developer will be required to install the civil facilities (i.e., trench, ducts, ducts in concrete bank) for express and/or commercial feeders;

d) install:
   i. the main distribution express feeder supply cable;
   ii. switch cubicle pre-cast concrete pads and grounding;
   iii. switch cubicles;
   iv. cable terminations for the express feeder supply cable;

e) provide, size, coordinate and install fuses for switch cubicles associated with source primary and express feeders;

f) provide SLD Schematic Plates, switch numbers, cable tags, ground test tags, danger signs, padlocks and asset tags;

g) inspect all cables laid in open trench, on sand or in duct, prior to backfill, as per Section 7.1;

h) assign all customer Site ID numbers post-construction, in accordance with AEUB Wire Service Provider Regulatory Requirements;

i) accept the design for the Developed Distribution Facilities;

j) provide Final inspection, acceptance and energization of the Developed Distribution Facilities, provided all specifications identified in this document have been met;

k) assume ownership of the facilities once energized;
l) complete a Final Acceptance Inspection of the facilities near the end of the Developer's warranty period; and

m) Supply meter and install the service cable from the drop box to the meter base on the dwelling.

n) Obtain approval from the Municipal Authority using all drawings and specifications provided by the developer.

2.2.1.2. The Developer

Has the responsibility to:

a) perform all work required to complete the design and installation of an underground electrical distribution system in a new residential subdivision;

b) develop a project schedule and lead negotiations to achieve a mutually agreed schedule;

c) coordinate the design and installation of joint-use facilities as per Developer and joint-use agreements, maintaining the minimum specifications provided in Appendix B and D;

d) provide all resources required to complete the work in accordance with these specifications, including items such as tools, equipment and personnel;

e) engage a Consulting Engineer, as defined in Section 1.1, to design and administer construction of the URD, which includes the following:

i. prepare plans and specifications, coordinating with all shallow and deep utilities located within the subdivision and all other entities (i.e., pipelines, railways, roadways) affected or crossed by the proposed distribution facilities;
ii. obtain all necessary URW agreements, pipeline and railway crossing agreements, acceptances and permits to allow construction in the appropriate name (see Section 4.2.2);

iii. provide an Area Structure Plan to ATCO Electric’s Engineering Representative (see Section 4.2.1, Step 1);

iv. authenticate design drawings as required, for acceptance by ATCO Electric’s Engineering Representative;

v. provide voltage drop calculations to ATCO Electric's Engineering Representative;

vi. provide street lighting design and supporting documentation to ATCO Electric's Engineering Representative;

vii. issue drawings for tender/construction;

viii. obtain from the municipal authority approved civic addresses for all lots requiring electrical service;

ix. inspect and control the quality of the work;

x. coordinate the Final inspection and the Final Acceptance Inspection of the Developed Distribution Facilities;

f) obtain an easement in ATCO Electric’s name if a switch cubicle pre-cast concrete pad and grounding system cannot be accommodated within the municipality’s URW, to allow ATCO Electric access in accordance with the terms of its Franchise Agreement with the municipal authority;

g) obtain all necessary permits and approvals required for performance of the Installation, except for Municipal approval, which approval will be obtained by ATCO and for the duration of the project be in compliance with the requirements of the municipality and any other governing authority (i.e., local permits, building restrictions, construction requirements, environmental caveats, etc.) ;
h) install the following:

i. express primary feeder civil requirements;*

ii. primary and secondary trench, backfill and warning tape;

iii. road crossing ducts and warning tape;

iv. single phase and three phase apartment and/or commercial service transformer pads, ground grids and transformers*;

v. subdivision primary feeder cable;

vi. apartment, commercial service and/or feeder cable*;

vii. cable terminations;

viii. single phase and three phase (commercial)* transformer terminations (primary and secondary);

ix. secondary pedestals and pedestal terminations;

x. secondary grounding connections;

xi. secondary cable, service entry point box, Omni balls as specified in drawing D.5.1;

xii. street light trench, backfill, and warning tape;

xiii. Street light davits, bases, conduit, electrical connections and grounding connections.

xiv. SLD Schematic Plates, switch numbers, cable tags, ground test tags, danger signs, padlocks and asset tags (as provided by ATCO Electric);

* Dependent on the decisions made as per Section 2.2.1.1. c.

i) ensure the work is completed under the auspices of a qualified journeyman power lineman who is experienced in the installation of underground residential facilities (see Section 2.9);
j) supply and utilize the vehicles and equipment required for the
    proper handling and installation of the Developed Distribution
    Facilities, so as to not cause any damage to the facilities;

k) provide site supervision by a qualified individual approved by
    ATCO Electric's Representative (see Section 2.9);

l) engage an Independent Inspector to perform required inspections
    and tests to ensure construction and equipment meets
    specifications, and to report compliance (optional, see Section
    2.10);

m) at least four weeks prior to energization, provide ATCO Electric
    with the approved civic addresses, so that a Site ID may be issued
    for each pre-serviced lot and/or site requiring electrical service;

n) within 30 days post-energization, provide to ATCO Electric final
    record drawings and documents, including authenticated as-built
    drawings, all easements and URW, railway and pipeline crossing
    agreements registered in ATCO Electric's name, a Construction
    Completion Certificate and complete asset documentation;

o) ensure proper coordination of the entire project, including the
    provision of sufficient lead times for submission and acceptance of
    plans, field inspections, testing, commissioning and energization
    of the Developed Distribution Facilities; and

p) In all aspects, adhere to the latest revision of these specifications.

q) return specification binder at project completion
### 2.3 Responsibility Matrix

The Responsibility Matrix provided below (Table 2.1) includes the provision and installation of specific equipment.

**Table 2.1 – ATCO Electric/Developer Responsibility Matrix**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ATCO ELECTRIC Provides/Installs</th>
<th>DEVELOPER AND/OR ITS AGENT(S) – SINGLE FAMILY DWELLING</th>
<th>DEVELOPER AND/OR ITS AGENT(S) – MULTIPLE FAMILY DWELLING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DESIGN &amp; DRAWINGS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration of Easements \ URW</td>
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</tr>
<tr>
<td>Easement Drawings \ Survey Plans</td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Crossing Agreements</td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>Area Structure Plan</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Drawing Authentication</td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>Municipal Authority Approval</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Planning Information on Location of Source Primary Feeders, Express Feeders, Commercial Feeders and Switch Cubicles</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Easement on Private Property Provided to ATCO Electric if Switch Cubicle Cannot be Accommodated Within URW</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Extend URW for transformer if placed in the 2.5m URW.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Acceptance of Design Plan</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Drawings Issued for Construction / Tender</td>
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<tr>
<td>As-Built Documentation</td>
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<tr>
<td>Coordination with Other Utilities</td>
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<td>Civic Address Data</td>
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<tr>
<td>Customer Service Site IDs</td>
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</tr>
<tr>
<td><strong>HIGH VOLTAGE PRIMARY SYSTEM</strong></td>
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<tr>
<td>Source Primary Feeder</td>
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</tr>
<tr>
<td>Source Connection Points</td>
<td>X (provides)</td>
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<tr>
<td>Express Feeders – <strong>Note 1</strong></td>
<td></td>
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<tr>
<td>Subdivision Primary Feeder Trench / Backfill</td>
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</tr>
<tr>
<td>Ducts (Road Crossings)</td>
<td></td>
<td>X</td>
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</table>
## SPECIFICATIONS FOR NEW UNDERGROUND RESIDENTIAL DISTRIBUTION SYSTEMS

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<tr>
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<th>DEVELOPER AND/OR ITS AGENT(S) – MULTIPLE FAMILY DWELLING</th>
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<tbody>
<tr>
<td>Warning Tape</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Single Phase Transformer Pads</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Three Phase Transformer Pads Note 1</td>
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<tr>
<td>Switch Cubicle Pads</td>
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<tr>
<td>Subdivision Primary Feeder Cable</td>
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<td>Apartment/Commercial Service Feeder Primary Cable Note 1</td>
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<td>Three Phase Padmount Transformers Note 1</td>
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<td>Single Phase Padmount Transformers</td>
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<tr>
<td>Switch Cubicles Including: Terminations, Grounding</td>
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<tr>
<td>Switch Cubicle Fuses</td>
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<td>Single Phase Terminations to Transformers</td>
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<tr>
<td>Three Phase Terminations to Transformers</td>
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<tr>
<td>Grounding System (Except Switch Cubicle)</td>
<td>X</td>
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<tr>
<td>SLD Schematics, Switch Numbers, Cable Tags, Ground Test Tags, Danger Signs, Padlocks and Asset Tags (Except Switch Cubicle)</td>
<td>X(provides) X(installs) X(installs)</td>
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### LOW VOLTAGE SECONDARY SYSTEM

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ATCO ELECTRIC Provides/Installs</th>
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<tbody>
<tr>
<td>Trench / Backfill</td>
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<td>X</td>
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<tr>
<td>Warning Tape</td>
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<td>Pedestals</td>
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<tr>
<td>Cable, Service Entry Box and Omni Balls</td>
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<td>Connectors / Terminations</td>
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<tr>
<td>Grounding System</td>
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### CUSTOMER SERVICE ENTRANCE

<table>
<thead>
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<th>DEVELOPER AND/OR ITS AGENT(S) – MULTIPLE FAMILY DWELLING</th>
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</thead>
<tbody>
<tr>
<td>Service Acceptance (Permit received, customer grounding meets requirements, trench adequate)</td>
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<tr>
<td>Post Acceptance Service Inspections</td>
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<td>Conductors</td>
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<td>Terminations at Pedestal</td>
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<td>Terminations at Meter Base</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Meter</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>ATCO ELECTRIC Provides/Installs</td>
<td>DEVELOPER AND/OR ITS AGENT(S) – SINGLE FAMILY DWELLING</td>
<td>DEVELOPER AND/OR ITS AGENT(S) – MULTIPLE FAMILY DWELLING</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>STREET LIGHTING (Subdivision and Express Feeder)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Design and Install</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Trench / Backfill</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Conduit</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bases, Davits and Luminaires</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Warning Tape</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>INSPECTIONS (see Section 7.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable in Trench on Sand or in Duct</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Compliance Prior to Installation Note 2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Transformer Primary Terminations (10%)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Overlay and Warning Tape Note 2</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Backfill and Compaction Note 2</td>
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<td>X</td>
<td></td>
</tr>
<tr>
<td>Final Inspection and Acceptance</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Energization</td>
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</tr>
<tr>
<td>Inspection / Test Forms Note 2</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1** – With respect to all three phase services installation of express and Apartment/commercial feeders, responsibility for the civil works and installation of transformer (i.e., trench, ducts or duct bank) is at the discretion of ATCO Electric and will be discussed with the Consulting Engineer during the Preliminary Design stage (see Appendix A, Step 3).

**Note 2** – The Developer and/or its agent(s) may engage Independent Inspectors to meet the inspection and testing requirements (see Section 2.10).
2.4 Bare Land Residential Development

Multiple residential services with single phase 120/240V service to a building which is supplied from a single point of entry. This includes townhouses, duplexes, fourplexes and sixplexes. Refer to Appendix D, drawing D.2.5

The installation of bare land residential development distribution facilities shall follow sections 2.4.1 and 2.4.2. ATCO Electric will own facilities in the following manner.

2.4.1 Primary and Secondary Facilities

ATCO Electric will own, operate and maintain primary and secondary facilities (i.e. primary/secondary cables, transformers and pedestals) within Bare Land Residential Developments and in doing so, the Developers and/or its agent(s) shall follow this Specification process and shall design and install the primary and secondary electrical distribution system in accordance with the standards and requirements stated in this document.

The Developers and/or Agent(s) shall provide a Utility Right of Way (URW) for all primary and secondary facilities excluding service cable. All URW shall be accepted and approved by ATCO Electric Engineering Representatives. The developers and/or agent(s) shall utilize the ATCO Electric URW form (Appendix F.1).

The primary and secondary facilities shall be accessible along roads and shall have enough space for maintenance and operation purposes.

Within the Bare Land Residential Development, primary cables shall be installed in ducts where it is under a pave surface. Consideration may be made for secondary ducts if the entire length of underground
is under a paved surface (i.e. sidewalks, row houses). All requests for direct buried shall be accepted and approved by ATCO Electric CSR and Engineering Representatives.

Secondary cables are not required to be looped in Bare Land Residential Development.

ATCO Electric service entrance shall be opposite side of the building from Gas services. Developer shall group electrical service entrance for two townhouses where possible. Customer installation of metering enclosures shall meet the applicable code requirements (i.e. CEC Part 1). Refer to appendix D, drawings D.1.2 and D.2.5.

2.4.2 Street Light Facilities

The ownership, maintenance and operation of street light facilities within the Bare Land Residential Development shall be mutually discussed and agreed upon between ATCO Electric and the developer following developer application.

2.5 Apartment and/or Commercial Services Loads (Single Phase or Three Phase) Within a New URD Subdivision

If the Developer and/or its agent(s) are responsible for developing any Apartment and/or commercial sites within the subdivision development boundary, the Developer must inform ATCO Electric’s CSR and Engineering Representatives for these sites.

The scope of these specifications includes single phase 120/240V self-contained commercial services and three phase 120/208V or 347/600V self-contained and instrument metered services. All apartment and/or commercial services must be designed and constructed in accordance with ATCO Electric’s Service and Metering
Guide. The latest revision of this guide may be found at the following web site: http://www.atcoelectric.com/.

It is extremely important that the Developer and/or its agent(s) identify any Apartment and/or commercial sites requiring three phase power to ATCO Electric’s Engineering Representative in the Preliminary Design stage. This will ensure the proper planning and coordination of all off-site construction requirements and the completion of proper phasing, looping and switching requirements within the subdivision, prior to any detailed engineering or construction of the URD.

The processes for testing and energization of these facilities are detailed in Sections 7.0 and 8.0. The Developer and/or its agent(s) must follow these processes and ATCO Electric’s General Service Process. Also refer to ATCO Electric’s Service and Metering Guide.

2.6 Construction Standards

All ATCO Electric standards and electrical installations must comply with the AEUC and any amendments thereto, under the Alberta Safety Codes Act. Where acts, bylaws and standards are referred to, they shall be the most current amended and updated issues (i.e., AEUC 4th Edition, 2013 and CSA Standards C22.3 No. 1-10 Overhead Systems and C22.3 No. 7-10 Underground Systems). The minimum construction standards to be applied by the Developer for Developed Distribution Facilities must meet or exceed the ATCO Electric standards as outlined in this document, or that of the governing authority.

2.7 Inspection of Developed Distribution Facilities

ATCO Electric reserves the right to conduct on-site inspections of the Developed Distribution Facilities at all times and at the discretion of ATCO Electric during the progress of construction in accordance with the Contract.

The Developer may engage an Independent Inspector to perform inspections and testing and report compliance, to ensure construction and equipment meets specifications (see Section 2.10 and Section 7.0).
The purpose of these inspections and acceptance procedures is to identify deficiencies at an early stage when it is easiest and most economical to correct them, and where possible to prevent design, material or construction defects from occurring prior to Final inspection and project completion.

2.8 Developer’s Warranty

A complete description of the warranty requirements associated with the Developer’s Warranty is included in the Underground Electrical Distribution Subdivision Service Agreement.

2.9 Consulting Engineer and Contractors

Prior to design of the Developer’s facilities, the Developer is required to submit a letter to ATCO Electric’s CSR outlining the Consulting Engineer’s and Contractor(s)’ qualifications and experience to complete the work in accordance with these specifications. ATCO Electric reserves the right to accept or reject any agents, including sub trades. ATCO Electric also reserves the right to request information on the qualifications of the personnel who will be completing the work.

2.10 Independent Inspectors

The Developer may engage Independent Inspectors to perform tests and inspect the various stages of installation and construction of the Developed Distribution Facilities, as per Section 7.1. If the Independent Inspectors are formally engaged, the Developer shall inform ATCO Electric’s Representative in writing.

2.11 Timelines and Scheduling Guidelines

Timelines for URD projects will vary depending on the size, complexity and specific requirements of the project. A meeting is required during Step 2 of the process (see Section 4.1 or Appendix A) between the Developer and/or its agent(s) and ATCO Electric’s Representatives (CSR, Planning and Design, Projects and Construction, and Operations), to determine and mutually agree upon timelines for the project. ATCO Electric’s CSR will initiate this meeting. See Appendix A for a rough guide to timelines.
Note: While ATCO Electric encourages early contact with Developers and their Consulting Engineers on upcoming projects to begin the process of formal drawing review, including concept planning, phasing, loop-feeds, service sizing, lighting levels, etc., priority in this regard is given to Developers with a signed Contract, Developer payment and proof of insurance.

2.12 Materials

All materials installed must either adhere to provided specifications, or match the manufacturers and catalogue numbers or ATCO Electric part numbers specified in Appendix E. See Section 6.0 and the Contract for details.
3.0 URD DESIGN GUIDELINES

3.1 Overview of ATCO Electric’s URD System Design

The power supply to all single lot underground residential services is through front lot service. Single phase transformers are connected to secondary pedestals, which in turn provide the connection to the residential service. The secondary design provides looping of the secondary conductors between the service pedestals. This allows more efficient and responsive restoration of service to customers in the event of an outage.

Appendix C, Drawings C.1.2A and C.1.2B illustrate a typical front lot service with the subdivision primary and secondary pedestal cable and secondary service cable connections. The supply is at 120/240 volts.

Note: For Single Family Dwellings, with the exception of commercial customers fed from a separate transformer, all secondary services are served from a secondary pedestal connected to a transformer.

3.2 Landscaping Adjacent to Underground Electrical Equipment

Before commencing the design of a URD system, the Developer and/or its agent(s) must confirm landscaping plans for all vegetation in the area with the Municipal Authority (see Appendix D, Drawings D.7.6A, D.7.6B, and D.7.6C for details).

3.3 URD Design

This section outlines the responsibilities and standards for design of an underground electrical distribution development within a neighborhood or major subdivision. It is intended to assist the Developer and/or its agent(s) in preliminary design discussions with ATCO Electric’s Engineering Representative.

3.3.1 Design Responsibilities

ATCO Electric is responsible for planning and designing the express and source primary feeders which supply a URD. In addition, ATCO Electric is
responsible for the planning, design, construction, installation and termination of three phase switch cubicle facilities.

ATCO Electric’s Engineering Representative will, at the request of the Developer and/or its agent(s), provide:

a) information on the switch cubicle requirements (dimensions, schedule and locations); and

b) the System Planning Study for the development area.

Appendix D, Drawing D.2.4 is a schematic representation of the facilities ATCO Electric and the Developer are each responsible to provide and install.

3.3.2 Design Standards

All underground electrical distribution facilities must be designed in accordance with ATCO Electric’s standards as outlined in this specifications document. Adherence to the planning and design standards ensures ATCO Electric is able to maintain required service levels.

3.3.2.1 Primary System Design

The design proposed by the Developer and/or its agent(s) must incorporate the system planning study for the development area provided by ATCO Electric.

Subdivision development may proceed in several phases and time frames. As such, arrangements for temporary looping and/or extension to future phases must be considered. Decisions regarding the system configuration at the boundary limits must be discussed with ATCO Electric’s Engineering Representative prior to design submission. Options to be considered include:
a) creation of a temporary underground loop by parking the elbows at the two padmount transformers nearest to the stage limit and/or;

b) creation of a temporary overhead loop;

c) cap and coil 30m of primary power cables at the end of the stage limits inside a pre-cast base;

d) installation of ducts to the development boundary; and,

e) placement of padmount transformers at the development boundaries.

Note: Designs for a URD shall minimize splices wherever possible. There should be no splices within the boundary of any project. Each unnecessary splice introduces another element which can fail and degrade the performance of the system.

### 3.3.2.2 Secondary System Design

The design proposed by the Developer and/or its agent(s) must include secondary looping between pedestals (see Appendix C, Drawing C.1.2A). In the event of a secondary system failure, each pedestal must have an alternate source of supply.

### 3.3.2.3 Street Light Design

The Roadway Authority (typically the Municipality) will dictate the roadway lighting requirements. Refer to the Municipality’s most recent guidelines.

The Developer and/or its agent(s), unless directed otherwise by the governing authority, shall utilize the “Guide for the Design of Roadway Lighting” published by Transportation Association of Canada (TAC) 2006, as the minimum requirement for the design of safe roadway lighting.
The Developer and/or its agent(s) must confirm the roadway classifications with the Roadway Authority before submitting any detailed engineering design. Street lighting design calculations and documentation must be submitted for ATCO Electric’s acceptance at design review; the minimum requirements are described in Section 4.2.6. A sample of inputs and calculations utilizing AGI 32 is provided in Appendix C, Document C.1.5.

All designs must be based on a uniform tilt of zero degrees (0°) parallel to the road surface. In residential areas, street lights should be placed on lot lines, where practical. In subdivisions with curved roads and irregular lot sizes, alternate locations may have to be determined to meet lighting requirements. A street light may be fed from either a transformer or a pedestal.

See Appendix D, Drawings D.7.1A, D.7.1B and D.7.2 for street light alignment details.

### 3.4 Performance Requirements

#### 3.4.1 Grounding

The Consulting Engineer is responsible to ensure all the requirements of the grounding system meet ATCO Electric’s standards (see Appendix D, Drawings D.4.5 and D.4.20).

#### 3.4.2 Voltage Drop

The Consulting Engineer shall use the voltage drop calculator provided on ATCO Electric’s website (see Appendix C, Report C.1.4 for Sample Voltage Calculation Report) to ensure:

a) the voltage drop from the transformer secondary to all customer meters shall not exceed 3%; and,
b) during a single contingency situation (i.e., the loss of a single phase padmount transformer, a subdivision primary feeder, etc.), the voltage drop from the transformer secondary to all customer meters shall not exceed 7.5%.

### 3.4.3 Transformer Loading

Tables 3.1, 3.2 and 3.3 identify the maximum number of 100 amp, 200 amp or a combination of 100/200 amp customers (services) that can normally be supplied from ATCO Electric’s standard single phase 14.4kV – 120/240V (nominal) rated primary and secondary loop-feed transformers to maintain the voltage within the limits identified in Section 3.4.2.

The number of services that can be supplied may be limited by size restrictions of the secondary compartments and/or the allowable secondary power cable voltage drop. ALL designs and calculations submitted must meet voltage and loading requirements.

**Table 3.1 - Maximum Number of 100 A Services Supplied by Padmount Transformers**

<table>
<thead>
<tr>
<th>Transformer Size</th>
<th>100 A Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>50kVA</td>
<td>16</td>
</tr>
<tr>
<td>75kVA</td>
<td>24</td>
</tr>
<tr>
<td>100kVA</td>
<td>31</td>
</tr>
</tbody>
</table>

**Table 3.2 - Maximum Number of 200 A Services Supplied by Padmount Transformers**

<table>
<thead>
<tr>
<th>Transformer Size</th>
<th>200 A Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>50kVA</td>
<td>8</td>
</tr>
<tr>
<td>75kVA</td>
<td>12</td>
</tr>
<tr>
<td>100kVA</td>
<td>15</td>
</tr>
</tbody>
</table>
Table 3.3 - Maximum Number of a Combination of 100 A and 200 A Services Supplied by Padmount Transformers

<table>
<thead>
<tr>
<th>Transformer Size</th>
<th>100 A Services</th>
<th>200 A Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>50kVA</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>75kVA</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>100kVA</td>
<td>22</td>
<td>8</td>
</tr>
</tbody>
</table>

3.5 Design Detail

3.5.1 Cable Trench Alignments/Depths

Standard alignments and trenching specifications for underground power and other joint-use facilities are generally defined by the Municipal Authority. It is the responsibility of the Developer and/or its agent(s) to obtain the most current version of the Municipal Standards. Any deviations to the standard vertical or horizontal trench details must be approved by ATCO Electric’s Engineering Representative prior to design submission. Refer to the following drawings in Appendix D for details:

- One Party Trenching details – See D.1.1, D.1.2, and D.1.3
- Two or Three Party Trenching details – See D.1.5 and D.1.6
- Four Party Trenching details – See D.1.7
- Road Crossing Installation details – See D2.2 and D.2.3
- Clearances to other facilities details – See D.7.3, D.7.4 and D.7.5

3.5.1.1 Service Entry Trench to Lot

For Single Family Dwellings, service boxes and stakes are to be installed as per Appendix D, Drawings D.3.1A, D.3.2, D.5.1 and D.5.2. Service boxes must be installed on the non driveway side of the lot.

For Multiple Family Dwellings, service boxes are not typically required as the secondary cables shall be stubbed a minimum of 1.5m from the building’s foundation (see Appendix D, drawing D.3.1B).

3.5.2 Primary and Secondary Cables
3.5.2.1 Primary Cables

The only acceptable cable to be used for subdivision primary service is:

1/C – #1 AWG TRXLPE compact aluminum strand 60% Cu concentric neutral

See Appendix E, Drawing E.1 for the primary cable information.

3.5.2.2 Secondary and Service Drop Cables

The following cables are to be used for secondary service:

2/C - #2 600V aluminum conductor jacketed type USEB90 reduced #6 Cu concentric neutral
2/C – 4/0 600V aluminum conductor jacketed type USEB90 reduced #1 Cu concentric neutral
2/C – 300 MCM 600V aluminum conductor type USEB90 full size 300 MCM Cu concentric neutral

See Appendix E, Drawing E.2 for the secondary cable information.

For Single Family Dwelling services, the service cable coiled inside the service box shall be three quarters of the lot length.

For Multiple Family Dwelling Services, the service conductor shall be 2/C – 300 MCM Aluminium. Developers shall be responsible for trench and installation of secondary conductors up the multi-meter junction box (see Appendix D, Drawing D.3.1B and D.2.5).
3.5.3 Switch Cubicles

If a switch cubicle is required, the Developer and/or its agent(s) are responsible to propose a final location to be approved by ATCO Electric’s Engineering Representative.

The switch cubicle must be located a minimum distance of 3.0m from the curb, and a 6.0m x 6.0m easement is required. If necessary, the Developer and/or its agent(s) will provide ATCO Electric with the easement (see Section 4.2.2).

Note: The distance from the curb must take into consideration the size and location of the base ground grid, which extends 0.5m to 1.0m beyond the boundaries of a switch cubicle base (see Appendix D, Drawing D.4.5).

3.5.4 Padmount Transformers and Secondary Pedestals

3.5.4.1 Installation

For the purposes of these specifications, padmount transformers will be single-phase, 14.4kV – 120/240V (nominal) rated primary and secondary, loop-feed transformers, and three-phase, 25kV – 120/208V or 347/600V (nominal) rated primary and secondary, loop-feed transformers.

For Single Family Dwellings, services shall be fed directly from a secondary pedestal.

For Multiple Family Dwellings, services will be fed directly from the transformer; a secondary pedestal is not required.

Padmount transformers are to be installed as follows:

a) The transformers must be mounted on pre-cast bases located at intersecting lot lines, and coordinated with other facilities located on the street so as not to encumber both lot lines of any residential family zoned lot.
b) The pre-cast base, where possible, should be located 0.5m from easement on a boulevard, or 0.5m from the edge of the trench, but only if the required ground grid will not be under existing or proposed sidewalks, curbs, roadways, and other known structures or on private property. If such a conflict exists, the pre-cast base must be shifted to allow for the ground grid installation. The Developer and/or its agent(s) are responsible to provide the required alignments (see Appendix D, Drawing D.3.1A).

c) Transformers must:
   i. not be installed onto pie-shape properties inside a cul-de-sac;
   ii. not be set less than 6.0m from a cut corner;
   iii. not be located within 1.0m from any other utilities’ above ground facilities and less than a 2.0m clearance to bus stops;
   iv. not be set in a sidewalk;
   v. not be placed on the driveway side of a lot; or
   vi. be positioned so its access lid/door faces the roadway.

Secondary Pedestals are to be installed as follows:

a) When installing pedestals, it is recommended to pair pedestals with street lights to minimize facility locations and the visual impact to lot owners.

b) When the pedestal is parallel to the road, the pedestal door faces the house; this includes pedestal/transformer combinations and street light/pedestal combinations.

c) When the pedestal is placed perpendicular to the road surface, the door shall be positioned so that the worker is facing oncoming traffic when accessing the pedestal.
d) The pedestal must not be placed on the driveway side of a lot
(If this cannot be avoided, ATCO Electric’s CSR should be consulted).


3.5.4.2 Equipment Identification

The circuit and equipment identification and tagging requirements on the engineering drawings must match the identification and tags on the cables and equipment installed (see Appendix D, Drawing D.5.6).

3.5.4.3 Grounding

The Developer and/or its agent(s) are responsible, as part of the overall installation of the URD system, to complete the design, installation and interconnection of the grounding facilities at each piece of equipment (padmount transformer, secondary pedestal, street light, etc.) as per Drawings in Appendix B (X409, X410, X411, X412 and X413), Appendix D (D.4.5 and D.4.14). The grounding materials must meet the requirements of Appendix E.5.

All conductive above-ground facilities (e.g., metal guard posts or bollards, stand-alone cable TV and communication pedestals, metering pedestals, etc.) within 3.0m of any electric utility facilities shall be bonded to the electric utility facilities’ ground grid.

3.5.5 Primary Fusing

ATCO Electric will complete the primary fuse coordination at the switch cubicle and supply the required on-site fuse units.

3.5.6 Street Lighting
3.5.6.1 Installation

The street light is to be positioned as follows:

- Single Davit: Where possible, the access door is to be positioned so that the employee is facing oncoming traffic when working in the light standard.

- Double Davit installed on an island: The door is to be installed parallel to the road so that the employee has visibility of approaching traffic from either direction when working in the standard.

3.5.6.2 Standard Luminaires

For residential street lighting, the standard davit pole is 9.0 m in height, and the davit arm is 2.0 m in length. (See Drawing X409 and X412 in Appendix B) If other davit poles or davit arms are required, please contact ATCO Electric’s Engineering Representative.

The following are the standard lamps for subdivisions, and the design shall contain only these lamps:

a) 100W HPS Type II with 0.78 Light Loss Factor

b) 150W HPS Type II with 0.78 Light Loss Factor

c) 43W LED Type II with 0.88 Light Loss Factor

d) 86W LED Type II and III with 0.88 Light Loss Factor

See Appendix E, Drawing E.8B for the street light poles and parts.
3.5.6.3 Photometric Files

A standard AGI 32 template will be available on ATCO Electric’s website for those using AGI 32 for lighting design. (Click HERE to download)

Contractors not using AGI 32 are required to download the photometric files from ATCO Electric’s website and modify the files to match the standard luminaires in Section 3.5.6.2. (Click HERE to download)

3.5.6.4 Design Task and Calculation Type

The following table specifies the standard calculation type for each design task:

<table>
<thead>
<tr>
<th>Design Task</th>
<th>Calculation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight Roadways</td>
<td>Luminance</td>
</tr>
<tr>
<td>Curved Roadways and Interchanges</td>
<td>Illuminance</td>
</tr>
<tr>
<td>Cul-de-Sacs</td>
<td>Illuminance</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>Illuminance</td>
</tr>
<tr>
<td>Intersections</td>
<td>Illuminance</td>
</tr>
<tr>
<td>Crosswalks</td>
<td>Illuminance</td>
</tr>
<tr>
<td>Roundabouts</td>
<td>Illuminance</td>
</tr>
</tbody>
</table>

For residential subdivisions, ATCO Electric requires calculations to be done on roadways and interchanges (straight and curved), cul-de-sacs, intersections and roundabouts. Sidewalks and crosswalks are not required unless otherwise specified or required by the Roadway Authority.
3.5.6.5 Calculation Grids

Separate calculation grids are required when the design task changes. This section discusses the grid settings required for each design task.

3.5.6.5.1 Roadways and Interchanges

a) The calculation grid shall cover the entire road surface (curb-to-curb) unless the Roadway Authority states otherwise. It shall start and finish at a luminaire with all luminaires within the section covered in between.

b) The left-to-right spacing between grid points is equal to the narrowest spacing between two luminaires in that section divided by 10, but may not exceed 5.0 m. The top-to-bottom points should be placed along the ¼ point of the lane width for straight roads, and 2.0 m apart for curved roads.

c) Symmetrical spacing ( staggered, opposite and median lighting) requires calculation for all lanes in a single direction of travel. For single-sided spacing with two way traffic (divided by a yellow line or a median), a separate calculation should be undertaken for the lane(s) in each direction of travel. The worst case luminance/illuminance and uniformity ratio for either direction shall take precedence.

d) Curved roads with less than five degrees (5°) curve shall be treated as straight roads, and luminance calculation type shall be applied.
3.5.6.5.2 Cul-de-Sacs, Intersections and Roundabouts

The grid points should be placed 2.0 m apart and take the shape of the area. The boundaries are determined by the end of curb return or cut corner.

3.5.6.5.3 Sidewalks (If Required)

Horizontal calculations for sidewalks should include a single line of grid points on the centreline of the sidewalk using the same grid as used for the roadway. If the sidewalk is over 2.0 m wide, additional rows of equally spaced grid points will be required. In all cases, each grid line should not be more than 1.0 m from the edge of the walkway. The horizontal grid should be at the surface grade of the sidewalk.

The vertical illuminance values should be calculated at a height of 1.5 m in the two directions parallel to the main pedestrian flow, along the centreline of the sidewalk using the roadway longitudinal grid, but not including grid points under the luminaires.

3.5.6.5.4 Crosswalks (If Required)

The calculation grid within the crosswalk is required on a vertical plane across the roadway at a height of 1.5 m, with calculation points spaced at 0.5m. Only a single line of calculation point is required. This calculation line should be centred in the crosswalk and extend from the curb line to the centreline of the roadway. The calculation direction should be towards the approaching driver. For intersection with multiple crosswalks, each crosswalk should be calculated separately.
4.0 URD Process and Documentation Requirements

4.1 Process Steps

The process of developing underground distribution facilities in a residential area consists of 10 major steps, which are summarized below. Refer to Appendix A for a Process Flowchart, which illustrates the Developer-ATCO Electric interface, and to the following sections for more detailed information.

Step 1 Initial Contact, Application and Decision to Proceed With URD

The Developer initiates the project by contacting ATCO Electric’s CSR (Customer Service Representative). ATCO Electric’s CSR will arrange to meet with the Developer to discuss the preliminary information required to initiate ATCO Electric’s process. The CSR will:

- Provide the list of preliminary information
- Have the Developer sign the Notice of Disclaimer; and
- Provide the developer with a provisional copy of this Specifications Manual.

Step 2 Preliminary Information

After deciding to proceed with the project, the Developer must provide the following to ATCO Electric’s CSR:

a) Area Structure Plan (see Section 4.2)

b) compiled survey legal plan (i.e. Single, Multiple Family Dwelling and Apartments)

c) Apartment building plan

d) number of lots

e) loading of lots (100A and 200A service)

f) proposed project schedule
g) proposed locations of apartment and/or commercial services,
   recreation centers, schools, etc.

h) proposed lighting requirements

ATCO Electric's CSR will:

- Review the information and, if acceptable, forward a copy to ATCO
  Electric's Engineering Representative; and
- Arrange a follow-up meeting with the Developer to negotiate and
  confirm a preliminary project schedule.

ATCO Electric’s CSR will initiate a cost estimate for the ATCO Electric
provided services and develop an Underground Electrical Distribution
Subdivision Service Agreement; this process is beyond the scope of this
document.

Once the cost estimate and Underground Electrical Distribution
Subdivision Service Agreement are completed, ATCO Electric’s CSR will
provide to the Developer:

a) a Service Agreement Cover Letter;

b) a copy of the Underground Electrical Distribution Subdivision Services
   Agreement, including the agreed upon preliminary project schedule;

c) paper or electronic documentation of ATCO Electric’s existing
   distribution facilities in the surrounding area; and

d) a proposal for additional offsite requirements outside of the tie-in
   scope (if required).

The Developer must provide to ATCO Electric's CSR:

a) both signed copies of the Underground Electrical Distribution
   Subdivision Service Agreement;

b) proof of insurance; and
c) acceptance of additional offsite requirements outside of the tie-in scope (if required).

The Developer is also required to identify its agent(s), (i.e., Consulting Engineer and Contractors) for ATCO Electric's review and approval.

After receiving all the required documents and information from the developer, ATCO Electric's CSR will:

a) have the Underground Electrical Distribution Subdivision Service Agreement executed by ATCO Electric and return a copy to the Developer;
b) invoice the developer for the estimated costs to provide ATCO Electric's services as per the Underground Electrical Distribution Subdivision Service Agreement; and
c) provide the System Planning Study for the development area to the Developer.

**Note 1:** ATCO Electric will not release Issued For Construction (IFC) drawings to the developer until payment is received for ATCO Electric's services.

**Note 2:** Subsequent changes to the scope of the project (e.g., design/alignment changes, changes to the number of lots, etc.) may change costs, which will require a re-quote and re-execution of the agreement to reflect changes.

**Step 3 Design**

Prior to design submission, the Consulting Engineer may contact ATCO Electric’s CSR and the Engineering Representative to discuss items including, but not limited to:

a) the overall planning study for the subdivision;
b) the number of phases required;

c) the normal direction of feed and proposed location of ATCO Electric’s switch cubicle requirements; and

d) the timelines required for the installation of facilities that are ATCO Electric’s responsibility (i.e., source primary feeders, express feeders and switch cubicles).

The Developer and/or its agent(s) can then begin the design process, which involves:

a) coordinating with other utilities (i.e., gas, communications, cable TV) and/or other affected entities such as pipelines and railways;

b) obtaining all necessary URWs, crossing agreements, acceptances and permits to allow construction in the appropriate name (see Section 4.3.1): and

c) requesting switch numbers and Asset IDs for the equipment the Developer will be providing within the subdivision.

Once this is complete, the Developer and/or its agent(s) shall submit the Design Transmittal Form (see Appendix F, Form F.22), along with any supporting documents outlined in Section 4.3.

ATCO Electric’s Engineering Representative will either accept the design submission or return it to the Developer and/or its agent(s) with any concerns, deficiencies and/or non-conformances for correction.

ATCO Electric will provide this service at no cost to the Developer for the first two (2) submissions. If the design is returned to the Developer and/or its agent(s) with deficiencies and/or non-conformances after the third submission, the Developer will be responsible for the cost of the third
review. The Developer will be responsible for all design review costs for further design review submissions.

**Note:** ATCO Electric will not release IFC drawings to the developer until payment is received for ATCO Electric’s services.

**Step 4 Municipal Approval (if required)**

Once the final design is accepted and signed off by ATCO Electric’s Engineering Representative, ATCO Electric will submit the plans for approval by the Municipal Authority. See Section 4.4.

Upon receipt of Municipal approval, ATCO Electric’s CSR will contact the Developer and/or its agent(s) to confirm receipt of Municipal approval.

**Step 5 Pre-Construction**

The Developer and/or its agent(s) are responsible to arrange a pre-construction meeting prior to any construction activity taking place. With at least ten (10) business days notice, the Developer must contact the ATCO Electric Construction Representative and Operation Representative to:

- agree upon a time, date and place for the meeting; and
- provide four (4) paper copies and one (1) electronic copy (in DWG or DGN format) of the approved electrical IFC drawings to ATCO Electric’s CSR for distribution (see Sections 4.3.2.1)

The Developer and/or its agent(s) are responsible to ensure that the consulting engineer, approved contractor, independent inspector (if applicable) and the designated representatives from the other shallow utilities are present at the meeting. The proposed site must also be staked as per the approved ATCO Electric design prior to the pre-construction meeting.
During the pre-construction meeting, the consulting engineer, contractor and ATCO Electric’s Representatives will:

a) exchange contact information;
b) complete a walkthrough of the proposed site to confirm all proposed facility locations and alignments as per the approved design;
c) discuss and resolve any questions or comments that arise during the meeting;
d) agree upon a preliminary construction inspection schedule (to be adjusted as necessary);
e) inspect the electrical materials for approval by ATCO Electric’s Representative; and
f) have the copy of Bill of Sale submitted to ATCO Electric’s Representatives.

ATCO Electric will make arrangements to deliver to the Developer and/or its agents the cable tags, SLD schematic plates, switch numbers, danger/warning signs, padlocks, ground test tags and asset tags required for installation (see Appendix D, Drawing D.5.6).

Step 6 Construction/Inspection

It is the Developer’s responsibility to liaise with ATCO Electric’s Representative throughout the construction period for the purpose of coordinating inspections. See Section 7.0 for detailed inspection and testing requirements. Sample forms are provided in Appendix F.

Note: If inspection fails, ATCO Electric will provide feedback to the developer to correct the failure. If the problem is rectified when ATCO Electric returns to re-inspect, there will be no charge. If the problem remains, ATCO Electric will begin charging for the inspection time and any further inspections.
Step 7       Final Inspection after Construction

Once construction is completed, the Developer and/or its agent(s) are responsible to contact ATCO Electric’s CSR to schedule a final inspection. Prior to the final inspection, ATCO Electric’s CSR will require, at minimum:

a) a Construction Completion Certification (CCC), authenticated by the Consulting Engineer;

b) all completed and signed inspection forms and test reports;

c) a completed Site Cleared of Personnel form and any other applicable forms (see Appendix F, Form F.14); and

d) three (3) paper copies of the “red-line” as-built IFC drawings with recorded notes and description of all as-built details of the Developed Distribution Facilities, including Universal Transverse Mercator (UTM) coordinates (see Sections 4.5).

The ATCO Electric Representative and the Developer and/or its agent(s) will conduct a detailed field inspection to either identify any defects, deficiencies and/or non-conformances, or to indicate the project can proceed to acceptance and energization.

Note: Any incomplete, incorrect or revised drawings or documents must be corrected and resubmitted before proceeding to Step 8: Acceptance/ Energization.

Step 8       Acceptance/ Energization

Upon satisfactory completion of the Final inspection, all parties are required to sign two (2) copies of the final red-line as-built drawings provided by the Developer and authenticated by the Consulting Engineer (see Section 4.2.9). One (1) copy will be retained by ATCO Electric, and one (1) copy will be returned to the Developer.
Prior to energization, the Developer and/or its agent(s) must provide ATCO Electric’s CSR:

a) a request for energization (see Appendix F, Form F.13);

b) one (1) copy of all required URW; easements and pipeline; and roadway and railway crossing agreements transferred to ATCO Electric's name (see Section 4.3.1.1); and

c) completed asset documentation forms, submitted electronically (see Section 4.3.1.5).

Once all requirements are met, ATCO Electric’s CSR will arrange offsite connection requirements and energization. Additional information may be requested from the Developer and/or its agent(s) before proceeding to energization.

Following successful energization of the system, the ATCO Electric Representative will sign the CCC, indicating acceptance of the Developed Distribution Facilities, and ownership of the assets will be transferred to ATCO Electric (see the Contract for Transfer of Ownership). ATCO Electric is thereafter responsible for all service connections; this is beyond the scope of this document.

**Note:** If energization fails, the Developer and/or its agent(s) are responsible to correct the deficiency(ies) and to re-submit the necessary documentation before another attempt to energize the system will be made.

See Section 8.0 for further details related to final inspection, acceptance and energization of the Developed Distribution Facilities.
Step 9  Final Record Drawings and Documents

Within thirty (30) days of energization, the Developer and/or its agent(s) must provide ATCO Electric's CSR with a complete package of final record documents for ATCO Electric's records. This includes:

a) two (2) paper copies and one (1) electronic copy (DWG or DGN format) of the final, signed and authenticated as-built drawings, including Universal Transverse Mercator (UTM) coordinates;

b) the final, accepted CCC, authenticated by the Consulting Engineer and signed by ATCO Electric's Representative;

c) the final asset documentation forms;

d) all legal documents, including all easements and crossing agreements, registered in ATCO Electric's name; and

e) the return of the provisional copy of this Specifications Manual.

Step 10  Warranty Period

See the Agreement for warranty details.

Thirty (30) days prior to the end of the warranty period, the Developer and/or its agent(s) must submit a Final Acceptance Certificate (FAC) to ATCO Electric. On receipt of the FAC, ATCO Electric will conduct a final acceptance inspection and either accept the Developed Distribution Facilities as is, releasing the Developer from all warranty obligations, or reject the FAC until the Developer corrects any identified defects, deficiencies or non-conformances (see Section 8.4).
4.2 Documentation Requirements

4.2.1 Electronic Data Submission
Electronic data submitted to ATCO Electric must be in Micro-station, AutoCAD, PDF or MS Office format (e.g., Excel), unless otherwise specified.

4.2.2 Area Structure Plan
The Developer and/or its agent(s) must supply ATCO Electric’s Engineering Representative with a Municipal approved Area Structure Plan or concept plan which outlines all subdivisions, phases and zoning designations within the development area.

This plan provides the basis for designing the primary distribution system, including phase balancing, padmount transformer locations and non-residential loads (i.e., municipal reserves and parks). It also allows integration of the subdivision plans and the overall electrical infrastructure, both within and beyond the development area, and identification of offsite construction requirements, including any necessary system upgrades, loop-feeds, temporary lines, etc.

4.2.3 Required Design Documents and Drawings
This section provides a detailed description of the files outlined in the Design Transmittal and their requirements. For CAD/Microstation drawings, a standard Design Drawing Template in DWG format can be found on ATCO Electric’s website or downloaded by clicking HERE. The Developer and/or its agent(s) must download the template and use the same symbols and conventions for all CAD/Microstation drawings.

4.2.3.1 Issued for Construction (IFC) Drawings
IFC drawings consist of facility maps that are plan view drawings depicting the geographic locations of ATCO Electric facilities within a subdivision and the alignments of electrical facilities and trench in relation to property lines.
Facility maps must be prepared according to the following guidelines:

a) The standard template must be downloaded from ATCO Electric’s website as outlined in Section 4.3.2.

b) The location of the secondary service drop boxes must be shown in relation to the nearest property line.

c) The locations of all power cable road crossings must be shown in relation to the property lines on both sides of the roadway.

d) The locations of all proposed padmount transformers, switch cubicles, street lights, secondary pedestals and ducts must be shown.

e) Any aerial equipment within or near the proposed subdivision must be shown.

f) The owners of other utilities (i.e. cable TV and/or communications) whose facilities occupy joint-use pedestals must be named on the drawings.

g) All other shallow utility alignments must be noted and include, where applicable, standard trench details; URW cross-sections; detailed drawings road cross-sections; road crossings and any other detail as required; for ATCO Electric’s review of the design and construction and to ensure compliance with ATCO Electric’s standard alignments and separations.

h) All driveway locations, water lines, water valves and fire hydrants must be shown.

i) All roadways (closes, ways, crescents, streets, avenues, trails, etc.) must be identified with the name or number shown on the subdivision’s registered plan. If a roadway is not identified by name, it must be identified in relation to a named road (i.e., as the lane, road, etc. east, west, north or south of a named road).
j) All street light locations must be shown and include the following: all pole and/or standard heights; davit lengths; wattages; luminaire types and manufacturer's information.

k) See Appendix C, Drawing C.1.2A for an example.

IFC drawings must be authenticated and stamped “Issued for Construction (IFC)”. Originals are to be plotted in ink on a 3-mil (0.076mm) vellum base or other high quality paper. IFC drawings must also include a signing block or stamp for ATCO Electric, indicating ATCO Electric's review and acceptance.

Once accepted, the IFC drawings are deemed “final” and essentially “frozen”.

4.2.3.2 Single Line Diagrams (SLDs)

An SLD must be prepared for the development area and included with the design drawings.

ATCO Electric SLDs are primary voltage schematic diagrams indicating the connection of electrical equipment and the phase information within the design area. The SLD must show all padmount transformers, switch cubicles and laterals with an ATCO Electric-designated switch number. Padmount transformers must indicate the kVA rating. Switch cubicles must show the correct configuration as provided by ATCO Electric. The scale of the drawing must be in the range of 1:500 to 1:2000 metric, depending on the size of the subdivision development. The Developer and/or its agent(s) are required to ensure the assigned device numbers are correctly transferred from the SLD to the IFC drawing and equipment.

See Appendix C, Drawing C.1.3 for an example
4.2.3.3 Voltage Drop Calculations

The Developer and/or its agent(s) must submit a copy of the Voltage Drop Calculations using the voltage calculator provided by ATCO Electric. The calculator can be found on ATCO Electric’s website or downloaded by clicking HERE.

4.2.3.4 Street Light Study File

An original study file shall be sent to ATCO Electric’s Engineering Representative. The files should be in AGI format for AGI-32 users and PDF format for non AGI-32 users.

4.2.3.5 Street Light Study Results

In the Street Light Study Results, tables for Luminaire Schedule and Calculation Summary, including each calculation grid, shall be clearly documented and authenticated. An example is shown in Appendix C, Document C.1.5.

4.2.3.6 URWs, Easements and Crossing Agreements

Within the Municipality, all distribution equipment (with the possible exception of switch cubicles) is located within the Municipality's URW on Municipal land. As such, properly-executed URW agreements/plans are required to locate facilities on these properties. Additionally, separate agreements are required to cross oil or gas pipelines and railway lines or roadways, and to locate switch cubicles on private property: These agreements should be registered as follows:

a) Unregistered crossings (e.g., crossings located in the field via Alberta One-Call): the agreement shall be administered in the Developer's name during construction and transferred to ATCO Electric’s name prior to acceptance.
b) Pipeline crossings: the agreement shall be registered in the Developer's name during construction and transferred to ATCO Electric's name prior to acceptance.

c) Railway crossings: the agreement shall be registered in ATCO Electric's name.

d) Switch cubicle easements: the agreement shall be registered in ATCO Electric's name. See Appendix F, Form F.1 for a blank ATCO Electric Utility Right-of-Way form.

e) Transformer URW: the agreement shall be registered in ATCO Electric's name. The following easements are required if the transformer is not in ATCO Electric's URW: 3m x 3m easement for single phase transformer and 5m x 5m for three phase transformer.

f) For additional transformer URW outside of ATCO Electric's 2.5m URW in Bare Land Development, extend the URW 1.5m x 3.0m to accommodate the transformer. See appendix F, Form F1 for a blank URW form.

When an agreement is initially administered in the Developer's name, the Developer and/or its agent(s) are responsible for obtaining written approval from the grantor stating that the agreement can be transferred to ATCO Electric.

The Developer bears full responsibility for meeting the conditions of all crossing agreements, including any extra costs, damage claims or insurance costs related to the installation.
All agreements must be executed and submitted to ATCO Electric’s CSR:

a) with the design documents (Step 3);

b) prior to energization (Step 8); and

c) within thirty (30) days post-energization with the final record drawings and documents (Step 9). At this point, all crossing agreements and easements must be registered in ATCO Electric’s name and complete with any attachments, conditions or schedules and engineering drawings or construction details.

4.2.3.7 Asset Documentation Form

The Developer and/or its agent(s) are responsible to request switch numbers and Asset IDs from ATCO Electric for all the padmount transformers, pedestal boxes, etc. that are identified in the Asset Documentation Form (See Appendix F. Form F.2). The Developer and/or its agent(s) must download and fill in the Asset Documentation Form and ensure the assigned device numbers are correctly transferred to the IFC drawing and equipment. The Asset Documentation Form can be found on ATCO Electric’s website or downloaded by clicking HERE.

Note: Asset IDs refer to individual location rather than individual equipment. For example, a pedestal box tied to a streetlight should only have one Asset ID.

4.2.4 Municipal Approval (If Required)

A copy of the design package will be sent for municipal approval after it has been accepted by ATCO Electric’s Engineering Representative. On receipt of municipal approval, ATCO Electric’s CSR will contact the Developer and/or its agent(s) to confirm the receipt of Municipal approval (Step 4)
4.2.5 As-Built Drawings and Documents

The Developer and/or its agent(s) must submit to ATCO Electric's CSR as-built drawings, including schematics, indicating in red all changes and the dimensioning of all alignments and/or offsets in accordance with Section 3.0 design guidelines and the timing requirements identified in Steps 7, 8 and 9.

The drawings must be on vellum or other high quality paper and authenticated by a Registered Professional Engineer (i.e., the Consulting Engineer).

The as-built documents must contain the following information, as surveyed by a Registered Surveyor and certified by the Consulting Engineer:

a) alignment of all trenches, in relation to property lines "boxed", and deviations from design;

b) location of all switch cubicles, transformer pads, street light bases and service stubs in relation to property lines and/or found iron pins, complete with universal transverse Mercator (UTM) coordinates (longitudinal and lateral dimensions);

c) location of all road crossings in relation to property lines and/or found iron pins (lateral dimensions only) for both sides of the roadway;

d) service cable and/or stub locations at each individual serviced lot in relation to property lines (lateral dimensions only); and

e) Special service stub locations, where applicable, in relation to property lines, complete with universal transverse Mercator (UTM) coordinates (longitudinal and lateral dimensions).

4.2.6 Civic Addresses and Site IDs
The Developer and/or its agent(s) must provide ATCO Electric's CSR with a list of all the approved civic addresses and corresponding lots within the subdivision at least four (4) weeks before energization. Each pre-serviced lot requiring electrical service must have an address to be assigned a Site ID.

As a “Wires Service Provider” (WSP), ATCO Electric has a regulatory obligation to issue and maintain a Site ID number for each lot and/or site requiring electrical service. This Site ID number must be tied to an approved civic address which the customer is required to provide to their “Retailer” of choice when enrolling their site for connection.

**Note:** No subdivision will be energized prior to the receipt of civic addresses.
5.0 INSTALLATION STANDARDS

The Developer and/or its agent(s) are responsible to ensure that all construction meets the conditions and/or requirements of any governing authority, other utility, pipeline, railway or other facility owner affected by or having an interest in the work (e.g., permits, crossing agreements, environmental caveats, etc.), and whose approval or acceptance of the proposed URD was required and obtained prior to ATCO Electric's acceptance of the final design and the start of construction.

5.1 Main Trench and Cable

5.1.1 Site Preparation and Grading

Before starting work within the URD area, the Developer and/or its agent(s) must prepare the site by defining the locations of the required distribution facilities and equipment, as well as grade levels and all vegetation plans, in relation to the subdivision site survey reference points provided by the Municipality.

Generally, the sequence of activities is to be as follows:

1. Rough grading along all required alignments and URWs.
2. Location staking for all bases for padmount transformers and switch cubicles, secondary junction boxes, joint-use pedestals and street light bases, and staking for proper grade elevation.
3. Alignment staking for all trenching, as well as grade level confirmation.
4. Location staking for all secondary service boxes.

Also prior to construction, all streets and lanes or walkways within the URD area must be rough graded, as per the definition in Section 1.1.
The Developer and/or its agent(s) are responsible for having all work related to alignments and grade levels, as required for the entire installation, laid out by qualified surveyors, and for the preservation of all stakes and marks during construction.

Future landscaping must be considered when determining the final grade, prior to the installation of any underground distribution power cables, bases for padmount transformers, secondary joint-use pedestals or street light screw-in bases. In addition, special care must be taken during landscaping, to avoid having electrical bases in the path of runoff water from rainstorms or snow melt.

5.1.2 Alignments

All main distribution power cable trenches located on boulevards must be laid at a minimum depth of 1.2m below rough grade level. Where cables fill the trench to more than 0.3m, the Developer and/or its agent(s) must ensure the top cables are at a minimum depth of 1.0m.

5.2 Trenches

5.2.1 Excavation

All trenches must have a minimum width of 300mm to a maximum width of 700mm. See Appendix B Drawings, U3A, U4A, and Appendix D, Drawings D.1.1 to D.1.8. Alignments are as noted on utility alignment plans.

Extreme care must be taken during excavation to not disturb any iron pins. If any iron pin is disturbed or removed by the Developer and/or its agent(s), it must be replaced and confirmed by a registered land surveyor.

The Developer and/or its agent(s) are responsible to arrange locates and to ensure all underground facilities have been located and marked prior to starting any excavation within the development area.
SPECIFICATIONS FOR NEW UNDERGROUND RESIDENTIAL DISTRIBUTION SYSTEMS

No deviation from the surveyed alignments or grade levels is allowed during construction except with the written approval of the Consulting Engineer and, if significant alignment or grade changes are necessary, the written acceptance of ATCO Electric’s Engineering Representative.

No trenching is allowed within 3.0m of an existing energized padmount transformer, switch cubicle or stub-out without the authority of ATCO Electric’s CSR. At the start-up meeting, the Developer and/or its agent(s) and ATCO Electric’s CSR will determine or verify:

a) the distance the Contractor must maintain from energized facilities;

b) coordination and method of excavation (e.g., hydrovac, hand digging, etc.) required to complete the installation;

c) coiling of the underground power cables;

d) barricading of open trench; and

e) any other requirements to ensure the required construction clearances are not jeopardized.

The Developer and/or its agent(s) are responsible to provide temporary support, adequate protection and maintenance for all underground and surface utility structures, drains, sewers and other obstructions encountered during the work, and to cover any and all associated costs including the costs of others.

Where the grade or alignment of the trench is obstructed by existing utility structures such as conduits, ducts, pipes or branch connections to main sewers or main drains, the obstruction must be permanently supported, relocated, removed or reconstructed by the Developer and/or its agent(s), in cooperation with the owners of the utility structures.

The trench bottom must be free of stones, loose earth (including scuffed material) and sharp objects. In backfilled areas, the trench bottom must
be compacted to the satisfaction of ATCO Electric’s Representative. The trench bottom must also be kept level, to facilitate the laying-in of the cable. Where there is a change in the contour of the surface, the Developer and/or its agent(s) must provide additional grade stakes as required.

Trenches must be backfilled the same day the cables are pulled; cables must not be left exposed in an open trench.

5.2.2 Sand Bedding and Backfilling

5.2.2.1 General Requirements

The Developer and/or its agent(s) must:

a) supply and place a minimum of 150mm of stone-free sand fill above and below the underground power cables (see Section 5.2.2.2);

b) arrange spoil piles in order to maintain the soil in the centre of the pile in a non-frozen state;

c) extract all backfill to be placed immediately above the top layer of sand from below the frozen surface of the spoil piles (see Section 5.2.2.3);

d) “berm” the trench line where possible, to minimize the void if sloughing does occur;

e) install warning tape as shown in Appendix B, Drawings U3A, U4A and Appendix D, Drawings D.1.1 to D.1.8; and

f) compact the backfill (see Section 5.2.2.4).

Extreme care must be taken during backfilling to not disturb any iron pins. If any iron pin is disturbed or removed by the Developer and/or its agent(s), it must be replaced and confirmed by a registered land surveyor.
5.2.2.2 Sand Bed Material

The Developer and/or its agent(s) are responsible to provide all sand. The sand must be free of clay, rocks and organic materials, and meet the following grading requirements:

a) 100% passing 25mm sieve;

b) 95% passing 5mm sieve, with a maximum allowable 10% passing 80 micrometer sieve; and

c) liquid limit not exceeding 25%, and plasticity index not exceeding 6%.

For sand definitions and requirements, refer to ASTM Standards D698-07e1 and D1557-09. **Note:** ASTM standards are copyrighted; the Developer and/or its agent(s) are advised to obtain their own copies. These are available through the ASTM web site at www.astm.org.

5.2.2.3 Backfill Material

Backfill material must be the soil excavated from the ditch or trench. Sand is to be substituted for poor existing soils (i.e., soils with high thermal resistivity, which includes organic soils, peat, black loam, sod, clay that has hardened and stones). All backfill material is subject to approval by ATCO Electric’s Representative during inspection of the open trench.

Backfill containing large stones, dry clay lumps, ice, snow, straw or organic or frozen materials is unacceptable and may not be used at any time. **Note:** If ATCO Electric’s Representative determines native frozen lumps may be utilized on top of the sand, and then the frozen lumps must be power compacted.
Backfill must be placed in uniform lifts not exceeding 300mm compacted depth. Where clay is used as the backfill material, the moisture content of the clay must not exceed the plastic limit, or more than 15%, when being placed in the ditch. For definitions and instructions related to the plastic limits of soil, see ASTM Standard D698-07e1.

Wherever possible, the excavated material should be placed back into the trench in both the vertical and horizontal order in which it was removed.

5.2.2.4 Compaction

The native backfill must be compacted to within 150mm of the top of the trench.

The backfill within road crossings, trenches, ditches and other excavations within the road allowance must be compacted as per the Municipality’s requirements. ATCO Electric’s Representative requires the Developer and/or its agent(s) to provide copies of certified tests of the soil compaction, as per ASTM Standard D698-07e1, and in accordance with the Standards provided by the Municipality (see Appendix F, Form F.16).

5.2.2.5 Road Crossings

Road crossings are to be installed as appropriate (i.e., one party, two party, three party or four party). See Appendix D, Drawings D.2.1, D.2.2 and D.2.3. Compaction requirements are as stated in Section 5.2.4.4.
5.3 Cables

5.3.1 General Requirements

The supply and installation of all single phase subdivision power cables and service stubs is the responsibility of the Developer and/or its agent(s), as part of the overall installation of the underground electrical distribution system.

Installation of express feeders is addressed in Section 2.0, Table 2.1, Note 1 (i.e., responsibility for the civil works is at the discretion of ATCO Electric and will be discussed with the Consulting Engineer at the Preliminary Design stage of the project).

Underground power cables should not be installed at temperatures below -25 degrees Celsius. If cables are to be installed at temperatures below -25 degrees Celsius, the cables must first be warmed to room temperature for a minimum of 48 hours, then installed (pulled and shaped) within 2-3 hours.

Underground power cables must be laid and pulled out in the trench at random separation, with primary cables generally trained to the street side of the trench, secondary and street light cables to the center of the trench and communication cables or gas line to the property side of the trench, as per ATCO Electric’s Single Party to Four Party Trenching Standards (see Appendix B Drawings, U3A, U4A, and Appendix D, Drawings D.1.1 to D.1.8, D.3.1A, D.3.1B and D.3.2.

The Developer and/or its agent(s) must exercise extreme care at all times when handling underground power cables to ensure the cables are not damaged due to negligence or rough handling (see Section 5.3.1.1). The underground power cables must not be unduly dragged over abrasive surfaces, crimped or cut where the exterior jacket or insulating properties of the individual cables are jeopardized.
Any vehicles utilized by the Developer and/or its agent(s) must allow safe handling and playing out of the underground power cable in a straight line, tangentially from the reel, without undue tension.

All underground power cables must be placed in the trench with great care to avoid kinking, damage to the concentric neutrals, or placing on rocks or other unacceptable material.

Care must be taken when laying the underground power cables to avoid excessive snaking and/or crossing of the cables over each other, which can create pressure points on the cables when backfilled and cause insulation damage.

### 5.3.1.1 Damage to Cables

The Developer and/or its agent(s) are responsible for the repair or replacement of any cable damaged during installation and prior to ATCO Electric’s acceptance of the Construction Completion Certificate (CCC) and energization of the system, even if the damage is through no fault of the Developer and/or its agent(s).

Any damage to an underground power cable must be reported immediately to ATCO Electric’s CSR, who will decide if the cable must be replaced.

Replacement of power cables must be made to the satisfaction of ATCO Electric’s Representative.

The two (2) categories of underground power cable damage and required corrective procedures are described below:

a) Minor Cable Damage: Minor scratches, marks, and indentations to outer jacket (e.g., after pulling cable through a duct).

Corrective Action: ATCO Electric’s Representative will determine if the cable needs to be replaced.
b) Severe Cable Damage: Any damage beyond that described in “Minor Cable Damage” is considered to be too severe for repair (i.e., a gouge or break through the concentric neutral strands).

**Corrective Action:** Cable must be replaced by the Developer and/or its agent(s).

### 5.3.2 Primary Cable

Any primary cable installed under a paved surface must be installed in 102mm duct. See Appendix E.13, Appendix B Drawings, U3A, U4A, and Appendix D, Drawings D.1.1 to D.1.7.

The ducts should be sized so the power cables do not exceed forty percent (40%) of the cross-sectional area of the duct. Also, the ducts must be used only for underground power cables. After installing the power cables, all road crossing duct ends must be covered by sand to a depth of 200mm.

When pulling underground power cable in duct, care must be taken to avoid the use of equipment or pulling distances that could result in damage to the cable or duct walls.

When determining safe pulling distances through duct, considerations include: coefficients of friction; cable lubricants; tension and sidewall bearing pressure levels. Where lubricant is required, accepted power cable lubricant must be used.

At entrances into ducts, bases, etc., the underground power cables must not be positioned beyond the allowable minimum-bending radius of each particular cable (i.e., eight (8) times the cable diameter, or as otherwise noted by the manufacturer).
5.3.3 Secondary Cable

All secondary power cables and/or terminations required at, or entering, existing padmount transformers, switch cubicles, splice boxes, riser poles, etc. must be installed and completed by ATCO Electric personnel only.

The Developer and/or its agent(s) will at no time have access to any energized facilities.

The Developer and/or its agent(s) must coordinate the excavation and installation of all secondary power cables within 3.0m of an existing energized padmount transformer, switch cubicle or stub-out with ATCO Electric’s Representative.

5.4 Pre-Cast Transformer Pads

5.4.1 Excavation

The Developer and/or its agent(s) must excavate a hole large enough to accommodate each padmount transformer base and ground grid before the trenching is completed or any underground power cable or ground wire is installed. The Developer and/or its agent(s) must also properly compact the unwashed gravel fill to support the base, and to ensure proper leveling at each transformer base location. The compaction should be at least 95% Proctor, as defined in ASTM Standard D698-07e1.

After the underground power cables are installed at the base, and the secondary cables, where applicable, are extended away from the base, the Developer and/or its agent(s) must place sand around the cables, to a minimum cover of 400mm and extending 500mm from the base, before backfilling the main trench.

See Appendix D, Drawings D.4.1, D.4.2 and Appendix E, Drawing E.4.
5.4.2 Sand Bedding and Backfilling

After the padmount transformer bases are installed, the Developer and/or its agent(s) must backfill the excavation and compact the surrounding fill up to 400mm below final grade.

The Developer and/or its agent(s) must then install the required ground grid (see Appendix D, Drawings D.4.5), backfill the remaining excavation and compact it to within +/- 150mm of rough grade. No backfill is allowed inside the padmount transformer bases, as per Appendix D, Drawings D.4.1 and D.4.2.

The Developer and/or its agent(s) are responsible to provide all sand for leveling bases for padmount transformers and/or raising bases to accommodate future landscaping. The sand must be free of clay, rocks and organic materials, and meet the following grading requirements:

a) 100% passing 25mm sieve;

b) 95% passing 5mm sieve and a maximum allowable 10% passing 80 micrometer sieve; and

c) liquid limit not exceeding 25%, and plasticity index not exceeding 6%.

For sand definitions and requirements, refer to ASTM Standards D698-07e1 and D 1557-09.

All costs for any corrective measures required after energization will be borne solely by the Developer.

5.4.3 Ground Grid Installation

The Developer and/or its agent(s) are responsible to install the ground grid at each padmount transformer location prior to backfilling and compacting the excavation.
The ground grid installation for padmount transformers and the protective guard posts are shown in Appendix D, Drawing D.4.5.

Specifications for grounding materials and parts are provided in Appendix E, Document E.5.

All grounding must meet the requirements of the AEUC. In addition, all ground grids must be tested before connecting the concentric neutrals using Fall of Potential to ensure ground resistance is below 6 Ohms (see Appendix D, Document D.4.20), as per the Code requirements.

If the ground grid does not meet the Code requirements, remedial action must be taken by the Developer and/or its agent(s) to ensure compliance.

Note: The use of deep driven ground rods provides a means of lowering ground resistance in most cases and is recommended. Test results must be documented, as per Section 7.2.3, showing the date of test, type and identification of equipment and measured ground resistances.

5.5 Transformers

The installation of transformers is shown in Appendix E, Drawings E.4. Also refer to the TPD-General Specification in Appendix E.

5.5.1 Cable Installation and Coiling

Primary and secondary cable coils must have one loop of cable left in the vault, coiled in a clockwise (primary cable) or counter-clockwise (secondary cable) direction (see Appendix E, Drawings E.4).

5.5.2 Transformer Bushing Designations

Padmount transformer primary bushings are designated H1 to indicate the bushing is connected to the H1 end of the primary winding.
For single phase transformers where one end of the primary winding is grounded, H1A and H1B are the primary terminals. H2X2 is the grounding point. Single phase mini-padmount transformers are loop-feed transformers with the primary bushings designated as H1A - H1B, with the H1A bushing on the lower left side of the transformer.

Three phase padmount transformers designed for feed-through operation have two sets of primary bushings, which are designated H1A - H1B, H2A - H2B, H3A - H3B, where A and B represent different connection points for the same phase.

When facing the bushings, the underground primary power cables feeding from the left side of the padmount transformer must be connected to the H1A bushing (H2A and H3A bushings for three phase), and the primary cables feeding from the right must be connected to the H1B bushing (H2B and H3B bushings for three phase), regardless of the number of phases or from where the system is fed.

5.5.3 Cable Terminations

All conductors must be properly dressed prior to termination, in accordance with the manufacturer's instructions, with the appropriate identification tag securely attached to each cable.

5.5.3.1 Primary Cable Tagging

Tagging requirements for primary cables within the padmount transformer compartment are as follows:

a) Each primary power cable connection inside the padmount transformer must be tagged with the appropriate cable tag supplied by ATCO Electric (i.e., A1,B1,C1). **Note:** The cable tag does not necessarily indicate the phase at the transformer.
b) A matching cable tag must be installed directly above the primary bushing on the padmount transformer tank wall (i.e., the primary power cable tag must match the cable tag on the tank wall).

c) The three phase and/or single phase switches on loop-feed padmount transformers must be marked with the appropriate cable number, directly above the switch handle on the tank wall, using lamicoids supplied by ATCO Electric.

d) The SLD Schematic plate supplied by ATCO Electric and the phase connection must be attached to the inside of the padmount transformer.

e) The Switch number supplied by ATCO Electric must be attached to the outside of the padmount transformer door.

f) All Equipment combined or standalone shall have its own asset tags attached to the outside of the equipment.

See Appendix D, Drawing D.5.6.

5.5.3.2 Secondary Cable Tagging

Each secondary cable (300 MCM) must be identified with the asset number of the previous or next pedestal or transformer to which it is connected.

A stick-on tag created with a labeler must be attached to the cable and encapsulated with a clear, heat-shrink sleeve. The lettering on the tag is to be uppercase, bold and of a reasonably legible size.

See Appendix D, Drawing D.5.6.

5.5.3.3 Load Break Elbows

At each padmount transformer, where the subdivision primary cable is to be terminated, the Developer and/or its agent(s) must supply and install the required separable load break (LB) connectors and fault
indicators, and make all the supply conductor connections and grounding bonds within the padmounted enclosure. See Appendix E, Document E.6 for fault indicator specifications and installation details. The individual performing the termination must complete and sign the cable termination form. See Appendix F, Form F.20.

All conductors must be properly dressed prior to termination, in accordance with the manufacturer’s instructions, with the appropriate identification tag securely attached to each cable. Fault indicators are to be located on the cable connected to the LC transformer bushing.

Elbow terminators are to be installed as follows:

a) The manufacturer’s instructions for installing the elbow and related parts must be followed in the sequence provided.

b) During installation, the male contact pin is not to be handled with bare hands, but only by workers wearing clean cotton gloves. This pin must be absolutely free of any lubricant and installed or removed only with the use of the approved probe insertion tool.

c) One half-lapped wrap of semiconducting tape is to be applied to bond the semiconductor portion of the elbow. Three half-lapped wraps of ozone-resistant tape or a cold-shrink sleeve are to be applied to bond the jacket of the cable up over the semiconductor tape and onto the elbow, providing a waterproof seal between the jacket and the elbow.

d) One strand of concentric neutral wire is to be utilized to ground the grounding eye. The remaining concentric neutral wires must be tightly twisted together and connected to the ground bus of the transformer.

e) Silicone grease must be applied and the elbow connector placed on the bushing, and the elbow pressed straight onto the bushing with sufficient force to ensure the top of the bushing is firmly
locked into place at the bottom of the elbow. A visual check should be done to ensure the skirt of the elbow is completely over the semiconductor portion of the bushing.

f) The conductor connectors must NOT be interchanged with the elbow pins and fitted into the elbow unless they are from the same manufacturer.

See Appendix E, Drawings E.4

5.5.3.4 Secondary Terminations

The Developer and/or its agent(s) are responsible to complete all secondary connections between the padmount transformer and the secondary pedestal. However, no cable terminations may be completed until each transformer is properly secured by four (4) hot dipped, galvanized hold-down plates and bolted to precast inserts. Once installed, all lifting bolts are to be removed.

The secondary cables connecting a single phase padmount transformer up to 300 MCM are to be trained such that they are installed into the proper secondary terminal block of the pedestal (see Appendix E, Drawing E.4).

After installation into the terminal block, the phase conductor must have a tie wrap installed on the end of the insulated conductor. The set screw is to be tightened only enough to prevent the cable from falling out of the terminal block.

5.5.4 Lightning Arrestors

ATCO Electric's Engineering Representative will confirm the type and location of lightning arrestors required during the Preliminary Design stage. See Appendix E, Drawing E.4.
5.5.5 Fault Indicators

A fault indicator must be installed on each primary loop cable on the LB elbow.

The fault indicator specification is provided in Appendix E, Document E.6.

5.5.6 Ground Grid Connections

For three phase padmount transformers, the neutral conductor must be grounded to the HO bus bar and interconnected with the secondary neutral conductor and then to ground. See Appendix E, Drawing E.4.

For single phase padmount transformers, the neutral conductor must be grounded to the HO bus bar and interconnected with the secondary neutral conductor and then to ground. See Appendix E, Drawing E.4.

5.6 Pedestals

All pedestals are to be installed as shown in Appendix D, Drawing D.4.14 and meet the specifications identified in Appendix E, Document E.7. All pedestals must be leveled and installed at the proper grade.

5.6.1 Cable Installation

The secondary cables used to connect the padmount transformer terminals and secondary pedestals must NOT be smaller than the largest secondary cable feeding out of that pedestal. For specifications for one party and 2/3 party pedestals, see Appendix E, Document E.7.

The source feed to street lights may be from the secondary pedestals.

All secondary power supply cables from the padmount transformers must be connected to the phase connector terminals. Each secondary power service cable in the pedestals is to be left unconnected for connection upon completion of the lot service, and properly identified by legal lot description and address, as per Section 5.6.3.
Caution must be exercised to prevent damage to the primary and secondary power cables when connecting to the secondary pedestals. Each secondary power cable must be trained into position to prevent unnecessary crossing of the cables.

5.6.2 Cable Termination

All cables (phase and neutral conductors) must be terminated in an acceptable fashion. The strands of the concentric neutral on each secondary power cable must be twisted together for a minimum of 200mm and connected to the neutral terminal. All terminal bolts must be tightened such that the secondary power cables cannot be moved by normal force.

5.6.3 Secondary Cable Tagging

Both ends of each secondary service cable must be properly identified by legal lot description (i.e., lot, block and plan number). Each service cable must be identified with the legal description of the lot being serviced by that cable.

A stick-on tag created with a labeler must be attached to the cable and encapsulated with a clear heat-shrink sleeve. The lettering on the tag is to be uppercase, bold and of a reasonably legible size.

See Appendix D, Drawing D.5.6.

5.6.4 Ground Connections

In secondary and joint-use pedestals, the concentric neutrals must be terminated to the neutral block and a separate #8 copper white TWH wire connected from the neutral block to the apparatus ground lug.

Bonding must also be provided between all above-ground metallic power and communication equipment (i.e., secondary and joint-use pedestals) separated
by a distance of 3.0m or less, as per CSA Standard C22.3 No. 7-94, Clause 3.6.1.

The communication sheath or shield must be bonded to the effectively grounded neutral conductor at an interval of not less than 300m, and there must be a minimum of five connections of grounding electrodes per km, as per CSA Standard C22.3 No. 7-94, Clause 4.3.3. Extra lengths of #2 bare copper conductor may be used to interconnect the communication sheath with the system neutral where required.

5.7 Service Boxes

5.7.1 Depth and Alignment

A wooden service box must be located within each residential service lot, as shown in Appendix D, Drawings D.3.1A and D.3.2.

The service box is to be located 0.5m past the easement, inside the property line. The top of the service box must be a minimum of 300mm below rough grade.

The location of the service box must be marked with a stake and marker tape on the property side of the box, extending a minimum of 200mm above rough grade.

To avoid secondary cable damage during excavation and installation of the secondary service to the home or building, marker tape or another suitable electrical marker should also be installed 500mm beyond the service box into the property. This indicates to the electrician to take extra care to ensure the service box and secondary service lead within are not damaged by the backhoe or ditcher.
5.7.2 Coiling of Cable

Two-thirds of the subdivision lot length of cable must be left coiled (see Appendix D, Drawing D.5.1), and heat-shrink capped within the service box.

5.7.3 Markers

An Omni ball marker (Appendix E, Document E.11) must be installed within 1.0m of each wooden service box. Refer also to Appendix D, Drawing D.5.1

5.8 Street Lights

All street lights must be supplied and installed by the Developer and/or its agent(s), as per the IFC drawings accepted by ATCO Electric for the development area, and in accordance with these specifications, the AEUC and the manufacturer’s recommendations and limitations.

5.8.1 Excavation

The Consulting Engineer must provide, classify and designate cross-sections for each street light and walkway within the subdivision design. This will be in relation to standard utility alignment.

5.8.2 Base and Davit Installation

The Developer and/or its agent(s) are responsible to install the bases and davit poles for each street light location. See Appendix E, Documents E.8A and E.8B.

Care and attention must be taken to not damage the davit or the finish. 100% of the threads on the nut must be engaged. All davit standards must be leveled utilizing the appropriate shims such that the pole shaft is perpendicular to the roadway cross section, and all standards have a uniform tilt of zero degrees (0°).
5.8.3 Sand Bedding and Backfilling

The Developer and/or its agent(s) must properly compact the fill to support the base and to ensure proper leveling at each screw-in base location. The compaction should be at least 95% Proctor, as defined in ASTM Standard D698-07e1.

The Developer and/or its agent(s) are responsible to provide all sand used to support the base. The sand must be free of clay, rocks and organic materials, and meet the following grading requirements:

a) 100% passing 25mm sieve;

b) 95% passing 5mm sieve and a maximum allowable 10% passing 80 micrometer sieve; and

c) liquid limit not exceeding 25%, and plasticity index not exceeding 6%.

For sand definitions and requirements, see ASTM Standards D698-07e1 and D1557-09.

All costs for any corrective measures required after energization will be borne solely by the Developer.

5.8.4 Cable Installation

The wiring between the luminaire, the insulated connector and the direct buried cable is to be completed by the Developer and/or its agent(s). A sufficient length of wiring must be maintained to allow a 460mm length out of the hand hole in the davit pole.

5.8.5 Cable Termination and Tagging

All street light circuits must be fed from transformers and pedestals. All cables must be terminated in accordance with Section 5.6.2.
Individual street light davits are to be controlled by a photoelectric cell mounted on each luminaire. The aperture of the photoelectric cell must face the northern skyline. Each light must be tested at time of installation by covering the photoelectric cell to ensure illumination.

Each street light cable must be identified with the asset number of the previous facility or next light to which it is connected. A stick-on tag created with a labeler must be attached to the cable and encapsulated with a clear heat shrink sleeve. The lettering on the tag is to be uppercase, bold and of a reasonably legible size. See Appendix D, Drawing D.5.6.

5.8.6 Ground Connections

The ground resistance must be measured at each screw-in base location. See Appendix D, Drawing D.4.20 for the ground test method and values. Treat the screw-in base as an individual ground rod.

5.9 Single Phase and Three Phase SLD Schematic Plates

SLD Schematic plates will be provided by ATCO Electric during the Pre-construction stage, at the request of the Developer and/or its agent(s).

SLD Schematic plates are to be installed as shown in Appendix D, Drawing D.5.6 and Appendix E, Drawing E.4
6.0 MATERIAL SPECIFICATIONS AND STANDARDS

6.1 General Requirements

The Developer is responsible to supply all personnel, materials and equipment required for the faithful performance of the work, notwithstanding the Developer’s delegation to its agent(s) (i.e., Consulting Engineer, Contractors and others) the actual performance of the work.

The Developer is further responsible to supply all material required for the design and installation of the underground electrical distribution system, including miscellaneous construction site materials (e.g., sand), EXCEPT the following:

a) distribution express feeder cables;
b) source primary feeder cables;
c) primary cable terminations at switch cubicles;
d) pre-cast bases for switch cubicles;
e) switch cubicles;
f) ground grids for switch cubicles; and
g) the required cable tags, SLD Schematic plates, switch plates, danger/warning signs, padlocks, ground test tags and asset tags.

These will be provided by ATCO Electric, as per Section 2.0, Table 2.1.

All material must be new. See Appendix E for material specifications, approved suppliers/manufacturers and ATCO Electric part numbers and/or manufacturer catalogue numbers for equipment used in the construction of underground electrical distribution systems and street lighting. Engineering standards and installation drawings are provided in Appendix B and D.
No deviation from material specifications is permitted without the prior written approval of ATCO Electric's Engineering Representative. The Developer must ensure that any authorized deviations are communicated to their inspector, construction crew and clearly are identified on the Red Line construction drawings.

ATCO Electric reserves the right to inspect any material at any stage to ensure it meets specifications and is from an approved manufacturer. Installed material not meeting the specifications or not approved will be rejected by ATCO Electric. The Developer and/or its agent(s) will be required to replace the rejected material with approved material, at their own expense, prior to ATCO Electric's acceptance of the Developed Distribution Facilities.

6.2 Storage of Material

The Developer and/or its agent(s) are responsible for the safe storage of all material until it has been incorporated in the Developed Distribution Facilities and accepted by ATCO Electric. Any material damaged in transit or damaged after delivery to the construction site must be replaced by the Developer.
7.0 INSPECTIONS AND TESTING

7.1 General Requirements and Inspection Process

As noted in Section 4.1, Step 6, it is the Developer’s responsibility to maintain a liaison with ATCO Electric’s Representative at all times throughout the construction period for the purpose of coordinating inspections.

Before construction begins, the Developer may engage an Independent Inspector to perform all required inspections and tests as described in the following sections. Selection of an Independent Inspector is not mandatory; however, it may expedite the inspection and testing process.

ATCO Electric will inspect all cables laid on sand in the trench or in duct prior to backfill. ATCO Electric may also participate in other inspections or tests. For this reason, the Developer and/or its agent(s) must provide ATCO Electric’s Representative with at least two (2) working days’ notice before:

a) backfilling road crossings;
b) installing cable in road crossings;
c) backfilling trenches, including backfilling over ducts;
d) all aspects of constructing, installing and completing padmount transformer bases, with regard to PVC duct placement (where applicable), foundation compaction, ground grid installation and precast base placement;
e) laying secondary and primary power cables in trenches;
f) installing and terminating power cables in respective apparatus;
g) installing and connecting grounding equipment to respective apparatus; and
h) testing primary cable terminations at transformers, as well as testing the continuity and insulation of all primary cable prior to energization of the system.
ATCO Electric’s Representative will advise the Developer and/or its agent(s), in writing, of any errors or deficiencies in the work at the time the error or deficiency is discovered.

7.2 Material Testing

7.2.1 Primary Cables

The Developer and/or its agent(s) shall contact the ATCO Electric Construction Representative and/or Operation Representative to coordinate a DC Hi-Pot cable test. Continuity and phasing checks must be performed on all primary cables before proceeding to the DC Hi-Pot cable test. All primary cable terminations must be completed prior to any testing, including the installation of all required fault indicators (see Appendix E, Document E.6) and cable tags (supplied by ATCO Electric, as per the ATCO Electric/Developer Responsibility Matrix, Section 2.0, Table 2.1 and Section 4.1, Step 3).

Test results must be indicated in the URD Turnkey Commissioning Form (Appendix F, Form F.21)

7.2.2 Transformers

The Developer and/or its agent(s) must provide transformer test reports and drawings from the applicable transformer manufacturer(s), as specified in Appendix E, Document E.3.

The transformer test report data must be recorded on the provided ATCO Electric Equipment/Ground Test Report (See Appendix F, Form F.7). The electronic file can be found on ATCO Electric’s website or downloaded by clicking [HERE](#).

7.2.3 Ground Grids

Ground grids for padmount transformers must be installed as shown in Appendix D, Drawing D.4.5. The Developer and/or its agent(s) are
responsible to ensure tests for ground resistance are performed prior to energization, in accordance with the test method and values provided in D.4.20.

The ground resistance readings must meet ATCO Electric standards or remedial action must be taken until the readings are acceptable. The test results are to be added to the as-built drawings, beside the device number of each piece of equipment.

The Equipment/Ground Test Report (see Appendix F, Form F.7) must be completed and signed by the Developer's qualified electrician, and submitted to ATCO Electric's Representative for approval. The electronic file can be found on ATCO Electric's website or downloaded by clicking HERE.

7.3 Construction Inspections
See Appendix F, Form F.21 for the URD Turnkey Commissioning Form to complete the visual checks described below, in addition to any other forms noted.

7.3.1 Trench and Cable Lay
Visual checks must be completed to verify:

a) the bottom of trenches and backfill materials are free of rocks;
b) sand bedding is installed;
c) trenches are in proper alignment, as per staking and the IFC drawing;
d) ducts are properly located and placed (where required);
e) all primary and secondary power cables are at the proper depth;
f) marker tape is properly placed along the primary and secondary power cable trench alignments; and
g) proper cable is installed.
7.3.2 Trench Sand Bedding and Backfill

Visual checks must be completed to verify:

a) sand bedding is installed, where required;

b) all road crossings are properly compacted as per Section 5.2.2.4 (if uncertain, ATCO Electric’s Representative will request certification that municipal standards have been meet); and

c) all trenching is properly compacted.

For compaction testing, see Appendix F, Form F.16.

7.3.3 Transformer Bases

Visual checks must be completed to verify:

a) unwashed gravel/sand bedding is installed, where required;

b) ducts are properly located and placed, where required;

c) pre-cast pads and bases are installed at proper grade, according to staking;

d) pre-cast pads and bases are level;

e) the ground grid surrounding the transformer base is properly installed;

f) proper wire has been used; and

g) all trenching and bedding of pre-cast transformer pads is properly compacted.

7.3.4 Equipment Installation

7.3.4.1 Primary Cables

All permanent cable tags (supplied by ATCO Electric) are to be installed prior to testing and verification of the cables.
In addition to the continuity and phasing checks completed as per Section 7.2.1, visual checks must be completed to verify:

a) primary cables are free of damage;
b) connections are tight and treated with inhibitor, where required;
c) bleed wires are properly connected on inserts and bushings;
d) primary cables are clearly and properly labeled;
e) cable tags correspond to the IFC Single Line Diagram (SLD).
f) primary cable open points correspond to the normally open points shown on the IFC SLD;
g) fault indicators are checked and reset; and
h) proper cables are used.

7.3.4.2 Transformers and Terminations

In addition to the test reports provided by the Developer and/or its agent(s) as per Section 7.2.2, visual checks must be completed to verify:

a) transformers are in proper alignment and location, as per staking and the IFC drawing;
b) the slope of the grade on which the padmount transformer base sits is no more than 9.5 degrees, or less than a six-to-one slope (i.e., 1.0m rise in 6.0m run).
c) access lid entry area of the padmount transformer is clear and accessible for switching;
d) padmount transformer is securely attached to the pre-cast base;
e) no traces of oil leaks, damage or paint scrapes are visible;
f) door hinges and captive bolt leads are in good condition;
g) padmount transformer primary grounding conductor goes directly to the H2 bushing and not via the X2 terminal;

h) ground connections are properly installed and connected;

i) warning and danger signs are installed and intact;

j) Switch numbers and transformer Schematic SLD Plates correspond to the switch and transformer numbers on the IFC SLD; and

k) phase indicators correspond to the phasing on the IFC SLD.

7.3.4.3 Ground Grids for Three Phase Transformers

The dimensions surrounding three phase transformer pads must be correct. Connections to the ground connectors must be tight and treated with inhibitor, where required. All ground resistance readings must be within AEUC limits (see Appendix D, Document D.4.20 for required ground test values.)

7.3.4.4 Secondary Cables, Pedestals and Terminations

All lugs must be installed at the padmount transformer. All secondary junction boxes and pedestals must be securely installed. All doors must be installed and all terminal blocks must be securely tightened.

Visual checks must be completed to verify:

a) all secondary power cables are free of damage;

b) connections are tight and treated with inhibitor, where required;

c) all secondary power cables are clearly and properly labeled; and

d) proper cables are used.

7.3.4.5 Street Lights and Terminations

All street light poles or standards must have a uniform tilt of zero degrees (0°). The vertical tilt and light pattern of each street light
assembly must be inspected by the ATCO Electric Construction Representative prior to final acceptance.

Visual checks must be completed to verify:

a) street lights are in proper alignment and location, as per staking and the IFC drawing;
b) proper street light standard and luminaire are installed;
c) headline and sideline are good;
d) street light standard is securely attached to the pre-cast base and nut covers are installed;
e) ground connections are properly installed and connected;
f) access lid on the bottom of the street light standard is properly orientated, intact and secure;
g) warning signs are installed and intact;
h) proper connections are used and insulated appropriately; and
i) proper cables are used.

7.3.5 As-Built Documentation

The Developer and/or its agent(s) must maintain accurate drawings throughout construction and inspection of the Developed Distribution Facilities. Any changes from designs previously approved by ATCO Electric shall be submitted and pre-approved in writing by ATCO Electric’s Engineering representative prior to construction. A drawing of the proposed changes may be required at the discretion of the ATCO Electric’s Engineering representative.

Visual checks must be completed to verify:
SPECIFICATIONS FOR NEW UNDERGROUND RESIDENTIAL DISTRIBUTION SYSTEMS

a) all construction is in accordance with the ATCO Electric accepted IFC drawings, and changes, if any, are recorded; and

b) phasing, equipment and switch numbers correspond to the approved SLD.
8.0 ACCEPTANCE AND ENERGIZATION

8.1 General Requirements

The Developer is responsible for the entire underground installation and all Developed Distribution Facilities (both exposed and unexposed) until energization and final acceptance of the CCC by ATCO Electric (see Section 8.2).

All areas of the installation, including utility right-of-ways and easements, must be brought to within +/-80mm of final grade before acceptance.

The Developer is also responsible for completing asset documentation (see Appendix F, Document F.5) and submitting the forms electronically to ATCO Electric's CSR.

ATCO Electric will conditionally accept the entire installation ("entire" defined as the area bounded by the Developer's plans, as initially covered by the Contract) on receiving the CCC from the Developer.

After a satisfactory Final Construction inspection of the installation, ATCO Electric will complete any work necessary to supply power to the subdivision. The Developed Distribution Facilities will then be commissioned and energized, subject to the following conditions:

a) ATCO Electric will not energize portions of the development in a piecemeal manner, unless specific arrangements are made and the Developer pays all additional costs.

b) If, on attempting to energize the system, ATCO Electric determines that certain cables have been damaged and are not considered serviceable, the Developer must expedite the retesting of such cables, as per Section 7.2.1, making arrangements with an Independent Inspector. All costs related to these tests will be the responsibility of the Developer.
c) In the event that a primary or secondary power cable or a portion thereof, fails during energization, ATCO Electric will determine the appropriate action, which will be taken at the cost of the Developer.

The Developer’s CCC will be accepted and signed upon successful energization. At this time, ownership of the Developed Distribution Facilities will transfer to ATCO Electric, along with full responsibility for its future operation and maintenance, excepting those items covered by the Developer’s Warranty.

8.2 The CCC

Upon completion of the Developed Distribution Facilities, and approximately 20 working days prior to the anticipated date of energization, the Developer must submit an authenticated CCC to ATCO Electric, along with copies of the as-built drawings and other documents (see Section 8.3). After inspecting the installation, ATCO Electric will sign the CCC indicating the installation is either Accepted or Rejected:

**Accepted** means ATCO Electric is satisfied with the Developed Distribution Facilities as-built by the Developer and/or its agent(s), and confirms there are no outstanding defects, deficiencies or non-conformances.

**Rejected** means ATCO Electric has identified defects, deficiencies or non-conformances in the installation significant enough that ATCO Electric cannot accept the Developed Distribution Facilities as is. Please note: The commissioning and energization process will not proceed until all of the identified defects, deficiencies and non-conformances have been resolved.

The Developer and/or its agents must make all the necessary corrections and re-submit the CCC and revised as-built drawings within thirty (30) days of the original submission, for review by ATCO Electric’s and Engineering Representatives.
8.3 Timeline for Final Construction Inspection, Acceptance and Energization

The timeline (approximate) for the acceptance and energization of the Developed Distribution Facilities is described below.

8.3.1 20 Business Days Prior to the Anticipated Energization Date

The Developer and/or its agent(s) must submit to ATCO Electric’s CSR:

a) CCC (original), authenticated and stamped by the Consulting Engineer (see Section 8.2 and Appendix F, Form F.8);

b) certified test reports for all primary cable and terminations (provided by the testing company);

c) manufacturer’s test data for all pad mount transformers and certified transformer test reports (see Section 7.2.2 and Appendix F, Form F.6);

d) test reports for all transformer ground grids (see Section 7.2.3 and Appendix F, Form F.6);

e) all completed and signed off inspection forms (see Section 7.3 and Appendix F, Forms F.12 and F.13);

f) a completed Site Cleared of Personnel form (Appendix F, Form F.10);

and
g) three (3) complete paper copies and one electronic copy of the red-line as-built IFC drawings (see Section 4.2.9).

8.3.2 15 Business Days Prior to the Anticipated Energization Date

The Developer and/or its agent(s) must:

a) complete a walk-through Final Construction inspection with ATCO Electric’s Representative (see Note below) and either:
i. accept and sign the red-line as-built IFC drawings, along with ATCO Electric’s Representative, verifying all underground power cables and markings are positively identified, all work has been reviewed and all parties are satisfied the entire installation has been constructed as designed and recorded on the red-line as-built IFC drawings; OR

ii. take action to remedy any defects, deficiencies or non-conformances identified by ATCO Electric and re-commence the process from Section 8.3.1;

b) upon successful completion of the Final Construction inspection (i.e., final red-line as-built IFC drawings are accepted and signed), submit a request for energization (see Appendix F, Form F.9);

c) ensure all easements, railway and pipeline crossing agreements (as applicable) and any other such legal instruments and documents (see Section 4.2.2) are assigned to ATCO Electric or registered in ATCO Electric’s name and forwarded to ATCO Electric’s CSR; and

d) submit completed asset documentation forms electronically to ATCO Electric’s CSR (see Appendix F, Document F.5).

Note: The Consulting Engineer and Contractor accompany ATCO Electric’s Representative during the Final Construction inspection.

ATCO Electric’s Representative will forward one copy of the signed red-line as-built IFC drawings to ATCO Electric’s Engineering Representative, to ensure all facilities are committed to ATCO Electric’s records prior to energization. The Developer and/or its agent(s) will retain the second copy.
8.3.3 Five Business Days Prior to the Anticipated Energization Date

ATCO Electric will complete all work required to supply power to the subdivision, and forward the Contractor’s Construction Clearance to ATCO Electric’s Operations Representative.

8.3.4 Prior to Energization

ATCO Electric’s Operations Representative will issue the formal clearances required to energize the Developed Distribution Facilities and complete system measurements as necessary.

Note: If energization fails, the Developer and/or its agent(s) are responsible to correct the deficiency (ies) and to re-submit the necessary documentation before another attempt will be made.

8.3.5 After Energization

Upon successful energization of the Developed Distribution Facilities, ATCO Electric’s Representative will sign the CCC, indicating ATCO Electric’s acceptance of the Developed Distribution Facilities. Ownership of the facilities is thereby transferred to ATCO Electric.

Within thirty (30 days of energization, the Developer and/or its agent(s) must provide to ATCO Electric's CSR a complete package of final record documents for ATCO Electric's records, which includes:

a) two (2) paper copies and an electronic copy of the final, signed and authenticated as-built drawings;

b) the final, accepted CCC, authenticated by the Consulting Engineer and signed by ATCO Electric's Representative;

c) the final asset documentation forms; and

d) all legal documents, including all easements and crossing agreements, registered in ATCO Electric's name.
8.4 Final Acceptance Certificate and Final Acceptance Inspection

Thirty (30) days prior to the end of the warranty period, the Developer and/or its agent(s) must submit to ATCO Electric's CSR a Final Acceptance Certificate (FAC) (see Appendix F, Form F.9). On receipt of the FAC, ATCO Electric will conduct a final acceptance inspection of the Developed Distribution Facilities.

If no defects, deficiencies or non-conformances are identified during the inspection, ATCO Electric will sign the FAC, accepting the Developed Distribution Facilities as is and releasing the Developer from all warranty obligations, as specified in the Contract.

If any defects, deficiencies or non-conformances are identified during the inspection, these must be corrected prior to acceptance by ATCO Electric.