CENTRE WELLINGTON HYDRO

ELECTRICAL PROJECT

SPECIFICATIONS

Revised May 15, 2002
Revised May 18, 2004
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Revised October 24, 2006
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PART 1 - GENERAL

1.1 Definitions

Wherever used in the Contract Documents, or other document forming part of the Contract:

a) The word "**Contract**" means: the Contract to do the Work, the Bonds or Securities, the Addenda, (if any), the Specifications, the General and Supplementary General Conditions, the Tendering Information, the List of Contract Documents, Drawings, and other documents referred to or connected with the Agreement.

b) The word "**Utility**" means Centre Wellington Hydro.

c) The word "**Contractor**" means the person or Corporation to whom the Contract for the Work has been awarded.

d) The word "**Sub-Contractor**" means the person or Corporation having a contract with the Contractor (or with another sub-contractor) for the execution of a part or parts of the Work included in the Contract, or for the supplying of material for the Contract and worked to a special design according to the Drawings and Specifications.

e) The word "**Engineer**" means the Utility's Superintendent or designate.

f) The word "**Work**" means labour, materials and other things required to be done, that are shown, described or implied in the Contract Documents.

g) "**Inspector**" means an inspector for the Engineer.

h) The word "**Plant**" shall mean the underground or overhead electrical distribution system

i) "**Drawings**" means all Plans, Profiles, Drawings, Sketches or copies thereof exhibited, used or prepared for or in connection with the Work embraced under the Contract.

j) The words "**authorized", "directed", "required", "requested", "approved", "ordered", "sanctioned", and "satisfactory**", unless some other meaning is obvious from the context, mean respectively authorized, directed, required, requested, approved, ordered or sanctioned by or satisfactory to the Engineer.

k) The words **"shall", "may", "herein", "person", "writing", "written", "surety", and "security**" and words used in the singular number or the masculine gender shall have the same meaning and effect as given in The Interpretation Act of the Revised Statutes of Ontario.

l) The words "**Subdivider", "Developer" or "Owner**" are to mean the same as Contractor.

m) **"Utility**" means Centre Wellington Hydro.

n) "**Town**" means the Corporation of the Town of Fergus and Village of Elora

o) "**Consulting Engineer**" is the Firm of Consulting Engineers who has been retained by the Developer to act as their agent for the development of the lands and installation of the services herein.

p) "**Town Engineer**" means the consulting engineers for Centre Wellington and Centre Wellington Hydro.

1.2 Electrical Plans

The Developer shall retain a civil engineer (electrical) registered with the Professional Engineers of Ontario to prepare the detailed design of the project and to direct the Developer's field staff and construction forces through the construction process:

The Sub-Divider and his Consultant shall:

I) Prior To Commencement of Work:

i) The owner or respective authorized agents shall submit to the Utility for preliminary approval, two (2) sets of prints to a scale no less than 1:500 detailing the proposed layout plan. The plan shall show the location of primary cables, secondary cables, service cables, transformers, switchgear, load-break junctions, splices, vaults, road-crossings, street lighting and connection points with existing distribution systems.

ii) After examination by the engineer, one (1) copy shall be returned to the owner or respective agents. The returned plan will be stamped approved and signed by the Superintendent if the plan meets the Utility's requirements and specifications. Should the plans not be approved, the owner or respective engineers shall resubmit two (2) copies incorporating the required revisions as instructed by the engineer. Only after final approval has been received from the Utility and all required agreements between the Utility and the owner have been completed, may work proceed, under direction of the Utility's inspector.

iii) Provide field survey work required after the design criteria and functional alignment have been established, which shall include all survey work necessary for the detailed setting of alignment and grade to fit controlling natural and artificial topographic and underground features, cables, vaults and transformers and stabilization requirements of these structures.

iv) Investigate and confirm the present location of all above and below ground utilities, update plans and profiles to show the present location and the proposed location and prepare additional drawings required for alternative utility relocation as required.

v) Participate in a reasonable number of meetings for informative, negotiative or presentative purposes with the Utility. Prepare and distribute minutes of project design meetings.

vi) Provide the Utility with estimates of cost for the electrical distribution system.

vii) Provide the Utility with separate accounting for the capitalization of the following: Distribution System, Transformers, Sub-Transmission Lines, Street Lighting

viii) Arrange any approvals or applications required by any Board or other body having jurisdiction over utility systems.

ix) Provide all field layout of the system. Changes from the approved drawings or specifications must have prior approval in writing from the Utility.

x) Be responsible for the ordering of all material and the letting and administration of the Contract.

II) Prior To Energization:

Prior to the energization by the Utility of any plant, the owner or his agents shall provide the Utility with one (1) set of as recorded drawings showing all plant constructed. Where there are no differences between the proposed and the installed plant, written notification by the owner or his agents to the Utility is required.

1.3 Location and Design Requirements

Location

When underground distribution is installed, the center line of primary cable trenches shall be installed as per Municipal standard road cross sections applicable to the subdivision or development. Deviations from the standard location must be approved by the Utility.

General Design Requirements

a) The system shall be an underground, installed in duct, multi-grounded electrical system. Sectionalizing and fault indicator requirements must provide for ease of fault identification and restoration of service.

b) Location of the system in the road allowance shall conform to current regulations of Centre Wellington Hydro.

c) Extent shall be all that system required for the servicing of the properties involved from adjacent substations or at such points at the boundaries as designated by the Utility.

d) Main Feeders:

i) Shall consist of three single conductor, 500 MCM copper, 33 1/3% concentric neutral, PVC jacket, to the Utility's specification.

ii) Shall provide a minimum 400 ampere capacity at a maximum 3.5% voltage drop.

iii) Shall be so arranged that a full loop feeder system will be achieved with coordination to adjoining areas.

iv) Sectionalizing equipment will be installed as indicated by service requirements and provided with surge arresters where fed from overhead lines.

v) Registered easements no less than 5 metres by 6 metres shall be provided for all 600 A sectionalizing equipment if placed on private property.

e) Local Service Feeders:

i) Local service primary cable shall be single conductor 1/0 copper 15 kV XLPE, (20 x 14 GA) 100% copper concentric neutral, PVCJ to CSA 68.2.

ii) Single phase primary shall be loop feed with a normal open point in each loop.

iii) Loop shall be considered as point of origin at main feeder to point of closure on a main feeder.

iv) Protection of local service primary loops shall be fuse-type load break equipment.

v) Loops fed directly from overhead lines shall be protected with non-fragmenting surge arresters, installed on dip pole on line side of terminators.

f) Transformers:

i) Minimum transformer size shall be 50 KVA, with a maximum of 10 customers per transformer. For standard loading use 6.5 KVA/non elec, 10 KVA/ elec.

ii) Transformer location to be approved by the engineer.

g) Grounding:

The system shall have multiple grounds, at each transformer, switchgear, vault and any cable terminations.

h) Switching:

i) The system shall have suitable fusing and/or switching facilities installed so that local service feeds may be protected and for isolation of the main feeder loop system.

ii) Such equipment shall be rated 600 ampere, and be of an approved Basic Impulse Level (B.I.L.)

iii) Shall be of such design as to create no hazard to the public and conform to the Canadian Electrical Code.

i) Street Light Installations:

i) Street light installations shall be in compliance with the electrical safety code requirements for roadway lighting systems.

ii) Street light conductors to be THREE # 6 AWG RWU 90 copper (one black/one white/one green) conductor in duct.

iii) Street light poles and luminaries shall be concrete and will be:
23' StressCrete E230-APR-G-MOO-c/w 140 30/30
27'6'' StressCrete E275-APR-G-MOO s/f 126
35' StressCrete E350-CPR-G-MOO s/f 126 c/w Capseal. Depending on the location, as specified by the Engineer. Poles are to be set vertical with hand hole perpendicular the street.

iv) Spacing of poles shall be at a minimum of 37 m. and a maximum of 43 m. and placed on road allowance on primary side of roadway. The luminaries for local roadways will be a decorative (colonial top) 100 watt high pressure sodium, part number Series 245 10S RN 120 R3 GL SD PC as approved by the Engineer. Luminaries on collector roadways will be cobra-head 100 watt high pressure sodium, Durastar Series 20 10S RN 120 R3 FG LC PC. Street lights to be arranged to provide adequate lighting at intersections.

v) Ensure the photometric characteristics of units are appropriate for the installation.

vi) For specifications on other than residential, contact the Engineer.

1.4 Description of Work

a) The contract is for the construction of the underground electric distribution systems located in the Town of Fergus, Village of Elora in the County of Wellington consisting of, but not limited to, the following:

i) Excavation, backfill and sandbedding of all trenches

ii) Installation of single-phase primary cables

iii) Installation of three phase primary cables

iv Installation of secondary cables

v) Installation of house service cables

vi) Installation of precast vaults, padmount transformer foundations, and buried pull boxes.

vii) Installation of concrete encased ductbanks and sand encased ductbanks.

viii) Placing, equipping and connecting low profile transformers on transformer foundations.

ix) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

x) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

b) Definition - The word "work" means supply labour, materials, equipment handling and cartage required for complete installation of the items concerned.

1.5 Joint Use

a) The Contractor may be required to place the Bell Telephone and/or Cable TV cable in a common trench with hydro cable. The cost of placing the telephone and/or cable TV is to be negotiated directly with Bell Canada and Cogeco Cable who will also provide the telephone and cable TV inspection of their plant.

b) Coordinate the work with the activities of Bell Canada and Cable TV to ensure that the trenching and backfilling is carried out in an orderly manner to the satisfaction of the Engineer. No trench shall remain open longer than 48 hours.

c) Any delays caused by coordination with Bell and Cable TV will not be the responsibility of the Utility.

1.6 Performance of Work

a) The Contractor shall do all work in accordance with the best practice and to the satisfaction of the Engineer.

b) The work quality and practice shall be those acceptable to the Engineer.

c) All installation work shall be undertaken by qualified personnel who have received previous instruction and training in installation of the plant.

d) The work practices followed shall be those established by the Utility. These practices will be enforced by the Engineer.

1.7 Utilities

a) The Contractor shall locate the exact position of all structures and Utilities in the field before starting any work.

b) The Contractor shall support any cable, main, line pole, etc. to the satisfaction of their individual owner.

1.8 Alignment of Work

a) The Contractor shall layout all the work in accordance with existing grades and building lines. Additional reference points shall be obtained by the Owner on request, if such points are considered to be essential.

b) The Contractor shall be responsible for the layout of the work and establishing grades.

1.9 Location of Trenches

a) The main trench and service trench is to be located as required by the Engineer or as otherwise specified by the Engineer's representative on the site.

b) Service lateral location is to be directed by the Engineer's representative on the site.

1.10 Preparation for Work

a) Grades to within 150 mm. of final grade are to be provided prior to commencement of the work. The Contractor shall arrange with other site Contractors for the removal of any obstructions which prevents the installation of any specified works.

b) The Contractor shall prepare the area in the vicinity of any splicing to eliminate the contamination of the splicing by dust or moisture. All splicing materials are to be kept clean and dry at all times.

PART 2 - TRENCH EXCAVATION AND BACKFILLING

2.1 General

a) Carry out all trench excavations in strict conformity with applicable acts and by-laws.

b) Trench depth is to be based upon +/- 150 mm. of final grade and the trench shall not deviate from its assigned location, in any direction, by more than 150 mm.

c) Protect the bottom of excavations against flooding and freezing. Use pumping or other means to keep bottom dry. Do not open trench ahead of cable laying and backfilling more than weather will permit. No trench shall remain open longer than 48 hours.

d) Break up rocks and boulders and remove by drilling and wedging.

e) Protect brace and support as required, existing utilities.

f) The trench bottom shall be free of stones and sharp objects. In backfilled areas, the trench bottom shall be compacted to the specification of the Engineer's requirements. This also applies where the cable trench crosses the water and sewer connections for each house.

g) Duct banks shall be constructed in accordance with Ontario Provincial Standards specifications. Duct banks to have 1.0 m cover in boulevards and under roadways.

h) The Contractor shall supply and place 150 mm of sand bedding below and 150 mm above high and low voltage cables, followed by 100 mm of selected backfill over the sand. The selected backfill shall be raked into the trench. The remainder of the trench may be backfilled by hand or machine with site selected native material.

i) Backfill shall be placed in a manner so as not to damage the cable and each 150 mm lift shall be compacted to 95% Standard Proctor Density.

j) It is required to install in all trenches warning tape 300 mm below finished grade. The tape shall be bright coloured plastic on polyethylene flat 150 mm with inscription "Caution - Buried Electric Cables Below".

k) Provide service lateral trench from main energy trench to property line for Hydro, Bell and TV service wires where required.

l) Provide trench from main energy trench to each individual street lighting pole for street lighting cables where required.

m) Fill placed adjacent to curbs, road crossings, driveways and sidewalks shall be compacted to 100% standard Proctor Density. Where excavated material is not suitable for backfill, unsuitable backfill shall be replaced at the Contractor's cost plus any repairs to curbs etc., attributed to faulty backfilling. Site selected material, granular B or approved fill shall be used as approved by the Engineer.

n) All grassed boulevards and road surfaces are to be properly reinstated to the original condition.

o) Do not excavate more trench than can be backfilled the same day.

2.2 Joint Use of Trench

a) Wherever possible, the Bell Canada telephone and Cable TV facilities shall be placed in the same trench as hydro cables.

b) Coordination and provisions of joint use plans are to be arranged by the Developer.

c) Vertical separation of 150 mm. shall be maintained between hydro and Bell Canada cables. Sand must be used for backfill over hydro cables.

d) Above grade Bell Canada telephone and Cable TV facilities shall be located so as not to conflict with above grade hydro facilities. Pedestals are to be placed at the rear side or side of transformers, if located together, so as not to interfere with access to the cable compartment.

2.3 Road Crossings

a) Cable road crossing shall be:

   i) Concrete encased for primary conductors.

   ii) 100 mm Type II PVC duct in appropriate numbers, in accordance with Ontario Provincial Standard

   iii) Covered with minimum 1.0 metre approved material

   iv) Of length to extend 1.0 metre minimum beyond edge of roadway.

   v) Conform to Utility specifications and Ontario Provincial Standards.

b) The Contractor is to supply, install and compact granular backfill materials in accordance with road authority specifications for the total length of the road crossing.

c) Where a crossing of an asphalt road is required, the surface is to be saw cut and the crossing reinstated with hot mix asphalt to the road authority requirements.

   Note: When crossing existing roads - Road crossing approval must be acquired from road authority.

d) Cable road crossings shall be perpendicular to the road surface.

e) Excavate the full length of trench across the roadway prior to the construction of ductwork. Only one half of the road can be closed at any time, and the excavated portion of traffic lanes are to be steel plated so as to minimize the inconvenience to the public.

f) Grade and shape the sub-grade of the excavated trench to a smooth surface before laying ducts and placing concrete.

g) Concrete encasement shall be formed in place, forms to be removed after 24 hour curing period.

2.4 Duct Installation

a) Direct buried duct installations shall be:

   i) sand buried to 150 mm below and 150 mm above

   ii) 100 mm Type II PVC duct in appropriate numbers, in accordance with Ontario Provincial Standards.

   iii) Covered with minimum 1.0 mm approved material, and compacted as specified.

b) Ducts shall be bell and spigot joint and laid end to end in a straight line to facilitate pulling of cables. Where duct lengths are cut to suit them, shall be joined together using approved couplings of the same make.

c) All trenches must be pumped free of water prior to placing duct to facilitate inspection.

d) The duct shall be cleaned and free of obstructions and ends must be plugged with approved duct plugs to prevent ingress of foreign objects.

e) Place a polypropylene rope 6 mm in diameter in each spare duct for future pulling of cables. Leave at least 1000 mm of loose ropes at each end of the duct and coded at each end.

f) When using existing ducts, the Contractor shall excavate carefully to expose the ends of the ducts without damaging the ends and shape the trench to provide a smooth entry into the ducts for cables.

g) Spare duct to be installed between transformers and/or switching kiosks.

PART 3 - CABLE INSTALLATION

3.1 Cable Placement General

a) Considerable care must be taken in the handling and laying of cables to avoid damage.

b) Cables shall be "looped" or "coiled" at terminal points with sufficient cable left for terminations. At riser poles, sufficient cable shall be strapped to the pole to allow for electrical connections. Wherever cables, primary, secondary and street lighting are installed requiring bend or loop, ensure that they are formed in a manner, and with a radius such as not to cause damage to the cables or installation.

Under no circumstances shall the bending radius be less than 12 times the cable diameter.

c) Do not install cables of any other systems with high voltage cables. Primary cables must be terminated and dead-ended where indicated and where required.

d) Carefully pull the cables through ducts. Do not drag or pull cables on the ground, or otherwise expose the cables to damage. Use appropriate strain relief grip to pull cables through duct.

e) Cables left coiled for future excavation shall be encased in 200 mm of sand (and marked with marker tape). Cables must be water sealed with approved tape.

f) All cables shall be placed through duct into the precast foundation or vault in which they terminate.

3.2 Primary Cable Installation

a) In general, the primary cables shall be placed in duct, which is directly buried, except for road crossings where the duct shall be concrete encased.

b) Splices in primary cables shall not be allowed unless absolutely necessary and approved by the Engineer. If a splice is allowed, it must be made in a vault or switching kiosk.

c) Primary cables will be identified with coloured tape as to the phasing and tagged with markers showing the routing to the next transformer, terminal pole or switching kiosk. Both ends are to be identified using approved numbers. An extra 3 metres will be left for neutral concentric terminations.

3.3 Service Cable Installation

a) Service cables shall be in 100 mm duct.

b) Duct is to be bedded with 150 mm of sand above and below which is compacted to specifications.

c) Secondary cables shall be identified at both ends using approved numbers or approved alternative indicating lot number and house number and service feeds.

3.4 Street Light Wire

Three # 6 AWG RWU90 Cu. (one black/one white/one green)

3.5

Street light poles are to be spun reinforced concrete. Approved suppliers are:
Stress Crete Ltd., Burlington, Ontario (905) 632-8116

Street light poles are to be set at a depth of no less than five (5) feet finished grade.

The height of the pole is to be the same as the previous subdivision phase subject to Centre Wellington Hydro approval.

Street light head: Contempo, Post top, 100 watt, high pressure sodium with photo control (see attached). Series 245 10S RN 120 R3 GL SD PC

Where possible, street light wire should be installed in combined trenches and treated as a service cable (as above).

PART 4 - INSTALLATION OF VAULTS, PADMOUNT FOUNDATIONS AND PULL BOXES AND STREET LIGHTS

4.1 General Excavation

a) Use either, as site conditions permit:

   i) A sloping side method of excavation or;

   ii) A shoring and timbering method of excavation

b) Excavation shall not be larger than that required to place the precast foundation or vault and provide working space for placing cables. Any excavation to a depth greater than required shall be filled with crushed stone compacted to specification.

c) Grade elevations for the transformer vaults, foundations, etc. are to be provided by the Contractor or Developer.

d) All duct work in vaults to be sealed with approved material (i.e. concrete, grout).

4.2 Single Phase and 3 Phase Switch Vaults

a) Install the precast switch vault in accordance with the approved drawings and in the following stages:

   i) Install a base of 19 mm crushed stone 300 mm thick including compaction

   ii) Place the vault in position

   iii) Install the grounding system

   iv) Backfill with granular "A" gravel, including compaction or acceptable native backfill upon approval of inspector.

   v) Place the frame and/or cover on the top of the vault

b) Keep the vault clean and dry. All foreign debris to be removed from vault (i.e. loose concrete, rubbish, dirt, etc.)

c) Grades must be determined and vaults placed so that the top of vault will be 75 mm above proposed finished grade.

4.3 Transformer Foundations and Kiosk Foundations

a) Install the precast foundation in accordance with the approved drawings and in the following stages:

   i) Install a base of 19 mm crushed stone 300 mm thick including compaction.

   ii) Place the transformer pit in position.

   iii) Install the grounding system

   iv) Backfill with selected native material, including compaction.

b) Keep the foundation clean and dry until the transformer or Kiosk is set and energized.

c) Grades must be determined and vaults placed so that the top of vault will be 75 mm above proposed finished grade.

d) All entrance holes/openings to vaults or pits will be covered with appropriate material (i.e. plywood) prior to placement of transformer or designated cover.

4.4 Secondary Vaults

a) Install the precast secondary vaults in accordance with the approved drawings and in the following stages:

   i) Trench is to be backfilled with sand and compacted to an elevation, which will afford setting of the vault such that its top elevation will be 150 mm below final grade. Vaults not satisfactorily placed will have to be adjusted once final grading is complete.

   ii) Install the vault, centered in the main trench. Connect duct into vault, flush with inside wall of vault. Concrete encase duct work for 1 m from outside wall of vault and grout inside walls.

   iii) Backfill and compact the trench around the vault with approved material, but do not cover the lid until after final approval by the Engineer.

b) Once the pull pit is in place, keep it clean and dry. Remove all foreign debris from vault (i.e. loose concrete, rubbish etc.)

c) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

d) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

e) All entrance holes/openings to vaults or pits will be covered with appropriate material (i.e. plywood) prior to placement of transformer or designated cover.

4.5 Street Lights

a) Pole is to be set vertical with handhole perpendicular to the street. Pole types to be approved by Engineer. That is, a 23’ pole over all length, direct embedded, class A prestressed round, mold finish complete with a tenon, 2 7/8” top o.d. tangent. Recommended supplier would be StressCrete (part #E230APR-G-MOO C/W 140)

b) The luminarie is to be installed on the pole and wired with 2-#12 AWG NMWU 90 solid copper conductors and connections made in the luminarie heads. Cable connections in the pole between the RWU90 #6 cu. with ground feed and the 2 - #12

AWG Cu. shall be made using taped split bolt connections. All terminations shall be done above grade at the hand hole in the pole. An inline fuse holder FEB 11-11 c/w 15amp fuse to be connected inside light standard.

c) The luminarie to be used on all residential streets shall be a 100 Watt HPS Contempo, grey in colour. It will have: HPF ballast, same starter as in the Durastar 2000, photo control receptacle and 120 volt feed, series 245 10S RN 120 R3 GR SD PC.
All other luminarie's shall be the 100 or 150 Watt Durastar 2000 with the universal docking assembly. Durastar Series 20 (10S or 15S) RN 120 R3 FG LC PC.

d) A permanent label indicating the socket positions required to provide the various distributions obtainable by use of various lamps shall be provided and attached to the interior of the luminaries so that it is clearly visible during maintenance operations.

e) A permanent label shall be provided and attached to the interior of the luminaries indicating the suitable supply voltage and frequency; input current and nominal operating voltage of the lamp.

f) A label including a wiring diagram shall be attached to each ballast showing the ballast schematic wiring diagram and shall be visible during maintenance operations.

g) Each pole shall have an individual weatherproof fuse at the hand hole location

PART 5 - TRANSFORMER AND KIOSK INSTALLATION

5.1

a) Immediately before placing a transformer or Kiosk onto a precast foundation, the unit shall be inspected for chips, breaks or damage. If such is found, the Utility's site inspector shall be notified for corrective repairs or replacement.

b) The unit shall be set firmly and squarely onto the foundation in such a manner that the bolted plates prevent it from sliding.

c) Each unit shall be numbered with Utility designated numbers, and danger signs on the roadside of transformer.

d) Leave lifting lugs and bolts in place.

PART 6 - CABLE TERMINATING AND SPLICING

6.1 General

a) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

b) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

c) All splicing materials are to be kept clean and dry at all times; any contamination of the splice parts is to be removed as soon as practical. Only cleaning fluids and methods recommended and approved by the manufacturer of the splice shall be used.

d) If a splice is deemed necessary by the Engineer, it must be a modular splice of a type approved by the Engineer.

e) Where cable ends are left unconnected or exposed, they are to be capped with rubber tape and made waterproof as follows:

   i) The first wrapping of tape shall be half lapped with self amalgamating properties to provide the necessary electrical characteristics for 600 volts and sealed against ingress of moisture.

   ii) The second wrapping of tape shall be restrictive tape and is to be applied to enclose the first wrapping of tape.

   iii) The restrictive tape shall be made and installed in a manner to eliminate unraveling. If necessary, tape to be coated with a suitable agent to bond the turns together.

f) Primary Local Service Terminations shall be:

   i) 15 kV moulded rubber load break rated equipment for transformer and junction box terminations.

   ii) Properly sized for primary local service cables and installed per manufacturer's instructions.

g) Primary Feeder Terminations shall be:

h) 15 kV, moulded rubber indoor style to be used in switchgear, outdoor style on dip pole.

i) Properly sized for primary feeder cables and installed per manufacturer's instructions.

j) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

k) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

l) Secondary splices shall be made using sleeves and heat shrinks or equivalent approved by the Utility, for buried use on the cable specified and installed to manufacturer's specifications.

6.2 Primary Terminations in Single Phase Vaults

a) Ducts brought into the vault will be cut flush with inside wall of pit. Bell ends to be installed on ducts and duct bank to be grouted into pit.

b) Cable in these vaults are to be left 3 metres long or with sufficient slack so that they rest in the bottom of pit when connected.

c) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

d) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

e) Grounding at single phase vaults shall consist of four 19 mm by 3000 mm copper clad ground rods, four grounding clamps and sufficient 2/0 bare copper conductor to completely encircle the foundation with a clearance of 1 meter, and connect the ground rods to the transformer ground bar.

f) 2/0 bare copper ground is to be brought in from the ground loop for each connector block.

g) Concentric neutrals are to be stripped back (in the approved manner), 1200 mm to 1500 mm and connected to the most convenient 2/0 copper ground. (Concentric neutrals are not to be connected directly to the connector ground lug).

h) Primary cable must be looped a minimum of one time before the connector block.

i) All primary cables must be tagged, identifying the Utilities' designation number.

6.3 Primary Terminations in 3 Phase FiberglassVaults

a) Ducts brought into fiberglass vaults to be terminated with 45% vertical bend.

b) Cables in these vaults are to be left 5.5 metres long.

c) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

d) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

e) Four way connectors are to be provided and installed. Connector blocks are to be bolted to the vault with galvanized through bolts. Point of attachment must be 350 mm below the lid of the vault centered on the wall.

f) Grounding at vaults shall consist of four 19 mm by 3000 mm copper clad ground rods, four grounding clamps, and sufficient 2/0 bare copper conductor to completely

encircle the foundation with a clearance of 1 meter, and connect the ground rods to the switchgear ground bus.

g) 2/0 copper ground is to be brought in from the ground loop for each connector block.

h) Concentric neutrals are to be stripped back (in the approved manner), 1200 mm to 1500 mm and connected to the most convenient 2/0 copper ground. (Concentric neutrals are not to be connected directly to the connector ground lug).

i) Primary cables must be looped a minimum of one time before the connector block.

j) All primary cables must be tagged, identifying the Utilities' designation number.

6.4 Secondary Termination in Secondary Vaults

a) Secondary cables are to be brought up into the centre of the vault

b) Cable in these vaults is to be left 2 metres long.

c) Provide all necessary connectors.

d) A joint compound, capable of penetrating the oxide film and preventing its reforming, to be applied on all connections.

e) Care must be taken to ensure cables are stored properly, smooth bends, no kinks.

f) All cables must be tagged, service cables are to be tagged both ends with the lot number or house number (house number preferred).

6.5 House Service Stubs

a) Install service wire in duct from transformer to property line, leaving enough conductors rolled up to reach future location of meter base.

b) Install a 100 mm x 100 mm x 2500 mm marker post at the termination of service duct with service wire coiled and attached to post. Duct to be sealed at property line with approved material.

c) Arrangements for the placement of the service from the property line to the meter base must be with the utility and inspected by the utility.

d) No splices in service cables will be allowed.

e) Installations from property line to meter base to be in 100 mm duct.

f) Service cable to connect directly onto transformer.

6.6 House Meter Connections

a) Install the service cable in the riser conduit and out through the face of the meter base leaving sufficient tails for connections.

b) Joint compound must be applied to all connections.

c) Meter base to be 200 ampere, CSA approved.

d) Shall be fitted with a CSA approved screw type ring.

e) Meter base location according to current Ontario Building Code requirements.

f) Shall meet all requirements of Utility's current Electrical Service Regulations.

g) The Utility will supply and connect to Electric Revenue Meter.

6.7 Terminations at Transformers

a) Cables must be brought through into the concrete transformer pit in duct. The duct, complete with bell ends, will be flush with inside of pit. Ducts to be concreted 1 m from outside of pit and re-grouted on inside of pit.

b) Cables in pit must be trained to bottom of pit before being connected to transformer.

c) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

d) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

e) Grounding at all padmounted transformers shall consist of four 19 mm by 3000 mm copper clad ground rods, four grounding clamps, and sufficient 2/0 bare copper conductor to completely encircle the transformer pad with a clearance of 300 mm and connect the ground rods to the transformer ground bushings.

f) Two ground wires from ground rods shall be attached to the ground bar on the face of the transformer.

g) Concentric neutrals on primary cables are to be stripped back (in the approved manner) 1200 mm to 1500 mm and then connected together with approved connectors onto ground on the face of the transformer.

h) All primary cables must be tagged, identifying the Utilities' designation number.

i) All secondary bus must be tagged, identifying the Utilities' designation number and service cables must be identified by the house or lot number (be consistent in numbering).

j) Joint compound must be applied to all joints.

k) All neutrals and secondary bus are to be connected in an approved manner. Service cables are to be left coiled and tapped.

6.8 Primary Termination in Kiosks

a) Ducts carrying primary cables must be brought into the vault through knockout in wall. Ducts, complete with bell ends, shall be flush to the inside wall of vault and grouted in place.

b) Terminations on the secondary as well as the primary in the transformer cabinet will be performed by a Utility employee and time and material billed to the Contractor.

c) If the contractor chooses to have someone other than the Utility do the terminations, secondary and primary, in the transformers the Utility will have a representative on site and their time will be billed back to the Contractor.

d) Grounding at vaults shall consist of four 19 mm by 300 mm copper clad ground rods, four grounding clamps, and sufficient 2/0 bare copper conductor to completely encircle the foundation with a clearance off 1 meter and connect the ground rods to the switchgear ground bus.

e) 2-2/0 bare copper ground wire is to be brought in from the ground grid.

f) Primary cables must be looped a minimum of one time before being terminated.

g) All primary cables must be tagged, identifying the Utilities' designated number.

h) The concentric neutrals of each cable should be connected separately to the ground bar opposite each appropriate elbow. These concentric neutral connections should have adequate length to enable the elbows to be disconnected, parked or relocated as required.

i) It should be verified that the hood installed on the kiosk is bonded to the compartment with a ground strap.

6.9 Termination of Riser Poles

a) Determine the height to the primary connection point and add 1.5 metres.

b) Coil cable and strap it to pole.

PART 7 - GROUNDING

7.1

a) At every distribution transformer, the transformer case and all other non-current carrying metallic parts shall be grounded as shown on drawings.

b) At least four (4) ground rods shall be provided at each distribution transformer and four (4) ground rods at each switching cubicle.

c) All exposed non-current carrying metal parts of padmounted transformers and switching cubicles and their enclosures shall be grounded by ground electrodes consisting of ground rods driven so as to be not less than 3000 mm and suitably interconnected with an annealed copper conductor not smaller than #2/0 AWG when buried in the ground to form a complete loop around the equipment at a distance of at least 1 meter from any part of the equipment.

d) Use approved clamp type connectors to make connections between ground conductor, ground rods and equipment.

e) Ground rods shall be installed at the time of duct installation, while ducts are exposed to avoid possible damage.

f) All connections of ground rods etc. will be performed by the owner's contractor.

PART 8 - TESTING

8.1

a) Upon completion of all terminations and grounding, cables shall be meggered and identified, to verify the correctness of cable tags prior to energization with Contractor and Utility personnel present. The Inspector will random check secondary service cable tagging and if incorrect tags are found, the Engineer may require the contractor to prove all tags.

b) Hy-pot testing of all primary cables using D.C. potential will be performed by approved contractor at the expense of the owner if the Utility deems it necessary to do so.

PART 9 - INSPECTION

9.1

The Utility shall provide an inspector as required at the expense of the owner. The inspector is empowered to stop work at any time he feels the contractor is not proceeding according to the specifications of the Utility.

Work shall not commence until the Utility has been notified that such work is to commence and until the inspector is present at the site.

2014-11-04

CENTRE WELLINGTON HYDRO

SPECIFICATION C1-72-1

1) SCOPE:

This specification covers the construction of 15 kV, jacketed, concentric neutral cable for direct burial application, with limited installation in individual ducts.

The cable will be utilized to provide single phase 200 amp service from a three phase 2400/4160 volt, multi-ground distribution system.

2) CONDUCTOR:

The conductor shall be 1/0 uncoated copper class B stranded.

3) CONDUCTOR SHIELD:

The conductor shield may be either a semi-conducting tape, or a thermosetting, semi-conducting extrusion.

4) INSULATION:

The insulation shield shall be extruded, semi-conducting, polyethylene with an average thickness of 30 mils.

The shield shall strip freely from the insulation and when removed shall not leave conducting particles, threads or residue on the surface of the insulation.

5) CONCENTRIC NEUTRAL:

The concentric neutral to consist of annealed, coated copper, #14AWG to provide 100% conductivity.

6) TESTING:

Test data to be supplied if requested.

CENTRE WELLINGTON HYDRO

SPECIFICATION C2-72-1

1) SCOPE:

This specification covers the construction of 15 kV, jacketed concentric neutral cable for installation in ducts.

The cable will be utilized to provide 400 amp., 3 phase, 2400/4160 volt multi-grounded service.

2) CONDUCTOR:

The conductor is to be 500 MCM uncoated copper class “B” stranded.

3) CONDUCTOR SHIELD:

The conductor shield may be either a semi-conducting tape, or a thermosetting semi-conducting extrusion.

4) INSULATION:

The insulation shall be neutral cross-linked polyethylene.

5) INSULATION SHIELD:

The insulation shield shall be extruded semi-conducting polyethylene, with an average thickness of 30 mils.

The covering shall strip freely from the insulation and when removed shall not leave conducting particles, threads or residue on the surface of the insulation.

6) CONCENTRIC NEUTRAL:

The concentric neutral to consist of annealed coated copper #12 AWG round wire conductors to provide 100% conductivity.

CENTRE WELLINGTON HYDRO

SPECIFICATION C3-72-1

SUPERSEDING C3-72 AND C4-72

SCOPE:

This specification covers the requirements for three (3) conductor insulated cables for underground distribution systems.

The cable consists of three (3) aluminum conductors each polyethylene (PE insulated and polyvinyl chloride (PVC) jacketed for 600 volt service in sizes 3/0 AWG, 250 and 500 MCM.

These cables shall be built to Ontario Hydro specification M-302-66 and latest revision.

Any deviations from Ontario Hydro specification M-302-66 must be approved by the Superintendent of the Centre Wellington Hydro.

CENTRE WELLINGTON HYDRO

SPECIFICATION T1-72

1) SCOPE:

This specification covers the requirements for a range of single-phase, oil immersed, mini-pad mounted transformers up to and including 100 KVA.

The term mini-pad mounted transformer herein is assumed to convey a dead front H.V. compartment and having absolute maximum profile dimension of 24" in height.

This specification supplements the CEMA standard for low profile, pad mounted single phase, distribution transformers.

Type ONAN - third draft - July 1972 or latest issue.

2) TRANSFORMERS DATA:

The transformer shall be of a standard distribution type, complete with oil, suitable for residential installation, complete with load break switch.

Transformer tank and switching compartment shall be tamperproof and waterproof, cover fitted with a provision for padlocking.

Voltage:

The transformer will have the following nominal voltage ratio: 2400-120/240 volts.

Voltage taps shall be 4 - 2 1/2%; 2 above 2 below normal voltage, located in the high voltage winding and designated on the name plate.

High voltage insulation class shall be suitable for primary Y connections 15 kV for 2400. Low voltage insulation class shall be 1.2 kV throughout.

KVA rating:

The KVA rating at rated voltage and at 65 Celsius rise shall be: 50, 75 and 100 KVA.

Frequency: 60 hertz

Cooling: O.N.A.N.

Polarity: Additive

Temperature Rise: Measured by resistance the maximum temperature of the windings at rated KVA and voltage shall be 65 degrees Celsius above ambient. Highest ambient air temperature to be considered 40 Celsius.

3) RADIO INTERFERENCE:

The transformers shall operate without causing interference to radio and TV reception or telephone communication circuits higher than the limits set forth in CSA standards C22.4 #103.

4) GROUNDING:

The transformer core shall be electrically connected to the tank.

Two grounding bosses complete with 2 - 3/8" holes at each location shall be provided in the transformer tank, one in HV side and one in the LV side.

Cover of the switching compartment shall be electrically bonded with extra flexible copper braid or cable equivalent to #2 AWG copper.

5) BUSHINGS:

The high voltage coil shall be terminated with 2 ESNA flower pot bushings, complete with 200 A, 15 kV ESNA load break inserts (for loop feed system).

Parking stand for elbow connector shall also be provided between the tow bushing in item #1 and shall operationally accept either the ESNA 160 ft. of 160 SOP accessories for feed through and applications.

The transformer LV bushing shall be of the welded type and shall be equipped with either plated copper or plated aluminum bars with 5 - 9/16" holes in line, spaced minimum 1 1/4" apart.

HV bushings shall be tilted upwards and the LV bushings shall be rotated from the vertical plane to provide convenient primary switching and secondary cable connections.

6) TRANSFORMER PROTECTION:

HV - RTE Bay - O-Net oil fuse cut-out with isolating link. Fuse to be overload sensing replaceable element.

7) MECHANICAL FEATURE:

The cover to HV and LV section shall open 180 degrees and removable.

The cover must be tamperproof and weatherproof and shall have provision for pad locking when using standard Centre Wellington Hydro padlocks.

Transformers shall be equipped with recessed lifting provision.

The cover front sill shall be made removable from the transformer tank and shall be complete with two (2) tamperproof emergency access holes approximately 2 1/2" diameter.

Two foundation clamps shall be provided.

8) OIL:

The transformer shall be delivered filled with oil to a level, which allows for the maximum oil expansion. The oil used shall meet the requirements of CSA standards C50-1965 or latest revision thereof.

9) VENTS:

The transformer shall be equipped with pressure relief valve.

10) FINISHING-MARKING:

Transformer tank, sill and cover shall be sand-blasted (or chemically treated) to remove all rust then coated with two coats of an approved primer followed by two coats of outdoor paint. Colour shall be equipped green.

The transformer base shall be coated with bituminous material to prevent the tank bottom from corrosion.

The inside of the cover of the HV and LV sections shall be coated with an anti-condensation compound.

11) TRANSFORMER LOSS EVALUATION:

The manufacturer must quote guaranteed maximum no load (N) and full load (L) losses for each transformer design. Centre Wellington Hydro Ltd. will evaluate the quoted

transformer losses and add the cost of losses to the quoted prices using the following formula:

Cost of Losses [4] = Nx + Ly

Where N = no load loss [watts]
L = load loss [watts]
x = cost of no load loss [$]
y = cost of load loss [$]

The loss values at the time of this revision are:

x - $8.30 per watt of no load loss at rated voltage
y - $4.10 per watt of load loss at rated kva and voltage

12) TRANSFORMER BASE:

Single Phase – Acton Precast Concrete LPE58P
58” x 40” x 42” high

Three Phase – Acton Precast Concrete LPC80
80” x 72” x 48” high

October 24, 2006