NASHVILLE ELECTRIC SERVICE
DOWNTOWN UNDERGROUND NETWORK
SECONDARY SERVICES GUIDELINES

Guidelines Effective October 18, 2016

NES is committed to providing safe, reliable electric service at a reasonable cost for all of our Customers. These guidelines provide direction for activities relating to providing electric service to all classes of Customers as well as activities related to the electric system.

DOWNTOWN UNDERGROUND NETWORK SECONDARY SERVICES GUIDELINES

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DOWNTOWN UNDERGROUND NETWORK SECONDARY SERVICES GUIDELINES

1.0 INTRODUCTION

1.1 The Nashville Electric Service (NES) **Downtown Underground Network Secondary Services Guidelines** is the governing document of guidelines for services within the Downtown Underground Network Service Area.

1.2 The word "Customer" in this document refers to the property owner or developer. Many steps will actually be completed by consultants, contractors, or electricians, but the ultimate responsibility rests with the Customer.

1.3 NES shall provide either ***grid*** network or ***spot*** network service within the network service area. The type of service provided will depend upon the Customer's electrical load characteristics. This document presents the requirements for both the ***grid*** network and ***spot*** network services.

1.4 Since the network service area is a critical growth and transition area, the Customer is required to contact NES Energy Services Engineering (ESE) before planning either a new service or changes to an existing service within the network service area. In this area, *electric supply lines* and *equipment* are installed in a *conduit system* below congested streets and sidewalks. Alterations and additions to this system generally require a great deal of time.

1.5 A glossary is included in Appendix A. Terms included in the glossary are in *italics* when they appear in this document.

2.0 DESCRIPTION OF CUSTOMER'S INSTALLATION

2.1 The Customer shall furnish ESE with a description of the Customer's new installation. This information is necessary to enable NES to determine the types and methods of service for which the Customer's installation may qualify.

2.2 At a minimum, the following items shall be furnished for each installation.

(a) Site Plan
(b) Power Distribution Diagram
(c) Service Load Calculations

2.3 Long lead times for network *equipment* may affect the customer's service date. NES shall not place an order for *equipment* until the Customer has made a formal request, provided the power distribution diagram and service load calculations, and if necessary executed a power contract.

2.4 A Residential New Business Agreement ("contract") will be required for residential projects before construction can begin.

2.5 The Customer should not proceed with construction until service voltage, *service point* and other service requirements have been confirmed by NES Customer Engineering (CE).

2.6 Any changes made to the information originally submitted will likely delay the service date, and require NES and Customer facilities to be redesigned.

3.0 STANDARD AND NON-STANDARD SERVICE

3.1 STANDARD AVAILABLE NETWORK SECONDARY VOLTAGES AND MAXIMUM ALLOWABLE SERVICE EQUIPMENT AMPACITY

3.1.1 125-volt service, 1-phase, 2-wire, ***grid*** network, Maximum allowable *service equipment ampacity*: 60A.

3.1.2 125/216-volt service, 1-phase, 3-wire, ***grid*** network, Maximum allowable *service equipment ampacity*: 125A.

3.1.3 216Y/125-volt service, 3-phase, 4-wire, ***grid*** network, Maximum allowable *service equipment ampacity*: 800A (unless NES determines additional capacity is available).

3.1.4 216Y/125-volt service, 3-phase, 4-wire, ***spot*** network, Maximum allowable *service equipment ampacity*: 4,000A.

3.1.5 480Y/277-volt service, 3-phase, 4-wire, ***spot*** network, Maximum allowable *service equipment ampacity*: 10,500A. To qualify for this service voltage, the demand estimated by ESE must be greater than or equal to 500kW.

3.2 NES shall provide one service voltage to a *building* or *structure* in the network service area.

3.3 New services shall be installed underground in the network service area.

3.4 The Customer shall contact CE to determine the available fault current at the *service point*.

3.5 The Customer is required to maintain a balanced load such that the difference in current flow between the highest and lowest phase does not exceed 10%.

3.6 For special services and voltages other than standard voltages, the Customer shall consult with ESE regarding the form and type of service desired.

3.6.1 The Customer should not proceed with the purchase of *equipment* or wiring until service requirements have been confirmed by CE.

3.6.2 NES will furnish information in writing on the character of service available, the location of NES' lines, and the ability of NES to meet special requirements.

3.6.3 Nothing contained in this guide shall bind NES to provide such special service.

4.0 SERVICE POINT

4.1 The *service point* shall be where electricity is delivered to the Customer by NES. The *service point* is defined by the following conditions unless redefined by written agreement.

4.1.1 The *service point* for ***grid*** network services shall be at the meter base or *service equipment* as long as it is located within five feet (5’) of the *conduit* penetration into the *building*. If the distance is greater than five feet (5’), the *service point* shall be the NES *collector plate* in the *handhole, manhole,* or *vault* specified by CE. The location of *conduit* penetration into the *building* shall be specified by CE.

4.1.2 The *service point* for ***spot*** network services shall be the NES *collector plate* in the *vault* or *manhole* specified by CE.

4.2 NES shall provide one *service point* to a *building* or *structure* in the network service area.

4.3 WORK BEYOND THE SERVICE POINT

4.3.1 The Customer is responsible for work beyond the *service point*.

4.3.2 NES shall terminate cables at NES *collector plate*s and meter bases. The Customer shall terminate cables at the *service equipment*.

5.0 NETWORK SERVICE CONNECTION REQUIREMENTS

5.1 ***GRID*** NETWORK SERVICE REQUIREMENTS

5.1.1 The ***grid*** network Customer shall design, furnish, install, and maintain the *service entrance* from the *service point* to the Customer's *service equipment*.

5.1.2 The Customer is required to provide one *duct* per run of cable, plus one spare *duct*, from the *service equipment* to the NES *handhole*, *manhole*, or *vault* specified by CE. Customer shall coordinate installation of *conduit* with NES Construction Crews. NES shall terminate *conduit* in NES *handhole, manhole,* or *vault*.

5.1.3 Service Entrance Cable

(a) *Service entrance cables* shall be copper with insulation rated for *wet locations* and a temperature rating of at least 90°C.

(b) Cables shall be 4/0 AWG unless otherwise specified in writing by CE.

(c) Customer shall coordinate the installation of cables with NES Network Crews. Customer shall not open or enter NES *handhole, manhole,* or *vault*.

(d) When *service entrance cables* exceeding 100 feet are paralleled, NES shall furnish cable limiter type fuses to be installed on each end of each *service entrance* phase *cable*. The Customer shall install these fuses at the *service equipment*, and NES shall install fuses at the *service point.* Customer may contact CE to obtain fuse details.

5.1.4 *Service equipment* shall be capable of interrupting the available fault current.

5.2 ***SPOT*** NETWORK SERVICE REQUIREMENTS

5.2.1 The ***spot*** network Customer shall design, furnish, install, and maintain primary *conduit, vault,* and secondary *service entrance* per NES requirements.

5.2.2 Primary Conduit

(a) The Customer is required to provide a minimum of three *ducts* for each NES transformer. The *conduit* shall extend from the *vault* to the *manhole* specified by CE. Customer shall coordinate installation of *conduit* with NES Construction Crews. NES shall terminate *conduit* in NES *handhole, manhole,* or *vault*.

(b) Customers choosing to connect to the NES system at a location other than the NES preferred location shall be responsible for construction of additional required facilities, in accordance with NES guidelines.

5.2.3 *Vaults* shall be constructed in accordance with the current issue of the **NES Vault Design Guide**.

5.2.4 Service Entrance Cables

(a) *Service entrance cables* shall be copper with insulation rated for *wet locations* and a temperature rating of at least 90°C.

(b) Cables shall be installed in multiple runs of 500 kcmil unless otherwise specified in writing by CE.

(c) Customer shall coordinate the installation of cables with NES Network Crews. Customer shall not open or enter NES *handhole*, *manhole*, or *vault*.

(d) 216Y/125-volt services: When *service entrance cables* exceeding 100 feet are paralleled, the Customer shall furnish NES *approved* cable limiter type fuses to be installed on each end of each *service entrance* phase *cable*. Fuses shall be installed by the Customer at the *service equipment*, and by NES at the *service point*.

(e) 480Y/277-volt services: The Customer shall furnish NES *approved* cable limiter type fuses to be installed on each end of each *service entrance* phase *cable*. Fuses shall be installed by the Customer at the *service equipment*, and by NES at the *service point*.

(f) Fire pump services: Cable limiter type fuses shall not be installed on fire pump services.

5.2.5 *Service equipment* shall be capable of interrupting the available fault current.

5.2.6 NES reserves the right to serve other Customers from equipment located in Customer owned vaults, provided this does not interfere with the vault owner's electric service.

6.0 TEMPORARY SERVICE

6.1 Standard temporary service consists of 216Y/125-volt service, 3-phase, 4-wire, supplying a load of 200 amps or less. Customer shall be responsible for installing *conduit* and *service entrance cable* to the NES *handhole*, *manhole*, or *vault* as specified by CE.

6.2 Large temporary service (over 200 amps) consisting of 216Y/125-volt service, 3-phase, 4-wire, may be available, but will require a longer time to design and a larger fee. Requests for large temporary services should be made with ESE as early as possible.

6.3 Temporary service consisting of 480Y/277-volt service, 3-phase, 4-wire, is available, but may require installation of a pad-mounted switch and transformer. Customer may experience unexpected interruptions with this type of service.

7.0 METERING

7.1 Customer shall adhere to applicable metering requirements in the **NES Electric Service Policies and Procedures**.

7.2 Current transformers (CT's) and potential transformers (PT's) shall not be installed in a *handhole*, *manhole*, or *vault*.

8.0 SECURITY OF SERVICE ENTRANCE

8.1 The Customer's *service entrance* shall be secured against unauthorized electrical connection.

8.2 When multiple services are tapped off of a common *service entrance*, such as in an incoming bus section with multiple mains, all removable and/or hinged covers shall be provided with a means for NES Metering Department to install seals and/or locks.

9.0 EMERGENCY POWER GENERATION SYSTEMS

9.1 Emergency power generation systems utilizing closed transition transfer switching *equipment* shall not be permitted by NES in the network service area.

9.2 Emergency power generation facilities shall comply with NES guidelines regarding safety, system protection, and operation. Emergency power generation facilities shall be accessible by NES for periodic inspections.

10.0 ALTERATIONS OR ADDITIONS TO CUSTOMER'S INSTALLATION

10.1 The capacity of NES electrical service to the Customer is based on information furnished by the Customer at the time of initial service design. Therefore, no significant additions or changes shall be made to the Customer's installation without first notifying the proper inspection authority and providing NES with the information described in Section 2.0 of this document.

10.2 Additions or changes to the Customer's installation may require facilities to be redesigned by both the Customer and NES.

10.3 Failure to provide this information may adversely affect the quality of service to the Customer and to other Customers served from the same NES facilities. Extreme cases may require disconnection of Customer's electric service while corrective action is taken.

11.0 MODIFICATION OF EXISTING NETWORK INFRASTRUCTURE

11.1 The cost of modification or relocation of existing NES network infrastructure requested by the Customer will be charged to the Customer (estimated construction costs including appropriate overheads).

11.2 No relocation or replacement will be made unless suitable easements or property rights are provided without cost to NES.

12.0 RECOMMENDATION FOR INSTALLING DISTRIBUTED GENERATION ON THE DOWNTOWN NETWORK SYSTEM

NES will not allow any connected Distributed Generation (DG) without first investigating the operation and safety concerns. The limits for the amount of DG allowed will be determined on a case-by-case basis.

NES requires a one year load study of the service or the customer must supply a load study of a like design from another utility. A minimum demand will also be set per customer. NES recommends that DG be allowed after review of a signed and stamped set of engineering plans that demonstrate compliance with the conditions outlined below.

Basic Parameters:

(a) DG cannot produce more than 25% of the total power being consumed measured in real time. This will also contain a minimum demand threshold.

(b) There must be a manual means of disconnect provided with access by NES field personnel.

(c) The minimum service size must be greater than 800 Amps.

(d) A current version of "Smart Inverter" must be used by the customer. The 75/25 rule would apply for load so the invertor output would not exceed 25% of the actual power being consumed. The inverters must be able to detect the status of the NES network protectors. 67% of the network protectors must be in service before the DG can operate.

The customer must provide 2-1 ½" conduits from the inverter to the vault to a NEMA 4X box with SEL-2505 remote I/O monitor with multi-mode fiber option. The customer shall also provide a communication cable from the inverter to the vault in one (1) of the 1 ½" conduits, and provide a pull-string in the other 1 ½" conduit.

(e) NES requires trip control if the DG is to interconnect with NES.

(f) The DG shall be connected to the Normal Service Poles of an open transition transfer switch. The Emergency Service Poles shall be connected to the utility power via a fused switch or circuit breaker in the customer's main switchboard. The automatic transfer switch shall be rated for the appropriate ampacity and AIC rating.

(g) The DG inverter shall be an UL1741 / IEEE 1547 Island type inverter which does not require a utility feed to operate.

APPENDIX A: GLOSSARY

Approved. Acceptable to the authority having jurisdiction.

Building. A *structure* that stands alone or that is cut off from adjoining *structures* by four-hour separation.

Cable. An insulated conductor suitable for carrying an electric current.

Collector Plate. A section of copper bus bar located in the NES *vault*, *manhole* or *handhole*, used as the connection point between NES facilities and the Customer's service. In the case of a ***grid*** network service, the collector plate is used to connect the Customer to the NES secondary grid. In the case of a spot network service, the collector plate is used to parallel multiple network transformers with the Customer's service.

Conduit. A *structure* containing one or more *duct.*

Conduit System. Any combination of *duct*, *conduit*, *conduits*, *manholes*, *handholes*, and/or *vaults* joined to form an integrated whole.

Duct. A single enclosed raceway for conductors or *cables*.

Electric Supply Equipment. *Equipment* that produces, modifies, regulates, controls, or safeguards a supply of electric energy.

Electric Supply Lines. Those wires, conductors, and cables used to transmit electric or light energy and their necessary supporting or containing *structures, equipment,* and apparatus that are used to provide public or private electric supply or lighting service.

Equipment. A general term including fittings, devices, appliances, fixtures, apparatus, and similar terms used as a part of, or in connection with, an electrical installation.

Handhole. An enclosure for use in underground systems, provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating, or maintaining *equipment* or wiring or both.

Manhole. A subsurface enclosure that personnel may enter used for the purpose of installing, operating, and maintaining submersible *equipment* and *cable*.

Service Entrance. The conductors and *equipment* for delivering electric energy from the serving utility to the wiring system of the premises served.

Service Entrance Cable. The service conductors between the terminals of the *service equipment* and the *service point.*

Service Equipment. The necessary *equipment*, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a *building* or other *structure*, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.

Service Equipment Ampacity. The sum total current-carrying capacity, expressed in amperes, of all *service equipment* for a *service point.* If fuses are used in the *service equipment*, the current-carrying capacity shall be based on the rating of the switchgear, not the fuses.

Service Point. The point of connection between the facilities of the serving utility and the premises wiring.

Structure. That which is built or constructed.

Vault. A structurally solid, isolated enclosure consisting of fire-resistant walls, ceiling and floor, above or below ground, where entry is limited to personnel qualified to install, maintain, operate, or inspect the *equipment* or *cable* enclosed. The enclosure may have openings for ventilation, personnel access, cable entrance, and other openings required for operation of *equipment* in the *vault.*

Wet Location. Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

DOWNTOWN UNDERGROUND NETWORK SECONDARY SERVICES GUIDELINES

APPENDIX B: REVISION HISTORY

REVISION DATE	REVISION HISTORY	APPROVALS	DEPARTMENT	INITIALS	DATE
Sept 9, 2016	Added 12.0	Originated by Network Group	Reviewed by Departments with Input	Signed off after review	
		Matt Thomas	CE Standards	MD	9/22/16
		Ronald Reasonover	CE Network	RR	9/22/16
		Ron Davidson	CE Network	RD	9/23/16
		Nick Thompson	CE Manager	NT	10/3/16
		Don Hill	V.P. Engineering	DH	10/7/16
May 1, 2015	Update Paragraphs: 3.1.5: Appendix-Glossary	Originated by Network Group	Reviewed by Departments with Input	Signed off after review	
		Jon Sipes	CE Network	JS	4/28/15
		Ronald Reasonover	CE Network	RR	4/28/15
		Ron Davidson	CE Network	RD	4/28/15
		Nick Thompson	CE Manager	NT	5/12/15
		Wes Allen	V.P. Engineering	WA	5/18/15
March 5, 2007	Original Issue. Guidelines specific in Network Area	Originated by Network Group	Reviewed by Departments with Input	Signed off after review	
		Sally Dunn	CE Network	SD	2/23/07
		Jeremy Hitchcock	CE Network	JH	2/23/07
		Ron Davidson	CE Network	RD	2/23/07
		Bob Simpkins	C&M	BS	2/23/07
		Chuck Reinitz	C&M	CR	2/23/07
		Frank Spickler	C&M	FS	2/23/07
		Dwight Tidwell	Energy Services	DT	2/24/07
		Jim Purcell	Energy Services	JP	2/24/07
		Nick Thompson	CE Manager	NT	2/25/07
		Paul Allen	V.P. Engineering	PA	3/5/07