ENMAX Power Corporation

Network Servicing Policies and Guidelines

Revised: November 21, 2016

Projects and Engineering
ENMAX Power Corporation (EPC)
141 - 50 Ave. SE Calgary, Alberta T2G 4S7

Important – Please note the following:

If there is any inconsistency between this document and any applicable EPC tariff or agreement, the terms of that tariff or agreement will prevail.

The contents of this document are provided for information purposes only. The information contained within this document is not binding on EPC and may be modified by EPC without notice.

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1. GENERAL INFORMATION

1.1 Introduction

The purpose of this guideline is to explain the basic procedural and technical requirements that must be met by the customer for ENMAX Power Corporation (EPC) to provide an electrical service connection within the Network area (see Figure 1.1).

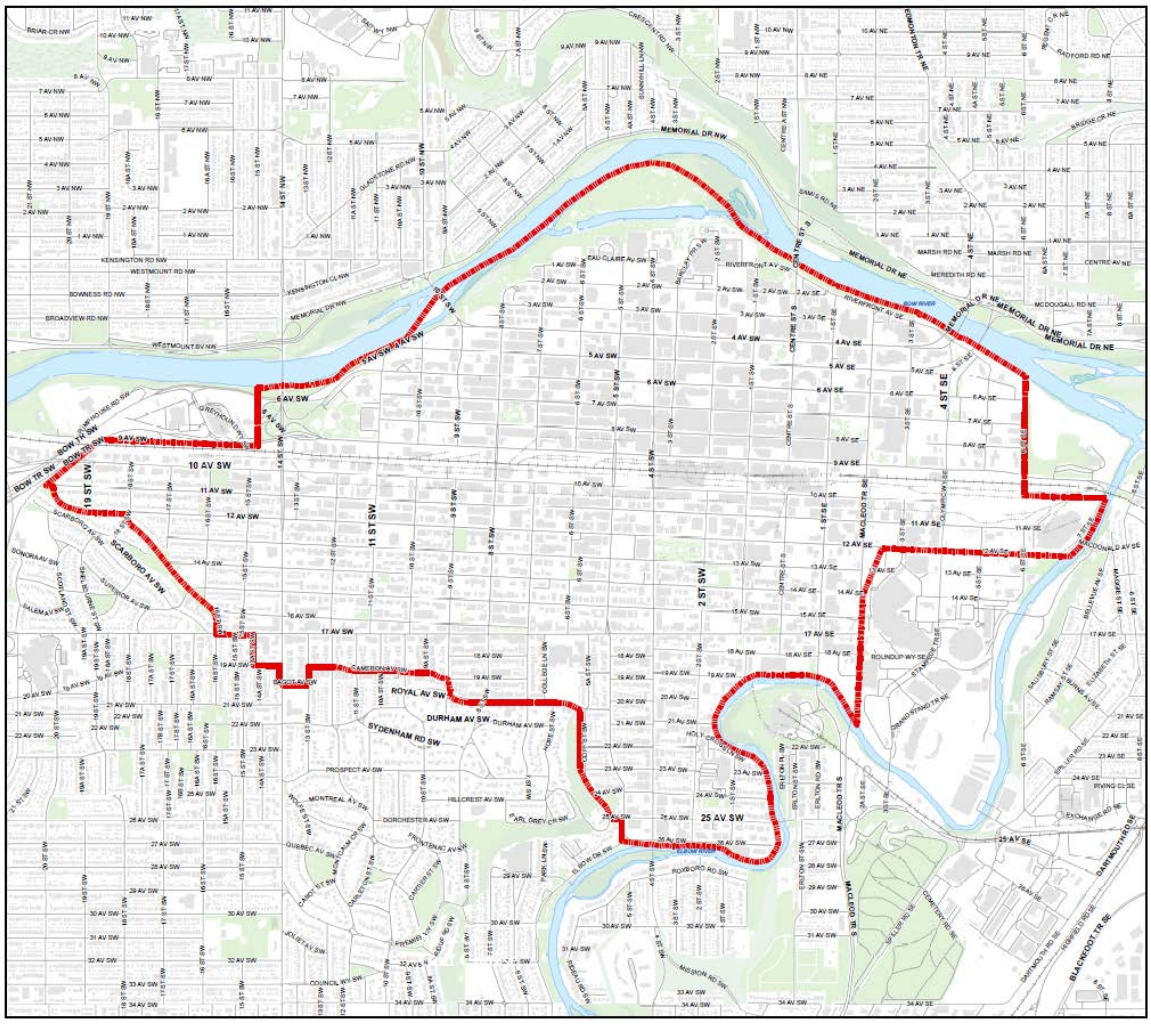


Figure 1.1 EPC Network Boundary Map

The term ‘Network’, as it is used in this publication, refers to the area of EPC’s electrical distribution system that is located in Calgary’s downtown core and portions of the adjacent communities. For an in-depth explanation of a Network system, see Section 2 ‘Network Systems’.

1.2 Voltage, Phase, Route of Service, and Utility Point of Supply

To ensure a consistent high quality of service to all customers on the Network system, EPC Engineering reserves the right to determine the voltage, phase (single or three), and the route of the service.

The service voltage level for any building in the Network area must be determined prior to the design being accepted by EPC.

If the customer requires voltages that are not available, it is the customer's responsibility to step up or step down to the appropriate voltage after the metering point.

Table 1.2.1 lists the voltages that are typically available in the EPC Network area.

Table 1.2.1 Network Nominal Service Voltages

1 Phase 3 Wire	3 Phase 4 Wire	3 Phase 4 Wire	3 Phase 4 Wire	3 Phase 4 Wire
120 / 208	120 / 208 Y	277 / 480 Y	347/600 Y	14,400 / 24,940 Y

EPC will, within the scope of the ENMAX Power Corporation Distribution Tariff Terms and Conditions, endeavor to maintain the steady state voltage at the service entrance at a level within the limits shown in Table 1.2.2.

This table represents the recommended voltage variation limits as per the Canadian Standards Association CAN3-C235. These voltages are measured at the customer service entrance and not at the downstream customer equipment locations.

Table 1.2.2 Voltage Variation Limits

Nominal System Voltages (3 Phase 4 Wire)	Extreme Operating Condition Voltages	Normal Operating Condition Voltages		Extreme Operation Condition Voltages
120 / 208	110 / 190	112 / 194	125 / 216	127 / 220
277 / 480	245 / 424	254 / 440	288 / 500	293 / 508
347 / 600	306 / 530	318 / 550	360 / 625	367 / 635

Note the following:

i. Voltages that are within the indicated limits for normal operating conditions do not require improvement or corrective action.

ii. Voltages outside the indicated limits for normal operating conditions but within the indicated limits for extreme operating conditions will require improvement or corrective action on a planned basis, but not necessarily on an immediate basis.

iii. Voltages outside the indicated limits for extreme operating conditions require improvement or corrective action on an emergency basis. The urgency for such action will depend on factors such as the location, nature of the load or circuit involved, extent to which limits are exceeded (with respect to voltage levels and duration), and other such factors.

EPC is responsible to resolve voltage conditions noted in **ii** and **iii** above and will develop a plan and cover the costs for any corrective action required.

1.3 The Utility Point of Connection

The utility point of connection for customers within the Network area is defined as the point on the utility system where a customer's electrical service will be connected to the EPC system. The utility point of connection is determined by EPC Engineering.

Conduit will be installed by EPC for the customer on public property from the utility point of connection to the property line, at the customer's expense. Note that if EPC determines the conduit might be used to service more than one municipal street address (or legal title), present or future, EPC may choose to invest in the common portion of the conduit.

i. If the customer chooses a location that requires additional trenching on public property, any additional costs will be charged to the customer.

ii. The customer is responsible for the construction of all duct, pull pits, etc., on private property.

iii. All civil construction at the interface point between the EPC installed conduit system and the customer's building wall must meet the requirements found in the attachment *'Network Conduit Attachment at Property Line'.*

iv. The cost of the cable from the utility point of connection up to the terminations on the main disconnect switch are the responsibility of the customer.

Standard sized service cables are utilized in the Network area and supplied by EPC. The size and number of cables required are determined by the customer's service panel frame rating. Service cable costs are based upon the number of circuits required, the length of

the cable and the cable size. Typical service sizes are 100 amp, 200 amp, 400 amp, 800 amp, etc.

1.4 Utility Demarcation Point

i. The utility demarcation point for customers within the Network area is the point where EPC's responsibility for the utility regulations (Alberta Electrical Utility Code) ends and the customer becomes responsible for meeting all of the requirements of the Canadian Electrical Code.

ii. The utility will review the prints that describe the service route to ensure they meet requirements with respect to the service route and access to pull pits or junction boxes. This ensures that the installation and future replacement of cables will be as cost efficient as possible.

iii. The customer is responsible for the supply, installation, and maintenance of conduit, fittings, pull pits and covers located on private property.

The location of demarcation points is described below.

1.4.1 Primary Voltage Service Demarcation Point

i. The utility demarcation point for primary voltage serviced customers within the Network area is the connections that are on the line side of the incoming switch.

ii. EPC Field Services and EPC Metering will lock the incoming switch and metering cells respectively.

iii. Although the cost of the metering cells is the responsibility of the customer, the maintenance on the metering cell must be performed by EPC Metering or a contractor that has been approved by EPC Metering. Having approved personnel maintain the metering cells ensures the integrity of the supply from the EPC system.

Note: Customers are to notify ENMAX Revenue Metering (403 514-2807) when they are planning to perform maintenance on their switchgear. EPC Metering will endeavor to schedule maintenance on the metering cell at the same time to minimize any impacts to the customer.

1.4.2 Secondary Voltage Service Demarcation Point

i. The utility demarcation point for secondary metered customers within the Network area is the terminations on the service conductor located on the line

side of the main service disconnect. Note that EPC does NOT terminate the main service cable at the customer's disconnect.

ii. EPC is responsible for the maintenance of the service cable located up to the line side, but not including, the customer's disconnect.

1.5 Criteria for Changing the Type of Service, Upgrading or Making New Connections

Customers who are planning to either construct a new secondary voltage service or upgrade an existing secondary voltage overhead or underground service must contact EPC Customer Intake for specific servicing information.

New connections or service upgrades will be made only after the following requirements have been met:

i. The installation meets all of the criteria outlined in this policy/guideline.

ii. An agreement (quote letter) for wire services between EPC and the customer has been signed.

iii. The City of Calgary electrical permit has been obtained.

iv. City of Calgary Electrical Inspection has approved the customer's electrical installation for commercial and/or industrial applications.

v. For underground services, all conduit work has been inspected and approved, prior to backfilling.

1.6 Number of Permitted Services

The number of services of the same voltage provided to a property or building is determined using the following criteria:

i. To address safety concerns arising from an emergency (e.g. fire), only one service per building is permitted.

ii. Buildings must be separated by an approved firewall in order to be considered for more than one service and each building must have a separate legal title.

iii. Only one service is permitted for locations where there is a single legal title but multiple municipal addresses or buildings.

EPC may approve an application for an additional service to a building under special circumstances.

iv. The additional service that is requested must have a different voltage than the original service.

v. All of the costs for the additional service, including cable, pull pits, vaults, and transformers are the responsibility of the customer:

vi. For locations where the customer load requires a vault to be constructed on private property and that vault is equipped with emergency disconnect devices, then multiple services with the same voltage characteristics will be permitted.

vii. Metered services cannot cross public property or any property lines.

viii. If a segment of unmetered service cable crosses private property, EPC will require an easement to cover the EPC infrastructure from one property to another, regardless of ownership.

1.7 Minimum Fault Level Ratings

i. All permanent secondary voltage Network service entrance equipment must meet or exceed the minimum fault level current ratings.

ii. Cold sequence metering is the standard for the Network area. For overhead residential and commercial services where the calculated fault level is less than 8800 amps, hot sequence metering may be allowed with permission of EPC Engineering and City of Calgary Electrical Inspection.

Note:

iii. Service disconnects for single phase overhead residential and commercial services must be capable of withstanding a fault level current of 21,000 amps.

iv. For temporary 480 volt construction services, as defined in this document, EPC Engineering may approve a reduced fault level rating.

1.7.1 Street Vault Fault Levels (Underground Services)

Underground services supplied from Street Vaults must be capable of withstanding fault levels as shown in Table 1.7.1.

Table 1.7.1 RMS Symmetrical Street Vault Fault Level (amps)

3 Phase 4 Wire Service	
Voltage	**Amps**
120 / 208 Y	100,000**
277 / 480 Y	170,000

*** 200,000 amps RMS symmetrical for 3 phase, 4 wire 120/208v Y may be required in some locations*

The customer should verify fault levels with EPC Engineering prior to ordering service entrance equipment.

1.7.2 Customer Built Indoor Vault Fault Levels

Main service disconnects supplied from indoor customer vaults must be capable of withstanding a fault level current of **200,000** amps.

Table 1.7.2 represents potential fault levels beyond the customers main disconnect switch based on transformer size.

Table 1.7.2 RMS Symmetrical Customer Vault Fault Level (amps)

3 Phase 4 Wire Service Voltage						
Voltage	**500 kVA**	**750 kVA**	**1000 kVA**	**1500 kVA**	**2000 kVA**	**2500 kVA**
120 / 208	110,000	165,000	215,000	-	-	-
277/480	-	70,000	100,000	140,000	190,000	
347/600	-	-	-	-	-	190,000

1.8 Customer's Equipment Causing Interference

When a customer's equipment causes interference with the customer's own electrical service or the electrical service of another EPC customer, EPC may require the customer who owns the equipment causing the interference, to purchase and install specialized equipment that will correct the interference.

Listed below are some examples of circumstances where this policy may be implemented:

i. The customer requires voltage control within unusually close tolerances.

ii. There is an imbalance of single phase and three phase loads on the customer's premises.

iii. The customer intermittently switches on and off large loads such as electric boilers, heaters, welders, or electric motors.

1.9 Metering

Refer to the EPC 'Metering Standard' for detailed metering information. The document can be found at *www.enmax.com*.

EPC will not energize a Network service that does not have a City of Calgary Electrical Inspection green sticker.

i. The customer must ensure they have contacted City of Calgary Electrical Inspection and obtained a green sticker for any of the following:

- Commercial services and sub services
- Temporary construction services
- Residential underground services
- Multi-family residential services

ii. EPC Engineering will require a copy of the single line drawing(s) approved by City of Calgary Electrical Inspection prior to energization to confirm the location and number of meters and main disconnect equipment

iii. EPC metering will require a copy of the equipment shop drawings approved by City of Calgary Electrical Inspection (see the 'Metering Standard' for additional information).

2. NETWORK SYSTEMS

2.1 Types of Distribution Systems

EPC operates three types of distributions systems: a radial distribution system, a low voltage secondary grid Network system (downtown) and a high voltage 25kV system (downtown).

2.1.1 Radial distribution system

A radial distribution system has a single high voltage path through which power flows to the distribution transformers. In the event of an interruption on the high voltage path, power will be disrupted to all the distribution transformers and hence the customers.

To improve the reliability and reduce the interruption to the customers, a looped radial system is usually employed which permits the damaged portion of the path to be electrically removed from the system. Field staff or automated equipment will perform switching to isolate failed equipment and restore power to the customers.

Typically in a residential area, one transformer supplies up to 12 customers. In a commercial area, a 3-phase transformer would generally be used to supply one building.

2.1.2 Secondary Grid Network System

The secondary grid Network system is usually used in high density areas or where a diverse number and size of loads exist (see Figure 2.1.2.1).

A secondary grid Network consists of multiple transformers connected to several different 13.2kV high voltage paths. The secondary (low voltage) side of the transformers are then connected together to create an electrical grid from which the individual customer services are connected. System capacity is increased in a secondary grid system by constructing new transformer vaults or by upgrading the size of the existing transformers.

A customer connected to the secondary grid Network system has improved reliability because they are connected to more than one high voltage source and there is more than one transformer supplying power to their building.

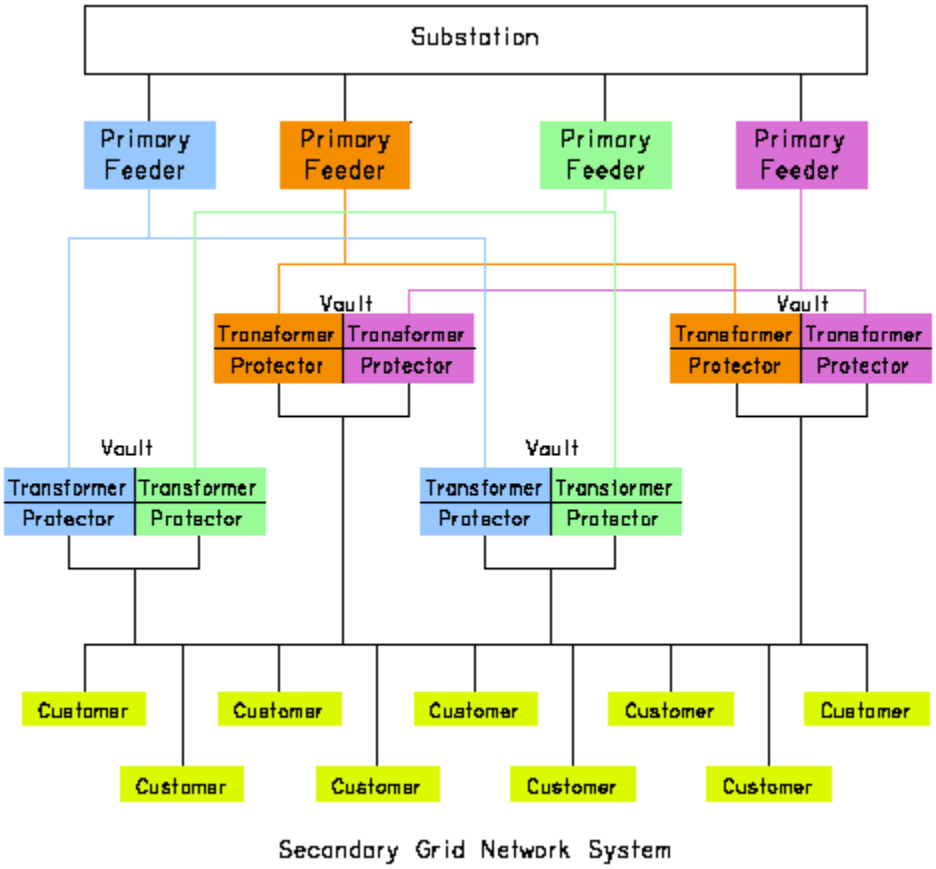


Figure 2.1.2.1 EPC Secondary Grid Network System

An additional advantage of a secondary grid Network system is that a single interruption to the high voltage feeders or transformers due to maintenance or system related issues does not result in an interruption to the customers' power. The key component which enables the multiple transformers' low voltage sides to be connected together is called a Network protector (see Figure 2.1.2.2). The Network protector has two key functions:

i. To isolate any faults in the high voltage paths or transformers from the other equipment. The protector opens when power flows in a reverse direction from the secondary grid into the transformer.

ii. To automatically close when a predetermined set of conditions exists within the secondary grid Network.

EPC utilizes a secondary grid Network system within the downtown core area of the City of Calgary as well as at three major malls in the city (Westbrook, North Hill and Chinook Center).

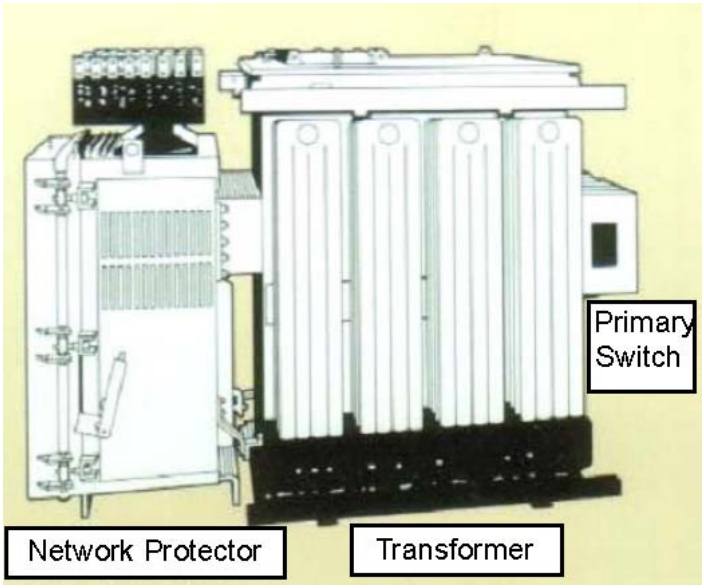


Figure 2.1.2.2 EPC Network Transformer with Network Protector

2.1.3 25kV System (Downtown area)

The 25kV system in the downtown area operates on a preferred/alternate scheme (see Figure 2.1.3). When there is an outage or interruption on a preferred feeder there is an automatic 'break before make' transfer in the buildings switchgear to the alternate feeder, during which a momentary interruption takes place. The return to normal operation is performed manually by EPC, and can be a 'make before break' transfer at the buildings switchgear with NO interruption.

All customers are given an alternate path, which is fed from the opposite side of the substation bus, to reduce the impact of a substation bus or transformer failure. The alternate path is designed to have sufficient capacity to handle the loads of 3 preferred paths. The loss of 3 preferred paths could occur during a substation bus or transformer failure.

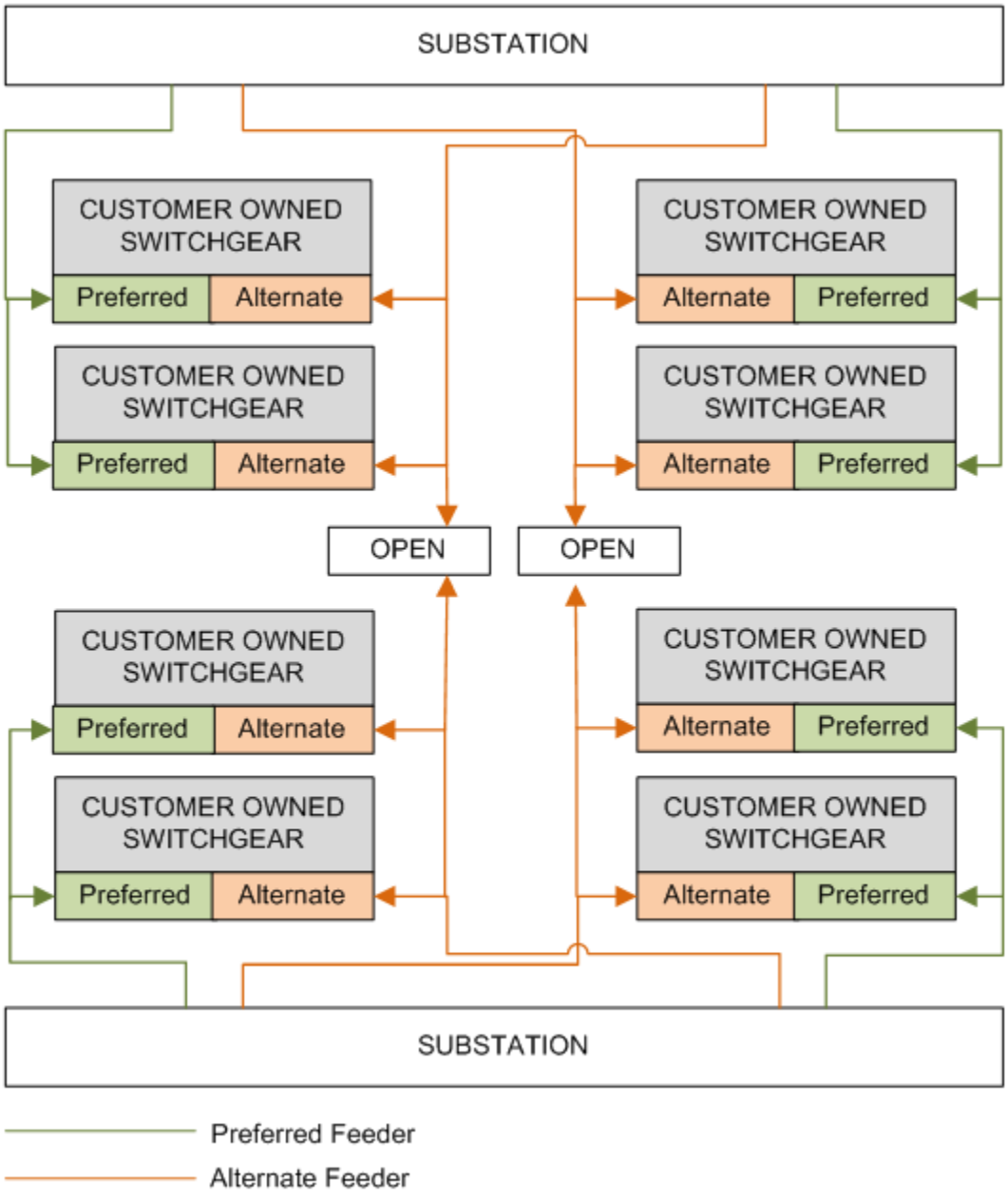


Figure 2.1.3 EPC 25kV Preferred/Alternate System

2.2 Why it Costs More to Connect to a Network System

Network system reliability is achieved through the solid interconnection of multiple transformation sources, resulting in a higher cost system. As a result of having multiple sources, fault levels are considerably higher than the fault levels in the more common radial system. To ensure public safety and to keep the secondary Network running, it is

necessary that every customer connected to the secondary Network system have the appropriate specialized equipment to withstand the high fault levels. Should just one customer have low-quality or improperly installed equipment, the system will be degraded creating problems for everyone connected.

3. SUBMISSION OF PLANS

3.1 Introduction

i. Any customer who wants a new or upgraded electrical service and/or is planning to install generating equipment, must contact the EPC Customer Intake section well in advance of the construction date to determine the service characteristics of the customer's specific area.

ii. The lead time required by EPC could be as much as 18 months to accommodate the following if required:

- Purchasing of special equipment,
- Performing major engineering design work on the Network system,
- Extension of the Network system infrastructure.

An overview of the estimated minimum time required by EPC is found in Section 3.5 'Network Service Request Timelines'.

3.2 Required Drawings

For new or upgraded commercial or industrial service requests (including larger multi-family residential structures), the customer must submit a set of plans with details as listed below:

i. A site plan with the legal property description showing all of the buildings (existing or proposed) on the property. The site plan must include:

- All street designations
- The location of service entrance, switchgear, meter centers, and other utilities (gas, telephone, sewer, etc.)
- A north or direction arrow, and
- The property boundary designations and the dimensions from building to property line.

A riser diagram showing all of the following:

- Size of the main disconnect with its interrupting capacity
- Size, type and designated use of conduit along with a cross section
- A detailed sketch of the service conductor route from termination to main disconnect including pull box location and size
- Size, type and number of service conductors
- Provisions for metering, and
- Service panel frame rating (amps)

ii. A load summary and panel schedule.

3.3 Network Customer Checklist

Table 3.3 Network Customer Checklist	
The following information is required to initiate the EPC design process.	
	Contact the EPC Customer Intake section • **email: network@enmax.com** • **fax: (403) 385-1926** • **phone: (403) 514-1357**
Step 1 – Preliminary Estimate Requirements	
	• **Site plan with the following: legal property description showing all buildings (existing and proposed) on property, North direction arrow & street designations and dimensions from Property Line to the service entrance**
	• **Single line drawing on title block. Must show frame rating of main disconnect with interrupting capacity, size of fuses or breaker**
	• **Service size (amps) and service voltage**
Step 2 – Detailed Design Phase Requirements	
	• **Service conduit location, relative to adjacent lot lines, size, number of conduits, cross section, conduit use designation.**
	• **Location of service entrance, switchgear, meter centers and other utilities.**
	• **Size, type and number of service conductors.**
	• **Load summary and panel schedule (Type 2 Customers Only)**
	• **Large Load Interconnection form (if applicable)**
	• **Generator Application (if applicable)**
For Service Energization the customer must do the following:	
	Provide approved single line which is signed or stamped
	Obtain a site ID from EPC Service Order Control • **fax: (403) 514-2975** • **phone: (403) 514-2807**
	Select a retailer from the government web site • **http://ucahelps.alberta.ca**
	Contact City of Calgary Electrical Inspection to obtain a 'Green Sticker' which will indicate your service has been inspected and approved.
	Contact your Energy Retailer to have them apply for a meter and a 'Connect Order' to have your service energized.

3.4 Acceptance of Plans

Consultants and contractors must obtain the acceptance of their plans including the location of the service conductors from EPC Engineering.

Additional requirements:

i. For 25kV high voltage services refer to the 'Network 25kV Switchgear and Switchroom Policies & Guidelines'.

ii. For services requiring the construction of a customer vault refer to the 'Network Customer Built Transformer Vault Guidelines'.

The above two guidelines can be found at *www.enmax.com*

3.5 Network Service Request Timelines

The services in the Network can be broken into 4 types (see Section 4.5 'Secondary Services') based upon the size of service being requested by the customer. The following figures show the approximate timelines required for each service type.

Note: that the timelines indicated are for working days and DO NOT include time related to activities that require customer action.

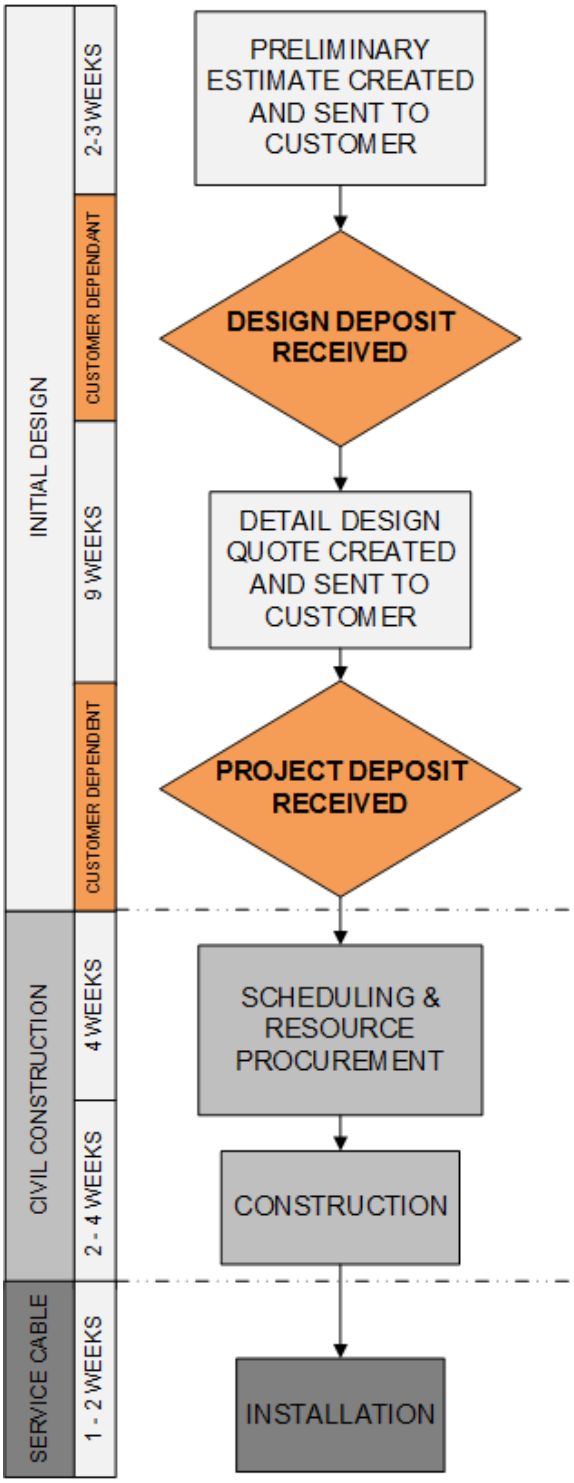


Figure 3.5.1 EPC Network Service Request Timeline - Type 1 Projects

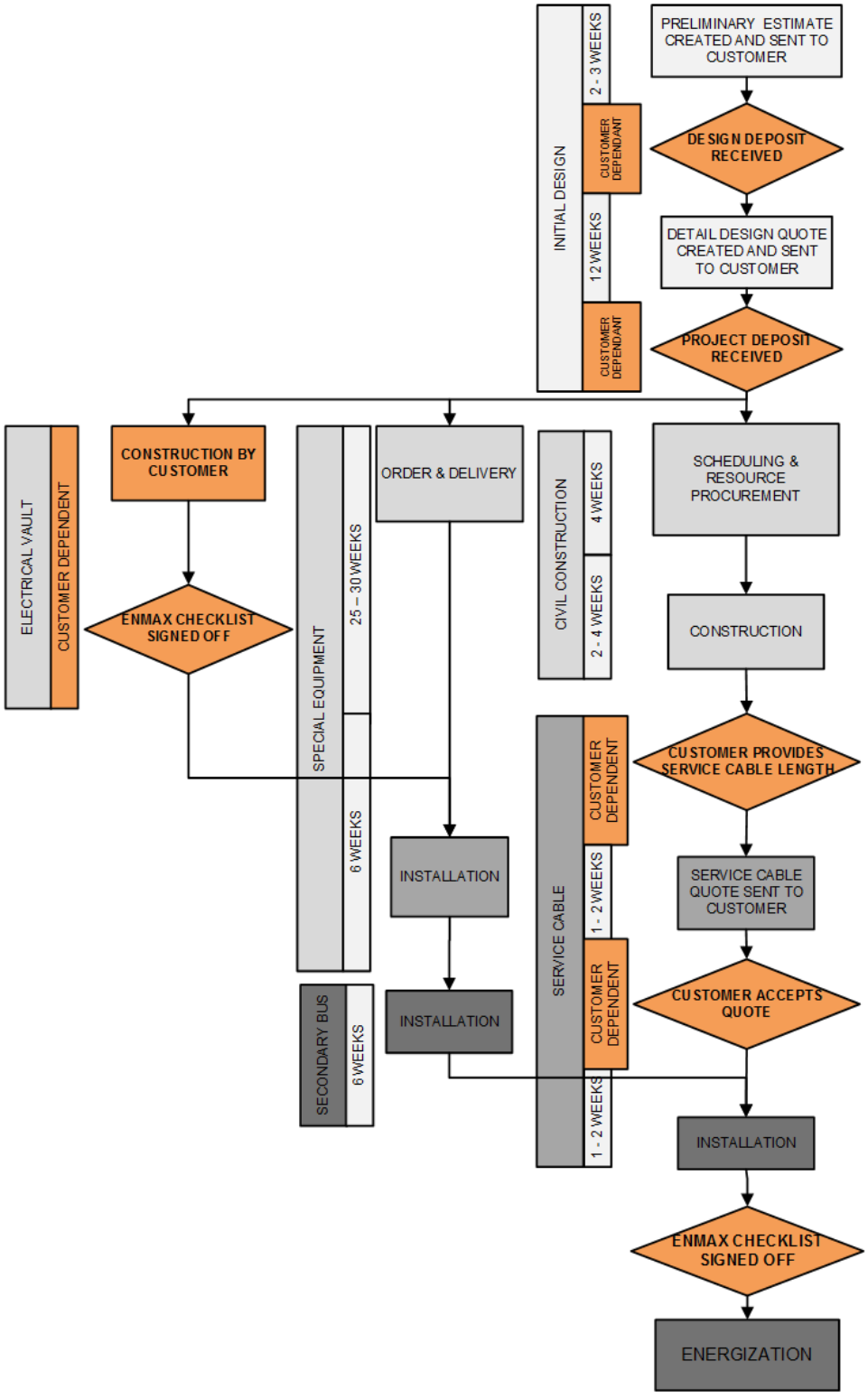


Figure 3.5.2 EPC Network Service Request Timeline - Type 2, 3 & 4 Projects

4. TECHNICAL AND SPECIAL SERVICE REQUIREMENTS

4.1 Introduction

This section outlines the technical and special service requirements that must be met by the customer when constructing or upgrading services that connect to EPC's electrical Network distribution system. To maintain the high reliability of the Network system it is necessary to have standards that are higher than other typical distribution standards.

For further information, contact EPC Engineering.

4.1.1 Residential Network services

i. Residential services of 100 amps or less are permitted but only as single phase connections.

4.1.2 Commercial Network services

i. EPC service entrance cable will be installed to match the customer's service panel frame rating.

ii. EPC will not install reduced ampacity to match a de-rated or under-fused customer switch gear.

iii. Any service of more than 30 amps must be installed as 3 phase underground service. These services must be equipped with a 3 phase disconnect and be cold sequenced metered.

4.2 Overhead Services

i. Overhead services are permitted on the customer's property for service sizes listed in Table 4.2 provided the following criteria are met:

- The service is in an area where overhead secondary lines already exist and are expected to remain in service for more than two years
- The number of service heads connected to an overhead service drop are limited to two. Any additional services requires the provision of a common electrical room, and
- The service is approved by EPC Engineering

Table 4.2 outlines the maximum allowable overhead services within the Network.

Table 4.2 Maximum Allowable Overhead Service

Type of Service	Service Size in Amps	
	Residential	Commercial
1 phase 3 wire 120 / 208v	100	30
3 phase 4 wire 120 /208v	100	100*

** 100A 3 phase commercial services are only available as a temporary service*

ii. Prior to installing the service entrance equipment for overhead services, the customer must receive the following from EPC Engineering:

- The location of the point where service wires will be attached
- The path for the service wires
- The location of the meter
- The location of service poles, including any poles that may be required for service drops longer than 40 meters (125 feet)

iii. The standard clearances from the ground and from the sides of buildings are found in the Alberta Electrical Utility Code. The standard clearances between trees and EPC overhead power lines are shown in attachment '*Living With Trees'.*

- The customer is responsible for keeping trees clear of the electrical utility wires on the customer's property
- For secondary service, a clearance of one meter from trees must be maintained

4.3 Underground Services

All new services in the Network area are to be underground unless the requirements for overhead connections are met and are approved by EPC Engineering. The permitted service sizes are shown in Table 4.3.

Table 4.3 Allowable Underground Service		
	Minimum Service Size (amps)	**Maximum Service Size (amps)**
1 phase 3 wire 120 / 208 volt	**N/A**	**100 - Residential 100 – Commercial ***
3 phase 4 wire 120/208 volt	**100 – Residential 100 - Commercial**	**See below**
	Minimum Service Size (amps)	**Maximum Service Size (amps)**
3 phase 4 wire 120 /208 volt		**8800**
3 phase 4 wire 277/480 volt	**1600**	**7600**
3 phase 4 wire 347/600 volt	**4800**	**7600**

Notes:

- * Applies only to temporary services as defined in this document.
- Largest single disconnect is restricted to **4000 Amps**

The standard clearances between trees and EPC infrastructure are shown in attachment *'Living With Trees', Planting Design - Underground Clearances* section.

i. EPC provides the service conductor(s) from the utility point of connection up to the termination on the service disconnect.

ii. The customer's service disconnect must be sized in accordance to the fault levels as outlined in Section 1.7 'Minimum Fault Level Ratings'.

Note: No splices are permitted in the secondary service cable between the Utility Point of Connection and the customers main service disconnect.

4.3.1 Conduit Installations

The service conduit from the utility connection point to the nearest property line will be installed by EPC. Any additional costs associated with the conduit work that is required on public property to reach an alternate point of entry into private property are the responsibility of the customer.

The customer is responsible for conduit installed on private property with the following requirements:

i. All conduit installed on private property must be concrete encased.

ii. A plan of the cable route within the customer's building indicating the conduit pull boxes and locations must be submitted to EPC Engineering for review.

iii. Conduit must be sealed at the termination within the building

iv. All exposed concrete encased conduit must be:

- Composed of colored concrete to identify high voltage cables as per City of Calgary Electrical Inspection, and
- Identified with surface mounted Red warning signs (minimum 12"x12") at 5 meter intervals with the wording **'CAUTION ENMAX HIGH VOLTAGE CABLES'.**

CAUTION
ENMAX HIGH VOLTAGE CABLES

All of the conduit that is located on private property between the property line and the building must be a minimum of 100mm (4") in diameter and be encased in a 50mm (2") envelope of concrete.

v. All conduit installations are limited to:

- A total length of no more than 70 meters from the Utility Point of Connection, and
- No more than two bends (not exceeding a total of 180 degrees) between the service cable pull points. This includes any bends in the EPC portion of the installed conduit.

vi. The minimum radius for any bend is 36 inches.

Note:

- The conduit route plan must be pre-approved by EPC Engineering
- LB conduit fittings are not allowed except by special permission from EPC Engineering.

Service conduit located on private property (including conduit within the customers' facility or building) must be constructed of materials as shown in Table 4.3.1.

Table 4.3.1 Material Used to Construct Service Entrance Conduit

Length of conduit	Type of material
3 meters or less	rigid steel or concrete encased
greater than 3 meters	concrete encased

Note: Within the customers' high voltage room, conduit may not be required if the racking is in accordance with EPC Engineering standard practices and approved in advance.

4.3.2 Exposed Service Conduit

i. Within the customer's property, conduit reductions above grade are allowed, if the conduit is located after an approved junction box.

ii. The junction box cannot be smaller than 150mm x 150mm x 150mm (6" x 6" x 6")

iii. For above grade installations the conduit material and sizes listed in Table 4.3.2 are approved for use in the Network area.

Table 4.3.2 Exposed Service Conduit Requirements For Above Grade

Service Size	Type Of Conduit Required	Service Conductor Size	Minimum Conduit Inside Diameter
125 Amps Or Less	Rigid PVC*	#2	38mm (1.5 Inches)
150 - 200 Amps	EMT*	4/0	76mm (3.0 Inches)
Greater than 200 Amps	Rigid Steel Conduit Or Concrete Encased PVC	500 MCM	100mm (4 Inches)

***** rigid steel or concrete encasement is required in any area that is subjected to vehicular traffic

Conduits within a building and encased in concrete are considered the same as if they were outside of the building.

IMPORTANT NOTES:

i. All conduits located under floor slabs must also be concrete encased.

ii. The entire service duct on private property is the responsibility of the customer, from the property line to the point of service.

iii. Secondary service cable may not be racked on a customer's property unless the cable is located within an approved and locked cable pull box or an approved enclosed raceway. Information regarding cable pull boxes is found in Section 4.3.3

iv. Flexible conduit is not permitted.

4.3.3 Pull Box Requirements

i. Cable pull boxes must be secured by an EPC padlock with a 5/16" diameter shackle. In addition, all metallic enclosures must be equipped with a 1/2" stud with locknut for enclosure grounding.

ii. Cover must be equipped with a Red warning sign (minimum 12"x12") with the wording **'CAUTION ENMAX HIGH VOLTAGE CABLES'.**

CAUTION
ENMAX HIGH VOLTAGE CABLES

iii. Pull box covers with dimensions greater than 24" x 24" require the following:

- Cover to be a minimum of 2 sections and equipped with a handle
- Cover(s) is equipped with removable hinge pins so that the doors can be taken off their hinges or the doors must be able to open a full 180 degrees
- For customer pull boxes, typical minimum dimensions are shown in attachment 'Customer Pull Box Dimensions'
- Dimensions should be confirmed with EPC Engineering prior to construction to avoid delays

4.4 Service Entrances

i. The location of the main disconnect must be approved by City of Calgary Electrical Inspection and must comply with any restrictions imposed by the City of Calgary regarding flood plains. In addition the main disconnect(s) cannot be located above the +15 level of the building.

ii. Bus ducts and enclosed raceways can be used only by special permission of EPC Engineering. Neither bus ducts nor enclosed raceways will be considered for street vaults.

Table 4.4 EPC Standard Service Cable Size and Rating

Service Cable Size	Service Ampacity Rating
#2	125 amps
4/0	200 amps
Multiple 500 MCM	Over 200 amps

Note: All service entrance conductors in the EPC Network area are to be copper.

4.5 Secondary Services

EPC Engineering designs service cable ampacity to match the customer's main service entrance nameplate ratings.

The standard voltage offered by EPC in the Network area is 120/208 volts. Services at this voltage are classified into a Type 1, 2 or 3 category:

- **Type 1** - Service size of 1600 amps or less @ 208 volts are typically supplied from the interconnected street grid system.
- **Type 2** - Service sizes between 1601 and 2400 amps @ 208 volts may require the upgrade of existing infrastructure or the construction of a new transformer vault on public or private property.
- **Type 3** - Service sizes of greater than 2400 amps @ 208 volts require the construction of a transformer vault on the customer's property. See the 'Network Customer Built Transformer Vault Guidelines' for detailed information.
- **Type 4** - Secondary service voltages of 277/480 and 347/600 volts are not generally available from the street grid system and will require the construction of a transformer vault on private property. See the 'Network Customer Built Transformer Vault Guidelines' for detailed information.

Note: For Type 3 & 4 services, the secondary service cable route on private property must be approved in writing by EPC Engineering.

4.5.1 Type 1 - Secondary Services of 1600 amps or less @ 208 volts

- Services in this range are supplied from the street grid system at 120/208 volts.

See Table 4.5.1 which outlines EPC and Customer responsibilities for a Type 1 service.

Table 4.5.1 Responsibilities for Supplying Secondary Services - Type 1

EPC	Customer
Supply and installation of service conduit on public property from the utility point of connection to the nearest property line. Note: EPC will not install conduit within the customer's building	**Supply and install service conduit on private property from the property line to the main disconnect location**
Supply and installation of secondary service conductor from the utility point of connection to the customers main disconnect(s)	**Termination of the service cable on the main disconnect**

4.5.2 Type 2 - Secondary Services between 1601 and 2400 amps @ 208 volts

- Services in this range may require the upgrade of existing EPC infrastructure or the construction of a new transformer vault dependent upon existing system capacity.

See Table 4.5.2 which outlines EPC and Customer responsibilities for a Type 2 service.

Table 4.5.2 Responsibilities for Supplying Secondary Services - Type 2	
EPC	**Customer**
Supply and installation of service conduit on public property from the utility point of connection to the nearest property line. Note: EPC will not install conduit within the customer's building	**Supply and install service conduit on private property from the property line to the main disconnect location**
Supply and installation of secondary service conductor from the utility point of connection to the customers main disconnect(s)	**Termination of the service cable on the main disconnect**
Supply and the installation of EPC infrastructure to meet the service size requested and may include: • transformers & secondary buss • primary cables • civil construction of an electrical transformer vault for EPC equipment	**Provision for construction of a transformer vault on private property may be required**

4.5.3 Type 3 - Secondary Services of Greater than 2400 amps @ 208 volts

- Services of greater than 2400 amps at 208 volts will require the construction of both a customer transformer vault and an emergency disconnect vault.
- Both of the vaults must be located on the customer's property. See the 'Network Customer Built Transformer Vault Guidelines' for detailed information.
- The transformer vault may supply more than one service in a customer's building provided that all of the main service disconnects are grouped into a common electrical room and the location is approved by City of Calgary Electrical Inspection.
- The transformer vault may serve more than one building provided all the proposed service cables remain within the site where the vault is located and a general easement is provided to cover all of the EPC equipment.

See Table 4.5.3 which outlines EPC and Customer responsibilities for a Type 3 service.

Table 4.5.3 Responsibilities for Supplying Secondary Services - Type 3	
EPC	**Customer**
Supply and installation of system conduit on public property from the utility point of connection to either the transformer vault or the property line. Note: EPC will not install conduit within the customer's building	**Supply and install service conduits on private property from the EPC facility to the main disconnect location**
Supply and installation of secondary service conductor from the utility point of connection to the customers main disconnect(s)	**Termination of the service cable on the main disconnect**
Supply and the installation of: • transformers • secondary bus • primary cables ▪ emergency disconnect devices	**Civil construction of a transformer vault, lift out well and emergency disconnect vault for EPC equipment as set out in the 'Network Customer Built Transformer Vault Guidelines'**

4.5.4 Type 4 - Secondary Service voltages of 277/480 or 347/600 volts

- Services at these voltage levels will require the construction of both a customer transformer vault and an emergency disconnect vault.
- Both of the vaults must be located on the customer's property. See the 'Network Customer Built Transformer Vault Guidelines' for detailed information.
- The transformer vault may supply more than one service in a customer's building provided that all of the main service disconnects are grouped into a common electrical room and the location is approved by City of Calgary Electrical Inspection.
- The transformer vault may serve more than one building provided all the proposed service cables remain within the site where the vault is located and a general easement is provided to cover all of the EPC equipment.

See Table 4.5.4 which outlines EPC and Customer responsibilities for a Type 4 service.

Table 4.5.4 Responsibilities for Supplying Secondary Services - Type 4	
EPC	**Customer**
Supply and installation of system conduit on public property from the utility point of connection to either the transformer vault or the property line. Note: EPC will not install conduit within the customer's building	**Supply and install service conduits on private property from the EPC facility to the main disconnect location**
Supply and installation of secondary service conductor from the utility point of connection to the customers main disconnect(s)	**Termination of the service cable on the main disconnect**
Supply and the installation of: • transformers • secondary bus • primary cables ▪ emergency disconnect devices	**Civil construction of a transformer vault, lift out well and emergency disconnect vault for EPC equipment as set out in the 'Network Customer Built Transformer Vault Guidelines'**

Note: EPC will consider new service requests rated at 347/600v if the service size is 5000 kVA or greater. Contact EPC Engineering for review/approval.

4.6 Primary Voltage Services

Primary voltage services are reserved for high density customers (minimum of 5000 kVA) at an EPC service voltage of 25kV. EPC has the sole and final discretion with respect to the provision of a 25kV connection.

See Table 4.6 which outlines EPC and Customer responsibilities for a primary voltage service.

Table 4.6 Responsibilities for Supplying Primary Voltage Services	
EPC	**Customer**
Supply and install the service conduit on public property from the utility point of connection to property line.	**Supply and install service conduit on private property.**
Supply and install the primary conductor and all the utility work from the utility point of connection up to the utility demarcation point.	**Construction of a room within the building which meets the criteria set out in the 'Network 25kV Switchgear and Switchroom Policies and Guidelines'.** **Procurement and installation of primary voltage switchgear which meets the criteria set out in 'Network 25kV Switchgear and Switchroom Policies and Guidelines'.**
Supply and installation of equipment required for emergency disconnect of the customer built transformer vault.	**Provision for a vault to house the emergency disconnect devices which meet the criteria set out in the 'Network Customer Built Transformer Vault Guidelines'.**
Perform all electrical work from the utility point of connection to the utility demarcation point including termination of the service cable on the main disconnect.	

Note: for primary voltage services, the primary cable route on private property must be approved in writing by EPC Engineering.

4.7 Network Investment Policy

EPC's financial contribution towards the construction of the electrical service is outlined in the following attachments:

- *Investment in New Services in the Network Area*
- *Investment in Staged Projects in the Network Area*, and
- *Investment in Upgraded Services in the Network Area*

Contact EPC Engineering If there are any questions as to who is responsible for the costs of equipment or installation that is required to provide the service.

4.8 Temporary Services

i. Temporary services may include construction services, pay phones, signs, surface parking lots, etc.

ii. Services must be installed in accordance with conditions as outlined in the City of Calgary Development Permit (if applicable) and under the condition that they will be removed 30 days after formal notification from EPC Engineering.

iii. These services may be allowed as an additional service with the approval of EPC Engineering.

iv. Where EPC reasonably believes that a requested service will be temporary, EPC will require the customer requesting the service to pay EPC's total cost of installation.

v. EPC will remove the temporary service at the customer's request. The customer has the option to keep the salvageable material and pay for removal or have EPC remove the service and keep the salvageable material.

vi. Construction services are permitted for a duration of one year from the connection date. The service time can be extended after review and approval by EPC Engineering.

vii. EPC will determine if system capacity is available to meet the construction service requirements. If additional capacity is required to meet the construction service request, the customer will be responsible for all additional costs.

viii. Cold sequence metering is required in conjunction with a disconnect equipped with HRC "J" class fusing.

Overhead Temporary Services:

ix. Overhead temporary service of 100 amps or less may be permitted by EPC Engineering provided overhead services already exist and system capacity is available.

Underground Temporary Services:

x. Must meet the conditions listed in Section 4.3 'Underground Services'.

Other temporary services:

xi. Includes signs, pay phones, surface parking lots and other limited term development permits (five years or less). Services will be installed in accordance with conditions as outlined in the Development Permit.

Note: Temporary services may not have the same reliability as permanent services in the Network area.

4.9 Existing Service Upgrades

For existing electrical services where the customer's building renovation or upgrade will require a new or upgraded service, EPC's investment policy will be applied to the increase in electrical demand or number of EPC meters installed.

i. An upgrade will be considered to be an increase in service capacity to an existing service. See attachment *'Investment in Upgraded Services in the Network Area".*

Note: If the permanent service and all temporary services have been removed for a period longer than six months, the request will have to be considered as a new service and will have to adhere to all of the requirements for a new service.

4.10 Phased (Staged) Project Investment

For all services (new or upgrades) where the development involves multiple phases, EPC will review the scope and determine if the development will be treated as a single project from an investment perspective.

See attachment *'Investment in Staged Projects in the Network Area'* for further details. The investment level will be based upon the current EPC Investment Policy in place at the time construction commences.

4.11 Public Sector Utility Services

Utility services are generally situated on public property and may be defined as:

- Parks and irrigation services,
- Traffic controller services,
- Street light relay services, and
- Communication company (e.g. Shaw/TELUS) services.

4.11.1 Underground Services

i. For service sizes that are three phase and 100 amps or greater, all of the existing conditions of Network servicing must be adhered to.

4.11.2 Overhead Services

i. Service sizes that are single phase and greater than 30 amps must be installed underground as per Section 4.1.2, otherwise all of the restrictions of Section 4.2 apply.

4.11.3 Non-Metered Services

i. To be considered a non-metered service, the maximum service size permitted is 50 amps and the following conditions apply:

- Overhead service will be permitted if the service is in an area where overhead secondary lines already exist and are expected to remain in service for more than two years
- Conduit size can be reduced to 2 inch rigid PVC versus 4 inch concrete encased conduit. The conduit must be supplied, installed, owned and maintained by the customer.
- Location of the connection between the service conduit and the EPC network structure must be approved by EPC Engineering before work can proceed.
- The coring of the EPC network structure will be performed by EPC Network crews.
- Any cable installation or stand-by will be performed by EPC Network crews.
- Service cable will be fused and connected by EPC crews.

- Non-metered services are allowed at the sole discretion of EPC as per Section 11.3 of the ENMAX Power Corporation Distribution Tariff Terms and Conditions. Non-metered services are considered as being:

    - always on at full rating

    or

    - controlled via a photocell

- Non-metered service of 50 amps or less must utilize #8 wire that is 90°C rated.

Non-metered services larger than 50 amps will be treated as per Section 4.11.1

In addition to these requirements, all of the costs from the utility point of connection (civil and electrical) are charged to the customer.

4.12 Access to EPC Equipment on Private Property

i. For vaults and substations located on the customer's property it is important that EPC be allowed 24/7 (24 hours a day / 7 days a week) unimpeded access to be able to service, repair, or replace equipment. The access must be via one of the following methods:

- A private outside entrance that has been keyed by EPC, or

- When the outside entrance has not been keyed by EPC, there must be a key box available to EPC staff that contains all of the necessary keys, or

- Access via an indoor vault and/or primary switchgear room that meets the requirements outlined in the 'Network Customer Built Transformer Vault Guidelines' and/or 'Network 25kV Switchgear and Switchroom Policies and Guidelines'.

4.13 EPC Phone Numbers

Note that the following numbers are subject to change. These numbers were accurate at the time of the publication of this guideline.

To obtain electrical service, first, call the following number and request a Site ID:

EPC Service Order Control

at

(403) 514-2807 or Fax (403) 514-2975

You will then be required to select a retail service provider and to provide this retailer with your Site ID.

A list or retail service providers is available from the Government of Alberta's web site at:

www.ucahelps.gov.ab.ca/4.html

or

call (403) 310-4822

Important note: EPC cannot energize any service that has not been successfully enrolled by a Retailer.

As the length of time required to obtain a site ID and have the site enrolled by a Retailer is usually between 2 - 5 business days, it is not possible to provide same day service to energize new sites. If electrical service is needed for a particular day, a site ID must be obtained and a Retailer selected in advance of the date that electrical service is required.

See Table 4.13 for EPC and City of Calgary contact information

Table 4.13 EPC and City of Calgary Contact Numbers		
Department	**Purpose**	**Phone Number**
EPC Customer Intake	All new or upgraded service inquiries inside the downtown core	(403) 514-1357
EPC Network Disconnects - Temporary	To arrange for the temporary disconnection of a service	(403) 514-1357
EPC Distribution (Outside of downtown) Design and Construction	All new or upgraded service inquiries outside the downtown core	(403) 514-3716
EPC Trouble Line	To report any trouble with the electrical system or street lighting	(403) 514-6100
EPC Easements and Encroachments	To answer questions about property rights, where city property ends and private property begins	(403) 514-3000
EPC Instrument Rated Meters	To answer questions for new customers requiring metering using current or potential transformers	(403) 514-3691
City Permits - Electrical	To obtain a permit to put in electrical services in a private building	311
City Planning & Building	To obtain a permit to demolish a structure or to build a structure	311

5. GENERATION

5.1 Introduction

The purpose of this section is to identify the requirements that must be met by customers for the interconnection of generation within the EPC downtown network area (see Figure 1.1) as well as three major malls in the city (Westbrook, North Hill and Chinook Center). The requirements set out in this section are applicable to all types of generation technologies such as inverter based, synchronous or induction generators.

EPC does not provide design or consulting services to customers. EPC recommends customers engage the services of a registered (APEGA) professional engineer or registered (APEGA) engineering consulting firm qualified to provide design and consulting services for electrical interconnection facilities.

i. Customers wishing to install a generator for the purposes of export, load shaving, or emergency backup must contact EPC at *generationinterconnection@enmax.com*

ii. Customers are also responsible to contact the Alberta Utilities Commission *http://www.auc.ab.ca* to ensure they have received all the required approvals.

EPC has created a document titled 'Guide for Generator Interconnection to the Wires Owner Distribution System' to assist customers with their generation design. This document may be found on the ENMAX website *www.enmax.com* under the link 'ENMAX Power Distribution Generation Interconnection Guideline'.

Due to the differences between a secondary network and a traditional distribution system, there are additional requirements for customers looking to install generation on a secondary Network. The requirements set out in this document are to be considered in addition to the guideline mentioned above.

5.2 Generation for Export Purposes

Generation for the purpose of export is NOT permitted within any of the secondary network systems within the City of Calgary.

i. Secondary network systems are not designed to allow customers to export power. This restriction is required for technical and safety reasons. EPC's network systems utilize network protectors for reverse power protection to prevent current flowing from the secondary system into the transformer and primary feeders. Network protector manufacturers and IEEE standards recommend that generation interconnections must be designed to prevent inappropriate network protector operations or impeding proper operations.

ii. Exporting power into the secondary Network could create the following problems:

- Network protector cycling
- Opening of network protectors on reverse current without a fault on the primary side of the transformer
- Islanding of the customer once generation exceeds the customer load
- Damage to the network protectors and generator upon reconnection to the secondary network
- Safety issues for EPC personnel from unanticipated generation into the secondary network

5.3 Generation for Load Shaving

Customers wishing to install generating equipment for the purpose of load shaving may do so provided they meet the requirements for their type of service as noted below.

5.3.1 Secondary Voltage Network Services

Customers connected to a secondary voltage network service (see Figure 5.3.1) must have a protection and control (P&C) system (e.g. minimum import relay) which meets the following requirements:

i. Designed to prevent export into the EPC secondary network system. The P&C system must be designed to sense the power flow on the customers' main service and trip out the generator main breaker or point of common coupling breaker at a pre-determined minimum import level.

ii. The minimum import level may vary between buildings and must be proposed by the customer and approved by EPC Protection & Control. The minimum import level must be designed and set **above zero (0) amps to ensure a net import of power**.

iii. The design of the customer's P&C system must be reviewed and approved by EPC Protection & Control.

iv. The design, procurement, installation, operation, maintenance and ownership of the P&C system and associated equipment is the sole responsibility of the customer.

v. The P&C system must physically be located on customer's property.

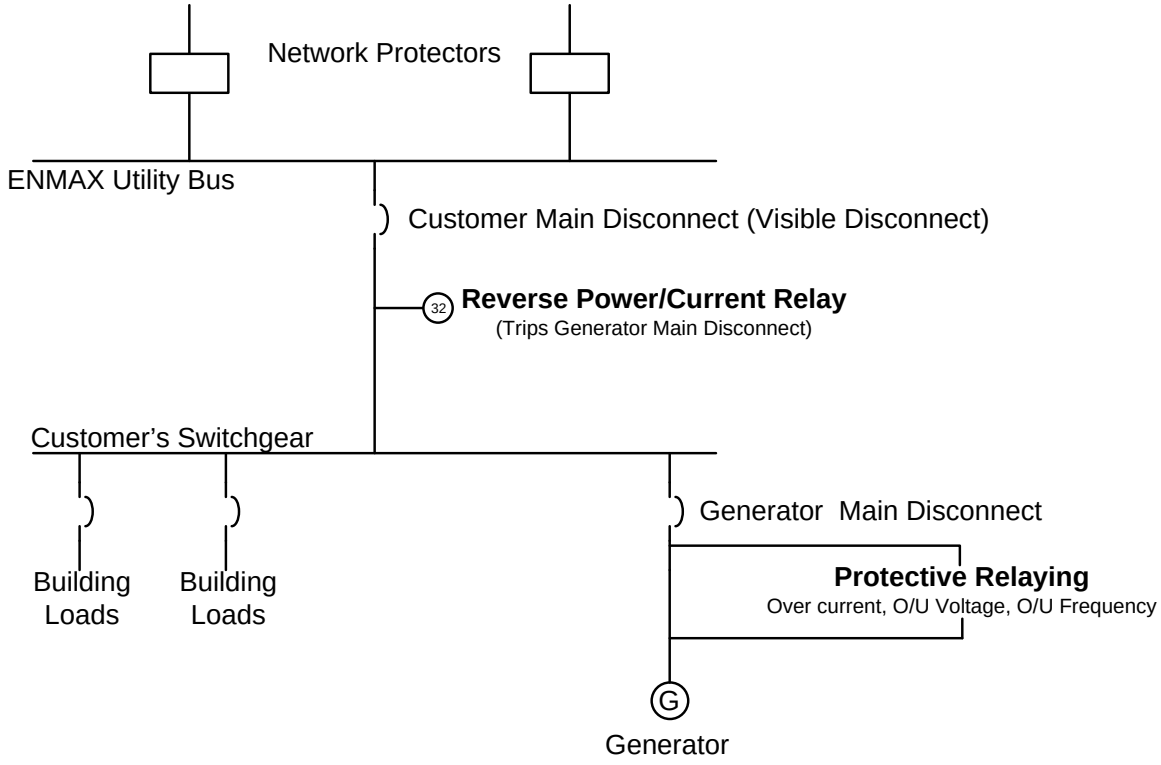


Figure 5.3.1 Sample Single Line Diagram for an EPC Network Service with a Generator

5.3.2 Primary Voltage Network Services

Customers who are supplied from the 25kV preferred/alternate system may install generation for load shaving purposes (see Figure 5.3.2).

i. If the generator is to be used exclusively for load shaving, a minimum import relay must be installed on the preferred and alternate services. The relays must be set **above zero (0) amps to ensure a net import of power**. The P&C system must be designed to sense the power flow on the customers' main service and trip out the generator main breaker or point of common coupling breaker at a pre-determined minimum import level. The minimum import level may vary between buildings and must be proposed by the customer and approved by EPC Protection & Control.

ii. If the customer intends to export power in addition to supplying the building load, a bi-directional meter must be installed on both the preferred and alternate feeders.

iii. Any customers wishing to export power must work with EPC to ensure their design/equipment will not adversely affect the EPC system operation or safety to employees.

iv. All costs associated with the high voltage service and switchgear required to accommodate export of power will be at the customer's expense.

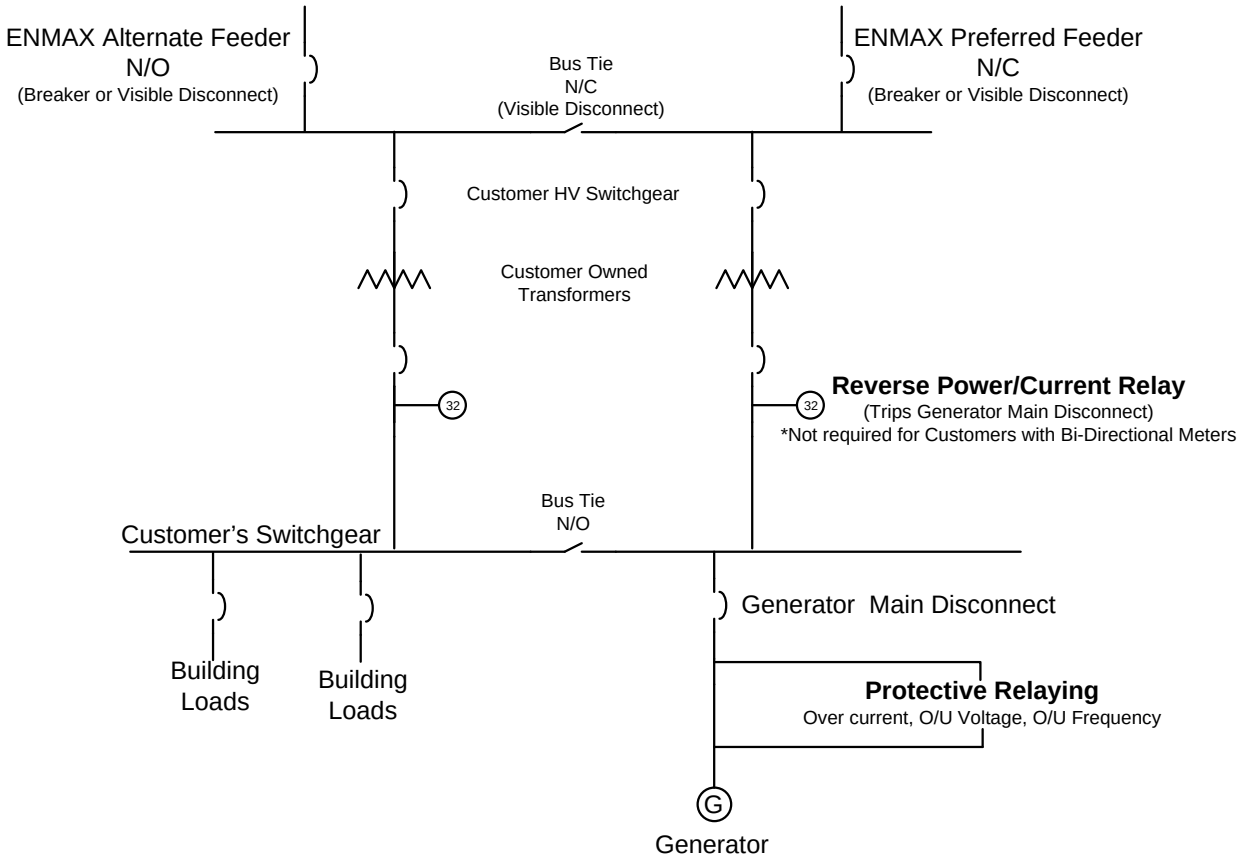


Figure 5.3.2 Sample Single Line Diagram for an EPC 25kV Service with a Generator

5.4 Generation for Emergency Backup

Emergency backup generators may be installed under the following conditions:

i. The operation of all generators must be approved by EPC

ii. When transitioning back to the utility supply, the customer switchgear must disconnect the generator before closing the incoming breaker(s) in a 'break before make' sequence

iii. Any closed transition emergency generators must be approved by EPC

5.5 Generator Design Requirements

i. When submitting an application for a generator interconnection, the customer must provide EPC with:

- A single line diagram (similar to Figures 5.3.1 or 5.3.2)
- The proposed generator size, type, voltage, connection, and physical location
- The protection and control settings and equipment types
- A coordination study (allow a minimum of 10 working days for EPC Protection & Control to review)
- A generator scheme test plan for use in EPC witness testing
- A generator scheme commissioning test report

ii. The customer's generation interruption device must isolate the generator from the utility under any of the following conditions:

- A customer relay fail alarm
- Relay maintenance or relay removed
- Loss of power to the reverse power (or reverse current) relay while generator is running
- Relay control voltage failure
- Minimum import level not satisfied or reverse power flow detected

iii. The main service disconnect must be sized to match the expected full load of the service and must be equipped with:

- A visible open with provision for a locking hasp to accommodate an EPC padlock

- A red laminated sign stating:

UTILITY MAIN INTERRUPTING DEVICE

- A yellow laminated sign stating:

CAUTION

TO PREVENT BACKFEED INTO THE UTILITY SYSTEM THE MAIN INTERRUPTING DEVICE MUST BE RACKED OUT AND LOCKED OUT

5.6 Generator Commissioning Checklist

Generators wishing to synchronize to the EPC system for any reason must have the commissioning tests witnessed by EPC. The checklist in Table 5.6 must be signed off by EPC before commissioning is considered complete.

Table 5.6 Network Generator Commissioning Checklist

Date	EPC Requirements for Commissioning Approval
	1. Protection scheme must be approved by EPC Protection & Control
	2. EPC reserves the right to witness the testing of the generator scheme prior to final energization and approval. A commissioning plan may be required by EPC if EPC is to witness the operation of the generator scheme
	3. Low forward power relay operates according to EPC Protection & Control requirements
	4. Protection schemes approved by EPC Protection & Control. Protection elements outlined in EPC 'Guide for Generator Interconnection to the Wires Owner Distribution System'
	5. Generator is able to pick up load
	6. Alarm system is in place to indicate failure of key relays
	7. Main disconnect is lockable
	8. Commissioning report submitted to EPC for final approval

ENMAX	536-NSPG-002
EPC Projects & Engineering	Investment in New Services in the Network Area Policy

Investment in New Services in the Network Area

ENMAX Power Corporation (EPC) will invest towards the project cost for customers who are installing a new electrical service. The EPC investment policy is outlined in the ENMAX Power Corporation Distribution Tariff Terms and Conditions which may be found on the ENMAX website *www.enmax.com*. This document contains further details on the EPC commercial and residential investment policy.

Within the EPC Network area (see Figure 1) the project costs will be determined based upon the customers requested aggregate service size as follows:

1. **Type 1 - Service size of 1600 amps or less @ 208 volts**

   Services in this range can be supplied directly from the street grid system. The EPC investment will be applied towards the dedicated civil and electrical infrastructure required to meet the service size requested by the customer. Dedicated infrastructure is defined as follows:

   - Service conduit from the utility point of connection to the customer's property line
   - Service cable from the utility point of connection to the line side of the customers main disconnect(s)
   - Civil infrastructure for the new service

2. **Type 2 – Service size between 1601 amps and 2400 amps @ 208 volts**

   Services in this ranges can be supplied from the street grid system but may require upgrades of the existing infrastructure to handle their load requirements. The EPC investment will be applied towards the dedicated civil and electrical infrastructure required to meet the service size requested by the customer. Dedicated infrastructure is defined as follows:

   - Service conduit from the utility point of connection to the customer's property line
   - Service cable from the utility point of connection to the line side of the customers main disconnect(s)
   - Civil infrastructure for the new service
   - Electrical transformers and secondary bus
   - Primary voltage cable

3. Type 3 - Service size greater than 2400 amps @ 208 volts

Services in this range will require the construction of a new customer built vault. The EPC investment will be applied towards the dedicated civil and electrical infrastructure required to meet the service size requested by the customer. Dedicated infrastructure is defined as follows:

- Service conduit from the utility point of connection to the customer's property line
- Service cable from the utility point of connection to the line side of the customers main disconnect(s)
- Civil infrastructure for the new service
- Electrical transformers, emergency disconnect switches and secondary bus
- Primary voltage cable

4. Type 4 – Upgraded services @ 480 or 600 volts

Services of this voltage will require the construction of a new customer built vault. The EPC investment will be applied towards the dedicated civil and electrical infrastructure required to service the customer. Dedicated infrastructure is defined as follows:

- Service conduit from the utility point of connection to the customer's property line
- Service cable from the utility point of connection to the line side of the customers main disconnect(s)
- Civil infrastructure for the new service
- Electrical transformers, emergency disconnect switches and secondary bus
- Primary voltage cable

Investment Level Options

The customer is responsible to select the EPC investment option applicable to their project. This selection must be determined prior to the request for the service cable installation. The customer will have the following investment options (or combination thereof):

- **Meter Based Investment** – the customer must provide an electrical single line which shows the number and type of EPC revenue meters (residential and/or commercial) being installed. This single line should be a copy of the signed drawing submitted to the City of Calgary Electrical Inspection.

- **Minimum Demand Agreement Investment** – this agreement establishes a minimum electrical demand level which the customer is required to maintain for a period of 15 years.

Contact EPC Engineering If there are any questions regarding investment options.

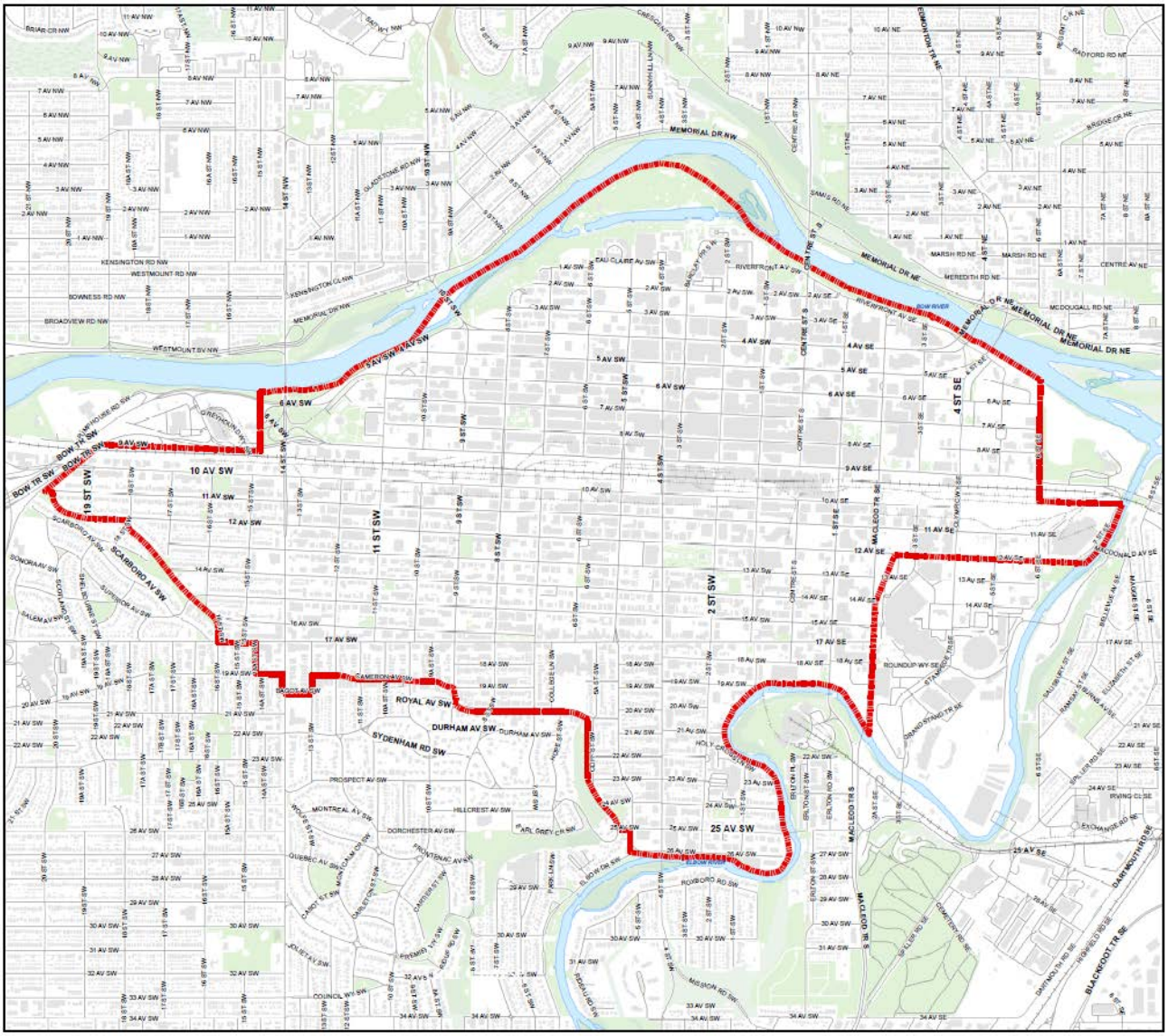


Figure 1 EPC Network Boundary Map

ENMAX	536-NSPG-003
EPC Projects & Engineering	**Investment in Staged Projects in the Network Area Policy**

Investment in Staged Projects in the Network Area

ENMAX Power Corporation's (EPC) investment in staged projects in the Network area (see Figure 1) is intended to address concerns raised by large customers regarding multi-staged developments and application of the EPC investment policy. The EPC investment policy is outlined in the ENMAX Power Corporation Distribution Tariff Terms and Conditions which may be found on the ENMAX website *www.enmax.com*. This document contains further details on the EPC commercial and residential investment policy

The following conditions must be met in order for EPC to consider a 'staged project' as a single project from an investment perspective:

- The customer has requested EPC to install an electrical service for a project which consists of two or more stages which are located on the same site and owned by the same customer
- The project site is to be built in multiple stages and EPC has been requested to install infrastructure in Stage 1 which is capable of supplying the total development load
- The customer must energize the second stage within two (2) years of the first stage energization
- EPC will produce an estimate for the service to Stage 1. The customer must provide a deposit to cover the cost for pre-ordering of any large equipment purchases (e.g. transformers, switches) and also provide a purchase order for the balance of the estimated cost.
- The customer must sign a 'letter of intent' prior to the energization of Stage 1 indicating they intend to build additional stages. EPC Engineering will provide a copy of the letter to the customer which will state that Stage 2 of the project must be energized within two years of the service to Stage 1 being energized.

If the above requirements are met, EPC will treat the two stages of development as one project and combine the EPC investment for each stage.

Note that no interest will be paid on any customer funds held by EPC.

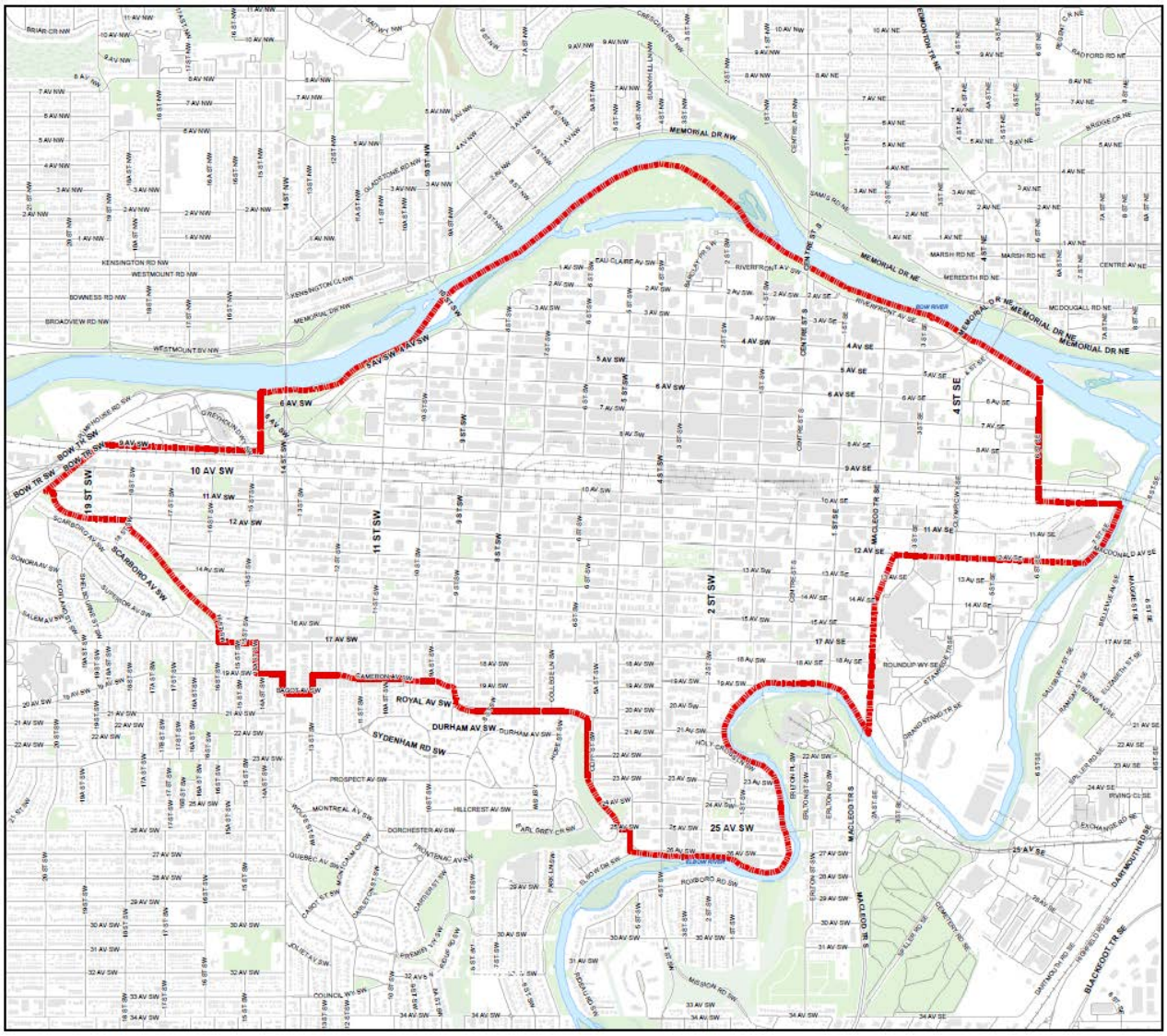


Figure 1 EPC Network Boundary Map

ENMAX	536-NSPG-004
EPC Projects & Engineering	**Investment in Upgraded Services in the Network Area Policy**

Investment in Upgraded Services in the Network Area

ENMAX Power Corporation (EPC) will invest towards the project cost for customers who are upgrading an existing electrical service. The EPC investment policy is outlined in the ENMAX Power Corporation Distribution Tariff Terms and Conditions which may be found on the ENMAX website *www.enmax.com*. This document contains further details on the EPC commercial and residential investment policy

Within the EPC Network area (see Figure 1) investment in an upgraded service will be based upon the increase in electrical demand and/or increase in the number of revenue meters.

The upgrade project scope will be reviewed by EPC Engineering to assess any previous investment (e.g. minimum demand agreement) which may have been made for the original service. This will be taken into account in determining any additional investment.

Note: for an upgraded service, EPC Engineering will need to review the existing system loading to determine if existing capacity is available to meet the upgraded service request. This may determine if other servicing options are available.

1. Type 1 - Upgraded service size of 1600 amps or less @ 208 volts

Services in this range can be supplied directly from the street grid system. The EPC investment will be applied towards the dedicated civil and electrical infrastructure required to service the customer. Dedicated infrastructure is defined as follows:

- Service conduit from the utility point of connection to the customer's property line
- Service cable from the utility point of connection to the line side of the customer's main disconnect(s)
- Civil infrastructure for the new service

2. Type 2 – Upgraded service size between 1601 amps and 2400 amps @ 208 volts

Services in this range can be supplied from the street grid system but may require upgrades of the existing infrastructure to handle their load requirements. The EPC investment will be applied towards the dedicated civil and electrical

infrastructure required to meet the service size requested by the customer. Dedicated infrastructure is defined as follows:

- Service conduit from the utility point of connection to the customer's property line
- Service cable from the utility point of connection to the line side of the customers main disconnect(s)
- Civil infrastructure for the new service.
- Electrical transformers and secondary bus
- Primary voltage cable

3. Type 3 - Upgraded service size greater than 2400 amps @ 208 volts

Services in this range will require the construction of a new customer built vault. The EPC investment will be applied towards the dedicated civil and electrical infrastructure required to service the customer. Dedicated infrastructure is defined as follows:

- Service conduit from the utility point of connection to the customers property line
- Service cable from the utility point of connection to the line side of the customers main disconnect(s)
- Civil infrastructure for the new service
- Electrical transformers, emergency disconnect switches and secondary bus
- Primary voltage cable

4. Type 4 – Upgraded services @ 480 or 600 volts

Services of this voltage will require the construction of a new customer built vault. The EPC investment will be applied towards the dedicated civil and electrical infrastructure required to service the customer. Dedicated infrastructure is defined as follows:

- Service conduit from the utility point of connection to the customers property line
- Service cable from the utility point of connection to the line side of the customers main disconnect(s)
- Civil infrastructure for the new service

- Electrical transformers, emergency disconnect switches and secondary bus
- Primary voltage cable

Investment Level Options

The customer is responsible for the selection of the EPC's investment option which must be determined prior to their request for the service cable installation. The customer will have the following investment options (or combination thereof):

- **Meter Based Investment** – the customer must provide an electrical single line which shows the number and type of EPC revenue meters (residential and/or commercial) being installed. This single line should be a copy of the signed drawing submitted to the City of Calgary Electrical Inspection.

- **Minimum Demand Agreement Investment** – this agreement establishes a minimum electrical demand level which the customer is required to maintain for a period of 15 years.

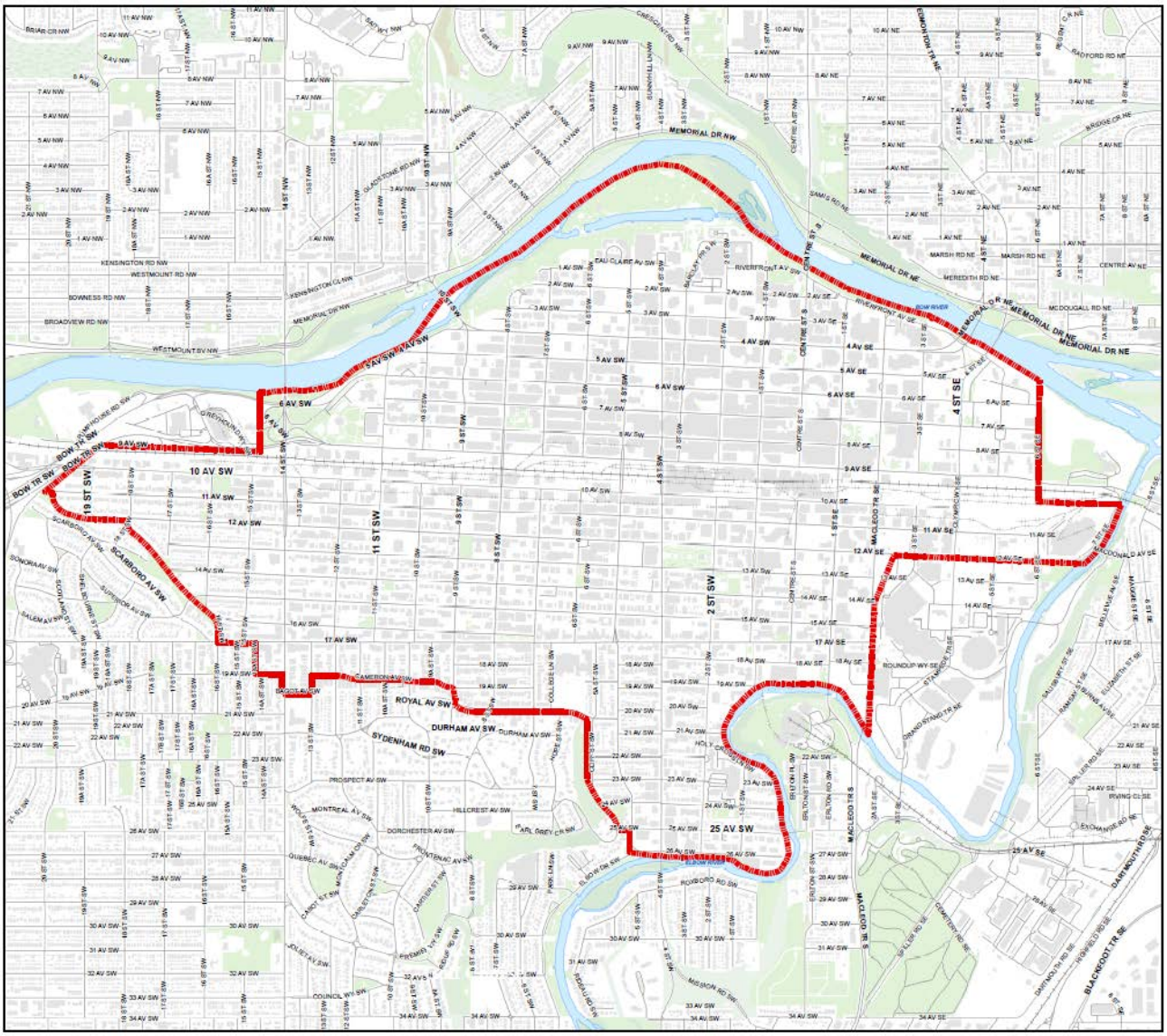


Figure 1 EPC Network Boundary Map

ENMAX	536-NSPG-005
EPC Projects & Engineering	**Network Conduit Attachment at Property Line**

Table of Contents

1.0 SCOPE

The procedures and requirements in this guideline cover the interface point between the ENMAX Power Corporation (EPC) installed conduit system and the customer's conduit system or building wall.

2.0 ATTACHMENT REQUIREMENTS

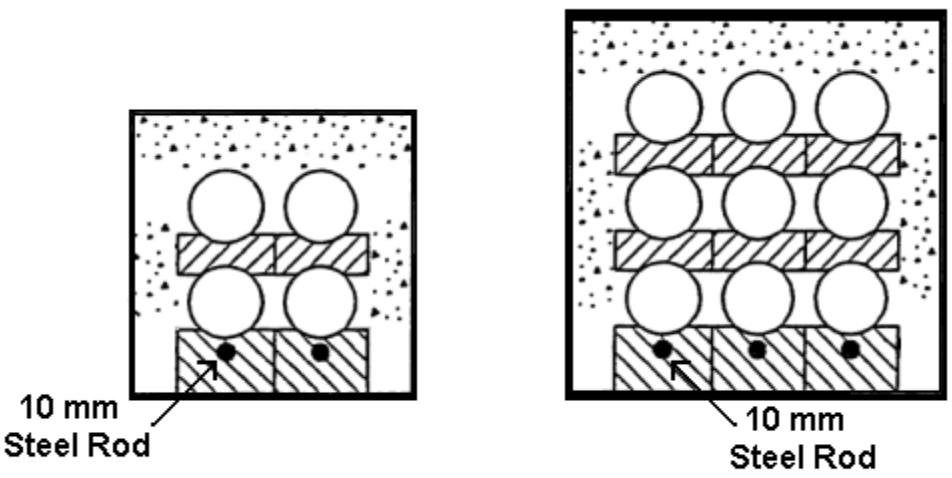
2.1 General

EPC requires structural reinforcement to be installed at any location where the EPC conduit system interfaces with a customer facility at the property line. The reinforcement shall limit vertical movement or sheering action between the EPC conduit system and the customer facility.

2.2 EPC Conduit to Customer Conduit Interface

Reinforcement at any EPC conduit duct bank to customer conduit duct bank interface must be done as follows:

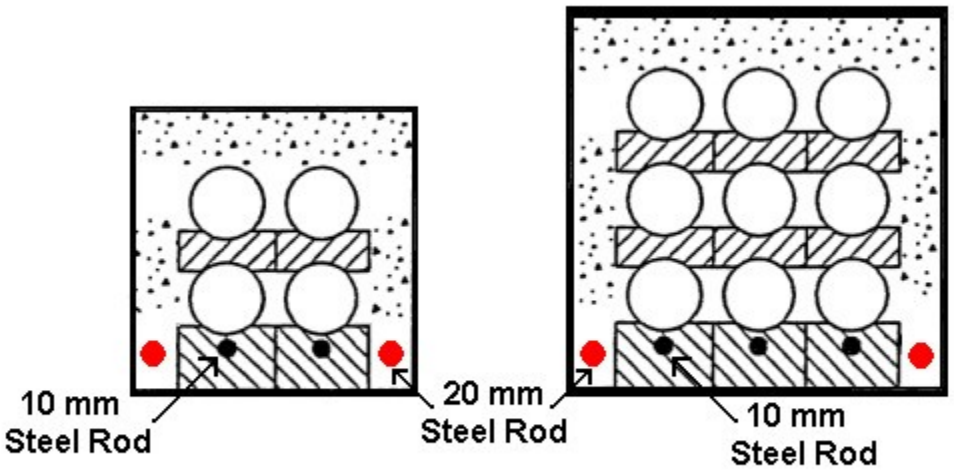
- Installation of a 10 mm diameter reinforcing steel rod under each column of conduit. See illustration below.



2.3 EPC Conduit to Customer Building Interface

Reinforcement at any EPC conduit to customer building interface must be done as follows:

- Installation of a 10 mm diameter reinforcing steel rod under each column of conduit in the duct bank. See illustration below.
- Installation of a 20 mm diameter reinforcing steel rod at each bottom corner of the conduit duct bank. See illustration below.



2.4 Construction Responsibilities

2.4.1 New Customer Facility (Customer's Responsibilities)

For new customer sites where the EPC conduit system is being installed after the customer's building structure or conduit system is completed, the following will be the Customer's responsibility:

- The customer will have all required reinforcing steel rods protruding from their facility in the configurations outlined in Section 2.2 and 2.3. The customer's reinforcing steel rods will be affixed to the reinforcing steel in the EPC conduit system by EPC.

2.4.2 Existing Customer Facility (EPC Responsibilities)

For customer sites where the EPC conduit system is being upgraded and the customer's building or conduit system already exists, the following will be performed by EPC:

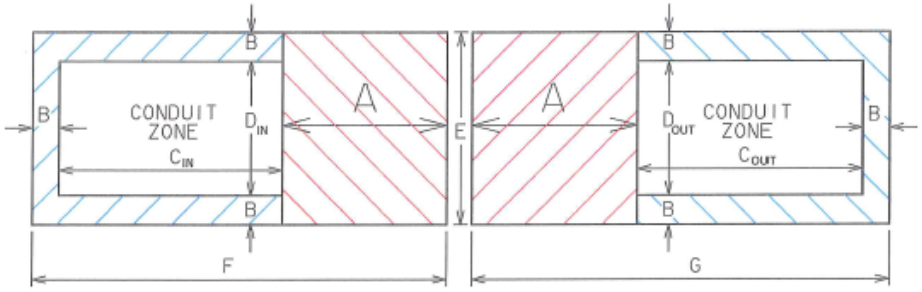
- EPC will drill into the concrete structure encasing the customer's conduit system and install reinforcing steel as outlined in the Section 2.2 and 2.3. The reinforcing steel rods will then be epoxied into place and interconnected to the reinforcing steel in the EPC conduit system.

2.4.3 Customers Facility Does Not Exist (EPC Responsibilities)

In situations where the EPC conduit system is installed prior to the construction of the customers building or conduit system, the following will be performed by EPC:

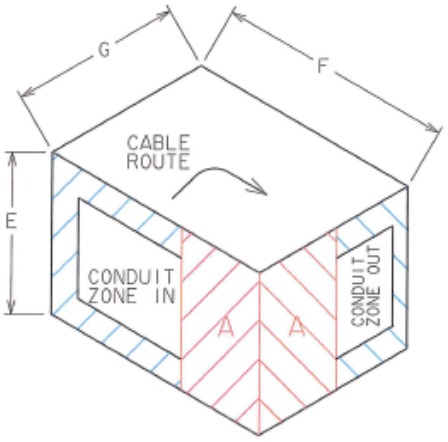
- Reinforcing steel rods in the configuration outlined in Section 2.2 and 2.3 will be left protruding from the end of the EPC conduit duct bank to permit the customer to affix their conduit system to the EPC conduit system.

ENMAX	536-NSPG-006
EPC Projects & Engineering	**Customer Pull Box Dimensions**

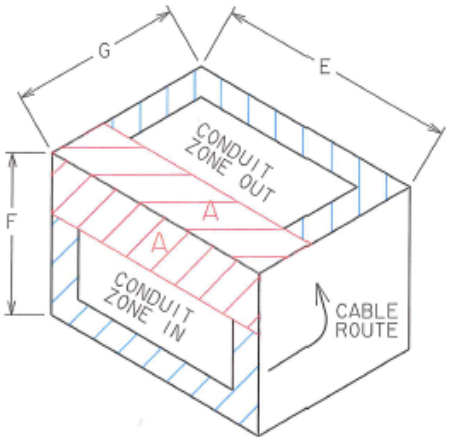


MINIMUM SERVICE CABLE PULL BOX DIMENSIONS	
$F = A + B + C_{in}$ $G = A + B + C_{out}$ E=the greater of $(2B + D_{in})$ OR $(2B + D_{out})$	
A	Based upon the minimum bending radius for Network Secondary cables 350mm min
B	Thickness of concrete from outer most edge of conduit 50mm min
C_{IN} /D_{IN}	Dimensions for the **IN** coming duct bank face of the pull box. Dependent upon the conduit configuration, (number of conduit wide & high, allow 150mm per conduit in each direction)
C_{OUT}/D_{OUT}	Dimensions for the **OUT** going duct bank face of the pull box. Dependent upon the conduit configuration. (number of conduit wide & high, allow 150mm per conduit in each direction)

SIDE TO SIDE



SIDE TO TOP/BOTTOM



DSGN APPR: PROFESSIONAL ENGINEER ALBERTA GARY P. FITZPATRICK

DATE: 2015/04/28

PERMIT NUMBER: P6756
The Association of Professional Engineers, and Geoscientists of Alberta

ENMAX

ALL DIMENSIONS ARE IN METERS EXCEPT AS INDICATED.

DATE	REVISION	DSGN	APPR.

TITLE: NETWORK CUSTOMER PULL BOX DIMENSIONS

SHEET 1 OF 1 | SCALE: N.T.S.

FILE: 536-NSPG-006

Living with Trees

The intent of this policy is to ensure the safety of the general public and ENMAX Power Corporation (EPC) personnel. Vegetation including trees, shrubs and root systems can be a good conductor of electricity and must be kept isolated from electrical apparatus to avoid the possibility of creating an electrical hazard or obstructing access for EPC field personnel.

Following are some general rules for planning of trees in the downtown Network area (see Figure 3).

Planting Design – Underground Clearances

- EPC underground cables are installed in concrete encased duct banks and the minimum clearance from the tree center to the outside edge of the duct bank is 2.0 meters.
- EPC underground vaults are generally identified by the concrete slabs within sidewalks with access grilles located at each end. These vaults contain high-voltage electrical equipment.
- Pre-cast tree planters or tree grates must not interfere with any removable concrete slabs which provide crane access to the electrical equipment.
- Pre-cast tree planters or tree grates must not be located over any existing or proposed cable conduit system.
- See Figure 1 for a typical street layout with tree grates

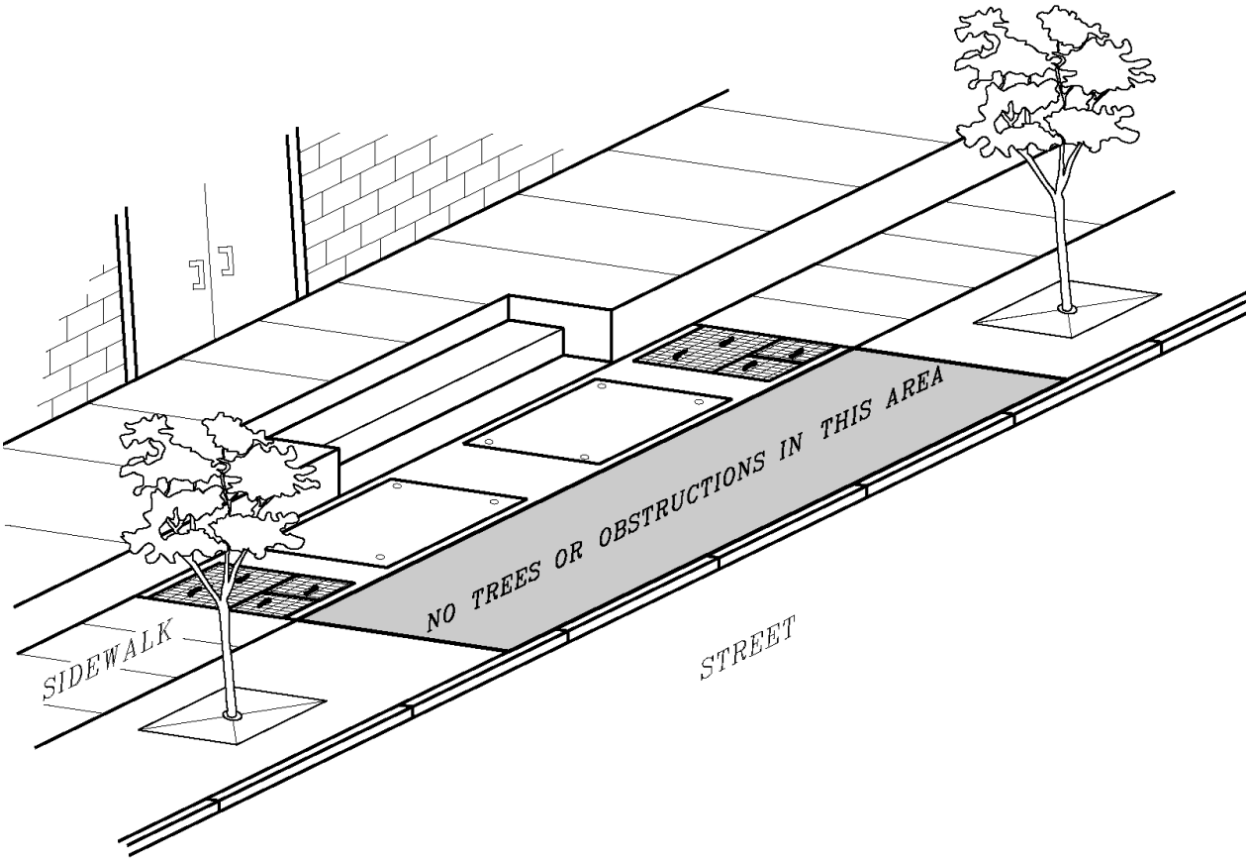


Figure 1 - Street Layout with Tree Grates

Planting Design – Overhead Clearances

When planting a tree, it is important to select one that has suitable characteristics for the location. No one tree is perfect for all locations.

Trees planted near power lines must be done according to how tall and wide the tree will become when it is fully grown. (see diagram below)

- Leave at least 1.0 meter clearance from the nearest power line overhead wire – Clear Zone
- Dwarf hedges and shrubs may be planted starting 1.0 meter from the nearest power line overhead wire - Zone 1
- Short and medium height trees may be planted beyond 4.5 meters from the nearest power line overhead wire - Zone 2

- Tall trees may be planted beyond 7.0 meters from the nearest power line overhead wire - Zone 3.
- See Table 1 for examples of tree species by height and Figure 2 for overhead powerline clearances

Table 1 - Tree Species by Height

SHORT TREES	MEDIUM TREES	TALL TREES	
Apple	Bristle Cone Pine	Amur Cherry	Mayday
Flowering Crabapple	European Mountain Ash	Ash	Paper Birch
Hawthorn	Ohio Buckeye	Basswood	Pine
Japanese Tree Lilac	Pin Cherry	Bur Oak	Poplar
Pear	River Birch	Chokecherry	Silver Maple
Plum	Showy Mountain Ash	Cut-Leaf Weeping Birch	Spruce
Schubert Cherry	Tatarian Maple	Elm	Willow
Tree Form Mugo Pine	Youngs Weeping Birch	Larch	Aspen
Ussurian Pear		Manitoba Maple	

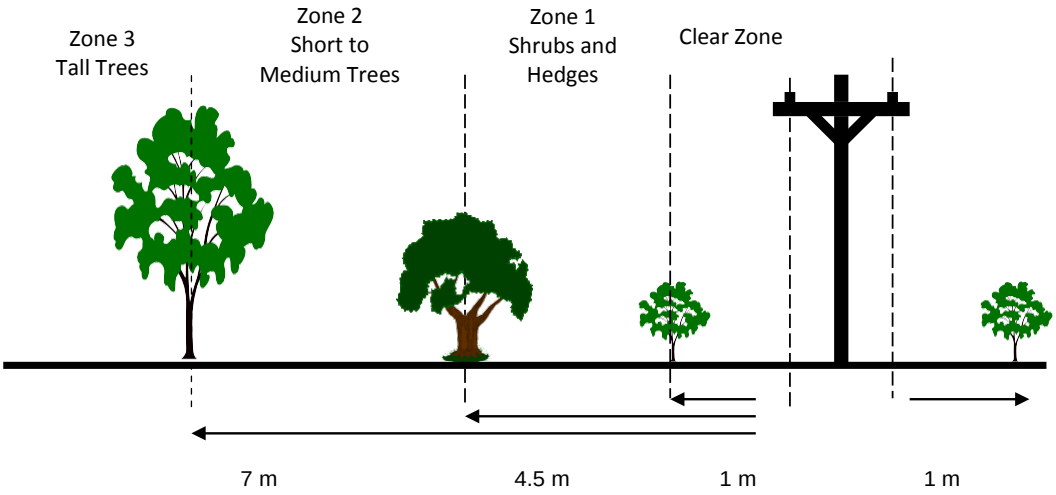


Figure 2 - Overhead Powerline Clearances

Remember – do not plant tall tree species under power lines. In addition, check the tree's mature width to ensure the tree will not make contact with a power line due to side growth. Most nurseries can provide information on tree sizes and planting designs.

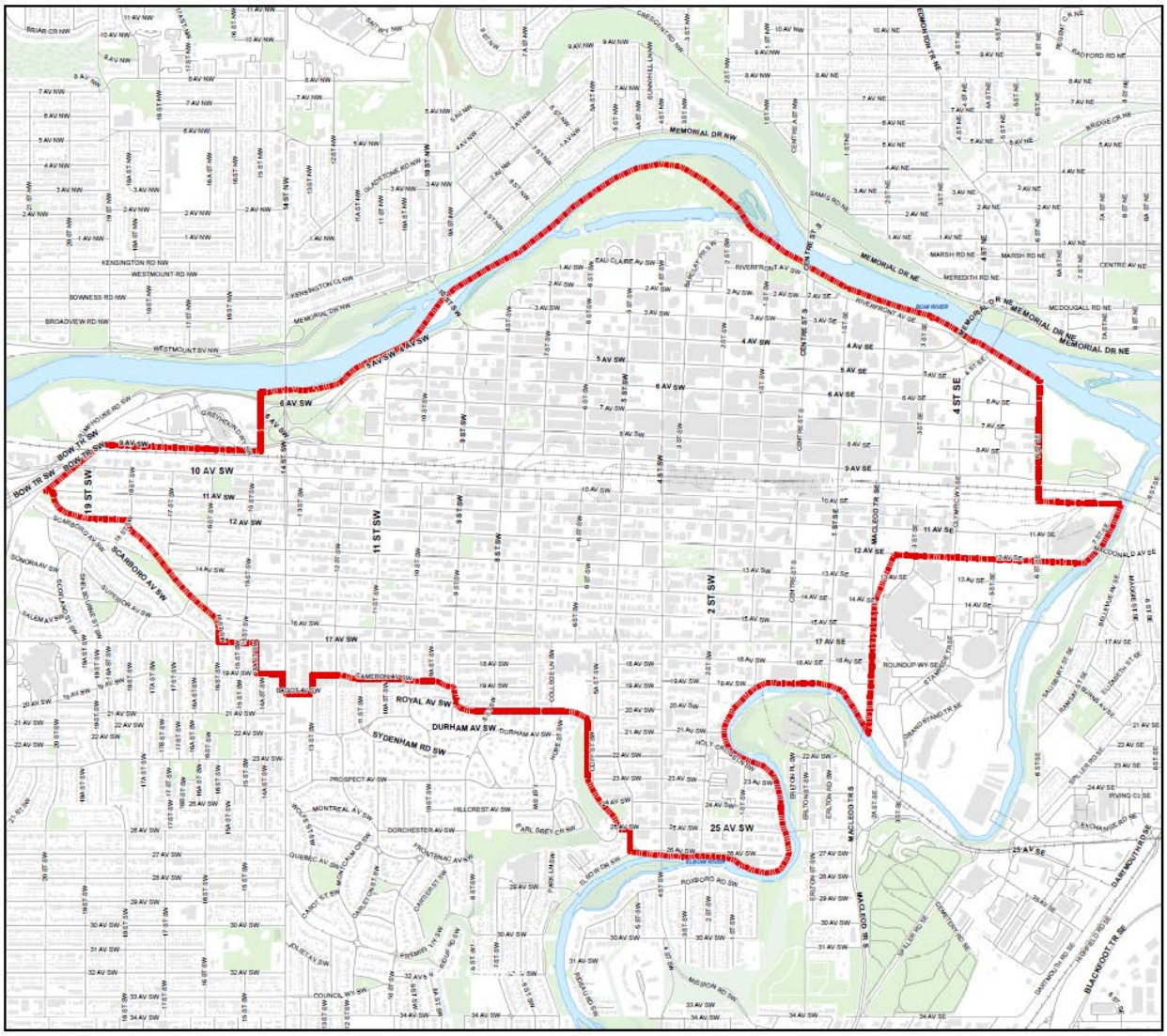


Figure 3 - EPC Network Boundary Map