TORONTO HYDRO
REQUIREMENTS FOR
THE DESIGN AND CONSTRUCTION
OF
CUSTOMER-OWNED STRUCTURES

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CERTIFICATE OF APPROVAL

THIS TECHNICAL SPECIFICATION MEETS THE SAFETY REQUIREMENTS OF SECTION 4 OF ONTARIO REGULATION 22/04

PROFESSIONAL ENGINEER	**January 1, 2027** **DATE**

Table of Contents

1.0 PURPOSE 3
2.0 DEFINITIONS 3
3.0 REFERENCES 4
4.0 TORONTO HYDRO REQUIREMENTS 6
4.1 Customer Responsibility 6
4.2 Engineering Drawings 8
4.3 Easements 9
4.4 Structures 9
4.5 Completion Date 14
4.6 Inspection By Toronto Hydro 15
5.0 VAULT DESIGN REQUIREMENTS 16
5.1 Vault General Requirements 16
5.2 Vault Location Requirements 16
5.3 Vault Access Requirements 17
5.4 Vault Design and Construction Requirements 17
5.5 Vault Grounding Requirements 18
5.6 Vault Electrical Requirements 19
5.7 Vault Ventilation Requirements 19
5.8 Vault Fire Protection Requirements 21
5.9 Vault Drainage Requirements 22

1.0 PURPOSE

a) The purpose of this document is to provide guidance to Toronto Hydro Customers and their agents in the preparation of plans and proposals for the construction of new or rebuilding of existing Customer-owned Structures (i.e. poles, cable chambers, cable pull rooms, duct banks, padmounts, vault and splice vault or splice/tap boxes) where Toronto Hydro cables or equipment shall be present.

b) Nothing contained in this document shall prejudice or supersede any requirements of the current edition of Ontario Electrical Safety Code and the Ontario Building Code.

2.0 DEFINITIONS

a) Cable Chamber
A reinforced cast-in-place or precast concrete underground structure where duct banks are terminated for the purpose of making cable connections or accommodating a change in cable direction/level.

b) Cable Pull Room
An enclosed structure with a walk-in entrance where ducts are terminated for the purpose of making cable connections or accommodating a change in cable direction/level.

c) Customer
A person that has contracted for or intends to contract for connection to a building. This includes developers of residential or commercial subdivision.

d) Duct Bank
A grouping of ducts either direct buried or encased in concrete.

e) Easement
The right to use the real property of another for a specific purpose other than for general use and occupation of land.

f) Padmount
A precast reinforced concrete foundation on which padmounted transformers or switchgears are installed.

g) Pole
A structure used to support overhead lines and equipment.

h) Splice Vault or Splice/Tap Box
A concrete or fiberglass enclosure used for the making of multiple cable connection or terminating ducts.

i) Structures
A general term used to refer to one or more of the Customer-owned plant where Toronto Hydro cable or equipment will be present.

j) Vault
A reinforced concrete structure used for the purpose of housing transformers, switchgear and other electrical distribution equipment.

3.0 REFERENCES

a) The Customer shall reference and conform to the latest version in effect at the date of construction of the following referenced codes, standards, regulations, and by-laws:

- Canadian Electrical Code C22.1
- National Building Code of Canada
- National Fire Code of Canada
- National Plumbing Code of Canada
- Occupational Health and Safety Act – Ontario Regulations 213/91 for Construction Projects
- Ontario Building Code (OBC)
- Ontario Electrical Safety Code (OESC)
- Canadian Highway Bridge Design Code, CAN/CSA S6
- Ontario Fire Code
- All local municipal and provincial regulations and by-laws
- City of Toronto Municipal Consent Requirements for the Installation of Plant within City of Toronto Streets
- The City of Toronto's Sewer By-law Chapter 681.

b) Toronto Hydro Documents:

- Conditions of Service;
- Offer to Connect;
- Requirements for Design and Construction of Customer-owned High Voltage Substations,

c) Toronto Hydro Standards:

The following referenced Toronto Hydro standards will be posted on the Toronto Hydro website:

- 13-2200 Vault Lighting Arrangement
- 15-8510 Temporary Primary Service Conduit Routing
- 18-4300 Ground Rod Installation Detail
- 18-5000 Guard Post Grounding Detail
- 18-5100 Underground System Cable Chamber Grounding
- 18-5300 Transformer Vault Hatchway Frame & Ladder Grounding
- 18-5500 Ground Grid Padmounted Equipment
- 31-0100 Underground Clearances
- 31-0300 Minimum Depth of Cover for Toronto Hydro Structures
- 31-0500 Heavy Equipment Operation in the Vicinity of the Toronto Hydro Underground Plant
- 31-0710 Settlement in the Vicinity of Toronto Hydro Plant
- 31-1100 Conduits - General Information
- 31-1120 Conduits - Concrete Encased and Direct Buried Ducts

- 31-1130 Conduits - Layout Ducts using Spacers
- 31-1150 Conduits - Depth of Duct Conduit
- 31-1160 Conduits – Capping Proposed Ducts for Future Extension
- 31-1170 Conduits - Diverting Duct Bank
- 31-1230 Conduits - Supplying Customer's Building
- 31-1250 Underground Secondary Service Projects for New Installation
- 31-1350 Duct or Cable Support in Place System
- 31-1360 Conduits - Identification of Hydro Ducts in Building Complexes
- 31-1400 Duct Sealant Installation
- 31-1600 New Duct bank Recess Installation in Existing Structures
- 31-2160 Precast Cable Chamber
- 31-2180 Cable Chambers Typical Racking Arrangements
- 31-2240 Splice Vault 'B'-3 Piece Precast 1930 x 3050 x 1370 mm Deep
- 31-2270 Energy Mitigating Cable Chamber Frame and Lid
- 31-3120 Splice/Tap Box Type 'A' - For Secondary Cables only
- 31-3150 Splice/Tap Box Type 'B' for Primary or Secondary Cables
- 31-3170 Splice/Tap Box Type 'C' For Primary Cables Only
- 31-4020 Single Phase Precast Padmount 1016 mm x 1473 mm
- 31-4030 Three Phase Precast Padmount 1830 x 1830 mm
- 31-4050 Three Phase PMH 9/11 Switchgear 1980 mm x 2160 mm x 1350 mm
- 31-4070 Padmount Transformers Without Internal Current Limiting Fuse and Pressure Relief Device (Padmount – Minimum Clearance and Barrier Wall Details)
- 31-4080 Pad-mounts Guard Posts (Bollards)
- 31-4100 Pad-mounts Clearance Zone
- 31-5120 Splice Vault 'A'
- 31-6020 Above-Grade Walk-In Vault
- 31-6030 Below-Grade Walk-In Vault
- 31-6035 Above-Grade or Below-Grade Switching Vault
- 31-6040 Stair and Access Well Details for Below-Grade Transformer Vault
- 31-6050 Louver Details for Vent Openings
- 31-6060 Bird Screen Detail
- 31-6070 Cable Pull Room Typical Installation of High and Low Voltage Cables
- 31-6080 4.16 - 13.8 kV Transformer Vaults
- 31-6100 Engineered Structural Wall for Residential Secondary Service
- 31-6110 Service Pedestal for Secondary Service to Parks and Utilities
- 31-7100 Sewer Drain Connection From Cable Chamber or Transformer Vault
- 31-7400 Temporary Support of Cables in Rebuild Structure
- 31-8200 Precast Concrete Riser
- 31-8210 Cable Pulling Loop for Poured & Precast Concrete Walls
- 31-8250 Cable Chamber 180mm Frame and Cover Underground Construction Materials
- 31-8320 Ladderway Grid Frame for Transformer Vault
- 31-8330 Aluminum Ladderway Grid
- 31-8340 Steel Ladderway Grating Guard
- 31-8350 Vault Exhaust Vent Grid: 1600 x 485 x 127mm
- 31-8360 Vault Exhaust Vent Grid: 1220 x 457 x 127mm
- 31-8390 Transformer Vault Ladder

- 31-8400 Vault Sump Hole Grid & Frame: 650 mm x 650 mm x 38 mm
- 31-8410 Caulking of Removable Slabs
- 31-8450 Ladderway Pipe Barrier
- 31-8470 Sleeve – Lifting for Removable Concrete Slab
- 31-8500 Door for Transformer Vault

4.0 TORONTO HYDRO REQUIREMENTS

4.1 Customer Responsibility

a) Customer is responsible to build new or rebuild existing Customer-owned Structures according to Toronto Hydro standards and all the other documents referred to in the References Section 3.0 in this document. Detailed construction drawings shall be submitted to Toronto Hydro for review and acceptance. Construction shall not commence until all drawings are accepted by Toronto Hydro.

b) For Customer-owned vault, Customer shall provide a letter sealed by a Professional Engineer certifying that the building and associated installations relevant to the electrical service comply with the Ontario Building Code (OBC), Ontario Fire Code, Ontario Electrical Safety Code (OESC) and Electrical Safety Authority (ESA) requirements. This documentation must be submitted to Toronto Hydro and accepted prior to scheduling final inspection and authorization to energize the service.

c) The Customer shall be responsible for providing, inspecting, maintaining, repairing, and replacing, in a safe condition satisfactory to Toronto Hydro, all Customer-owned Structures.

d) Unless there is a written agreement or a drawing that specifies otherwise, all of the following items are considered to be Customer-owned plant:

1. Structures: vaults, duct banks, cable chambers, padmounts, splice vaults and splice/tap boxes, poles and cable pull rooms;

2. Hardware: doors, vents, louvers, grates, grills, ladders, ladderway enclosures, lids and covers;

3. Grounding: ground rods, grounding loops and all associated hardware dealing with grounding;

4. Drainage: sump pump, oil containment products and all materials associated with drainage;

5. Electrical: light bulb (lamp) or light fixture, circuit breaker panel box, light switch receptacle, GFI outlet, fire alarm, mechanical vents and all materials associated with electrical.

e) It is the Customer's responsibility to obtain qualified Toronto Hydro Contractors to rebuild all structural deficiencies found in the Customer-owned Structures.

f) If qualified Toronto Hydro Contractors are unavailable, then a non-qualified contractor can perform civil remedial work provided the following conditions are met:

1. A Toronto Hydro Person in Attendance (PIA) shall be present when work is being conducted inside the structure. One (1) PIA is required for every five (5) crew members.

2. The PIA shall conduct a tailboard meeting to review the dangers in the work space at the start of each work day.

3. Isolations are established when working within the limits of approach.

g) The Customer is responsible for maintaining the Customer's property in a condition that is safe as to not inhibit the operation or threaten the integrity or reliability of equipment or infrastructure owned by the Customer or Toronto Hydro. The Customer's responsibility includes, but is not limited to, clearing vegetation, keeping storm drains clear and drainage systems fully functional, removing debris, maintaining operational and electrical clearances, and maintaining proper grading and surfaces.

h) Customer shall inspect and maintain the Structures and property at regular intervals (i.e., once a calendar year). When access to the Structure or property is under the control of Toronto Hydro (e.g. a transformer vault), the Customer shall contact Toronto Hydro at the phone number posted on Toronto Hydro's website to make appropriate arrangements (e.g. access) prior to undertaking any inspections, maintenance, repairs, or replacements.

i) If the Customer does not inspect, maintain, repair, or replace the Structure and all items deemed part of the Structure and property as required, Toronto Hydro may disconnect the supply of electricity to the Customer.

j) Where Toronto Hydro identifies, through an inspection or other activity, deficiencies relating to the Customer-owned Structures and/or including items deemed part of the Structure, Toronto Hydro may notify the Customer of the deficiencies; provide a reasonable time for the Customer to correct the deficiencies; and if circumstances merit, request the Customer to correct the deficiency in a manner that brings the Structure or property up to current Toronto Hydro standards even if the Structure or property was designed, installed, or constructed to an older Toronto Hydro standard i.e. the existence of health or equipment and any other item dealing with the Structure's safety hazards, legal or regulatory requirements, and conditions that may impact the integrity, reliability, or operability of the distribution system or any equipment that supplies the Customer.

k) It is the Customer's responsibility to ensure all Customer-owned structures constructed to house Customer-owned Equipment and/or Toronto Hydro's Facilities and Equipment must be impermeable to water, hazardous materials and gas. Toronto Hydro shall not be responsible for any damage caused by the leakage of water, hazardous materials or gases entering or exiting any Customer-owned Structure. If during inspection or other activity it is determined that the Structure is not properly sealed, Toronto Hydro will ask the Customer to remediate this deficiency. Customer can use Toronto Hydro approved material or procure its own material. Materials and all specifications procured by the Customer, shall be reviewed, and approved by Toronto Hydro Standards Department prior to installation.

l) If Customer requests equipment upgrade for higher capacity, modifications to the structure shall be made to meet current standards at the expense of the customer. Considerations shall be given to additional weight of equipment, vault footprint, ventilation area, drainage, etc.

m) All Customer-owned Structures housing Toronto Hydro cables and equipment shall have nomenclature that follows Toronto Hydro standards and naming convention.

n) Where required, cable supports, racks, and mechanical protection shall be supplied and installed at the Customer's expense.

o) Duct banks, splice vaults, cable chambers, pull rooms and padmount foundation requirements listed within are also part of the requirements needed for Customer-owned Substation Structures (Refer to Toronto Hydro Conditions of Service -).

4.2 Engineering Drawings

a) The Customer shall submit, in digital file format (.dgn, .dwg or .pdf) or hard copies of fully dimensioned scaled drawings signed and stamped by a Professional Engineer to confirm the proposal is in compliance with applicable codes and Toronto Hydro requirements.

b) All drawings shall be designed and stamped by the Customer's registered Professional Engineer of Ontario. Customer shall be responsible for ensuring that the Structure is constructed in accordance with the design criteria established by the Customer's Professional Engineer.

c) All drawings shall be reviewed and accepted by Toronto Hydro prior to commencement of construction. Construction must not commence until drawings are accepted by Toronto Hydro. Drawings will be reviewed to ensure that the design aligns with and meets Toronto Hydro operational requirements.

d) If the drawings and information provided do not meet Toronto Hydro requirements or are unclear, revised, or additional drawings and information must be submitted for further review and acceptance.

e) All drawings for installations are required to include the following information (if applicable):

- Property lines and easements;
- References to the nearest intersecting streets;
- Location and grade levels of the Structure and the building;
- Location, elevation, section views and any other item dealing with the Structure;
- Layout of the equipment in the Structure clearly indicating aisle clearances and exits;
- Vehicle and personnel access route to the Structure for a truck and/or crane (during and after construction);
- Location of incoming Duct bank;
- Details of Structure grounding arrangements and location of any ground grids used,
- Adjacent utilities such as gas, water, sewers, telecommunications etc.;
- Landscaping details;

- Surface and sub-surface features including any obstructions, i.e. overhang, balconies, building emergency access route, stairs or any other feature might be deemed to be an obstruction;
- Drainage details;
- Temporary Shoring details;
- Structural shop drawings;
- Electrical Drawings showing all relevant information, including, but not limited to: site plan; single line distribution drawings; shop drawings of equipment, transformers, and protection co-ordination study; grounding details; and on-site commissioning of transformer and cable testing results for Customer-owned High Voltage service entrance equipment.

4.3 Easements

a) Registered easements are required whenever Toronto Hydro's plant is located on private property to service a Customer other than the owner of the property where the plant is to be located.

b) When easement requirements have been identified for a particular project, the Customer shall be responsible for the following:

1. Preparation of a legal survey plan identifying the proposed easement for the overhead and surface/sub surface equipment and also easements where Toronto Hydro deems necessary. It may be necessary to identify the easements in three dimensions. Toronto Hydro requires four (4) copies of the reference plan.

2. Prior to registering the easement, the site survey plan shall be reviewed and accepted by Toronto Hydro.

3. Preparation of a registerable easement in favor of Toronto Hydro comprising of transfer land title deed, schedule 'A' and land transfer tax affidavit. The Easement document shall be prepared by Toronto Hydro's Legal Department.

4. The Customer shall register the easement. The cost of preparing a reference plan, easement, its registration and any other associated cost shall be borne by the Customer as part of the consideration for the provisions of electrical power supply.

4.4 Structures

4.4.1 Location Requirements

a) If possible, Structures shall be located on the premises closest to Toronto Hydro's source of supply.

b) The proposed location of the Structure shall be discussed and accepted by Toronto Hydro prior to the preparation of the formal drawings.

c) During construction, Customer shall not operate cranes in the vicinity of a Structure while Toronto Hydro personnel are working in or around the Structure.

d) Structures shall be easily accessible to Toronto Hydro personnel and be located so as to present no undue hazard or danger to the public or Toronto Hydro personnel. Structures shall be located so as to meet all required clearances from obstructions.

e) Structures shall be located away from driveways, loading docks, overhangs/balconies with low vertical clearance less than 5.5 m (18'-0") measured from the finished grade, patios, building egress/exits, staircase, waste storage areas, locations where dangerous goods or chemicals are stored, and restaurants/processing plants that have a potential of generating liquid waste. In locations where vault exit doors open into an area where the means of egress may be impeded by vehicular traffic, Toronto Hydro approved removable guard posts (bollards) shall be installed by the Customer. Guard posts (bollards) should be installed to prevent vehicles from driving over or parking on top of access points. Location of guard posts (bollards) shall not impede access to vault or equipment replacement activities.

f) Structures shall not be installed in the lower part of a sloped area, where water can run off and flood the Structure.

4.4.2 Access Requirements

a) A minimum 6.0 m (20'-0") wide paved driveway to access the Structure is required. Access route shall be able to accommodate required vertical clearances of minimum 4.3m (14') and accommodate a minimum truck load of CL-625-ONT as identified in CSA S06. It is highly recommended that access routes are of greater dimensions and loading to accommodate future equipment replacements.

b) Customer shall maintain clean and clear access 24-hours a day for the life of the Structure for maintenance and operational needs. Access routes shall present no undue hazard or danger to Toronto Hydro personnel accessing the Structure.

c) Landscaping or other changes to an access route before or after installation of cables and equipment shall not be made without Toronto Hydro acceptance.

d) No hoarding is allowed to be placed on top of or around a Toronto Hydro Structure during Customer's site construction without Toronto Hydro acceptance. If hoarding is being installed, it shall not block access to Toronto Hydro personnel. If the hoarding is going to be locked, access by Toronto Hydro personnel shall be provided in the hoarding Structure. The gate shall be equipped with a hasp for a Toronto Hydro padlock. If hoarding exists around a building under construction, a section of hoarding adjacent to the Structure shall be removed by the Customer upon request to allow access for cranes and other vehicles required to install Toronto Hydro cables and/or equipment.

e) At locations where vehicles obstruct access into the Structure or where vehicles present an undue hazard, guard posts (bollards) shall be installed around the Structure to prevent vehicle parking and to protect the Structure.

f) Any Customer plant, obstruction, vegetation, or other material including but not limited to patios, parking of vehicles, trees, shrubs, and landscaping shall not be built, planted or placed in front or on top of a Structure. This is to enable the safe and proper operation of Toronto Hydro's distribution system.

g) Immediate access to the Structure (vault or pull rooms) shall be provided on a 24-hour basis for Toronto Hydro personnel. A door equipped with a Toronto Hydro lock, providing direct access from the outside (e.g. street) shall be installed where practicable. Alternatively, the doors along the route leading to the Structure must be equipped with Toronto Hydro locks.

h) If Toronto Hydro locks are not practical, the Customer shall provide Toronto Hydro the appropriate access keys or magnetic cards to enable entry from outside (e.g. street). Toronto Hydro shall supply and install a key box at a suitable location to safekeep the key(s).

4.4.3 Types of Structures

a) Cable Chambers

1. Shall be designed in accordance with Toronto Hydro standards. Chamber can be constructed using cast-in place as per Toronto Hydro standard 31-2110 or precast concrete as per Toronto Hydro standard 31-2160. If precast units are used, dividing sections shall be sealed to prevent water from leaking in. Toronto Hydro Standards Department shall review Customer's chamber specifications for approval.

2. Cable Chamber shall have internal dimensions similar to or as specified in Toronto Hydro standards 31-2110 and 31-2160. Chambers shall have a minimum head-room of 2100 mm (7'-0") and a maximum head-room of 3000 mm (10'-0").

3. Customer's Engineer is responsible to provide design and fabrication drawings stamped by a Professional Engineer of Ontario for review and acceptance.

4. Customer's Engineer is responsible for designing the roof and walls in accordance with the Canadian Highway Bridge Design Code, CAN/CSA S6, CL-625-ONT live loading.

5. Chamber roof depth of cover shall be as per Toronto Hydro standard-31-0300. Lids shall be a minimum 450 mm (1'-6") clear of walls. Chamber lids shall be located away from any obstructions or safety hazards.

6. The exterior surface of a roof and neck shall be waterproofed with a self-adhered bitumen membrane.

7. Ducts shall be installed at least 300 mm (1'-0") below ceilings, 300 mm (1'-0") above floors and 225 mm (9") clear of walls. All ducts shall be plugged with duct plugs. All ducts shall be roped.

8. All chambers shall have 3000 mm (10'-0") ground rods installed in all four corners, protruding 150 mm (6") above the floor and 75 mm (3") clear of the walls and grounding loop installed in compliance with Toronto Hydro standard 18-5100.

9. Permanent ladders shall not be installed in cable chambers.

10. All chambers shall have sump holes. Sump holes shall be located in a corner. Chamber floor shall be sloped toward the sump hole. Sump holes shall have removable galvanized

grating. Sump hole inside dimensions shall be 300 mm x 300 mm x 300 mm deep (1'-0" x 1'-0" x 1'-0"). Sump hole exact location shall be determined according to site sewer location.

11. All chambers shall be properly drained to the sewer per Toronto Hydro standard 31-7100. Drains that cannot connect to a floor drain shall be terminated with a backwater valve at inside wall face. The valve shall be installed, whenever possible, below the lowest incoming ducts. Backwater valves shall be at least 900 mm (3'-0") away from adjacent walls and duct banks, and 300 mm (1'-0") clear of floor.

12. No foreign pipes shall be installed inside cable chambers.

13. Cable pulling loop as per Toronto Hydro standard 31-8210 or 31-8220 or 31-8230 shall be installed in-line with and opposite of each duct face.

14. Cable racking shall be installed to support cables. Toronto Hydro will install racking and charge back to the Customer.

15. Cables will have to be supported during construction as per Toronto Hydro standard 31-7400.

b) Cable Pull Rooms

1. Shall be designed in accordance with Toronto Hydro standard 31-6070. If specifications are different, Toronto Hydro Standards Department shall review Customer's cable pull room specifications for approval.

2. Secondary circuit feeding the lighting system inside the cable pull room shall be supplied and installed by the Customer as per the Ontario Electrical Safety Code (OESC). Installation shall be accepted by the Electrical Safety Authority (ESA).

3. For existing locations, the Customer must rebuild the electrical system as needed if defective or corroded.

4. Light switch and GFI outlet shall be installed near the entrance with one or two 200 W LED equivalent light bulbs/LED light fixtures. Lighting apparatus shall be supplied and installed by the Customer. If exposed to the elements, the setup shall meet IP65 rating minimum.

5. Customer is to install grounding in compliance as applicable ESA and IEEE requirements.

c) Duct banks

1. Configuration shall be in accordance with Toronto Hydro standard 31-1120.

2. Minimum depth of cover shall be a minimum 800 mm (2'-8") or as per Toronto Hydro standard 31-0300 and City of Toronto Municipal Consent Requirement document. The depth is measured from the top of duct bank to the top of final finished grade. If duct banks are built less than minimum depth of cover, mechanical protection shall be added on top of the duct bank as per Toronto Hydro standard 31-1150.

3. Duct bends shall not be less than 900 mm (3'-0") in radius. Where sweeping bends are necessary, 5° (degree) couplings or sections of long sweep bends shall be used.

4. Duct bank shall be graded and sloped away from Customer's building with a minimum slope of 1-2% sloping towards supply point to prevent water or hazardous materials from entering the building as per Toronto Hydro Standard 31-1230.

5. All ducts entering any part of the Customer's building including but not limited to vaults, pull rooms and/or electrical rooms shall be sealed by the Customer at the duct face to prevent water or hazardous materials or gases from entering the Customer's building. The Customer may use Toronto Hydro standard 31-1400 sealant or procure an equivalent product rated to withstand fire and 3.0 m (10ft) of pressure head. The equivalent product specs shall be sent to Toronto Hydro for review and approval prior to installation. Toronto Hydro Qualified Contractors can seal the ducts. All spare ducts shall be roped and plugged.

6. All duct banks entering the Customer's building wall shall be installed with reinforcement bars tying the duct banks to Customer's building wall to prevent the duct banks from shearing off the wall.

7. Duct bank shall terminate in Customer's building wall with bell end fittings.

8. Duct bank shall be a minimum 150 mm (6") above finished floor or flush with the inside surface of a wall.

9. Duct bank in Customer's building shall be marked and identified as per Toronto Hydro standard 31-1360.

10. Where there is no space for temporary transformation facilities on Customer's property, Customer may install temporary Customer-owned transformation facilities on a raised platform within the city road allowance. This temporary installation is permitted with the written approval from the City of Toronto. Customers are to refer to construction standard 15-8510 for the details of duct installation to a raised platform. Upon completion of Construction, the temporary installation shall be disconnected and removed. The Customer shall provide a structural analysis and design report, stamped and signed by a Professional Engineer licensed to practice in the Province of Ontario, for any structure that may be housing or supporting a Toronto Hydro owned asset.

11. Duct banks suspended from the Customer's ceiling shall be concrete encased. Other methods of suspension will require Toronto Hydro approval as long as the installation meets the requirements of Ontario Building Code and Ontario Electrical Safety Code.

d) Padmounts

1. All padmounts shall be precast concrete and shall be installed by Customer in accordance with the Toronto Hydro standards listed in Section 3.0 (c) of this document.

2. Padmount installation requirements:

- Location and access requirements indicated in sections 4.4.1 and 4.4.2 of this document;
- Be installed as close to street access as possible;
- Be installed on a flat ground level surface on operational side (at door locations) and have sufficient space around the transformer for opening equipment doors;
- Meet all required clearances from adjacent building walls, windows, doors, ventilation openings and any other surface Structure. Barriers from windows, doors or ventilation opening and combustible walls/surfaces installed as per Toronto Hydro standard 31-4070;
- Have minimum overhead clearance of 5.5 m (18'-0") for lifting equipment during removal or installation operations;
- Guard posts (bollards) shall be installed as per standard 31-4080 where clearance to curb is not met, or if padmount is located in the parking lot or in the path of vehicles;
- Not be fenced off or gated without obtaining Toronto Hydro acceptance.

3. Customer shall procure precast padmounts from Toronto Hydro approved precast manufacturers. A Toronto Hydro representative will provide a list of approved manufacturers to Customer. If Customer decides to procure from a non-approved manufacturer, then Customer shall send P.Eng stamped shop drawings to Toronto Hydro for review and approval, and obtain approval from a Toronto Hydro Standards Department prior to installation.

4. Customer is to install grounding in compliance with Toronto Hydro standard 18-5500. If the Customer's grounding design does not comply with this standard, then the Customer shall provide a P. Eng. stamped grounding study that validates compliancy to applicable code requirements, including acceptable ground potential rise (GPR), touch and step potential. The study shall be submitted to Toronto Hydro for review and approval, and the Customer shall not start construction prior to receiving approval from Toronto Hydro Standards Department.

e) Vaults

1. Location and access requirements shall be as indicated in section 4.4.1 and 4.4.2 of this document.

2. Vaults shall be designed in accordance with Toronto Hydro standards listed in Section 5.0 of this document.

f) Splice Vault or Splice/Tap Box

1. Location and access requirements shall be as indicated in section 4.4.1 and 4.4.2 of this document.

2. Customer shall install Splice Vault or Splice/Tap Box in accordance with Toronto Hydro standards listed in Section 3.0 (c) of this document.

4.5 Completion Date

a) Structures shall be completed and accepted by Toronto Hydro eight (8) weeks before the requested service date to allow sufficient time for scheduling and for installation and connection of cables and equipment.

b) Equipping of the Structure shall not commence until construction is completed in full and accepted by Toronto Hydro and the Structure can be closed or locked without further entry being required by the Customer or Customer's agents.

4.6 Inspection By Toronto Hydro

a) Toronto Hydro shall be given 48-hour notice to review and or inspect the poured in place concrete Structures (duct banks, cable chambers, cable pull rooms, splice vaults and vaults). Customer's Engineer must be present during the inspection. Customer's Engineer shall provide a sign-off confirming the work was done according to the design drawings:

- When formwork is completed;
- Before any concrete is poured;
- When construction is completed.

b) Toronto Hydro shall inspect the Customer-owned Structures to ensure the construction meets Toronto Hydro requirements:

- Dimensions of Structures;
- Access routes (personnel and equipment);
- Drainage (location and workability);
- Primary and secondary duct banks (location and elevation);
- Pulling eyes (installation location);
- Grounding (locations of ground rods, ground loops and bonding of all metallic hardware);
- Proper clearances are met and adherence to Toronto Hydro safety requirements;
- Vault (ventilation, hatchways, grills, removable slabs and caulking);
- For vaults with removable slabs, a trial lift of the vault's removable slabs shall be arranged by the Customer with Toronto Hydro representative to satisfy Toronto Hydro requirements.

5.0 VAULT DESIGN REQUIREMENTS

5.1 Vault General Requirements

a) Nothing contained shall prejudice or supersede any requirements of the current edition of Ontario Electrical Safety Code and the Ontario Building Code.

b) These General Requirements shall be read in conjunction with Toronto Hydro standards: 31-6020, 31-6030, 31-6035, 31-6040, 31-6050, 31-6060 and 31-6080.

c) The vault sizes shall comply with Toronto Hydro standards and shall be suitable for oil-filled transformers.

d) Above-grade, walk-in vault is a preferred type of vault. If not possible, below-grade walk-in or top entry vault can be accepted, provided the vault shall be at the floor immediately below the ground level and accessible from either removable metal grates or concrete slabs.

5.2 Vault Location Requirements

a) Vault shall also be located as indicated in Section 4.4.1.

b) Vaults shall not be installed under or adjacent to public living areas as the effect of sound (low frequency vibrations) produced by the transformers and the cold temperatures produced as a result of the ventilation openings can present unnecessary public complaints. Sound dampening or insulation products can be installed in the vault. P.Eng. stamped drawings including specifications for the products shall be sent to Toronto Hydro to be reviewed and approved by Toronto Hydro Standards Department.

c) A minimum of 5.5 m (18’-0”) clear headroom above the vault is required to permit the use of a crane for Toronto Hydro transformers and equipment. Where a below grade vault is required and access with 5.5 m (18’-0”) headroom cannot be provided to the vault, a suitable areaway with necessary crane headroom above, into which equipment could be lowered and moved into the vault, shall be considered.

d) At existing locations where vehicles obstruct entry into the vault, guard posts (bollards) shall be installed.

e) To ensure that radio communication with the Toronto Hydro Control Centre is adequate, Toronto Hydro may, in its sole discretion, require the Customer to provide provisions for communication equipment installation including the following:

1. 600 mm x 600 mm (2’-0” x 2’-0”) interior wall space inside of vault for mounting Toronto Hydro equipment. Allocated space shall be between 1000 mm (3’-3”) and 1700 mm (5’-7”) above the floor level and be within 1500 mm (4’-11”) of 120 VAC power supply (e.g. receptacle), and within 1000 mm (3’-3”) of access/entry door.

2. 300 mm x 300 mm (1'-0" x 1'-0") wall space on outdoor wall of vault structure at least 3000 mm (10'-0") above ground level for mounting of antenna. Allocated wall space shall have a clear line-of-site to one (or more) Toronto Hydro radio repeater sites.

3. Dedicated civil infrastructure (agreed upon by Toronto Hydro) for running a coaxial cable between equipment installed as per above items a) and b) (e.g. conduit, duct, etc.). The minimum size of conduit/duct shall be 50 mm (2"), with minimum bending radius of 300 mm (1'-0"). Pullbox shall be installed after every two (2) 90-degree bends, with maximum distance of 30 m (100'-0") between pullboxes.

4. Toronto Hydro will supply and install the required equipment (e.g. antenna, cable, pullbox), and assume ownership and maintenance of installed communication equipment.

5.3 Vault Access Requirements

a) Vault access shall be as indicated in Section 4.4.2. The access route shall be designed for crane and truck loadings. The design load for crane shall be to suit the Customer's equipment and location.

b) Vault lock requirements shall be as indicated in Section 4.4.2. If a fence is erected around the vault, it shall be provided with Toronto Hydro padlock to allow Toronto Hydro personnel to gain access.

c) Vaults on Customer property shall not be used as a driveway path to getting into the Customer's building.

5.4 Vault Design and Construction Requirements

a) The vault shall be constructed in accordance with the latest editions of the applicable codes, standards and by-laws referenced in Section 3.0.

b) Where vaults are subject to vehicular loading, they shall be designed in accordance with the Canadian Highway Bridge Design Code CAN/CSA S6, CL-625-ONT live loading.

c) As per OBC 3.6.2.7. (3) a vault, that is part of a building and houses electrical equipment indoors, shall have roofs or ceilings consisting of reinforced concrete of adequate strength for the conditions and not less than 150 mm thick, and floors consisting of reinforced concrete of adequate strength for the conditions and not less than 150 mm thick, except that floors that are at excavation level are permitted to be of reinforced concrete not less than 100 mm thick.

d) As per OBC 3.6.2.7. (4), walls, roofs or ceilings and floors shall be adequately anchored together in a manner designed to resist dislodgement by explosion.

e) As per OBC 3.6.2.7. (7), each door to an electrical equipment vault shall be provided with a substantial lock or padlock.

f) As per OBC 3.6.2.7. (18), every electrical equipment vault shall be provided with adequate lighting, controlled by one or more switches located near the entrance, luminaires located so that they may be relamped without danger to personnel, and a grounded receptacle located in a convenient location inside the vault, near the entrance.

g) Minimum suspended slab loading capacity shall be designed in accordance with Toronto Hydro standards listed in Section 3.0 c) of this document.

h) The grading around a below-grade vault shall be such that water will flow away from the vault roof.

i) No foreign materials or pipes shall be attached to any part of the inside wall, ceiling or floor surfaces of a new or legacy vault unless accepted by Toronto Hydro. Specifications for proposed products shall be sent to Toronto Hydro to be reviewed and approved by Toronto Hydro Standards Department.

j) For walk-in, above grade vaults, pulling eyes shall be installed on the wall directly opposite to the duct entry, as specified by Toronto Hydro, in order to help with cable pulling. Also, a pulling eye shall be installed on the ceiling at door entrance for lifting of transformer/equipment into the vault. Pulling eye shall be installed as per Toronto Hydro standard 31-8210.

k) For waterproofing purposes, Customer may add waterproofing products to walls, ceiling and floor. Waterproofing products shall be non-conductive and non-flammable. Specifications for proposed products shall be sent to Toronto Hydro to be reviewed and approved by Toronto Hydro Standards Department.

l) For below-grade vaults similar to Toronto Hydro underground vaults, doors and ladders shall be built according to Toronto Hydro standards 31-8390 and 31-8500.

5.5 Vault Grounding Requirements

a) All vaults shall be grounded. Grounding shall be as per Ontario Electrical Safety Code (OESC).

b) Depending on the size of the vault, four or more 19 mm x 3000 mm (¾" x 10'-0") long galvanized steel ground rods shall be supplied and installed by the Customer. Ground rods shall be placed in undisturbed ground. If possible, ground rods shall be taken to the last level of the building into the ground. Ground rods shall be a maximum 3000 mm (10'-0") apart.

c) Alternative grounding locations can be used if ground rods are not placed into undisturbed ground or are not within 150 mm (6") of inside Vault wall. In such cases, grounding study, stamped and signed by a Professional Engineer licensed in Ontario, shall be submitted to Toronto Hydro to be reviewed and approved by Toronto Hydro Standards Department.

d) All metal products including but not limited to doors, ventilation louvers, security bars, ladders, and ladderway enclosures shall be grounded and connected to the grounding loop. An extra flex wire shall be used for this purpose.

e) Toronto Hydro requires 48-hour notice to inspect grounding before floor is poured.

f) In existing vaults, Customer is responsible to replace ground rods and grounding loop, if existing grounding system is damaged or rusted.

5.6 Vault Electrical Requirements

a) For all vaults, secondary circuit feeding the lighting system inside the vault shall be supplied and installed by the Customer as per Ontario Electrical Safety Code (OESC). Installation shall be approved by the Electrical Safety Authority (ESA). The secondary circuit shall be 120 V/30 A. The secondary circuit shall be supplied separately from the circuit feeding the vault.

b) For new vaults, lighting system shall be:
- 30 A circuit breaker panel box;
- 200 W LED equivalent light bulbs (lamp) with lamp holders or LED light fixtures. If exposed to the elements, the setup shall meet IP65 rating minimum;
- 15 A rated light switch;
- 20 A rated GFI outlet.

c) For existing vaults, Customer is responsible to rebuild the electrical system as needed if broken or corroded.

d) Light switch and GFI outlet shall be installed near the entrance of the Vault.

e) Type 1 vault shall contain 4 light bulbs/fixtures and Type 2 and 3 vault shall contain 6 light bulbs/fixtures. Lighting fixtures may be mounted on the ceiling or walls of the vault, provided they are located so that they may be re-lamped without danger to personnel.

f) For new vaults having doors facing the exterior of the building, a light system shall be installed by Customer on the outside wall at 300 mm (1'-0") above center of doors and if possible connected to the building emergency and security lighting systems.

5.7 Vault Ventilation Requirements

a) Natural cross-ventilation shall always be used to ventilate the vault. Inlet and outlet vents shall be located in such a way as to provide maximum separation.

b) Mechanically assisted ventilation can be used, if natural cross-ventilation cannot be achieved.

c) As per OBC 3.6.2.7 (6), a ventilation duct or opening, that penetrates the fire separation to the outdoors, need not be protected by a closure at the penetration.

d) As per OBC 3.6.2.7.(8), explosion-relief devices and vents or other protective measures shall be provided for every electrical equipment vault containing dielectric-liquid-filled electrical equipment

e) As per OBC 3.6.2.7.(9), every electrical equipment vault shall be provided with a ventilation system to prevent the ambient temperature in the vault from exceeding 40°C.

f) As per OBC 3.6.2.7 (10), where the vault ventilation system is directly from an outdoor area by natural ventilation without the use of ducts, and where the electrical equipment is the principal source of heat, the combined net area of inlet and outlet openings shall be not less than 0.002 m^2/kVa of electrical equipment capacity with a minimum of 0.093 m^2, except that where equipment in the power class as described in CAN/CSA-C88-M, "Power Transformers and Reactors" is installed, ventilation requirements are permitted to be based on the actual full-load losses, or where the equipment is installed for emergency purposes only and is not normally energized, it need not be considered in determining the ventilation requirements.

g) As per OBC 3.6.2.7 (11), the inlet for fresh air shall lead from an outdoor area and shall terminate at a point not more than 1000 mm above the floor level of the vault.

h) As per OBC 3.6.2.7 (12), where the vault ventilation system is a mechanical system, it shall be separate from the system for the remainder of the building and shall be designed so that the vault temperature is thermostatically controlled, the fan is located so that it may be serviced without danger to personnel, a high temperature alarm is provided in the vault, the system is automatically shut off in the event of a fire in the vault, and a filter is provided in the air inlet if there is a possibility of dirt being drawn in.

i) As per OBC 3.6.2.7 (13), all ventilation openings shall be installed in such a manner that it cannot be removed from the outside by the use of common tools and it is tamperproof.

j) As per OBC 3.6.2.7. (16), where the electrical equipment vault is located in a hazardous location classified as Class II, Division 1 in accordance with the Electrical Safety Code adopted under Ontario Regulation 164/99 (Electrical Safety Code) made under the Electricity Act, 1998, it shall have no vent opening except to the exterior of the building, and suitable pressure-relief openings communicating only with the air outside the building. Where doors are provided between the vault and the rest of the building, they shall have suitable seals such as weatherstripping to minimize the entrance of dust into the vault.

k) All ventilation openings in transformer vaults shall be covered with double-louvers, bird screen and security bars. All metal parts shall be galvanized and shall be installed in such a way that they are tamper proof and cannot be removed from the outside by the use of common tools.

l) The Customer shall be responsible to keep the ventilation openings clean from debris and landscaping in order to ensure adequate ventilation at all times.

m) Mechanically assisted ventilation in vaults, if required, shall be approved by a Professional Engineer of Ontario hired by the Customer. A letter signed by the Professional Engineer that the ventilation meets the minimum requirements shall be submitted to Toronto Hydro prior to commencement of the vault construction.

1. Requirements for mechanically assisted ventilation:

- Vault ventilation shall be separate from the main building system;
- Vault temperature is thermostatically controlled;
- Fan is located so that it may be serviced without danger to the personnel;
- A high temperature alarm is provided in the vault;
- The system is automatically shut off in the event of a fire in the vault;

- A filter is provided in the air inlet if there is a possibility of dirt being drawn in;
- Customer shall routinely inspect and maintain the mechanical ventilation.

n) No ventilation is required for vaults only containing switchgears.

o) As per OBC 6.3.2.9 (4), exterior openings for outdoor air intakes and exhaust outlets shall be shielded from the entry of snow and rain and shall be fitted with corrosion-resistant screens of mesh having openings not larger than 15 mm, except where experience has shown that climatic conditions require larger openings to prevent the screen openings from icing over. Screens required shall be accessible for maintenance.

p) As per OBC 6.2.3.12. (2), outdoor air intakes and exhaust outlets on the exterior of buildings shall be designed or located so that the air entering the building system will not contain more contaminants than the normal exterior air of the locality in which the building is situated.

5.8 Vault Fire Protection Requirements

a) Fire protection (alarm) systems shall be built in accordance with the latest applicable codes and by-laws, Ontario Building Code and Ontario Fire Code.

b) The Customer shall own and at all times maintain the fire protection (alarm) systems in proper working order.

c) As per OBC 3.6.2.7. (1), the building vault shall be totally enclosed by a fire separation of solid masonry or concrete construction having a fire-resistance rating of not less than 3 hours if the vault is not provided with an automatic fire extinguishing system and not less than 2 hours if the vault is so protected.

d) Customer shall install detectors (alarms) for vaults located inside the building. Customer to verify with the fire marshal's office, the Ontario Fire Code and the Ontario Building Code on the type of detectors required. Detectors shall be located in the ceiling above the door. No other location in the vault shall be accepted. Control wires and/or conduit shall not enter the vault except at the detectors. Detectors shall be connected to the building fire alarm system.

e) As per Ontario Fire Marshal's office, detector alarms are optional or not required for vaults outside of Customer's building envelope.

f) As per OBC 3.6.2.7 (2), where a building is required to be equipped with sprinklers, the electrical equipment vault does not need to contain sprinklers provided that vault is designed for no purpose other than the electrical equipment and a smoke detector is provided in the vault that will actuate the building fire alarm system in the event of a fire in the vault.

g) As per OBC 3.6.2.7. (5), only pipes or ducts necessary for fire protection or the proper operation of the electrical installation shall penetrate the fire separations surrounding the electrical equipment vault.

h) All building vault doors shall be hollow metal fire doors having a fire separation rating of 3 hours or as is indicated in the Ontario Fire Code and the Ontario Building Code. A free sliding pad, tamper proof pad bolt and mortise strike shall be installed. Pad bolt shall be fastened to door and

frame with tamper proof bolts. All metal parts including doors, hinges and pad bolts shall be rust proofed. Astragal strips and cadmium plated cane bolts (top and bottom of stationary door) are required on double door installations.

i) All door hinges shall be stainless steel, i.e. mortise type rust proof hinge with non-removable pin and ball bearings or equivalent.

j) An emergency door shall be required in new building vaults as indicated in Toronto Hydro standard 31-6020, 31-6030, and 31-6080, location of which shall be accepted by Toronto Hydro. Emergency door shall have panic hardware installed to allow door to open from the inside. There shall be no method of opening an emergency door from the outside.

5.9 Vault Drainage Requirements

a) As per OBC clauses:

- 3.6.2.7 (14), the floor of an electrical equipment vault shall be liquid tight and surrounded by liquid tight walls and sills of sufficient height to confine within the vault all of the liquid from the largest item of electrical equipment, but to a height of not less than 100 mm.

- 3.6.2.7 (15), the floor of the electrical equipment vault may be provided with a floor drain connected to a covered sump capable of holding all of the liquid from the largest item of electrical equipment, and the connection shall have a non-combustible trap to prevent the spread of fire from the vault to the sump.

b) The Customer shall provide drainage to the vault, according to the latest version of the Ontario Building Code and the National Plumbing Code of Canada. It is the Customer's responsibility to provide a vault drainage system consisting of a sump pit with a fully functional sump pump and a drain connection to the building drainage system or sewer. The Customer shall be responsible for keeping the whole drainage system clean and operational at all times.

c) The City of Toronto’s sewer by-law for discharges to sanitary or combined sewers is located in Chapter 681 of Toronto’s Municipal Code. The discharge of oil from a transformer is not allowed into either the sanitary or storm sewers. Limits for the discharge of oil and grease (mineral and synthetic) are 15mg/L in sanitary and combined sewers, and 0 mg/L in the storm sewers. As the vault equipment (transformers) contain oil, the Customer shall be responsible for installing an oil containment system or barriers in all vaults preventing oil from the equipment (transformers) from draining into the City sewers or building drain system. This requirement will apply to all vaults (new or existing) containing transformers. The Customer shall contact the City of Toronto Environmental Monitoring and Protection Department for confirmation and applicable guidelines and requirements. For legacy vaults, oil containment might not be needed. Customer to verify with the City of Toronto for requirements.

d) The floor shall slope downwards towards the drain with a minimum pitch of 2%.

e) Drains shall be provided under each ventilation and hatchway opening.

f) Precaution shall be taken not to install drains where transformers or other vault equipment is located (under a ladder or in front of a doorway).

g) A backwater valve is required and shall be located inside the transformer vault where possible.

h) Where a sump pump in the vault is used, the pump and its wiring shall be provided and installed by the Customer.