5.0 Service Entrance Wires

FROM SERVICE DROP TO SERVICE EQUIPMENT

These are the wires that pick up where the **service drop** wires end. They extend down to the **service equipment** (**main disconnect, service panel, service box**). The electrical meter is often part way along the **service entrance wires**. The correct name for these wires is **service conductors.** Where these wires pass through a wall from outdoors to the service equipment, they are properly called (according to some authorities) the **service entrance conductors.**

THREE WIRES

The service conductors include a black and a red wire, which are hot (ungrounded), and a white wire, which is neutral (grounded).

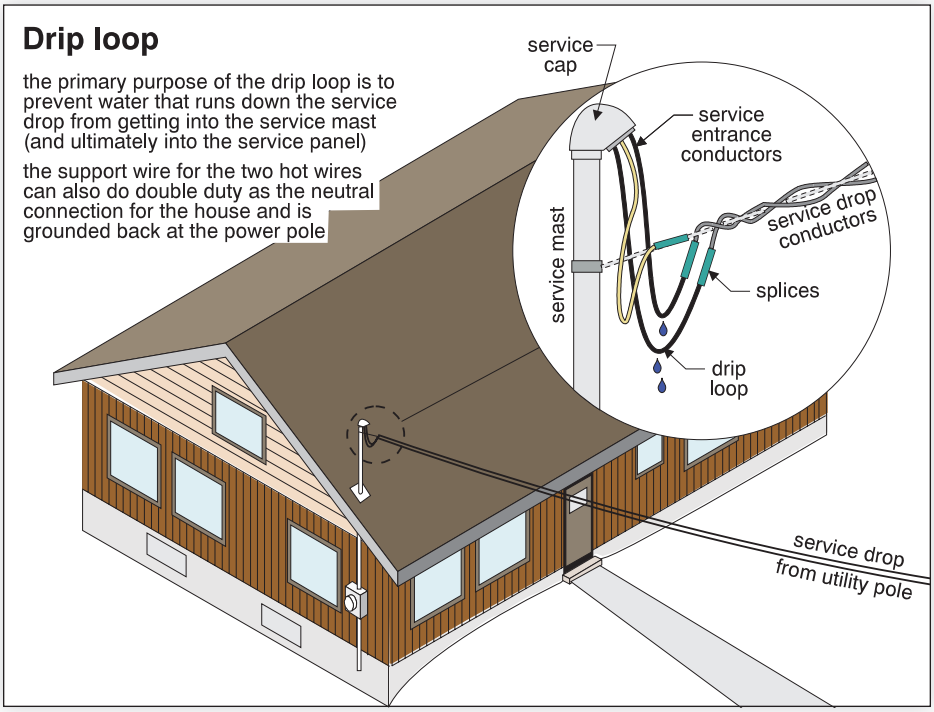
30 INCHES AT TOP

Many jurisdictions require the service entrance wires to extend at least 30 inches out of the **service cap** at the top of the conduit or masthead. This gives the utility enough room to make their connections and leave a drip loop.

DRIP LOOP

As we said earlier, the drip loop is simply a low point in the wires where water can drip off rather than run down inside the conduit or masthead and into the service box. A drip loop also shows that the service drop wires are supported properly and there is no tension on the splices between the service drop and service entrance wires.

A drip loop should be provided whether there is a mast above the roofline or a conduit or cable below the roofline.



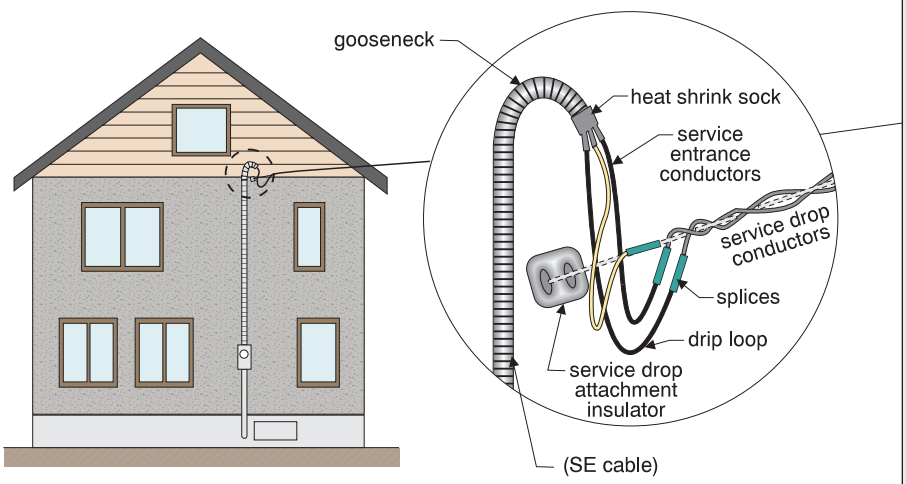
GOOSENECK ON SE CABLE

Where service entrance (SE) cable is used without conduit or masthead, the cable itself is bent downward (like a candy cane or **gooseneck**) before connecting to the service drop wires. This discourages water entry into the cable between the wires and the exterior sheathing.

CONDUIT OR SERVICE ENTRANCE CABLE

The service entrance wires may be in a conduit on the outside of the building, or there may be a special **service entrance (SE) cable** that does not require a conduit. Either situation is permitted.

Using service entrance cable



Some service drops are attached to the side of a building. Here the conduit will extend up the building and terminate in a service cap.

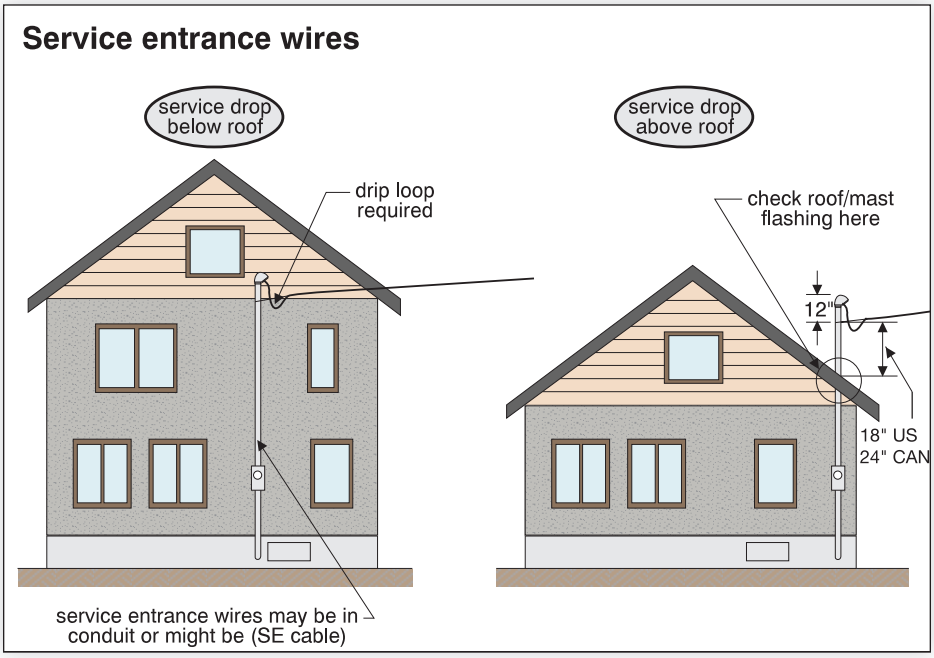
MAST

Where the service drop wires are above the roofline, a **service mast** is required. This mast extends up through the roof and terminates in a **service cap**. This mast often forms a conduit that contains the service entrance wires. It is also the mechanical support for the service drop wires. Depending on the height of the mast, guy wires may be necessary to hold the mast straight. The weight of the service drop wires is significant, and poorly supported masts can be bent or even broken.

FLASHING

Where the mast comes up through the roof, the hole must be properly flashed. Good practice dictates that the service drop wires are attached to the mast within about 12 inches of the top. We don't want the service wires too close to the roof. Many jurisdictions call for them to be 2 feet above the roof surface. This means that the mast usually extends at least 3 feet above the roof.

WIRES WELL ABOVE ROOF



SERVICE ENTRANCE WIRE TYPE

If you can see the service conductors at the service cap, you can sometimes check the gauge and find out whether they are copper or aluminum.

SERVICE SIZE

Most standards ask you to report the service size (amperage and voltage rating). Based on the gauge of the wire, you can determine whether you have wires suitable for a 60-amp, 100-amp or 200-amp service. The number of service drop wires told you already whether it's a 120-volt or 240-volt service.

METERS OFTEN SEALED

While some inspectors look inside the meter base, most do not. The meters are often sealed by the utility for safety reasons and because they don't want anyone bypassing the meters or tapping electricity off before the meter, and stealing electricity. Home inspectors should not break seals.

METER WEATHER-TIGHT

You can look to see whether the connections at the meter base are secure and weather-tight.

5.1 Conditions

Let's look at some of the problems that you'll find with service entrance wires:

1. No drip loop
2. No masthead (entrance cap, service cap, pothead, weatherhead)
3. Masthead not weather-tight
4. Service entrance wires too close to the roof
5. Mast or conduit bent
6. Mast or conduit rusted
7. Mast rotted (if wood)
8. Mast, conduit or cable not well secured
9. Mast, conduit or cable not weather-tight
10. Conduit or cable not well sealed at house wall penetration
11. Cable frayed, mechanically damaged or covered by siding

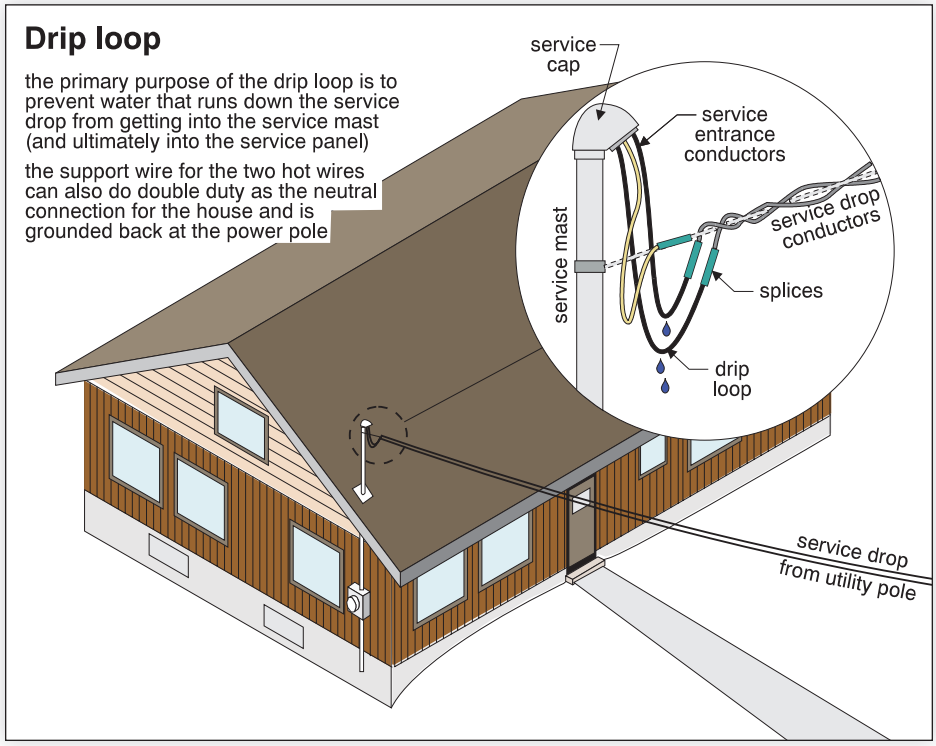
5.1.1 No drip loop

We've talked about how the drip loop is designed to prevent water getting into the conduit and to show that the service drop wires are not straining the splices.

CAUSES This is usually an installation problem, although it can also be the result of a failed support for the service drop.

IMPLICATIONS The implications are water entry into the electrical system and possible mechanical stresses on the wires and splices.

STRATEGY Look for the service entrance wires to have a low spot where they connect to the service drop wires. The wires should be visibly slack.



5.1.2 No masthead or service cap

CAUSE This is usually an installation defect.

IMPLICATION The implication is water getting into the electrical system.

STRATEGY Make sure there is a weather-tight cap on the conduit or mast. This should be arranged so that wires enter the underside of the cap.

Common sense should tell you whether the connection to the service drop is likely to allow water in.

5.1.3 Masthead not weather-tight

Sometimes there is a service cap (masthead), but it is not tightly installed or not installed at the right angle. It should be weather-tight.

CAUSES This is usually an original installation problem, although mastheads may be loose or out of position.

IMPLICATION The implication is water entering the electrical system.

STRATEGY Using common sense, make sure the top of the mast, conduit or cable is weather-tight.

5.1.4 Wires too close to the roof

CAUSES This is an installation issue.

STRATEGY The bottom of the drip loop should be well above the roof. In the US, the requirement here is at least 18 inches. In Canada it is 24 inches. Speak to authorities to learn what is accepted in your area. More height is required where snow and ice occur.

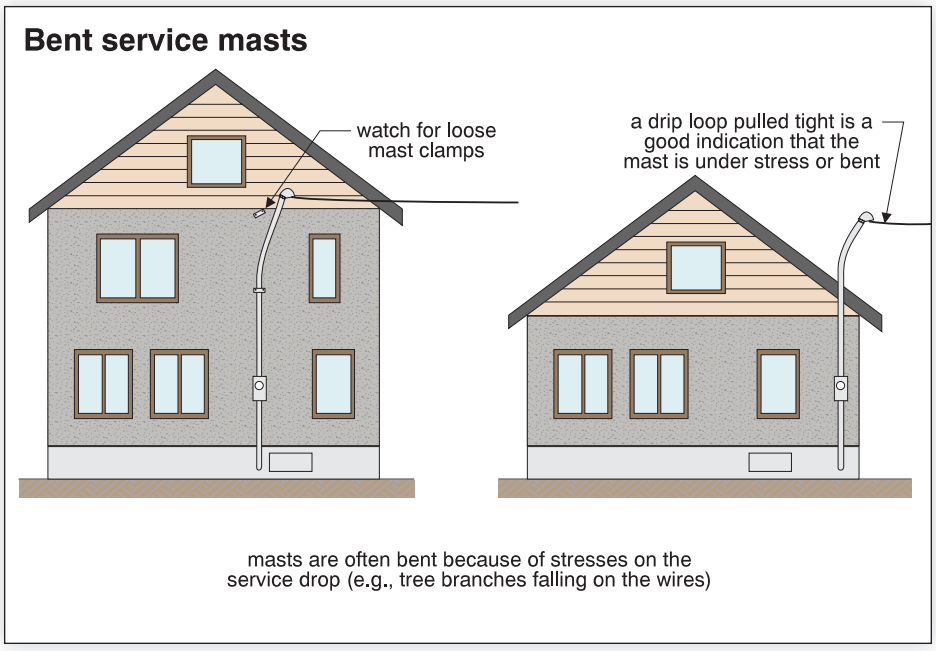
5.1.5 Mast or conduit bent

The masts or conduits should be straight and, in most cases, vertical.

CAUSES Masts or conduits may be bent by the stresses exerted by service drops. If the service drop wires are not well secured by the building, they may pull the mast or conduit. Where the service drop wires are supported by the mast, failures may occur if the mast is not properly secured with a guy.

Masts or conduits may be loose because the mechanical fasteners or clamps have failed. There are many reasons for this including –

- rust
- rot
- inappropriate connectors



IMPLICATIONS The wires may sag, reducing overhead clearance or fall, creating a dangerous situation. Weather-tightness may also be lost.

STRATEGY Make sure the masts and conduits are not bent or pulled out of position. Look at clamps for evidence of movement. Masts taller than 5 feet should have guy wires.

Where there is a mast, look at the roof flashing connection to see if it has been displaced. The drip loop may or may not be intact, depending on how it fails.

5.1.6 Mast or conduit rusted

CAUSES Rusting metal parts may be the result of age or inappropriate materials.

IMPLICATIONS The implications are –

1. mechanical failure, allowing wires to fall
2. water entry into the electrical system

STRATEGY Look for rust at electrical connections. Rust is most likely to occur at horizontal surfaces where water may collect. Pay particular attention to threaded connections where the pipe walls have been made thinner by cutting threads into them.

It's helpful to distinguish between surface rust and rust that compromises the strength of the mast or conduit. In some cases, scraping and coating with a rust-preventative paint may be adequate. In most cases, you won't want to touch the systems or probe with a screwdriver. This is dangerous, of course, because of the electricity. Recommend further investigation, and improvement as necessary.

5.1.7 Mast rotted

Rot is common on wooden masts, particularly near horizontal surfaces where water may accumulate, and near roof flashings. Wood masts are not allowed on new work in many areas.

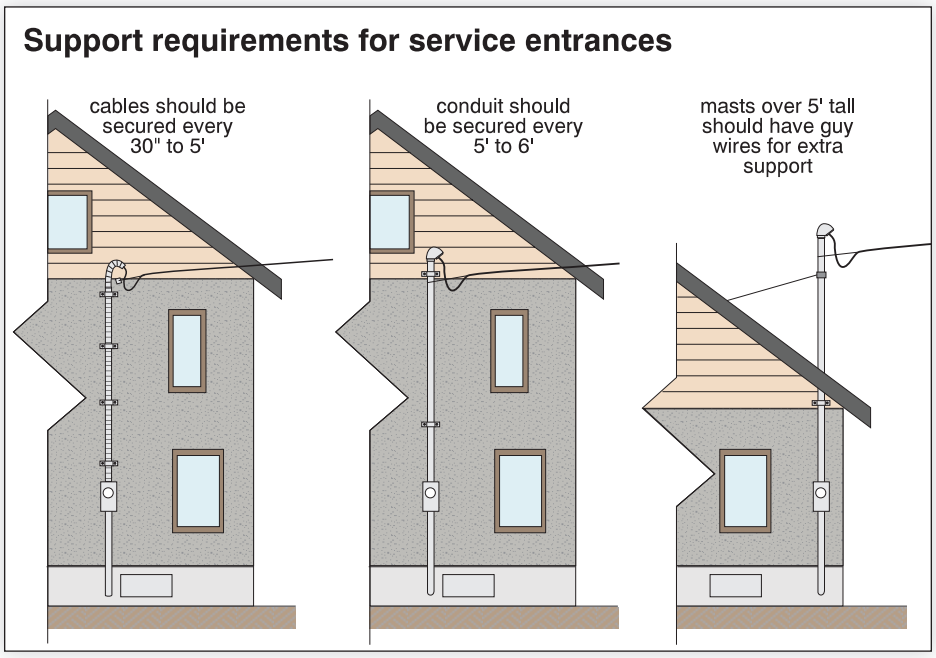
CAUSE A high moisture content (over 20%) in the wood allows rot fungus to get a foothold. This is often the result of poor drying due to designs that let water collect.

IMPLICATIONS The implications are a loss of strength of the mast and collapse of the wires.

STRATEGY Look carefully at wooden masts for rot or insect damage.

5.1.8 Mast, conduit or cable not well secured to the building

Depending on the material, conduits are usually secured to the building every 5 to 6 feet along the building wall. Masts extending more than 5 feet above the roof are typically secured with a guy. Service entrance (SE) cables should be secured every 30 inches to 5 feet, depending on the cable type (the manufacturer's recommendations should be followed).



CAUSES Failure to secure the mast, conduit or cable is usually an installation issue. It can also result from a fastener failure.

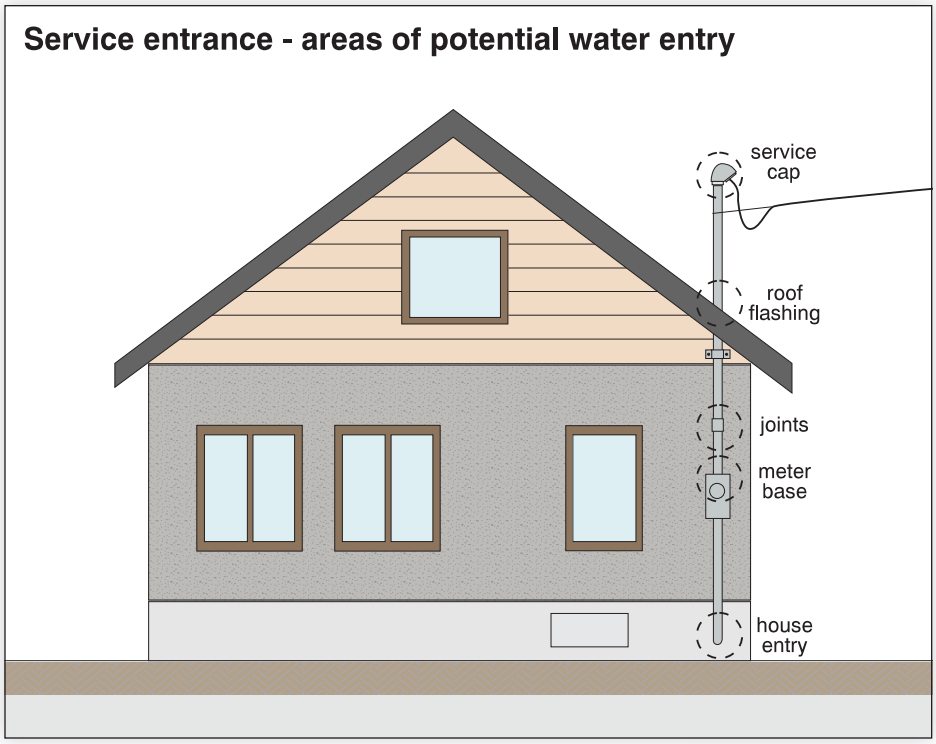
IMPLICATIONS The mast, conduit or cable may pull away from the building, resulting in fallen wires and a dangerous situation. Open joints will allow moisture into the electrical system.

STRATEGY Rather than memorizing numbers for cable and conduit supports, look for evidence of movement or failure of connectors.

5.1.9 Mast, conduit or cable not weather-tight

We've talked about some of the conditions that may cause this already. Common spots where weather-tightness may be compromised include –

1. joints in conduits
2. the service cap (masthead)
3. the flashing at the roof level
4. the meter base



CAUSES This may be a result of –

1. poor workmanship
2. movement of the components
3. deterioration of materials over time
4. building settlement

IMPLICATIONS Water in the electrical system is hazardous. In a best case scenario, the electrical system may shut down. In the worst case, the system may cause an electric shock or start a fire.

STRATEGY Follow the mast, conduit or cable from top to bottom looking for places where water may enter.

5.1.10 Conduit or cable not well sealed at house wall penetration

CAUSES This may be a maintenance problem or the result of poor installation.

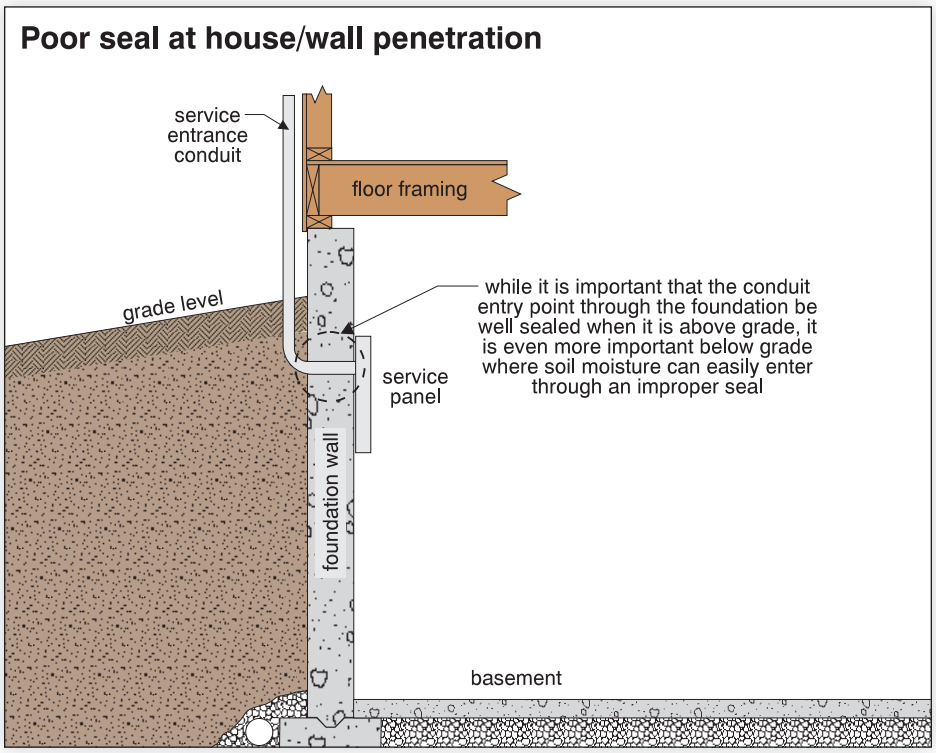
IMPLICATIONS The implications are –

1. water getting into the electrical system causing a shock hazard
2. water getting into the basement causing a nuisance
3. rusting of the service equipment

STRATEGY Make sure the wall/conduit junction is well sealed, if it's visible.

CHECK INSIDE The conduit or cable may enter the house below grade. In this case, you won't be able to see whether the cable is well sealed where it goes through the wall. You'll have to check this inside when looking at the service equipment.

Where the conduit or cable enters the building above grade, you can check that it is properly caulked and weather-tight.

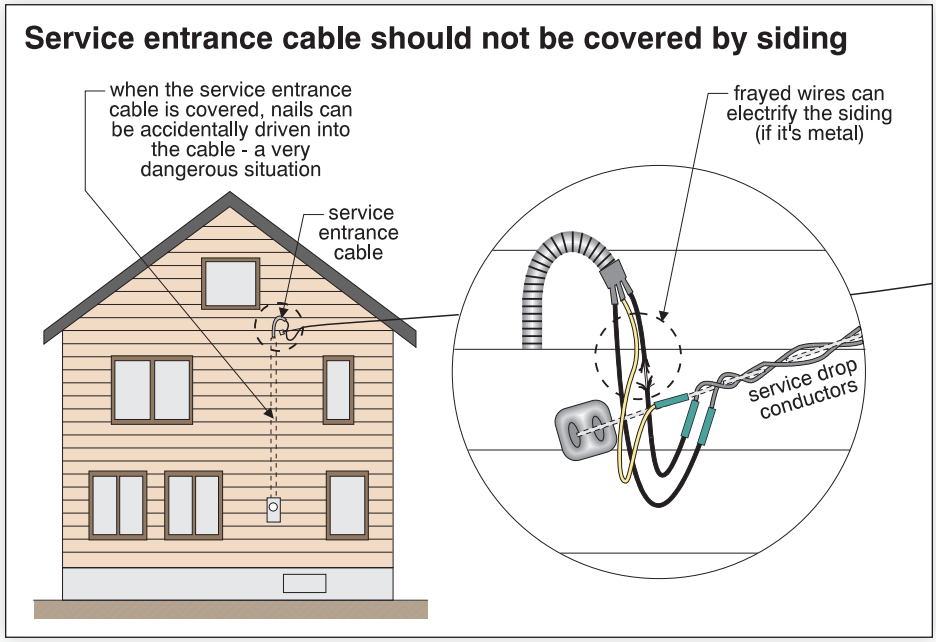


5.1.11 Service entrance cable frayed, damaged or covered by siding

CAUSES Cable or conduit should not be frayed, damaged or covered by siding. The cable may be damaged or frayed if it is allowed to move in the wind, or if tree branches rub against the cable. These cables are also vulnerable to mechanical damage by ladders, for example.

Cable covered by siding is an installation problem.

IMPLICATIONS This can create a dangerous electrical condition. Anyone touching the cable could get a shock. If live portions of the cable touch metal siding, the entire skin of the building could become electrically charged. If the cable is covered by wood siding for example, driving nails through the siding creates a shock hazard.



STRATEGY Where cable is used, carefully check its condition. Make sure it is accessible and visible over its entire length. Some authorities allow conduit to be run behind brick siding, for example, since the wires are protected from damage. Cable, however, should never be buried.

5.2 Summary

We've talked about how to get electricity from the street into the house. It's time to discuss the **service size**. How much is enough, and how do you tell what's there?

