WEBINAR

Wiring for Canadian Homes - Part 1

February 21, 2023

By: Wissam Geahchan, Applications Engineer

Nexans
ELECTRIFY THE FUTURE

ATTENTION

AUDIENCE PARTICIPATION

- Questions can be asked at any time using the chat function on the webinar screen
- Any unanswered questions will be followed up through email
- This presentation, a recording of the webinar and a brief survey will be emailed to all registrants

Nexans
ELECTRIFY THE FUTURE

ABOUT ME

Wissam Geahchan

Applications Engineer, Nexans

- Active member on several industry standards committees
- Experience applying the Canadian Electrical Code in a variety of applications
- Licensed soccer coach

Nexans
ELECTRIFY THE FUTURE

Nexans is a global leader with a long legacy in Canada

Weyburn, SK

Fergus, ON

Montreal, QC

1911 canada wire®

Started with Canada Wire in Toronto, ON

3 Plants

750+ Products

- Residential, Commercial, Industrial & Utility
- Copper Rod & Wire

MADE IN CANADA / FABRIQUÉ AU CANADA

ONTARIO MADE / FABRIQUÉ EN ONTARIO

Nexans
ELECTRIFY THE FUTURE

Agenda

Introduction
Part 1 - *Today*

- Service Installations
- Panel and Service Size
- Branch Circuits

Part 2 -

- Receptacles
- Lighting

Part 3 -

- Smoke Alarms and CO Detectors
- Major Appliances & Electrical Equip.

Summary
Q&A

Preface: Nexans Products

Residential

For single and multi-family dwelling units, Nexans manufactures high quality, reliable and innovative solutions that provide ease of installation and increased durability and safety when installed in residential structures.

Nexans - Residential

RESIDENTIAL

SUPERVEX® NMWU

RESIDENTIAL

CANADEX® NMD90 Copper

RESIDENTIAL

CANADEX® NMD90 Aluminum

RESIDENTIAL

HEATEX® NMD90

Preface: Nexans Products (2)

Utility – Transmission & Distribution

Nexans manufactures a complete line of utility wire and cable for power transmission, distribution and service entrance from the generating station to the residential, commercial or industrial installation.

Nexans - Utility – Transmission & Distribution

UTILITY – TRANSMISSION & DISTRIBUTION

NS75 & NS90

UTILITY – TRANSMISSION & DISTRIBUTION

USEI90

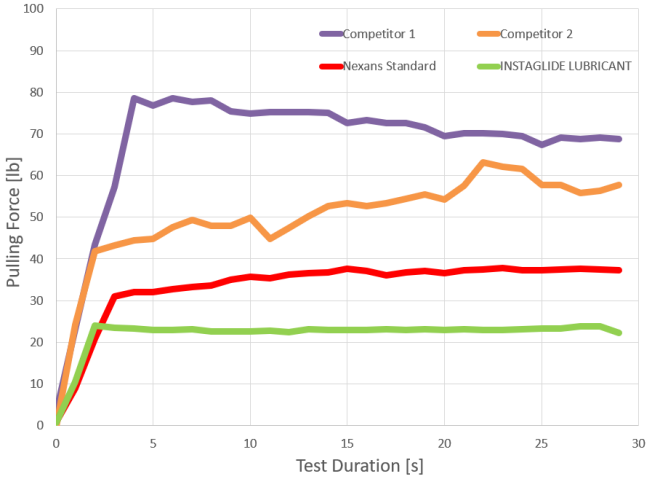
UTILITY – TRANSMISSION & DISTRIBUTION

USEI75

UTILITY – TRANSMISSION & DISTRIBUTION

USEB90

CANADEX® 2.0 NMD90



Instaglide lubricant

Easy-lifting handle

Metre markings

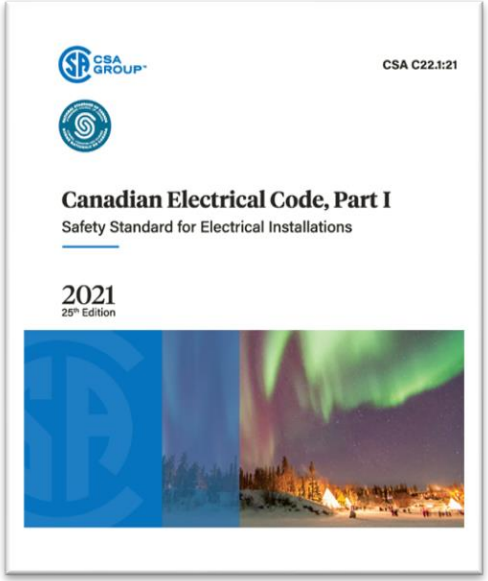
Nexans
ELECTRIFY THE FUTURE

Introduction

This presentation is meant to be a practical guide to the residential requirements of the CSA Canadian Electrical Code (the “Code”) in order to:

- understand the electrical requirements of home wiring products
- assist home buyers/sellers in determining whether a house is up to Code
- provide electricians with an understanding of the Code for residential projects
- help real estate professionals/property managers quickly assess the wiring status of a residential property

NOTE - This presentation is NOT a substitute for the Canadian Electrical Code, municipal, provincial, or territorial requirements, nor of the expertise of licensed electrical contractors, certified electricians, and inspection authorities.



Nexans
ELECTRIFY THE FUTURE


SAMSUNG

Service Installations

Basic Requirements for Service Installations

The “supply authority” supplies electrical energy through conductors that run from the supply authority’s mains to a consumer’s service.

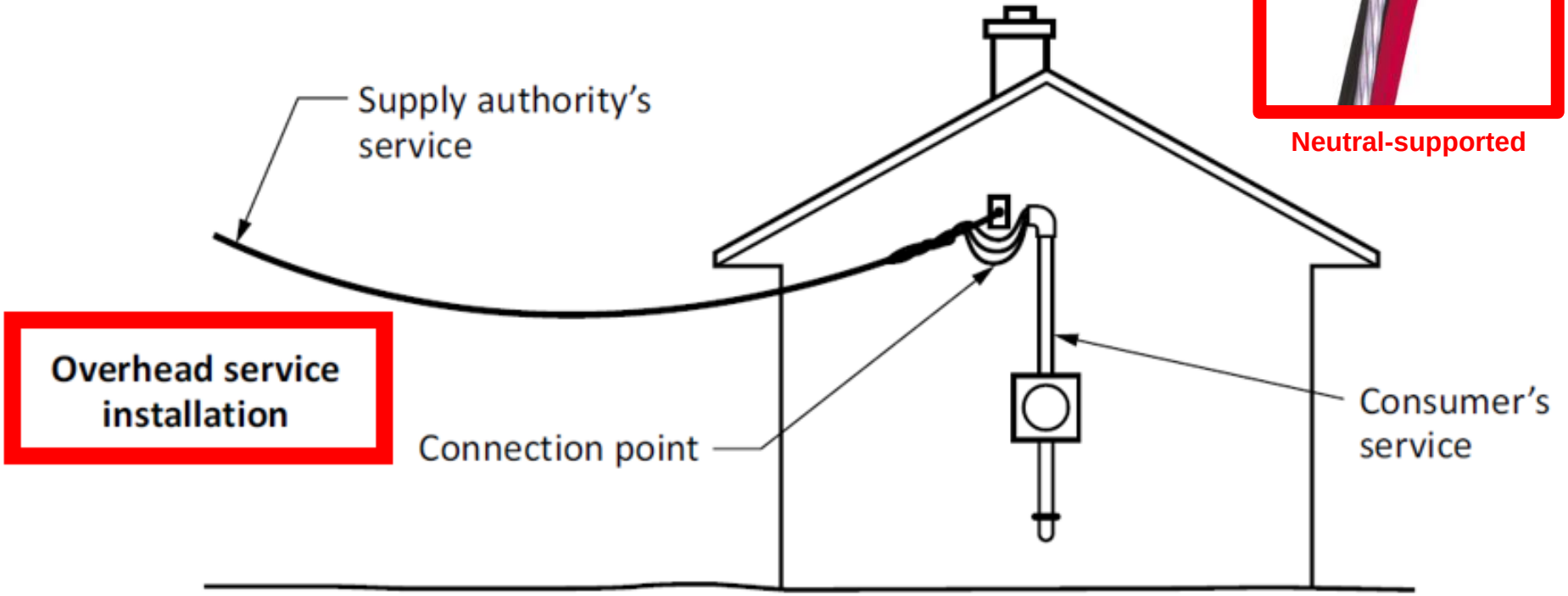
The “consumer’s service” refers to the portion of the consumer’s installation between the supply authority connection and the service disconnect inside the building where the consumer’s service conductors terminate.

To prevent accidental contact, the supply service is located either overhead or underground.

Service Installations (2)

Electrical service connection/demarcation points - <u>OVERHEAD</u>

Neutral-supported

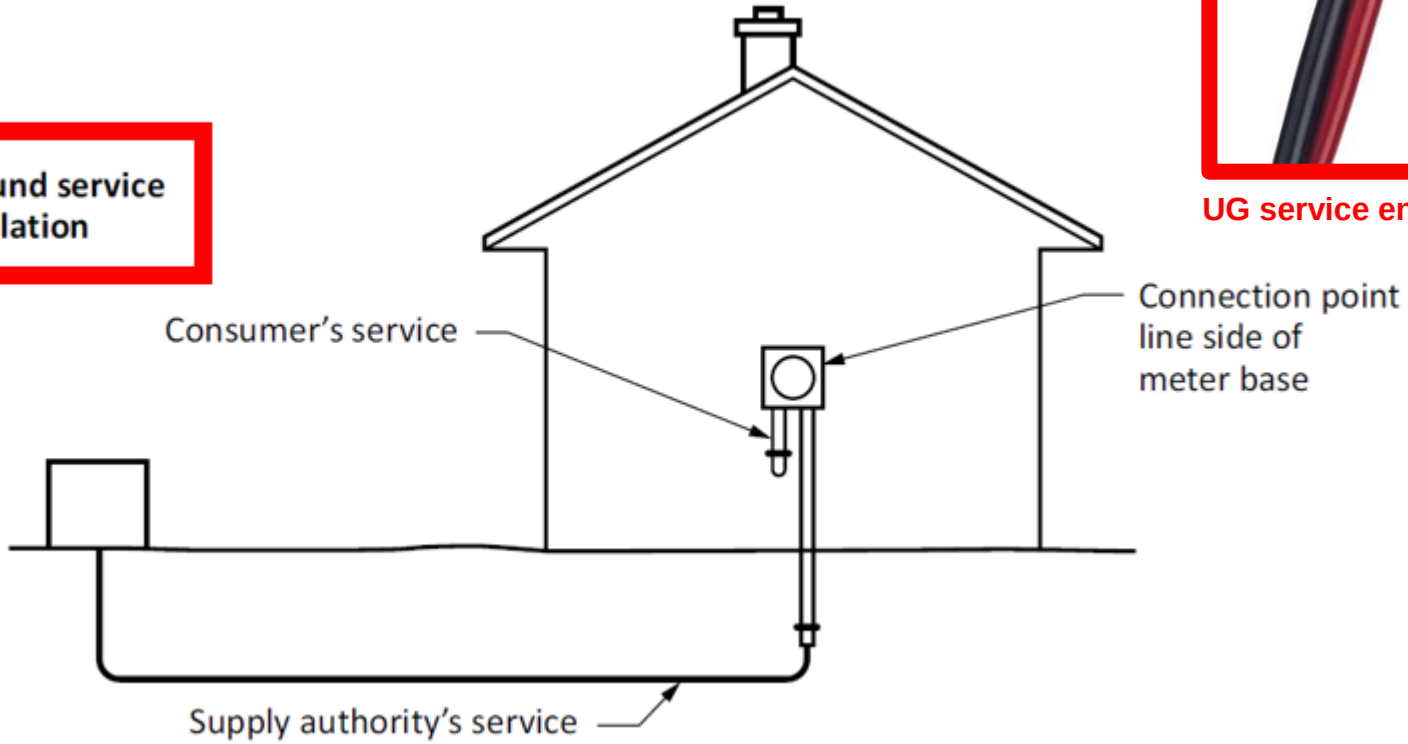


Service Installations (3)

Electrical service connection/demarcation points - <u>UNDERGROUND</u>

UG service entrance

Underground service installation



Service Installations (4)

The following checklist summarizes the steps in the process and the key information that will be required.

Step 1: Determine the size of service the dwelling will require

Step 2: Arrange a meeting with a representative from the customer service department of the supply authority that will provide the electrical energy to the dwelling.

For this meeting, assemble:

- Information and calculations related to the planned service size;
- A site plan of the dwelling;
- A set of architectural drawings for the dwelling; and
- Any other information the supply authority requests

Service Installations (5)

Step 3: In consultation with the supply authority's representative, determine the following:

- The location of the service meter at the dwelling;
- The type of meter base into which the supply authority will install its meter;
- The size of meter base, in amperes;
- The mounting height of the meter base;
- **For an *OH service*:**
  - The location of the point of connection (rack)
  - The type of insulated rack;
  - The required number of insulators;
  - The mounting height of the rack;
  - The routing of overhead supply service conductors; and
  - Any costs that the customer must pay

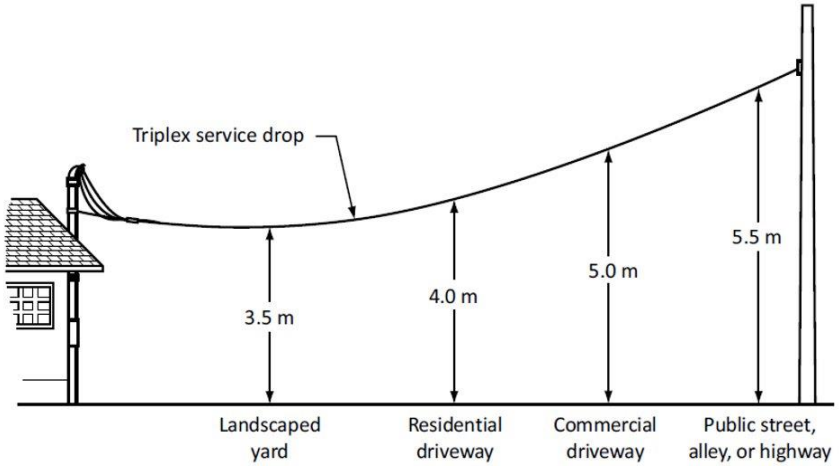
Service Installations (6)

- **For an *UG service*:**
  - The routing of the underground trench from the meter on the dwelling to the connection point of the supply authority's underground conductors.
  - The depth of the trench
  - The method of installing underground conductors – direct burial or raceway (sealed channels). If direct burial, the type of conductors or cable that must be used;
  - For an underground raceway:
    - The type of raceway
    - Who will supply and install the underground conductors;
    - Whether a wire or rope will be required for the supply authority's installation of the conductors;
  - The length of the underground conductors to be left for termination by the supply authority
  - Any costs to the customer

Service Installations (7)

What are the requirements for OVERHEAD SUPPLY SERVICES?

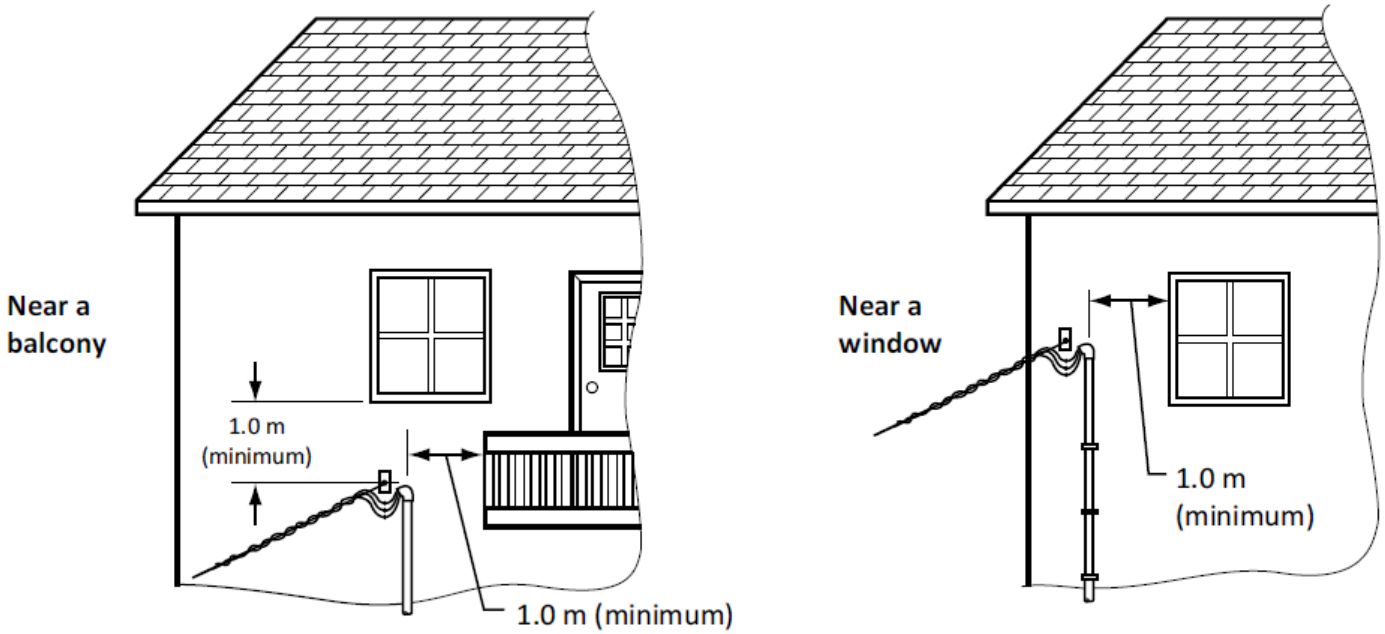
An overhead service installation puts the supply service conductors out of people's way by installing them a minimum distance above the finished ground level.



Nexans
ELECTRIFY THE FUTURE

Service Installations (8)

Exposed service conductor clearances

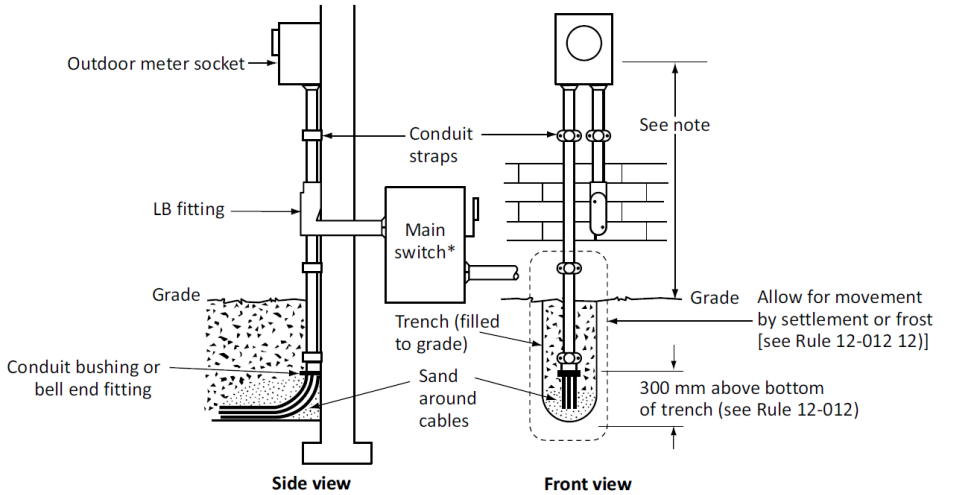


Nexans
ELECTRIFY THE FUTURE

Service Installations (9)

What are the requirements for UNDERGROUND SUPPLY SERVICES?

The service conductors are buried to protect people and machinery from accidental contact with them.



**The main switch may be a combination panelboard.*

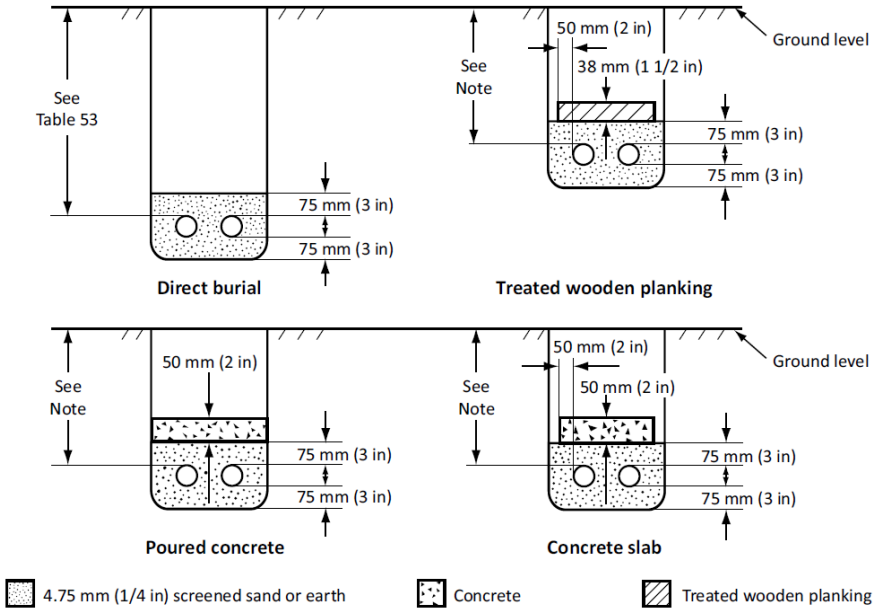
Note: *The meter mounting height is to be determined by the supply authority and the* National Building Code of Canada.

Typical underground residential service

Nexans
ELECTRIFY THE FUTURE

Service Installations (10)

Minimum cover requirements for direct buried cables or insulated conductors in raceways



Note: *Table 53 requirements may be reduced by* 150 mm *(6 in) where mechanical protection is placed over the installation as per Rule 12-012 2).*

Wiring method	Minimum cover, mm			
	Non-vehicular areas		Vehicular areas	
	750 V or less	Over 750 V	750 V or less	Over 750 V
Cable not having a metal sheath or armour	600	750	900	1000
Cable having a metal sheath or armour	450	750	600	1000
Raceway	450	750	600	1000

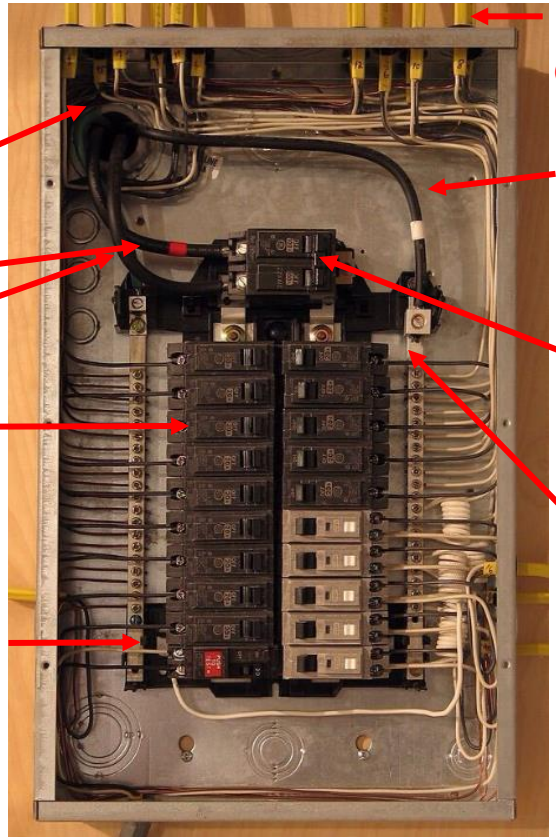
Note: *Minimum cover means the distance between the top surface of the conductor, cable, or raceway and the finished grade.*

Table 53 (CEC)

Nexans
ELECTRIFY THE FUTURE

Panel and Service Size

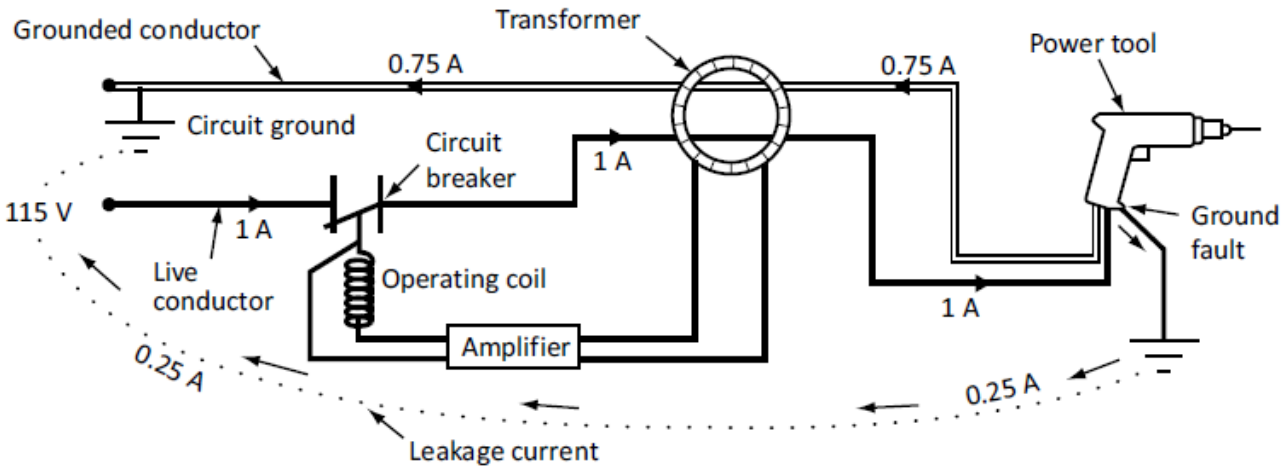
A **panel** regulates the amount of load on the dwelling's branch circuits by means of circuit breakers contained in the panel exposure.



Nexans
ELECTRIFY THE FUTURE

Panel and Service Size (2)

Some circuits are provided with electrical equipment that will sense the presence of a ground fault and cause the faulted circuit to be de-energized. AKA - **Ground fault circuit interrupter (GFCI).**

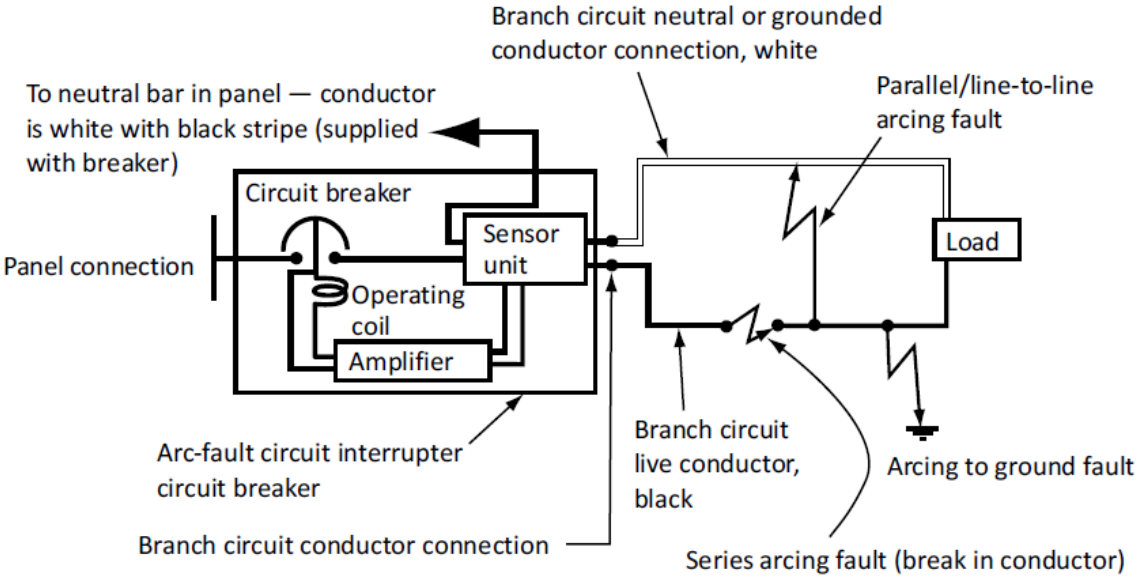


The **GFCI** measures the current flowing into the circuit and compares it to the current flowing out of the circuit. The most common GFCI (Class A) trips and de-energizes the circuit when it detects a leakage current of 4 to 6 mA.

Nexans
ELECTRIFY THE FUTURE

Panel and Service Size (3)

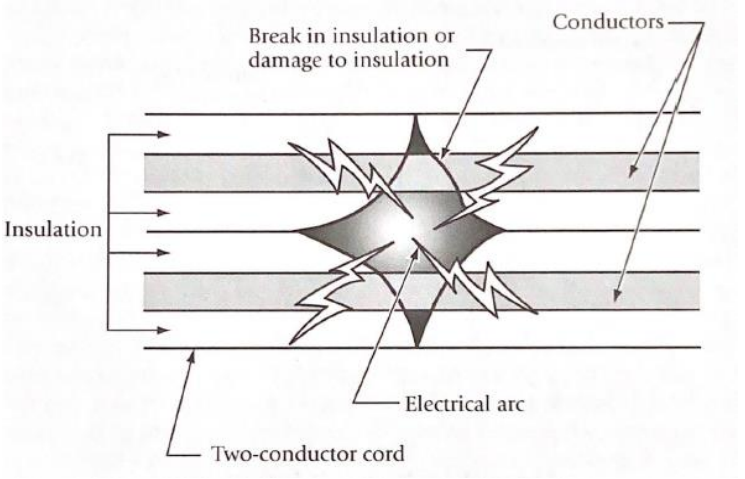
In other circuits, the overcurrent device may be supplemented by electrical equipment that will sense the presence of electrical arcs.



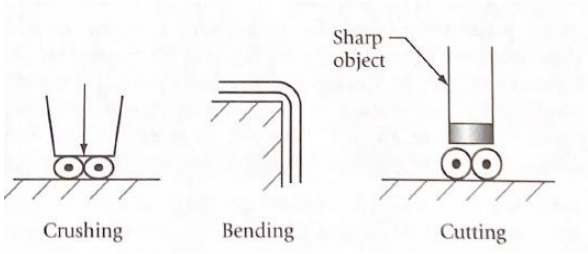
An **arc fault circuit interrupter (AFCI)** recognizes the current or voltage characteristics associated with electrical arcs and trips to de-energize the circuit.

Nexans
ELECTRIFY THE FUTURE

Panel and Service Size (4)



Examples of series (low level) and parallel (high level) arc faults.



Possible causes for insulation damage:

Nexans
ELECTRIFY THE FUTURE

Panel and Service Size (5)

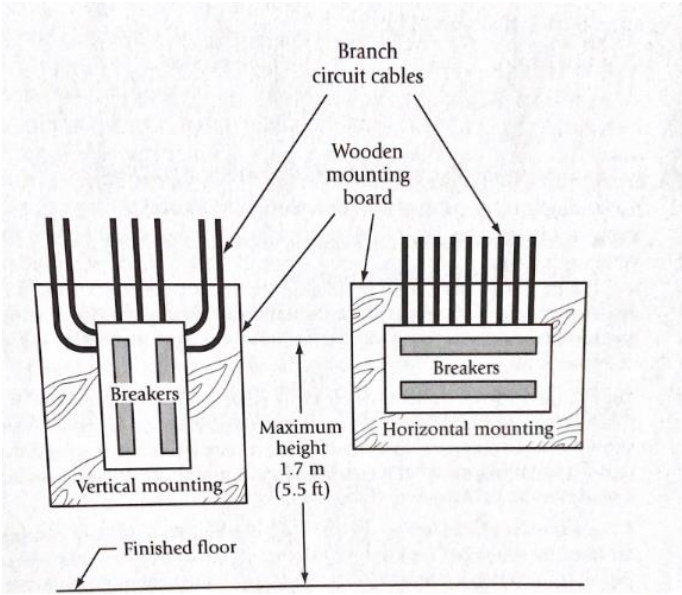
General Requirements

With a few exceptions, each individual dwelling unit should be supplied with its own panel.

In Canada, a panel must be tested and certified to CSA standards. A CSA certification mark indicates that the equipment has passed rigorous tests for safety and reliability.

Panels must also be properly grounded.

Panels should be located in areas where they will not be subject to damage or abuse, so they are usually installed out of the way of everyday household activities.



Panel and Service Size (6)

Overcurrent Protection

The panel itself is provided with overcurrent protection, either as an integral part or as a separate overcurrent device on the supply side of the panel.

The rating of the panel and number of branch circuit positions are determined by the loads that the overcurrent devices installed in the panel are expected to supply. The loads to be supplied, in turn, depend on the number and intended use of the branch circuits.

A panel typically supplies a combination of lighting, heating, appliance, and receptable branch circuits. It may also supply motor circuits and feeder circuits (to smaller panels).

Panel and Service Size (7)

Branch Circuit Positions

Panelboards installed in single dwellings shall, at the time of the original installation, have at least four additional spaces for future overcurrent devices with provision for a two-pole device.

This makes it possible to provide proper protection for the conductors that feed additional panels and makes it unnecessary to try to connect two conductors in a lug that is not designed and tested for that purpose.

When expanding the electrical service, it is good practice not to use a spare position in a panel to add an individual circuit, but to use it to feed a small panel.

Panel and Service Size (8)

Service Size

Size of service refers to the maximum amount of electricity, measured in amperes (A), that a panel and its overcurrent devices can supply to residential circuits.

It is determined by a dwelling's area and electrical demand, measured in watts (W), of the dwelling's electrical circuits and equipment.

Most new homes have a 100 or 200 A service, and larger services are often installed in anticipation of higher demands for power, such as EV charging stations.

Panel and Service Size (9)

How is the size of service calculated for a single dwelling?

To calculate the size of a new service, or to assess the adequacy of an existing service, you need the following information:

- Area of the ground floor (m^2);
- Area of any living area above the ground floor used for living purposes (m^2);
- Area below the ground floor (m^2);
- Total of any electric space-heating and air conditioning loads (W);
- Size of any electric range or stove loads (W);
- Size of any electric tankless water heaters or electric water heaters for streamers and swimming pools etc.. (W);
- Size of any electric vehicle supply equipment loads (W);
- Size of any loads provided for that have a rating in excess of 1500 W (W).

Panel and Service Size (10)

For **SINGLE DWELLINGS**, the calculated load for the supply service / feeder shall be based on the greater of a) or b):*

a. _
   i. a basic load of 5000 W for the first 90 m^2 of living area; plus
   ii. an additional 1000 W for each additional 90 m^2 or portion thereof in excess of 90 m^2; plus
   iii. any electric space-heating or air-conditioning loads (100% demand factor); plus
   iv. any electric range load provided for as follows: 6000 W for a single range plus 40% of any amount by which the rating of the range exceeds 12 kW; plus
   v. any electric tankless water heaters or electric water heaters for steamers, swimming pools, hot tubs, or spas (100% demand factor); plus
   vi. any electric vehicle supply equipment loads (100% demand factor); plus
   vii. any loads provided for that have a rating in excess of 1500 W, in addition to those in items outlines in i) to vi), at:
      i. 25% of the rating of each load, if an electric range has been provided for; or
      ii. 100% of the combined load up to 6000 W, plus 25% of the combined load that exceeds 6000 W, if an electric range has not been provided for; or

b. _
   i. 24 000 W where the floor area, exclusive of the basement floor area, is 80 m^2 or more; or
   ii. 14 400 W where the floor area, exclusive of the basement floor are, is less than 80 m^2.

*subject to some additional rules in the Code.

Nexans
ELECTRIFY THE FUTURE

Branch Circuits

What kind of branch circuits are found in residential installations?

Typically, the panel distributes electrical power through four kinds of circuits:

1. General-purpose circuits;
2. Multi-wire (or split) circuits;
3. 20 A T-slot receptable circuits; and
4. Feeder circuits.

Nexans
ELECTRIFY THE FUTURE

Branch Circuits (2)

1. What is a general-purpose circuit?

A **general-purpose circuit** is a **two-wire** branch circuit that supplies current to a number of outlets that are **rated 1 A or less**.

Although the code allows a maximum of 12 outlets on any one general-purpose circuit, it is often prudent to have fewer outlets, and if necessary, more circuits, so as to reduce the likelihood of accidental overloads and nuisance tripping of the fuse or circuit breaker protecting the circuit.

For example, the receptable that is required next to the sink in a bathroom might be used for appliances like hair dryers or curling irons, which draw relatively high current.

Branch Circuits (3)

2. What is a multi-wire (split) circuit?

A **multi-wire circuit**, or **split circuit**, is a **three-conductor circuit** consisting of a **live (ungrounded) conductor** from each line and a **neutral** conductor. The three conductors are the same size.

In this type of circuit, the neutral conductor carries the unbalanced load, which is the difference between the loads on the two conductors. In a general-purpose, two conductor branch circuit, the line and the neutral conductors both carry the same load.

Multi-wire circuits are commonly installed to supply areas where two appliances or devices that have high ratings (usually 1000W or higher) are to be connected to the same outlet box or plugged into the same receptacle.

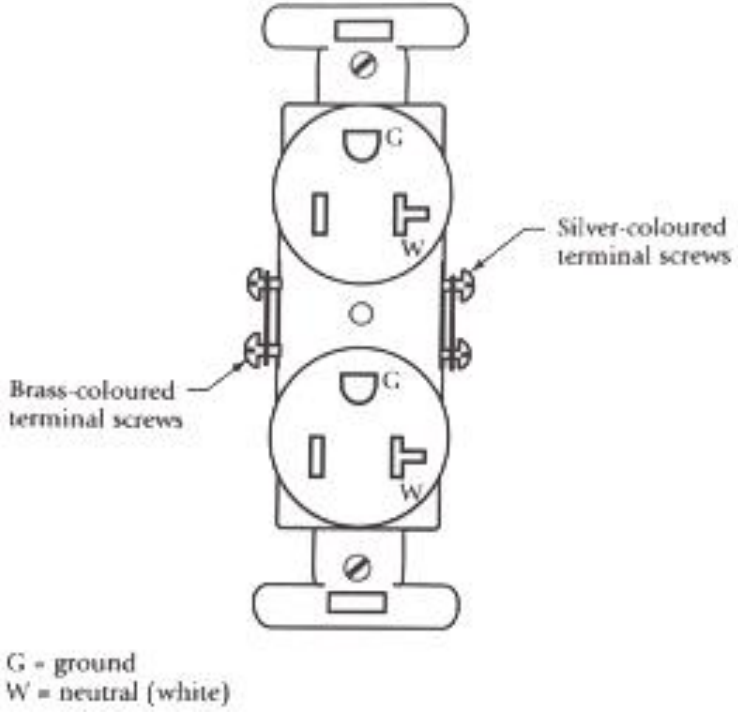
Branch Circuits (4)

3. What are 20 A T-slot receptacle circuits?

The **20 A T-slot receptacle** gets its name from the shape of the slots for the neutral blades of a portable make cord/plug cap. The shape of the slot for the neutral connection is the capital letter “T” on its side.

Used to supply high wattage portable appliances, such as kitchen appliances, central vacuum units, etc.

The minimum conductor size is # 12 AWG, and the circuit must have an ampacity rating of 20 A and be protected by a 20A maximum overcurrent device.



Branch Circuits (5)

4. What is a feeder circuit?

A feeder circuit runs from the main service equipment to supply another, usually smaller panel that contains overcurrent devices. Feeders and secondary panels are usually used to supply loads in specific areas, such as detached garages, workshops, basements, second kitchens, granny suites, etc.

The conductor used to feed the panel must not have a lower rating than the overcurrent device itself, regardless of the rating of the panel.

For example, a panel rated for 200 A might be protected by a 100 A overcurrent device; in this case, the minimum ampacity of the conductor feeding the panel would have to be 100 A.

Branch Circuits (6)

The rating or setting of overcurrent devices shall not exceed the allowable ampacity of the conductors that they protect, with some exceptions described in the Code.

The rating of overcurrent protection shall not exceed:

a. 15 A for No. 14 AWG copper conductors
b. 20 A for No. 12 AWG copper conductors
c. 30 A for No. 10 AWG copper conductors
d. 15 A for No. 12 AWG aluminum conductors
e. 25 A for No. 10 AWG aluminum conductors

Conductor size, AWG	Allowable ampacity @ 60C, Copper, A	Allowable ampacity @ 60C, Aluminum, A
14	15	-
12	20	15
10	30	25
8	40	35
6	55	40
4	70	55
3	85	65
2	95	75
1	110	85
0	125	100
00	145	115
000	165	130
0000	195	150

Key Takeaways

Today, we learned about:

- requirements and considerations for Service Installations from both supply and consumer perspectives;
- components and purpose of a Panel and the Service Size considerations;
- different types of Branch Circuits; and

In **Part 2**, we will discuss:

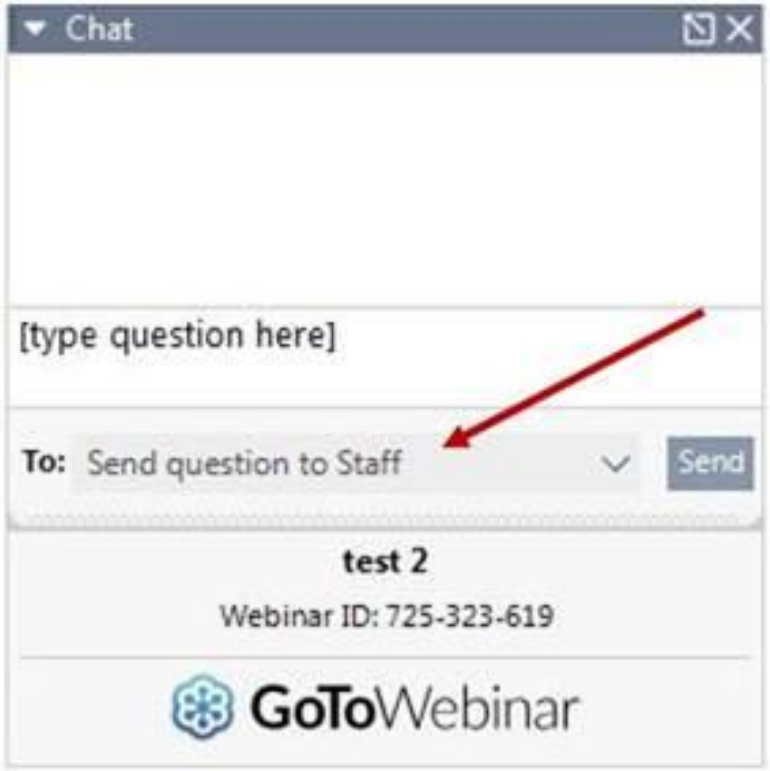
- requirements for Receptacles in various locations in a house
- requirements for Lighting in various locations in a house

In **Part 3**, we will discuss:

- requirements for Smoke Alarms and Carbon Monoxide Detectors
- more detailed wiring requirements for Major Appliances and Electrical Equipment

Nexans
ELECTRIFY THE FUTURE

Q & A


Chat
[type question here]
To: Send question to Staff
Send
test 2
Webinar ID: 725-323-619
GoToWebinar

Thank you for your attention!

Contact:

Wissam Geahchan
Applications Engineer, Nexans Canada
wissam.geahchan@nexans.com

www.nexans.ca

Nexans
ELECTRIFY THE FUTURE