ELECTRICAL SERVICE

Pillar To Post Continuing Education Program

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Table of Contents

Chapter 1

CHAPTER 1

Overview and Objectives

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Chapter 1

Overview and Objectives

Questions about the electrical service are common in the Real Estate industry. In this workbook we will explore the electrical service as it relates to real estate professionals in their day-to-day dealings with their clients.

This resource will also provide you with more insight into how the electrical service relates to a Realtor's risk management and liability concerns.

Learning Outcomes

This course covers simple techniques you can use to determine the electrical service size of a house. It also helps you understand the implications of service size.

This course will teach you:

- Basic terms and definitions
- A few techniques to determine service size
- The implications of service size and its relationship to electrical components

By the end of this session you should be able to:

- Define electrical terms
- Identify different electrical components
- Estimate the service size through first guess techniques
- Distinguish between service size and the individual ratings of each electrical component

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- Describe the implications of the difference between service size and the individual ratings of each electrical component
- Outline the process and implications of upgrading the service
- Offer your clients alternatives to upgrading their service

This knowledge will:

- Help you serve your clients better
- Help you answer your clients' questions
- Show your clients that you are a knowledgeable professional

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Chapter 2

CHAPTER 2

The Electrical Service Size – Size Matters

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Chapter 2

The Electrical Service Size – Size Matters

Why does Size Matter?

Service size refers to the amount of AC (alternating current) coming into a home 110-120/220-240 volts. Indirectly, the **service size indicates how many electrical appliances or fixtures can run at the same time.** For example, if you have an electric stove and electric clothes dryer, you may need a larger service size than if you have a gas stove and a gas clothes dryer.

Basically, every electrical appliance and fixture draws electrical power; for example, an electric stove element may draw 10 amps of current. A house with a larger service size will be able to run more things at the same time before tripping the main fuse or breaker.

Hence, service size indicates how much electrical power you can draw from the system at any one time. Another way of looking at it: how many lights, stoves, power tools and blow dryers can you have on at the same time before you trip the main fuse or main breaker?

Most of your clients will not understand the significance of service size. All they know is that the house they are looking at has a 100 amp service and their friend has 200 amps. These clients need to understand that the electricity that comes out of the plug is the same.

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Your Client May Ask: If I have a larger service size, will the electricity be stronger and I can run my appliances more easily?

Your Possible Answer: There is no difference in the electricity supplied to a home with a large service size and a home with a small service size. The electricity that comes out of the outlet is exactly the same. The only difference is how many different things can be run at the same time.

Your Client May Ask: If I have a high-power computer or stereo system do I need a larger service size?

Your Possible Answer: The truth is these appliances take very little power, even though they are advertised as "high power". On the other hand, electric stoves, electric clothes dryers and electric water heaters draw a lot of **power.** Electric heat also draws a lot of power.

Typical Draw for Some Major Appliances

Here is the typical current draws for a few major appliances:

An electric stove with the oven and a few stovetop elements running may draw 25 or 30 amps

An electric clothes dryer may draw 20 amps

A hair dryer may draw about 12 amps

A toaster draws approximately 10 amps

Central air conditioning draws around 15 to 20 amps, with start up draw as high as 40 amps.

A hot tub may draw 20 to 40 amps

An electric water heater may draw 20 amps

Possible Service Sizes for Some Typical Homes

Here is a look at the service size for a few typical houses:

3bdrm, 2story	Gas heat	100 amps
3bdrm, 2story	Electric heat	150-200 amps
5bdrm	Gas heat	150-200 amps
* 5000 sq-ft home	Gas heat	200 amps

* This is typical, but you might find it as high as 400 in unusual circumstances

.

Your Client May Ask: What's a typical service?

Your Possible Answer: It's a combination of the size of the home and the potential power demand, taking into

consideration if there is gas or electric heating. (refer to above) Older homes built before the introduction of modern appliances like microwaves, blow dryers, and central air conditioning were typically provided lower service size than newer homes.

The largest every-day service size you will most often see 200 amps (The size is usually as big as it gets, but most homes do not need even this amount)

The Largest residential service size you will likely see, but only in unusual circumstances, is 400 amps .(This size is unusual and may only be found in a very large home with lot of electrical appliances)

What About Upgrading?

Your Client May Ask: This is an older home – do I always need to upgrade?

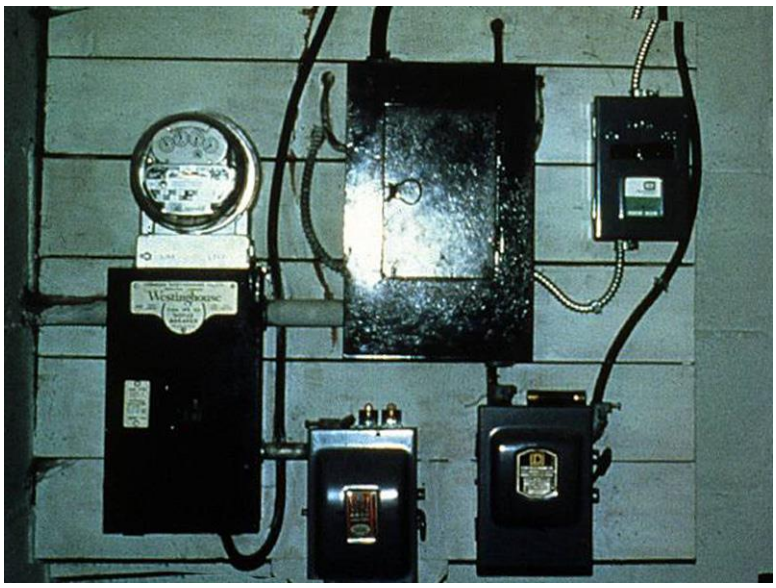
Your Possible Answer: When older homes were built, they did not anticipate needing so much electrical capacity. As a result, the electrical service size in older homes, that have not been upgraded, is smaller than if the home were built today. In most cases, this size is not an issue because there is usually plenty of power. If your service size is adequate, upgrading the service to higher amperage only lightens your wallet.

Sometimes the service size is just not adequate for the lifestyle of a modern household For example, a three bedroom home may have had a gas stove and oven, a gas water heater and gas clothes dryer. The service size may be 60 amps. The house is then renovated and the gas appliances replaced with electric; 60 amps is not adequate for the new appliances.

A Word about Insurance Companies

A 60 amp service is common in older homes and almost never used today. Insurance companies have taken 60 amps to be an indicator of an old electrical service. They think if the electrical system is old, it's more of a risk. Hence the perception: "60 amp service is dangerous".

In reality there is nothing dangerous about 60 amp service. All it means is that 60 amps is the maximum you can draw. Furthermore, there are situations where you can use 60 amp service even today on a small home. To say 60 amp service is dangerous is ridiculous. BUT - The fact remains that some insurance companies do not want to insure a home with 60 amp service.



Spotting an Older Electrical Service

This is an old electrical service. This system is just fine if as is but a modern family will find it quite limiting. There are probably very few plugs throughout the house. Even if this is working fine for your client, insurance companies may not want to insure it. This is a regional issue and may not apply in your area.

What's involved in an upgrade?

May involve removing and replacing:

- Service entrance cable and conduit
- Possibly the meter and meter base
- Service box
- Breaker or fuse panel

May involve relocating the system

- An upgrade has to comply with today's electrical code
- If today's code requires that the meter be located outside close to the front of the house, and your meter is inside or near the back of the house, you will have to move it
- This means moving the service box and breaker panel, too

Check Your Knowledge

Answer the questions below in the spaces provided

1. **What would you say to a client who wants to know what a typical service is?**

_____

_____

_____

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2. Why does the service size matter to your clients?

3. What would you say to a client who has a high-powered computer and/or stereo and is concerned about having to upgrade the service size to run these items?

4. Do most homes require a 200 amp service? Why or Why not?

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Chapter
3

CHAPTER 3
Understanding the Technical Stuff

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Chapter

3

Understanding the Technical Stuff – The Basics

The electrical system and plumbing system in a home are very different but have some interesting similarities. When you think about plumbing in a home, most of us can relate to the concept of water flowing into a home through a pipe that is under pressure. When you turn on a tap the water will flow out at a certain rate (gallons per minute). We commonly think of this as water pressure in a home.

Electricity also enters the home but this time through wires under pressure and this is called **voltage and is measured in volts.** When you turn on an electrical device the electricity will flow at a certain rate which refers to the **current, which is measured in amperes, or amps.** In our plumbing comparison, think of a geyser as high voltage, and the shower of a low-rent apartment on the fifth floor of a tenement building as low voltage.

Unlike water flowing out of a tap, electricity is intended to do work. Electricity is converted from energy to power and this is measured in **watts. 1 kilowatt = 1,000 watts** The total amount of electrical energy used on any period is measured in kilowatt-hours (kwh).

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The Components of the Electrical Service

Before determining the electrical service size of a house, you need to know about a few of the components that make up the electrical service.

The Service Entrance Cable

This cable brings electricity into your house. It often runs from a "mast", down the outside wall of the house inside a conduit. In newer areas, the cables run underground.

The Meter

The meter measures how much electrical energy you consume. The meter itself is the property of the utility. The base of the meter, or the socket that the meter sits in, is the property of the homeowner

The Conduit

The conduit is the pipe that the cables pass through. The conduit protects the cables from mechanical damage.

The Service Box

The service box contains the main fuses or breakers. In some cases, the service box is a separate item. In modern installations, the service box is combined with the main breaker panel (called a combination panel).

The Main Fuse or Breaker

The main fuse or breaker is the gatekeeper. If the main breaker is 100 amps, when you attempt to draw more than 100 amps, the breaker shuts off to protect the rest of the system from overheating.

The Distribution Panel

The distribution panel is either a fuse panel or a breaker panel. Today, breakers are used almost exclusively because they are more convenient.

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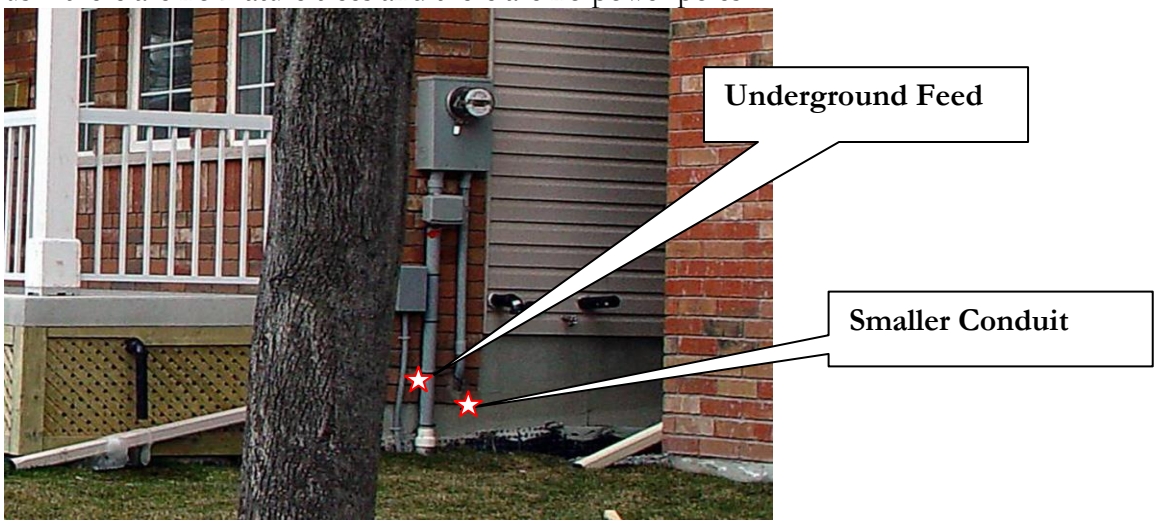
Spotting the Service Wires

Electricity is delivered into a neighborhood either by overhead wires or, in newer areas, through underground wiring.

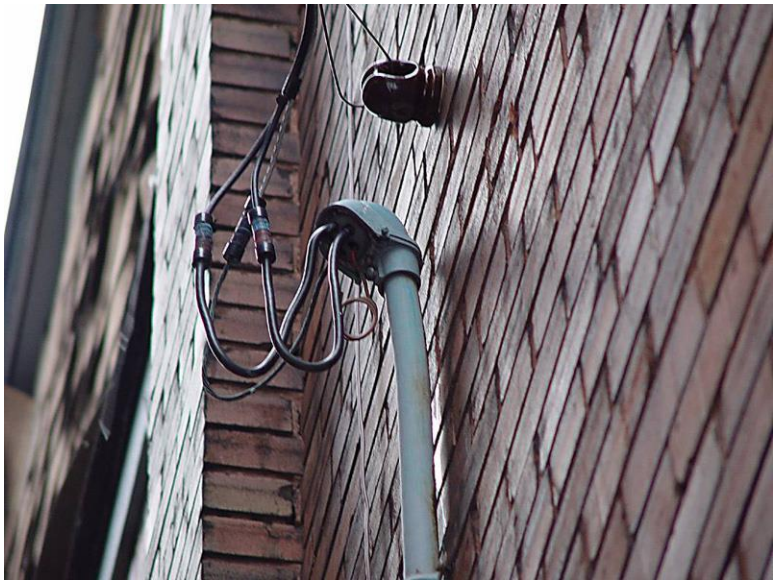
The image above shows a transformer and the overhead distribution wires that run along the street and into the houses. The overhead cables that feed electricity to the house are called the **"service drop"**

This image shows a newer area. Notice that there are no power poles or overhead wires. This is one of the reasons that new developments often look unfamiliar to us – there are no mature trees and there are no power poles.



This is the underground service to the house. The large conduit (pipe) on the left is the underground feed to the house. The smaller conduit on the right, feeds the electricity into the house. Underground cables that feed electricity to the house are called the **"service lateral"**

Spotting the Service Drop



At the top of the image we can see the "service drop". The service drop splices into the "service entrance". The service entrance is the set of cables inside the conduit

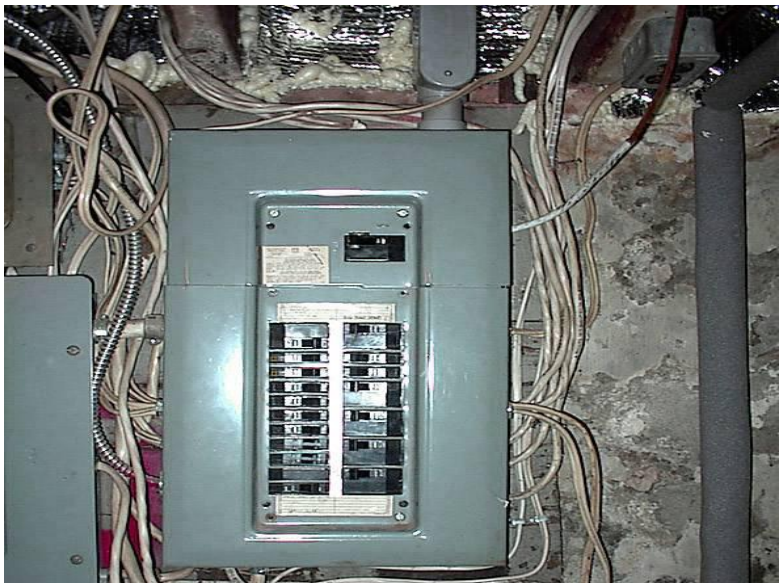
Spotting the Meter

This is the meter. The meter shows how much electrical energy has been consumed by the household. Usually the utility owns the meter.

Spotting the Service Box

The service box is where the main breakers or fuses are housed. In some homes, the service box is a separate box and, in some homes, it's part of the breaker panel

This is a service box with cover.



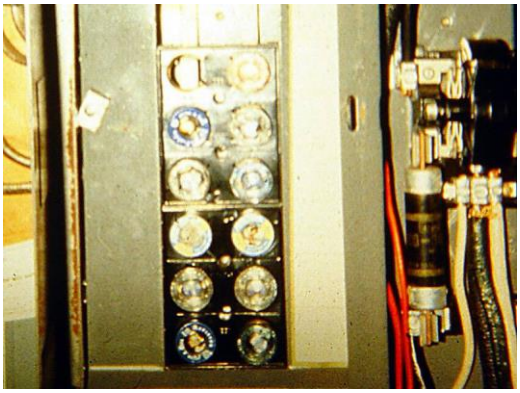
In this image the cover has been removed. This system has the service box in the same package as the distribution panel (or breaker panel). You can see the main breaker here.

The service box part of this "combination panel" is the part above the split. Most home inspectors don't open this part of the panel during a home inspection.

Spotting the Distribution Panel

The distribution panel is where the main electrical lines split to distribute electricity to all of the areas of the home

A Circuit Breaker Panel



A Fuse Box

The distribution panel may be a circuit breaker panel or a fuse panel ("fuse box")

Spotting the Distribution Wiring

This photo shows standard cable used to distribute electricity throughout the home. Some areas require all wiring to be enclosed in conduit (pipe).

This pictures shows some very old, "knob and tube" wiring in the foreground and newer cable in the background.

Check Your Knowledge

Answer the questions below in the spaces provided

1. **Overhead cables that feed electricity to the house is called the** _____

_____

2.  **This component is called the _____**

3. **Underground cables that feed electricity to the house is called the**

_____

4. **The distribution panel may be a circuit breaker panel or a fuse panel ("fuse box") Circle the correct answer below.**

True False

5..  **This component is called the _____**

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Chapter 4

CHAPTER 4
Determining the Service Size

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Chapter 4

Determining the Service Size

Determining service size can be tricky. There are a number of variables that can throw you off. Often, the determining factor is not visible. The bottom line here is that you should avoid quoting the service size in your listings, unless you indicate that it is the reported service size. Ask your attorney and/or broker how you should word it so that you don't get sued because you quoted service size in a listing description that turned out to be incorrect.

Better still, when you see how complicated it can be, you may decide not to add this information into the listing. Leave it to the home inspector!

We recommend that you exercise caution when determining service size. It is easy to get it wrong. Having said that, here is how you can approach it for the best results.

The Right Way to Determine Service Size – Step-by-Step

1. Identify the main fuse or breaker. Start with the assumption that this is the service size

2. Check that the service box and breaker panel are rated for at least this much

3. Check the meter and verify that it is rated for at least this much

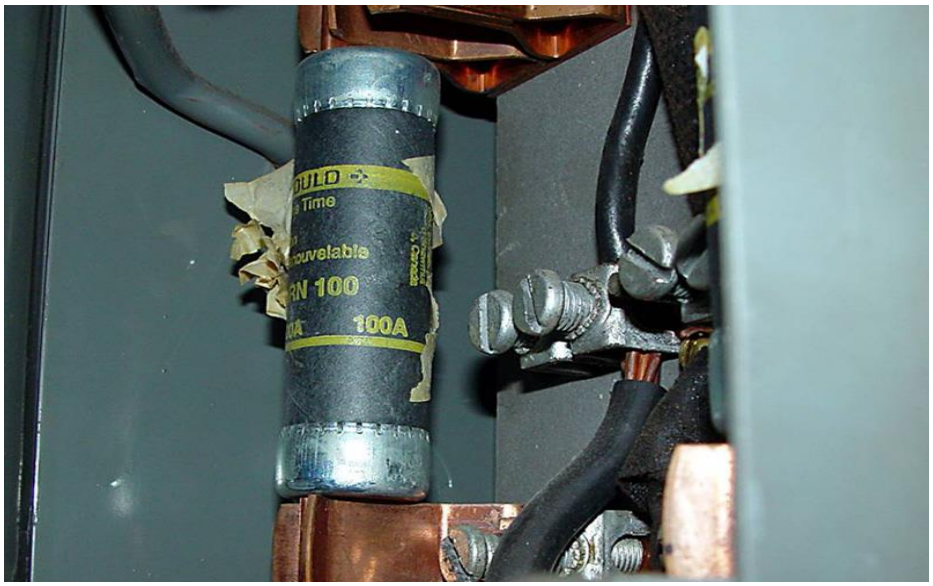
4. Check the size of the conduit

5. Check the size of the cable and verify that it is rated for at least this much. (This is the part that may not be possible for you. If you can't read the data on the cable because it is not accessible or it's faded, you have to rely on your experience recognizing cable sizes. (Unless you were an electrician in a former life, you may get this wrong.)

Caution! Avoid electrocution. Do not open any panel covers or doors. Some of our photographs show electrical boxes open with live components exposed. These photographs were done with the aid of an expert in electrical power. We do not suggest you open or touch any electrical equipment.

Guess #1 Based on the Service Size Rating of the Main Fuses or Main Breakers

Most of the time, you can nail down certain assumptions about the service size by the rating of the main breaker or fuse. Start with the assumption that this is the service size



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This photograph shows a main fuse in the service box.. There are two but you can only see one of them in this picture. It says 100 amps on this fuse. This is **most likely** a 100 amp service.

If we were to evaluate the service box above in more detail we would see that there are 2 fuses - each one of the fuses says 100 Amps. This indicates a 100 Amp service (as a first guess only)

Note that you do not add up the two fuses. This is not a 200 Amp service.

If the service box is combined with a breaker panel, the main shut off will be breakers as shown. The breaker says 100 amps. This is **most likely** a 100 amp service.

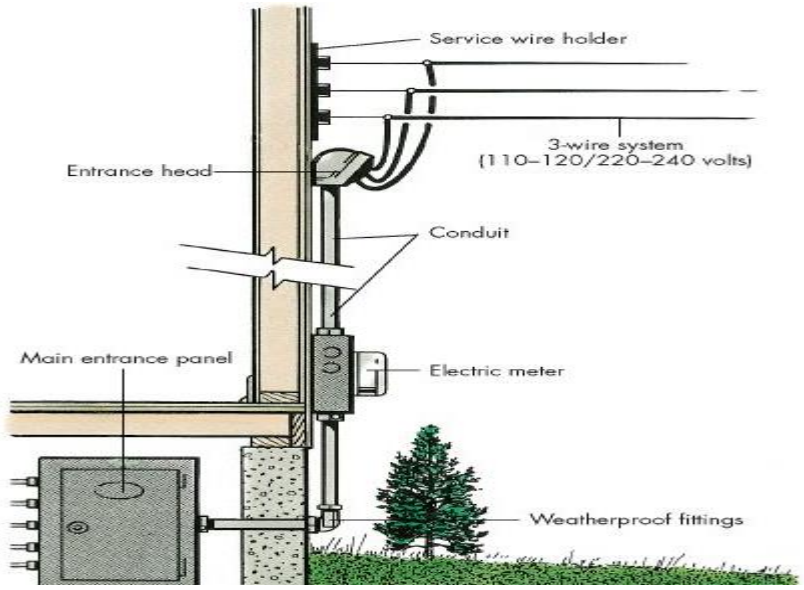
Consider the Smallest Component in the Chain

Although the first guess comes from the main breaker or fuse, it is possible to get it wrong. Here's why - the service size is determined from the rating of **the smallest component in a chain of components** that make up the electrical service.

You may be wondering why the components installed in the electrical system are different from one another. The reality is that "mistakes" are made all the time when the system is being repaired, replaced or upgraded by different individuals. If all the components were all installed correctly or renovated correctly, all of the components in the chain would be compatible. If all components in the chain are compatible, you would be correct all the time by reading the rating of the main fuse or breaker. Unfortunately, you probably have a 10% chance of being wrong using this method due to incompatible components.

The chain of components below must be examined to determine the smallest component:

- Main fuse or breaker.
- Service box
- Breaker
- Meter
- The size of the conduit



A Word about Compatibility

When you think about compatibility you might think of it as analogous to common light bulbs and fixtures within your home – a 60 watt bulb can be used in a lamp that is rated for a maximum of 150 watts. But if you try to put a 200 watt bulb into that lamp,

the lamp will overheat. The same is true when we examine the components of the electrical system to determine the service size.

The main service entrance cables are rated for the maximum current they can handle. This is called the cable rating. This is a critical component and it must be compatible with the main fuse or breaker.

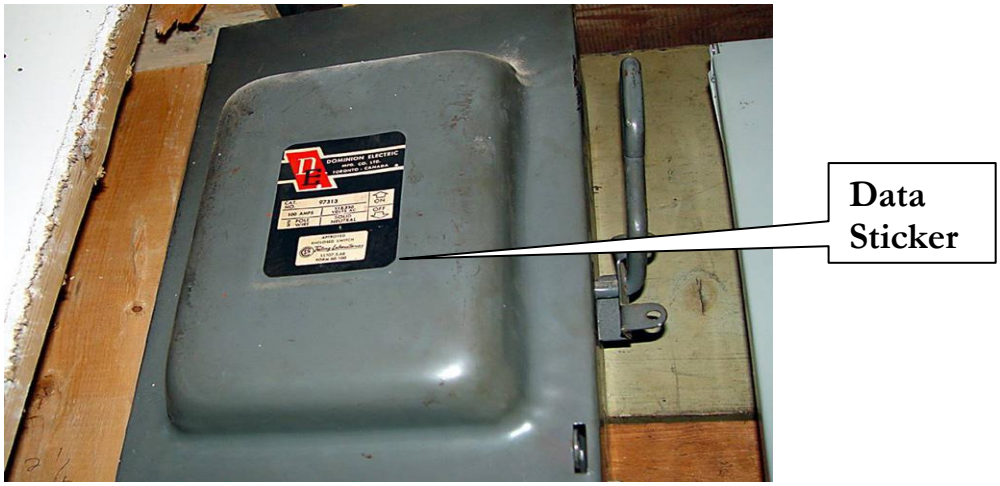
Again to determine the service size you must determine what is the smallest component. For example: the main fuses or main breaker may be the wrong size for the system. If the cable coming down the outside of the house is only rated for 60 amps, but the main breaker is 100 amps then the service size is 60 amps, not 100 amp

See some examples below to illustrate compatibility

Main Service Entrance	Main Breaker	Result
If the service entrance cable is rated for 60 amps	The main breaker is rated for 100 amps	**On the surface, this is improper. However many utilities allow this when factors in their system compensate. (ie, overhead lines cooled by surrounding air, reducing fire risk)**
If the service entrance cable is rated for 100 amps	The main breaker is rated for 200 amps	**Since it is possible for 200 amps to flow through a 100-amp cable, this situation presents a fire hazard.**
If the service entrance cable is rated for 200 amps	The main breaker is rated for 100 amps	**No problem exists The maximum that can be drawn through the cable before the breaker shuts off is 100 amps, but the cable can handle 200 amps.**

Ratings on the Service Box

The rating on the service box is the maximum service size that the box can be used on. It follows the same rule as the breaker panel.



This is the service box. There is a data sticker on the cover.

You can't be sure you have 100 amp service here

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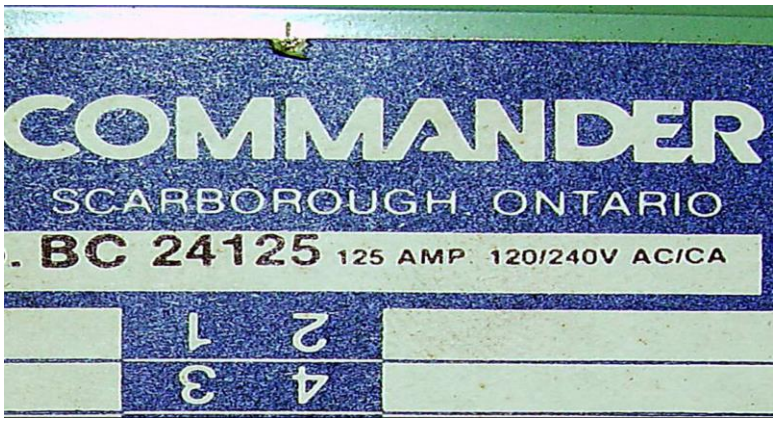
Ratings on the Breaker Panel

Breaker panels (and fuse panels) have a number marked on them indicating the maximum service size they can be used with

This is a standard breaker panel. You can see a data sticker on the left. From the data sticker you can determine what the breaker panel is rated for.



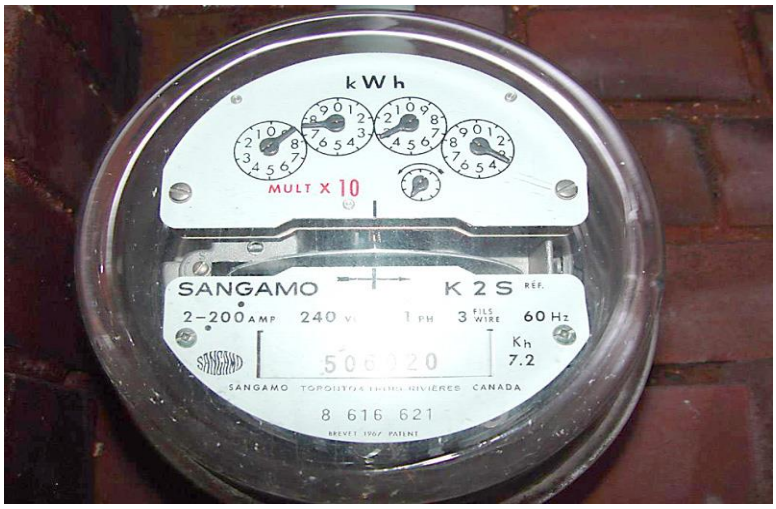
The rating here says 125 amps. This means the panel can be used for **up to** 125 amps.

You can't be sure you have 125 amp service here

Ratings on the Meter

The rating of the meter is the maximum service size it can be used with. It follows the same rule as the breaker panel and service box

This is the meter. The front of the meter has a data plate



In this view you see the data plate which states that this is rated for 200 amps

You can't be sure you have 200 amp service here

Size of Conduit on Outside of Home

Many people just look at the size of the conduit on the outside of the home and guess the service size. It is true that the conduit diameter indicates the rating for the conduit, but once again it's the **maximum rating.** It could be used for a smaller service size than it is rated for.

Cable Size (copper wire size - USA) Service Size Compatibility

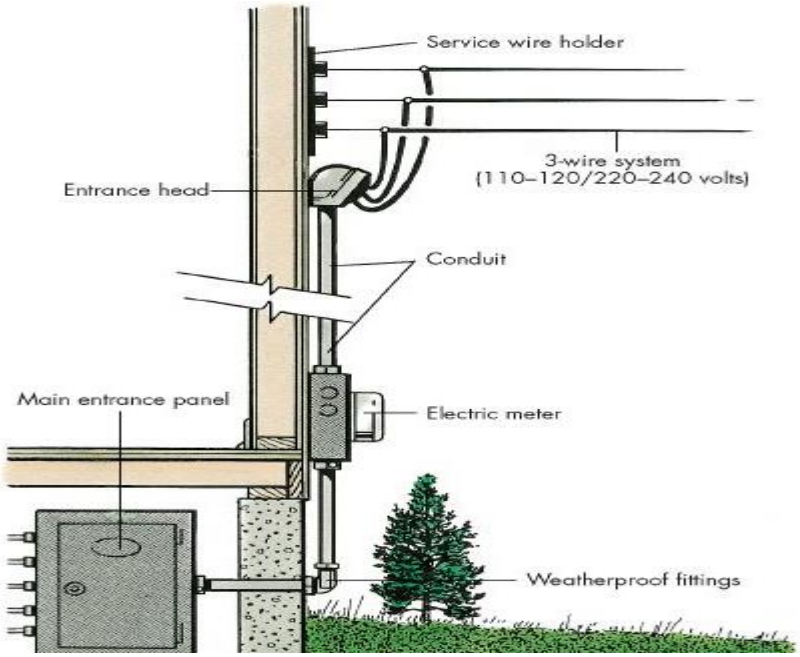
The cable size is a visual means of determining what the cable is rated for. Here is a chart of ratings of common service entrance cables.

#6 AWG; 60 amp service
#4 AWG; 100 amp service
#2 AWG; 125 amp service
#1 AWG; 150 amp service
#2/0 AWG; 200 amp service

Conduit rating

The diameter of the conduit is a tip off for service size.

60 amp service – 1 inch conduit minimum
100 amp service – 1 ¼ inch conduit minimum
200 amp service – 2 inch conduit minimum



How NOT to determine service size

One of the tricks to determining service size is not to be fooled by the ratings on the components of the service entrance. For example, if the electric meter is rated for 200 amps, this simply means that it can handle up to 200 amps. But there is no reason it cannot be used for a 100-amp service, so for efficiency the power companies purchase and install the most common safe component.

- Do not use the rating on the meter alone but make sure it is compatible
- Do not use the size of the conduit alone but make sure it is compatible
- Do not use the rating on the service box alone but make sure it is compatible
- Do not use the rating on the distribution panel alone but make sure it is compatible

In Conclusion

In conclusion, determining the service size is a tricky business and requires expertise. For this reason you are always best to consult an expert to assist you in making this determination.

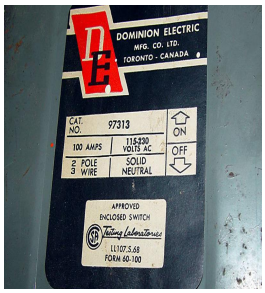
Check Your Knowledge

Answer the questions below in the spaces provided

1. 

This photograph shows a main fuse in the service box. It is a 100 amp fuse. Is it safe to assume that this home has a 100 amp service? Explain why or why not.

_____
_____
_____
_____
_____
_____

2. 

This data sticker is located on the service panel. What can a data sticker indicate? Is it a reliable means of determining the service size?

_____
_____
_____
_____
_____

3. If the service entrance cable is rated for 60 amps and the main breaker is rated for 100 amps – Is there a problem? Why or Why not?

_____
_____

4. If the service entrance cable is rated for 100 amps and the main breaker is rated for 200 amps - Is there a problem? Why or Why not?

_____
_____

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Chapter 5

CHAPTER 5
CEP Quiz

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CEP Quiz – Electrical Service Size Name_____

1. The name for the component from which distribution wiring branches out is called:

   _____

2. The name for the wires that run overhead to your house is:

   _____

3. True or False. Service size indicates how much electrical power you can draw from the system at any one time.

4. True or False. A house with a large service size has more electricity coming out of each individual outlet than a house with a smaller service size.

5. Do older homes tend to have larger or smaller electrical service sizes?

   _____

6. To an insurance company, a 60 amp service suggests what?

   _____

7. If the service entrance cable is rated for 60 amps, and the service box says 100 amps, what is the service size?

   _____

8. If the breaker panel is rated for 60 amps, but the main breaker is 100 amps what is your service size?

   _____

9. True or False. You can use a smaller size component, like a meter, for a larger service but not vice versa.

10. Give one way to upgrade a service without doing an expensive electrical upgrade.

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Chapter 6

CHAPTER 6

Presentation Evaluation

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Presentation Evaluation – Electrical Service

TECHNICAL CONTENT	Excellent	Average	Poor	No Opinion
Presenter's knowledge of subject matter	○	○	○	○
Ability to keep you interested	○	○	○	○
Discussion / overview / recap	○	○	○	○
How well did this course meet your expectations?	○	○	○	○

Comments:

_____

_____

ORAL PRESENTATION	Excellent	Average	Poor	No Opinion
Explanation of objectives	○	○	○	○
Voice (volume, clarity, speed)	○	○	○	○
Answers question clearly	○	○	○	○

Comments:

_____

_____

VISUAL PRESENTATION	Excellent	Average	Poor	No Opinion
Voice (volume, clarity, speed)	○	○	○	○
Answers question clearly	○	○	○	○
Effectiveness of visual aids	○	○	○	○
Presenter's eye contact	○	○	○	○

Comments:

_____

_____

MATERIAL HANDOUTS	Excellent	Average	Poor	No Opinion
Effectiveness of handouts	○	○	○	○

Comments:

_____

_____

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