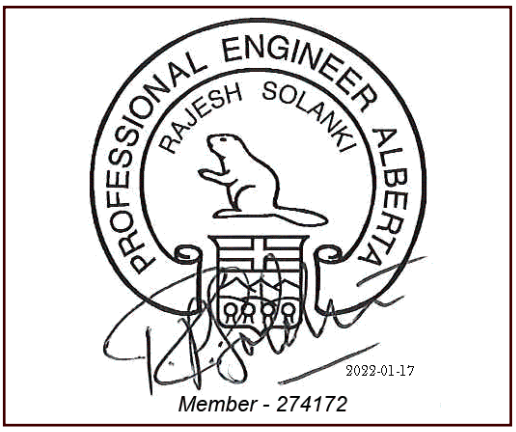
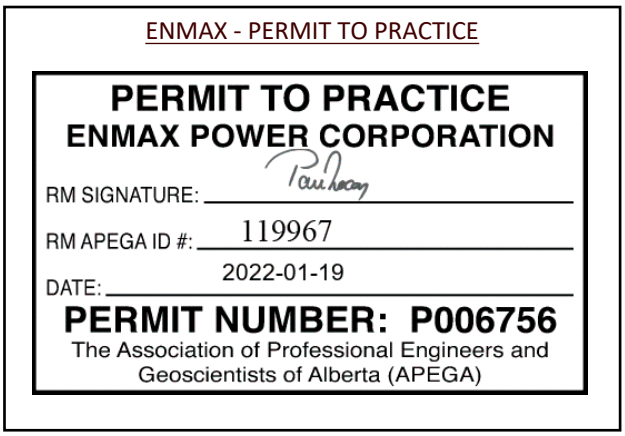
General Technical Specification

Network Customer Built Vault Specifications

EPC-NCBV-001

Document Owner	Title	Date Approved
Tracy Spratt	Manager, Standards and Equipment	2022--01-17
Technical Content Manager	**Title**	
Paul Mocan	Senior Lead Engineer	





Important - Please note the following:

This document is intended to supplement all relevant legislation including the Electric Utility Act, Alberta Electric Utility Code, Canadian Electric Code and EP Distribution Tariff Term's and Condition's. If there is any inconsistency between this document and any of the above, the terms of that tariff, agreement or legislation will prevail.

The information contained within this document can be modified by EP without notice.

Revision History

Rev	Effective Date	Revision History	Revised by:	Approved by:
0		Issued for Implementation		
1	2022-01-17	Updated formatting; updated customer facing specs and standards; New Maintenance notes and clarities.	R. Solanki	P. Bautista

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List of Standards Referenced	
Number	**Name**
536-NCBV-003	Network EDD Switch Placement Template
536-NCBV-004	Customer Equipment Access Requirements
536-NCBV-005	Typical Customer Built Vault Lift out Well / EDD Combo
536-NCBV-006	Typical Customer Built Vault Dimensions (600 Volt)
536-NCBV-007	Typical Customer Built Vault Dimensions (208 Volt or 480 Volt)
536-NCBV-009 536-NCBV-016 536-NCBV-017	Cable Entrance Duct Zones
536-NCBV-014	Customer Built Vault (Door Hardware)
536-NCBV-015	Customer Ground Plate
9250	Lift Out Well Civil Detail
9272	Typical Customer Built Vault Door Sill
9561	Typical Customer Built EDD Chamber Lighting Standard
9562	Typical Customer Built Vault Lighting Standard (208 Volt or 480 Volt)
9565	Customer Vault Station Service
9705	Customer Vault EP Grounding - ENCLOSURE GROUNDING DETAIL
9706	Customer Vault EP Grounding - ENCLOSURE GROUND GRID ALTERNATIVE

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1.0 Introduction

1.1 Purpose of this Specification

Customers within the Calgary Network service area with large electrical loads may require an indoor customer vault, located on or within the Customer's property, to supply their electrical needs. This customer owned vault is to be designed and built by the Customer . To ensure the integrity and service quality of the Network System is maintained, ENMAX Power (EP) has written this specification that outlines the basic procedural and technical requirements that shall be met in the design and construction of a customer-built vault, which includes the transformer vault, the Emergency Disconnect Device (EDD) room and/or lift out well.

The term 'Network', as used in this publication, refers to the area of EP's electrical distribution system that is located in Calgary's downtown core and portions of the adjacent communities (see Figure 1).

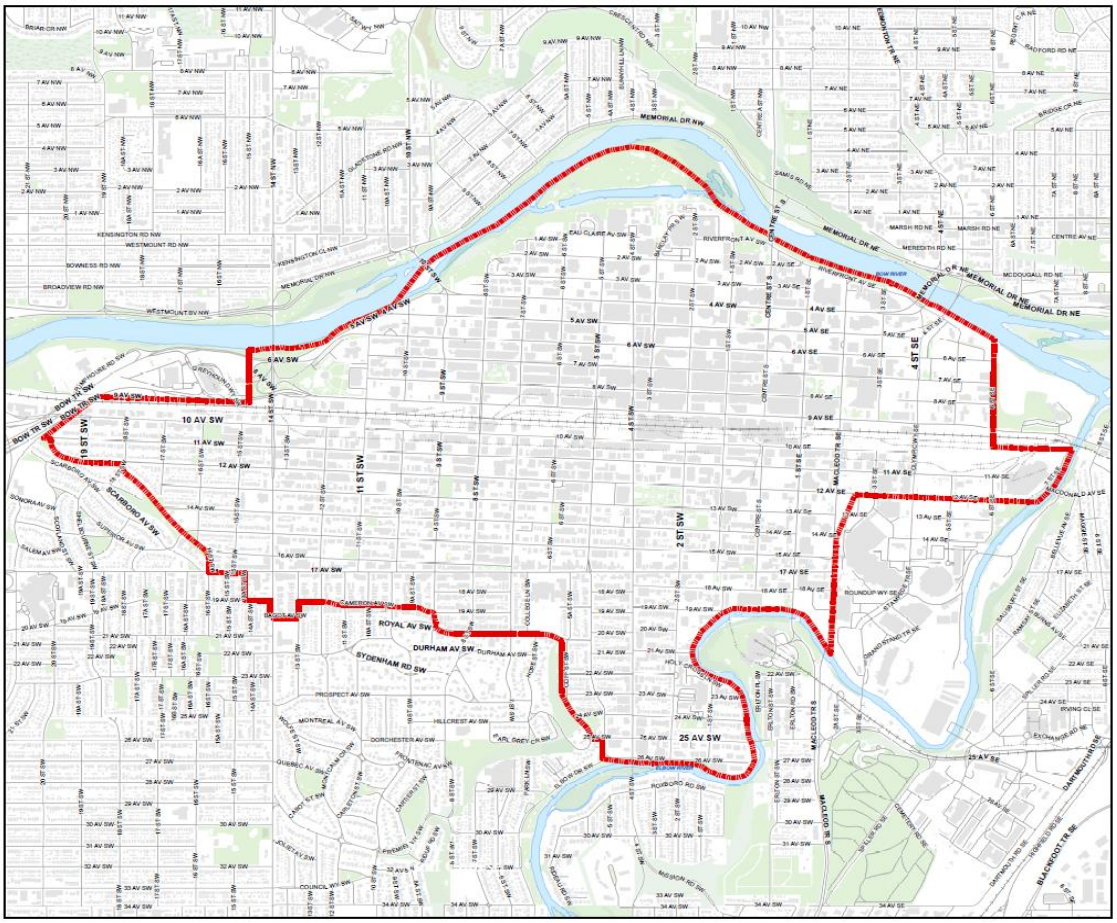

Figure 1 EP Network Boundary Map

1.2 Limitations and Notes

This Specification is not a design manual nor is it a substitute for responsible engineering practice. All requirements listed within this specification are the minimum requirements. A Customer intending to construct an indoor vault with the intention of receiving service from the EP Network System is advised to hire a qualified professional engineer licensed by APEGA and comply with APEGA's Authenticating Professional Work Products standard. It is essential that these technical resources have related engineering experience in Alberta to ensure compliance with all provincial codes, standards, and all other requirements directed by EP.

For all other aspects of Network servicing, please refer to the Network Servicing Policies and Guidelines under "Get Connected" at www.enmax.com - contact 403 514-3716 or getconnected@enmax.com

1.3 Interpretation

This document is intended to provide EP's Customer with the minimum utility requirements as outlined in applicable Utility Codes, Acts, Standards and relevant ENMAX Standards to aid the Customer and the Customer's designer(s) in the minimum requirements for compliance with EP's requirements. The Customer is also required to meet all relevant Building Codes, Standards, architectural and any applicable legislation in the design and construction of the vault. Where conflicts between EP requirements and Building Code or other legislation exist, the Customer shall notify EP immediately such that EP can work with the applicable bodies to resolve and provide clarity for design and construction parameters.

The word 'shall' has been used throughout this document and when used, is a mandatory requirement to be in compliance with this specification.

1.4 Customer Drawings and Construction

The customer owned and built vault consisting of the transformer vault, lift out well and/or Emergency Disconnect Device (EDD) room all fall under the Alberta Building Code (National Building Code – AB Edition) definition of an 'Electrical Equipment Vault' and shall adhere to those requirements. All customer installations are required to pass City of Calgary building code inspection.

The Customer is required to submitted authenticated drawings for review and acceptance by EP for all aspects of the vault as outlined in this specification. The customer shall not start construction until all drawings have been accepted by EP.

The Professional of Record shall ensure that associated design packages (Professional Work Products - PWP) are complete and in compliance with all applicable Authority Having Jurisdiction Requirements, Engineering and Regulatory codes. The 'Authority Having Jurisdiction' (AHJ) may include, but not be limited to, EP, City of Calgary, other utilities, etc.

1.5 Customer Checklists (Construction & Energization)

A Customer built vault commissioning checklist for the construction of the transformer vault, EDD room and lift out well is provided by EP in Appendix A . This checklist shall be signed off by the Customer and EP before any EP installation work commences.

Prior to any EP construction, EP requires a site coordination meeting to be setup by the Customer, with a minimum notification of 10 business days notice to coordinate scheduling. At the meeting, an EP representative will review any outstanding deficiencies that will need to be corrected prior to the beginning of the EP installations in the transformer vault, EDD room and/or lift out well. The EP Project Manager will then establish a tentative schedule for construction that will commence when the customer meets all the requirements in this specifications and checklist.

1.6 Types of Transformers to Be Used

The transformers that are used within the indoor transformer vault are filled with an insulating fluid that is approved for indoor application. EP will supply and install the transformers at the customer's expense.

1.7 Utility Right-of-Way

EP requires the customer to grant a strata Utility Right-of-Way to EP for the transformer vaults, EDD rooms, lift out wells and the associated conduit systems for EP cables on the customer's property.

The conduit system includes the conduit connecting the customer vault to the external EP system, as well as the conduit between the transformer vault and the customer's main disconnects.

2.0 DESIGN SPECIFICATIONS FOR STRUCTURES AND FACILITIES

2.1 Customer Vault Location Requirements

The vault shall be located such that it meets the following requirements:

i. The vault shall have two (2) access points and EP personnel shall have 24-hour direct access from outside the building via one of the two access points in accordance with Section 3.1. This direct 24-hour access is necessary for EP personnel to facilitate maintenance and emergency /routine switching on the ENMAX system without delays.

ii. The installation of equipment access doors shall meet all of the conditions outlined in Section 3.2 and if applicable, the installation of a standard EP vault steel hatch and slab assembly for lift out wells. Vault steel hatch and slab assemblies shall not be installed in driveways or other vehicular traffic corridors.

iii. Sufficient space shall exist in the area immediately adjacent to the vault to allow EP equipment and vehicles to maneuver. During construction, two (2) temporary but dedicated parking spots for EP field service trucks shall be provided by the customer – these locations shall be adjacent to the proposed vault access and shall be confirmed with the EP Coordinator. Customer to coordinate with EP via the EP Project Manager.

iv. The customer vault shall be located on the customer's property and cannot be located above the +15 level of a building. Where below grade, the vault floor shall not be located deeper than P2 parking level and the ductbank entry point at Customer property line shall not be deeper than 1.2m from top of duct to finish grade.

v. To facilitate the movement of EP equipment, e.g., transformers into and out of the vault, the customer shall consult with EP if the floor of the proposed vault is not designed flush with the grade at the equipment access doors directly outside the building (i.e., for grade level vaults).

2.2 Customer Vault Dimensions

Details regarding the vault are as follows:

i. The transformer vault shall be large enough to house a minimum of four (4) network style transformers with protectors.

ii. The interior of the customer vault shall be completely free of any obstacles or protrusions (posts, pillars, bulkheads, supporting beams, etc.).

iii. The vault shall have enough room to permit safe operation of all electrical equipment by EP Network staff and allow for safe installation and removal of equipment, if required.

Table 1: Minimum Internal Transformer Vault Dimensions

Service Voltage	Typical Internal Vault Dimensions (L x W x H)
120/208 V	11m x 5m x 4.5m*
277/480 V	11m x 5m x 4.5m*
347/600 V	12m x 11m x 4.5m*

* Dimensions exclude the space requirement for mechanical ventilation equipment.

For details of the customer vault, see standards:

- 536-NCBV-006: Typical Customer Built Vault Dimensions (600 Volt)
- 536-NCBV-007: Typical Customer Built Vault Dimensions (208 Volt or 480 Volt)

2.3 Location of Emergency Disconnect Device (EDD) Room

i. EP requires an EDD room inside the building that contains the switchgear equipment to electrically disconnect the incoming EP high voltage cables from the network transformers in the event of an emergency.

ii. The EDD room shall be located in a manner so that EP is provided with 24-hour direct access from outside the building to facilitate access to a building for any emergency operations and/or switching.

iii. The interior of the EDD room shall be completely free of any obstacles or protrusions (posts, pillars, bulkheads, supporting beams, etc.)

iv. Room dimensions shall be as shown in standard 536-NCBV-003: Network EDD Switch Placement Template

v. EP will supply and install the EDDs for which the customer is accountable for the cost.

Note: The EDD room may also be incorporated as part of a vault's lift out well, if applicable. Please contact EP Engineering for more details.

2.4 Electrical Load Criteria for Customer Vaults

Table 2 outlines the maximum aggregate service panel size that can be connected to a transformer vault at the given voltages.

Table 2: Design Criteria for Customer Built Vaults (Maximum Allowable Service Size)

Secondary Voltage	Transformer Size (kVA)	Maximum Aggregate Service Panel Size (amps)*
120 / 208	500	4,400
120 / 208	750	6,600
120 / 208	1000	8,800
277 / 480	750	2,800
277 / 480	1000	3,800
277 / 480	1500	5,600
277 / 480	2000	7,600
347 / 600	2500	7,600

* Note: the largest single service disconnect is restricted to 4000 amps.

2.5 Grounding of Customer Built Vaults

The Customer shall contact EP Engineering for design and installation details of the ground grid to be installed with the applicable transformer vault, EDD room and lift out wells as applicable. The Customer is responsible for the operational condition, maintenance, and replacement of the EP ground grid. EP will communicate any related concerns to the vault owner as required.

i. For personnel safety and electric system protection, a ground grid is required for all transformer vaults, EDD rooms and lift out wells. This ground grid is designated the 'EP ground grid'.

ii. The EP ground grid shall be located within the floor when the room is part of the customer building, or where applicable, directly in the substrate immediately below the floor of the transformer vault, EDD room or lift out well when those facilities are not directly within the building.

iii. The customer is responsible for the supply and installation of the EP ground grid for transformer vaults, EDD rooms and lift out wells located inside the building and property line.

iv. Previously, the customer was also responsible for the supply and installation of the EP ground grid for EDD rooms and lift out wells located outside of the building and property line. At the time of this publication, the City of Calgary no longer accepts installation of Customer Built Vaults within public corridors.

For ground grid details see standards:

- 9705 - ENCLOSURE GROUNDING DETAIL.
- 9706 - ENCLOSURE GROUND GRID ALTERNATIVE

2.6 Customer Equipment Bonding

i. It is the customer's responsibility to review, design and apply electrical bonding for any electrical and metallic hardware that extends into public space. Examples include, but not limited to, door frames, sprinkler systems, lighting, etc.

ii. The customer shall install their own ground plate in the transformer vault and connect it to the building's grounding system. The customer ground plate is indirectly electrically bonded to the supply authority (EP) ground bus via the building electrical system. EP has provided a typical Customer ground plate in drawing 536-NCBV-015: Customer Ground Plate, for reference only.

iii. Ensure a minimum separation of 2.5m between the EP Neutral Bus Bar and Customer ground plates if in proximity to each other.

2.7 Painting

i. The customer is responsible for painting all the interior surfaces of the transformer vault, EDD room and lift out wells. This includes the ceiling, walls, and floor.

ii. All floors shall be smooth and free of irregularities to permit the use of air-pallet equipment.

iii. Non-slip surfaces are NOT to be installed on, or applied to, any floor surfaces.

iv. The color of the paint shall be white and be latex based.

2.8 Transformer Vault, Lift out Well and Emergency Disconnect Device (EDD) Room Construction

i. The transformer vault, EDD room and lift out well (including their ceilings) shall be of a "*cast-in-place*" concrete construction with a fire-resistant rating of not less than 3 hours.

ii. All walls shall be smooth and free of any protrusions.

2.9 Floor/Ceiling Loading Weights

The customer is responsible for ensuring that the floor and/or ceiling load ratings are capable of supporting the EP installed equipment. Table 3outlines the approximate weights for transformers and the associated secondary bus work and cables.

Table 3: Standard Weights for Network Transformers with Protector Fitted

Service Voltage (volts)	Base Footprint (W x L) *	Unit Weight (kg)
120 / 208	1.3m x 1.6m	6,500
277 / 480	1.5m x 1.6m	9,000
347 / 600	1.4m x 2.1m	10,000
Secondary Bus Work and Cables	N/A	2,000**

* The base footprint is not the same as the transformer dimensions

** The secondary bus work and cables are supported via I-beams mounted to the walls

2.10 Customer Service Duct Locations

The permitted locations for customer service ducts entering the transformer vault are as shown in standards '536-NCBV-009; 536-NCBV-016; 536-NCBV-017 Cable Entrance Duct Zones'. The customer service duct location shall be reviewed and accepted by EP Engineering prior to construction.

For installations where the customer's main service panel is located in close proximity to, or above the transformer vault, the customer may have to supply cable strain relief grips to support the weight of the EP secondary cable and reduce the tension on the cable terminations within the customer service panel. The customer shall contact EP Engineering to determine the requirement for and obtain approval of the cable strain relief system.

3.0 EQUIPMENT AND PERSONNEL ACCESS REQUIREMENTS

The Customer shall submit design drawings showing both equipment and personnel access doors to EP Engineering for review and acceptance prior to construction.

EP will install signage on the customer side of the doors to the transformer vault and the EDD room.

3.1 Personnel Access Requirements

The Customer shall consider the following requirements when designing the vault:

i. A minimum of two (2) access points at the floor grade of the transformer vault are required and one (1) access point at floor grade for the EDD room (if applicable). The number of doors required will be dependent upon their location in the transformer vault room.
   - If equipment access doors (i.e., double doors) are located on the side walls (11m side) then EP will require 1 personnel access door (i.e., single door) on each of the end walls (5m side).
   - If equipment access doors are located on the end wall, then EP will require 1 personnel access door on the opposite end wall.

ii. EP personnel shall have 24-hour access via one of the access points.
- This access shall be directly from the outside of the building and not require the permission or assistance of a third party such as building security or the fire department.
- This access shall be from outside of the building and lead directly into the transformer vault
- If applicable, a lift out well will meet the access requirements as defined in this specification

iii. All doors shall be tamperproof and be fitted with EP supplied cores for the locks.

iv. For locations where the EDD is in a separate room, the access shall be from outside of the building and lead directly into the EDD room.

v. For locations where the exit is not via the ceiling, the bottom of the personnel access door is to be at the same level as the floor of the transformer vault.

ii. If the access to the transformer vault is via the ceiling, a fixed in place steel ladder is required to facilitate EP personnel access via the grates. EP will supply and install the ladder at a charge cost to the customer.

vi. Wall located personnel access doors (i.e., single doors) shall adhere to the following:

- The personnel access doors shall have dimensions of 0.91 meters wide x 2.1 meters high.
- The customer will supply and fit the door hardware as shown in standard '536-NCBV-014: Customer Built Vault Door Hardware'.
- Personnel access doorway shall have a concrete sill with a minimum height of 100mm and comply with Section 3.6.2.7 'Electrical Equipment Vaults' of the National Building Code – AB Edition. EP Engineering will supply the oil capacity of each liquid filled piece of equipment as required. See Detail 2 in standard '9272 - Typical Customer Built Vault Door Sill'. See also section '4.1 Liquid Containment – Door Sill'.
- The door may be alarmed if required by the customer. The supply and installation of any building security related equipment is the responsibility of the customer. Note, EP will not be responsible for notifying the building security staff when EP staff are on-site and accessing our equipment via alarmed doorways.
- If the personnel access door does not open into public space, the next door shall open into public space and be equipped with a panic bar.
- Personnel access doors shall open outward from the transformer vault, or EDD room (if applicable).

3.2 Equipment Access Requirements

The Customer shall supply an equipment access either via the ceiling in a lift out well for below grade vault installations or via wall access to provide the opening to move any EP electrical equipment in or out of a customer vault

3.1.1 Lift Out Well Access

An outdoor ceiling access to the transformer vault may be constructed by installing a standard EP vault steel hatch and slab assembly as part of the lift out well. This ceiling access shall be integrated as part of the customer vault building structure. Please contact EP Engineering for design details.

i. When a customer vault is constructed below grade, a lift out well is required for the removal of EP equipment.

- The minimum size for the lift out well is shown in standard 536-NCBV-005: Typical Customer Built Vault Lift Out Well/EDD Combo.
- The preferred location of the lift out well is outside the footprint of an exterior wall of the building and adjacent to the transformer vault.
- The bottom of the equipment access doors shall be located at the same level as the floor of the transformer vault.

ii. The steel hatch and slab assembly are installed in a portion of the ceiling of the lift out well for direct outdoor access.

iii. EP will supply the standard steel hatch and slabs at customer's cost. EP supplies the 'top steel' components, and the customer shall install it during their lift out well construction. The installer shall ensure EP Civil Engineering liaison for correct 'top steel' installation during this phase. The 'top steel' components are per standard for street vaults - they are manufactured and supplied per EP Supply Chain Management process.

iv. The ceiling access (lift out well) may be combined with the EDD room for equipment access.

v. The lift out well shall be equipped with a sump pit, see Section 4.3 - Sump Pits and Covers). The sump pit shall have a perforated cover and a removable hatch with a minimum diameter of 0.3 meters to allow for pumping out any liquid.

- The location of the sump pit shall be reviewed and accepted by EP Engineering prior to construction.

vi. There are to be NO obstructions (e.g., structural members, signage, portions of the building such as overhangs, trees, etc.) above the hatch and slab assembly. This clear vertical space above the lift out well is required for a crane to safely lower into or remove transformers and other service equipment from the customer vault.

For more information see standard drawings:

- 536-NCBV-004: Customer Equipment Access Requirements
- 9250: Lift Out Well Civil Details

3.1.2 Transformer Vault Equipment Access

Wall access to the transformer vault shall be constructed via a door assembly. Equipment access doors shall meet the following requirements:

i. The minimum internal dimension for the wall access equipment doors is 2.1 meters wide x 2.9 meters high. Ideally, this is a double door without a center support. Where center support is required, it shall be a removable type approved by EP. Doors shall open outwards from the transformer vault room, or the EDD room (if applicable).

ii. The equipment access doors shall either be equipped with removable door hinge pins so the doors can be taken off their hinges or the doors shall be able to open a full 180 degrees.

iii. The customer will supply and fit the door hardware per EP requirements.

iv. See standard drawing '536-NCBV-014: Customer built Vault Door Hardware' for information.

Where an unavoidable grade differential exists at the equipment access doors between the vault floor and its exterior, the design shall make accommodations to eliminate the grade deviation. Such design and installation shall be authenticated by customer's PoR and accepted by the ENMAX Project Engineer prior to any construction.

Where the grade is lower inside the vault at the equipment access doors, a removable platform shall be supplied by the customer. This flat level removable platform shall be maintained by the customer. It shall meet the following minimum requirements to eliminate any grade deviation between the vault floor and the outside grade:

i. Minimum dimensions: 2.1m (W) x 3.0m (L)

ii. Removable and easily accessible. Considerations shall be made for a secure, clean, dry, and safe storage space for this platform within the building or vault, for the duration of its lifetime. This will facilitate effective equipment movement for any future operational and maintenance needs.

iii. Ergonomically designed for two workers to move without aid of other mechanical equipment.

iv. Weight bearing capacity, at minimum, equal to the weight of the largest Network Transformers.

v. Smooth surface, free of joints permitting the use of an air pallet device for moving large equipment.

If grade is lower on the exterior of the vault, the customer shall supply a concrete access apron. This surface shall smooth, free of joints that will allow for safe and fluid use of an air pallet system to move large equipment. The maintenance of this apron is the responsibility of the customer.

3.3 Vehicle Access

i. Equipment rooms and lift out wells shall be designed and located with sufficient unrestricted space exterior to the building for EP large construction vehicles to safely operate and facilitate installation / removal /maintenance of EP electrical equipment.

ii. Typical equipment used is a mobile crane and flatbed tractor trailer.

iii. Minimum dimensions for equipment setup are shown in standard '536-NCBV-004: Customer Vault Equipment Access Requirements'.

iv. At least two (2) temporary parking spots dedicated for EP crew trucks shall be provided by the customer during construction. Location shall be adjacent to the vault, to be coordinated and confirmed with the responsible EP coordinator.

4.0 LIQUID CONTAINMENT

4.1 Door Sill

i. All personnel access points (i.e., single doors) to the transformer vault shall be equipped with a concrete sill. See Detail 1 in standard '9272 - Typical Customer Built Vault Door Sill'.

ii. Locations with equipment access doors (i.e., double doors) shall be equipped with a removable oil containment sill. This sill will be supplied and installed by EP. See Detail 2 in standard '9272 - Typical Customer Built Vault Door Sill'.

4.2 Lift Out Well Drainage System

The floor of the lift out well shall incorporate a drainage system. The drainage system shall be as follows:

- A dry sump pit located at the ladder end of the lift out well, directly beneath the fixed portion of the access/ventilation grates. Dimensions of the dry sump are to be 0.6 x 0.6 x 0.6 meters (L x W x H).

4.3 Transformer Vault and EDD Room Drainage System

Floor drains are not allowed in the Transformer vault or EDD room.

4.4 Sump Pits and Covers

i. To maintain safety and ensure ease of access into the sump pit, the sump pit shall be equipped with a removable cover of a minimum thickness of 6.35mm. This cover shall be constructed from galvanized steel, stainless steel, or aluminum. For stand-alone systems (no storm water connection), the cover shall be hinged or removable and 0.3m in diameter to facilitate the insertion of a pump hose for liquid removal. See standard '536-NCBV-005; Typical Customer Built Vault Lift Out Well / EDD Combo' for sump pit location.

ii. All covers shall be installed flush with the surrounding floor surface.

iii. The sump pit cover shall be perforated to permit liquid to enter the sump pit.

5.0 FIRE PROTECTION AND DETECTION

5.1 Alarms

EP does not require alarms within the transformer vault, EDD rooms or lift out wells.

i. If an alarm is required by the customer to accommodate building code requirements, only silent strobe-style alarms are permitted. Audible alarms are not permitted within a building enclosure containing EP equipment.

ii. Any alarms installed by the customer shall adhere to the National Building Code – AB Edition.

iii. The design, location and type of alarms deemed necessary by the customer shall be reviewed and approved in advance by EP Engineering.

5.2 Smoke and Heat Detectors

i. The transformer vault shall be equipped with two (2) ceiling mounted heat detectors and two (2) ceiling mounted smoke detectors. These devices will provide detection of overheating or potential hot spots and fire.
   - The detectors shall be located so that there is a smoke detector positioned between each pair of Network transformers.
   - The design and specific location for each detector shall be reviewed and accepted by EP Engineering in advance.

ii. If the EDD room is inside the building and not part of the lift out well, the room shall be equipped with the following:
   - One (1) ceiling mounted heat detector
   - One (1) ceiling mounted smoke detector

iii. All smoke and heat detectors shall be connected to the building alarm system and actuate the main building alarm if fire or overheating occurs in the transformer vault or EDD room.

iv. Smoke detection and alarm systems shall also be configured to disable the ventilation system when activated. See Section 7.1

5.3 Sprinkler Systems

If the current building code stipulates that the customer shall install a sprinkler system, then the following is required:

i. Sprinkler system shall be a non-pressurized, dry type (non-liquid).

ii. Location of the sprinkler heads shall be reviewed and accepted by EP Engineering.

iii. A by-pass system shall be installed to enable EP crews to disable the sprinkler system when performing their work activities in the vault.

5.4 Fire Ratings

i. The floors, ceiling, and walls of the transformer vault, EDD room and lift out well shall be ‘cast in place’ concrete that has a fire-resistant rating of not less than three (3) hours.

ii. The customer shall not affix any sheathing, coverings, or panels (wood, metal, foam, fiberboard, masonry, etc.) to the interior surfaces (walls, floors, ceilings) of the transformer vault, EDD room or lift out well to achieve an increase in the fire-resistance rating.

5.5 Fire Rated Doors

In those locations where the transformer vault, EDD room and lift out well have wall access style personnel and equipment access doors, the doors shall have a fire-resistant rating of not less than two (2) hours. All doors shall be constructed of metal with no composite or glass sections.

5.6 Fire Dampers

In the case that an HVAC intake or exhaust outlet is not on an exterior building wall, the outlet shall have a fire damper rated for a minimum of two (2) hours.

NOTE: Only pipes or ducts necessary for a vault’s fire protection or proper electrical facility operation are allowed in the vault. These pipes or ducts shall be placed at minimum 4500mm above the vault floor.

6.0 LIGHTING AND DUPLEX RECEPTACLES

6.1 General Room Lighting and Duplex Receptacle Requirements

The customer is responsible for the supply and installation of room lighting and duplex receptacles for the transformer vault and EDD room.

All lighting and duplex receptacles shall meet the following requirements:

- Lighting be rated to operate at temperatures down to 0 degrees Celsius.

- Any customer supplied power be connected to circuits backed up by on-site generation or an uninterruptible power supply (UPS).

For more information see standard drawings:

- 9561 - Typical Customer Built EDD Chamber Lighting Standard for EDD room requirements
- 9562 - Typical Customer Built Vault Lighting Standard (208 Volt or 480 Volt) for transformer vault requirements

Lighting and receptacle designs for 600V transformer vaults shall be submitted to EP Engineering for review and acceptance.

6.2 Emergency Lighting

The customer is responsible for the supply, installation, and maintenance of the emergency lights, the 24-hour “Unswitched” lighting and exit signs for the transformer vault and the EDD room.

The 24hr unswitched lighting, the Emergency lights and exit lighting shall meet the following requirements:

i. An emergency exit sign, the 24-hour unswitched lighting and emergency light (with backup battery power) be located above each point of exit.

ii. In locations where the emergency exit from the indoor vault/room leads into a second room, the customer install similar emergency lighting in the second room as well, which includes the continuously on, unswitched 24-hour lighting.

iii. Emergency lighting installed in transformer vaults and EDD rooms be tested and maintained regularly in accordance with the testing of all other building security/alarm systems. Access to these rooms for testing shall be arranged 5 business days prior to testing by contacting EP Customer Intake.

For more information see standard drawings:

- 9561 - Typical Customer Built EDD Chamber Lighting Standard for EDD room requirements
- 9562 - Typical Customer Built Vault Lighting Standard (208 Volt or 480 Volt) for transformer vault

7.0 VENTILATION SYSTEM

7.1 Transformer Vaults

i. The customer is responsible to install and maintain an air handling (Heating, ventilation, and Air Conditioning - HVAC) system which provides adequate heating and cooling of the transformer vault.

ii. The transformer vault shall have both sufficient heating and cooling to prevent the ambient air temperature from falling below freezing (0 degrees Celsius) or exceeding +40 degrees Celsius. Typical transformer heat losses for EP equipment (on a per transformer basis) are listed in Table 7.1.

Table 4: Standard Network Transformer Heat Loss

Service Voltage	Transformer Size (kVA)	Transformer Loss (watts)
120 / 208	**500**	**7,000**
120 / 208	**750**	**8,000**
120 / 208	**1000**	**12,000**
277 / 480	**750**	**8,000**
277 / 480	**1000**	**11,000**
277 / 480	**1500**	**12,000**
277 / 480	**2000**	**14,000**
347 / 600	**2500**	**19,000**

iii. A typical ventilation system will be comprised of either a passive air intake or conditioned air intake, an exhaust fan, and exhaust opening. The system shall provide cool / hot air as required.

iv. The location of the air intake and exhaust system inlet shall maximize the air flow across the EP transformers. Customer HVAC equipment shall not be installed within the EP wall cabling zones. Refer to standards 'Cable Entrance Duct Zones' for available locations for ventilation grate openings.

- The HVAC system shall be controlled by an adjustable thermostat within the transformer vault and accessible to EP personnel at all times.
- The customer vault ventilation system shall be separate from the system for the remainder of the building and shall be designed so that it is automatically shut off in the event of a fire within the vault.
- All ventilation equipment requiring routine maintenance shall be accessible externally to the vault, to facilitate their maintenance activity without need to enter the vault. Annual testing and maintenance of the ventilation system and components (including louvers, motors, filters, etc.) is the responsibility of the building owner and shall be coordinated with EP.

v. The air intake shall provide fresh outside air and be covered by louvers, a bird screen, and include an air filter(s). Air intake shall not be drawn from a parkade.

- The air filter(s) shall be a common standard size, sturdy quality to withstand high external wind forces, disposable and available locally. The customer is responsible to provide the first set of filters required. Subsequent filters will be purchased and installed by EP at a charge cost to the customer.

iv. To ensure a safe and efficient outlet for the exhaust air, the exhaust outlet shall be installed in a place that will not allow the room exhaust to be drawn into the vault air intake.

- The exhaust outlet shall not be located in a lift out well.
- The exhaust outlet shall be covered by louvers and a bird screen.
- A two-hour fire rated damper may be required for both the intake and exhaust openings as per prevailing building code.

v. It is the customer's responsibility to supply and install the control panel and supply the energy to power all the ventilation related equipment within the customer vault.

vi. The customer's PoR shall be responsible for the complete design and shall include but not limited to:

- The design of the ventilation equipment / system shall meet all EP requirements, AHJ requirements, the current building codes and be approved by the City of Calgary.
- The control panel shall be installed at the designated 24hour access point which shall be reviewed and accepted by EP Engineering.
- The control panel shall have a manual off, manual on, and an automatic position. The switch shall have a light that indicates the status of the ventilation equipment.
- Prior to construction, the design plans of the physical layout for the ventilation equipment shall be submitted to EP Engineering for review and acceptance.

7.2 Emergency Disconnect Device Room (EDD)

Ventilation is not allowed in the EDD room.

8.0 MAINTENANCE REQUIREMENTS

EP is responsible for performing timely maintenance of the EP owned electrical equipment inside the Customer Built Vaults. Additionally, EP will also assess the civil and structural condition of these vaults on a predefined inspection cycle to ensure personnel safety. However, the regular inspection, maintenance and

repairs/replacements of the vault's structural, mechanical, fire protection and non-EP owned electrical components are the responsibility of the customer.

The Customer may, from time to time, impliedly or expressly request or consent to the operation or maintenance of Customer Facilities by EP. Refer to the EP 'Network Servicing Policies and Guidelines'.

The Customer is responsible to ensure all Customer owned installations shall not pose any hazard and are free of obstructions during their operating lifetime. The customer is responsible for routine inspection, maintenance, repair and replacement activities including, but not limited to, the following:

1. Ensuring the vault is structurally sound (Repair any major cracks or damages that may hinder the structural integrity).
2. Ensuring routine checks, maintenance and replace as need of the grade levelling platforms, concrete aprons, and the equipment access doors system, ensuring they are structurally sound and in good working condition.
3. Ensuring the vault is dry and address any water ingress concerns.
4. Ensuring the HVAC system is tested and maintained annually, and associated air filters are replaced annually or more frequently as required by EP.
5. Ensuring the fire protection and detection system is tested and maintained annually.
    a. Smoke and heat detectors installed in transformer vaults and EDD rooms shall be tested regularly in accordance with the testing of all other building security/alarm systems.
6. Ensuring the vault lighting including emergency lighting is tested and in good working condition.
7. Ensuring all vault doors are in good working condition and EP crews have direct 24-hour access.
8. Ensuring routine checks, maintenance, and replacement as needed of the steel hatch and slab system.
9. Ensuring routine checks, maintenance, and replacement as needed of the access/ventilation grates and steel ladder.
10. Ensuring routine checks and maintenance of the sump pit and removable cover to ensure good operable condition.

For any specific vault maintenance related inquiries, please contact EP Customer & Stakeholder Relations at:

Telephone: 403.514.3990 and Email: powercustomerrelations@enmax.com

8.1 Vault/EDD Room Access Coordination

Access to these rooms for inspection, testing, maintenance, repairs or replacements shall be arranged a minimum of 5 business days prior by contacting:

EP Customer Intake / "Get Connected" at 403 514-3716 or getconnected@enmax.com.

Any EP costs associated with this testing will be a customer / owner responsibility and shall be charged accordingly.

APPENDIX A – CUSTOMER COMMISSIONING CHECKLIST

Page intentionally left blank, see attachment.

PROJECT NAME:
PWO#
PROJECT ENGINEER:
EDD# / VAULT #:

CUSTOMER:
SITE CONTACT NAME:
SITE CONTACT #:

APPENDIX A

INDOOR VAULT COMMISSIONING CHECKLIST

INSPECTION #1: GROUND GRID INSTALLATION

ITEM	DATE	CUSTOMER INITIALS	ENMAX INITIALS	NOTES
Section 2.5 Grounding of Transformer Vaults				
ACKNOWLEDGEMENT		PRINT: SIGN:	PRINT: SIGN:	

PROJECT NAME:
PWO#
PROJECT ENGINEER:
EDD# / VAULT #:

CUSTOMER:
SITE CONTACT NAME:
SITE CONTACT #:

APPENDIX A

INDOOR VAULT COMMISSIONING CHECKLIST

INSPECTION #2: PRE-CONCRETE POUR

ITEM	DATE	CUSTOMER INITIALS	ENMAX INITIALS	NOTES
Section 2.1 Transformer Vault Location Requirements				
Section 2.2 Transformer Vault Dimensions				
Section 2.3 Location of Emergency Disconnect Device (EDD) Room				
Section 2.8 Transformer Vault and EDD Room Wall Construction				
Section 2.9 Floor/Ceiling Loading Weights				
Section 2.10 Customer Service Duct Locations				
Section 3 Equipment and Personnel Access Requirements				
Section 3.1 Equipment Access				
Section 3.2 Lift Out Well Equipment Access				
Section 3.3 Personnel Access Doors				

PROJECT NAME:
PWO#
PROJECT ENGINEER:
EDD# / VAULT #:

CUSTOMER:
SITE CONTACT NAME:
SITE CONTACT #:

APPENDIX A

INDOOR VAULT COMMISSIONING CHECKLIST

INSPECTION #2: PRE-CONCRETE POUR (CONTINUED)

ITEM	DATE	CUSTOMER INITIALS	ENMAX INITIALS	NOTES
Section 3.4 Vehicle Access				
Section 4.2.1 Lift Out Well (Drainage System)				
Section 4.2.2 EDD Room (Drainage System)				
Section 4.2.3 Transformer Vault (Drainage System)				
ACKNOWLEDGEMENT		PRINT: SIGN:	PRINT: SIGN:	

PROJECT NAME:
PWO#
PROJECT ENGINEER:
EDD# / VAULT #:

CUSTOMER:
SITE CONTACT NAME:
SITE CONTACT #:

APPENDIX A

INDOOR VAULT COMMISSIONING CHECKLIST

INSPECTION #3: PRE-ACCEPTANCE / FINAL ACCEPTANCE

ITEM	DATE	CUSTOMER INITIALS	ENMAX INITIALS	NOTES
City Building Code Approval				
Section 1.4 Utility-Right-of-Way				
Section 2.4 Electrical Load Criteria for Transformer Vaults				
Section 2.6 Customer Equipment Bonding				
Section 2.7 Painting				
Section 4.1 Door Sill				
Section 4.3 Sump Pits and Covers				
Section 5.1 Alarms (Fire Protection and Detection)				
Section 5.2 Smoke and Heat Detectors				
Section 5.3 Sprinkler Systems				

PROJECT NAME:
PWO#
PROJECT ENGINEER:
EDD# / VAULT #:

CUSTOMER:
SITE CONTACT NAME:
SITE CONTACT #:

APPENDIX A

INDOOR VAULT COMMISSIONING CHECKLIST

INSPECTION #3: PRE-ACCEPTANCE / FINAL ACCEPTANCE (CONTINUED)

ITEM	DATE	CUSTOMER INITIALS	ENMAX INITIALS	NOTES
Section 5.4 Fire Ratings				
Section 5.5 Fire Rated Doors				
Section 5.6 Fire Dampers				
Section 6.1 General Room Lighting and Duplex Receptacle Requirements				
Section 6.2 Emergency Lighting				
Section 7.1 Indoor Transformer Vaults (Ventilation System)				
Section 7.2 EDD Room (Ventilation System)				
ACKNOWLEDGEMENT		PRINT: SIGN:	PRINT: SIGN:	**Note: Doors must be lockable before ENMAX can accept vault