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How to Choose Surge Protection for Your Home

You may not realize it, but your stereo system, home computer, television, VCR, microwave oven -- anything with internal electronic circuits -- is under attack every day. The attacks are silent, but destructive.

The culprit -- **POWER SURGES**. Power surges are extremely brief spikes in electrical power that burn up the electrical circuits inside appliances and electronics. For more detail about what power surges are and where they come from, read ***Facts about Power Surges***.

Not only can power surges destroy appliances and electronics, they can ruin electrical outlets, light switches, light bulbs, air conditioner components, and garage door openers. How can you protect yourself?

Surge protection devices can prevent the damages from most power surges. There are two types:

1. Service entrance surge protection device, which is mounted at or near the incoming electrical service
2. Point-of-use surge protection device, which is used at the appliance being protected and includes the type of surge protectors that plug into a wall outlet

For the typical home, many experts recommend a minimum surge protection network consisting of:

1. Service entrance surge protection device protecting the incoming electrical power line, incoming telephone line, and cable TV and satellite dish cable.

   This can be done with a single surge protection device that is capable of protecting all types of incoming lines (electrical, telephone, cable TV, and satellite dish cable) or separate surge protection devices at each incoming line. Protection of the incoming electrical line can be located at the main electrical panel or electric meter.

2. Point-of-use surge protection devices with a 330-volt clamping voltage at all expensive electronics and appliances, such as TVs, VCRs, stereos, and computers; all have electronic circuits which are susceptible to power surges.

   Susceptible appliances can be identified because many times they have electronic push buttons, electronic clocks, or digital displays. If the appliance has other wires connected to it (such as telephone lines, cable TV cable, antenna cable, or satellite dish cable), those wires or cables must run through the point-of-use surge protection device as well to provide protection on all lines.

- For home office or special medical needs, additional and different protection from other types of electrical power interruptions may be appropriate as well.

There is no surge protection device or system that can protect against all power surges. A direct lightning strike to the house's electrical system may be too great for the surge protector(s) to handle. The two-stage surge protection system recommended in this article should protect against most of the power surges.

Why is it Better to Have a Two-Tiered Surge Protection System?
By combining a service entrance surge protector with point-of-use surge protectors located at all sensitive electronics, a better protection system is created.

1. Using a service entrance surge protection device provides protection for the entire electrical system. They protect things such as motors, lights, outlets, light switches, and all the other "hard wired" items in the house that do not plug into an electrical outlet and can't be connected to a point-of-use surge protection device.

2. If the power surge is created by a lightning strike or power fluctuation on the utility lines, the service entrance surge protection device can reduce the power surge to a lower level before it gets to the point-of-use surge protection device. This helps:

   a. Prevent damage to the point-of-use surge protection devices from surges too strong for them to handle

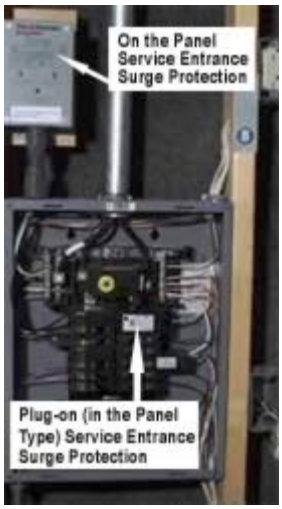
b. Reduce the level of the power surge at the appliance being protected. (The power surge's energy level is reduced at the service entrance device and again at the point-of-use device.)

3. **Service entrance surge protection devices do not eliminate the need for point-of-use surge protection devices**.

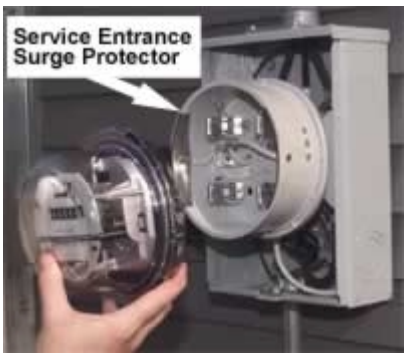
a. The power surge may not be generated on the incoming utility lines. For example, lightning may hit an outside light fixture creating a power surge on the circuit powering the light. If there are outlets on the same circuit as the outside light fixture, any electronics plugged into those outlets will be better protected if a point-of-use surge protection device is used.
b. The point-of-use surge protection devices help protect appliances against surges that are generated within the home.
c. Good quality point-of-use surge protection devices have the ability to reduce power surges to lower levels than typical service entrance surge protection devices.

Examples of Service Entrance Surge Protection Devices

There are service entrance surge protection devices that mount in or on your main electrical panel, or at the base of the electric meter. Several examples are shown in this article. Only one service entrance surge protection device is needed if it protects all incoming lines, including electrical, telephone, and cable TV lines. As an alternative, separate devices can be installed on each incoming line.



Service Entrance Surge Protection at the Main Electrical Panel
(Both of these devices will require additional surge protection devices on the incoming telephone and cable TV lines because neither provide protection of those lines as an integral part of the device.)



Service Entrance Surge Protection at the Electric Meter
(This device requires additional protection devices on the telephone and cable TV lines.)

Service Entrance Surge Protection at the Main Electrical Panel (with face cover removed)
(This device protects the electrical service, telephone service, and cable TV service lines.)

Point-of-Use Surge Protection Devices

There are also several types of point-of-use surge protection devices.

Point-of-use surge protection devices (plug-in type): You may be familiar with the plug-in type surge protectors. They look like plug strips, having several plug-in locations on one device. **A regular plug strip, unless it specifically says so, does not provide surge protection. Be careful when buying such items to make sure that you are getting the surge protection you need.**

Plug-in (Point of Use) type Surge Protector

Surge protection electrical outlets: Special electrical outlets contain surge protection in those places that you don't have room for or don't want a plug-in type surge protector, such as at a countertop microwave oven.

Electrical Outlet with Built -in Surge Protection

Surge Protection Terminology

Surge protection and the associated protection devices on the market can be confusing to a homeowner. Understanding the terminology can help.

Surge Protection Devices have several names: surge protectors, surge suppressors, transient voltage surge suppressors (TVSS), or secondary surge arresters. But they essentially have the same function of protecting against power surges. Other common terms you may hear when shopping for surge protection devices are listed below.

Surge Protector: For the type of products one would find around the home, this a general term that can refer to TVSS or secondary surge arresters. These devices are designed to protect equipment "downstream" against power surges by reducing the amount of voltage they let through.

Many electric utility companies also use secondary surge arresters and devices called lightning arresters throughout their electrical grid to protect their equipment from lightning damage. The devices they use are more durable, but can't reduce the power surge down to the lower voltage levels that in-home products can.

However, the utility company's surge protection measures can help the homeowner by reducing the energy level of a power surge before it gets to the home.

Secondary Surge Arrester: These devices are designed to go on the inside or outside of the house. If tested, they are tested according to the recommendations of the Institute of Electrical and Electronics Engineers (IEEE) standard C62.11, Metal Oxide Surge Arresters for Alternating Current Power Circuits, with a 10,000-volt, 5,000-amp power surge. IEEE C62.11 is not a test and does not assign a clamping voltage for secondary surge arresters. This makes it difficult to compare the capabilities of one product to the next.

These devices include the meter-mount surge protectors and the plug-on surge protectors that snap into the electrical panel.

Transient Voltage Surge Suppressor: TVSSs are generally designed to go on the inside of the house. If tested, they are tested according to Underwriters Laboratory (UL) standard UL 1449 with a 6,000-volt, 500-amp power surge. UL 1449 assigns a clamping voltage to the TVSS which can be used for comparison from one product to the next.

These devices include the point-of-use surge protectors and service entrance surge protectors mounted on the electrical panel.

Clamping Voltage: TVSSs should have a clamping voltage specified. Clamping voltage is the

voltage at which a surge protector begins to work by redirecting the power surge to ground. The lower the clamping voltage of the surge protector, the lower it will reduce the power surge voltage.

UL 1449 2nd Edition: This is a test standard that was developed by UL in conjunction with industry to certify product ratings and ensure proper markings on TVSS products. Through this test, the clamping voltage is determined.

IEEE C62.11: This standard, written by the Institute of Electrical and Electronics Engineers, has recommendations on how to test secondary surge arresters. [IEEE C62.11: Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV)]

Let-Through Voltage: This is the residual surge voltage that passes through a surge protector after the protector has "clamped" in response to the power surge.

The clamping voltage does not determine the level of let-through voltage for all power surges. For example, if a point-of-use surge protection device has a clamping voltage of 330-volts, that means the device will let-through no more than 330-volts if the power surge is exactly the size, shape and duration of the 6,000-volt surge required in the test standard, UL 1449.

If the same device (with a 330-volt clamping rating) is subjected to a power surge with a higher energy level (voltage, amperage, or duration), the let-through voltage will most likely be above 330-volts.

Metal Oxide Varistors (MOVs): MOVs are a common technology (not the only type) and are at the heart of the surge protector's (TVSSs) ability to protect against power surges. Generally, the larger they are and the more there are equates to better protection and a more durable, longer-lasting surge protection device.

MOVs redirect the electrical current in the event of a power surge. How an MOV works is easier to understand if you think of it as a water spigot. Under normal conditions, without power surges, the MOV is a "closed valve" allowing current to flow in the electrical circuit and not through the MOV.

If there is a power surge, the MOV clamps the voltage by redirecting the electrical current (opening the valve) from the electrical circuit into the grounding system until the surge voltage drops below the clamping voltage of the protective device. When the power surge is over, the MOV returns to the "closed-valve" position.

During the power surge, all of the excess energy of the surge is diverted by the MOV, causing it to get hot. The temperature of an MOV disc can vary from room temperature to several hundred degrees after a power surge has been redirected.

The higher the voltage of the power surge, and the longer it lasts, the more energy that must be diverted and the hotter the MOV becomes. MOVs are sacrificial, meaning they will divert a finite number of power surges until they are eventually destroyed. They may reach end-of-life after only a single large surge or over several years from several smaller surges.

Thermal Fuse Protection: Because MOVs heat up when handling a power surge, there is a potential for the surge protection device or material surrounding the surge protection device to catch fire. The 2nd Edition of UL 1449 tests the fire safety of the TVSS surge protection devices by requiring severe overvoltage tests, causing the MOVs to fail.

The surge protection device passes if it does not create a fire or electrocution hazard. This is commonly accomplished by the use of thermal fuse protection. Under the previous version of UL 1449 surge conditions could cause the surge protector to overheat and catch fire. The thermal fuse reduces that risk.

L-N, L-G, & N-G Protection: The electrical system in your home is typically a three-wire system. The wires are the ground, line (hot), and neutral. A power surge can exist across any of these wires. The surge protection should protect against surges coming through any of these wires. When a surge protection device indicates the following, you know all wires are protected: Line to Neutral (L-N), Line to Ground (L-G), and Neutral to Ground (N-G). Secondary surge arresters installed at the service entrance have only Line to Neutral (L-N) protection because there is no ground wire in the locations where they are installed.

Shopping Tips
Here are some shopping tips to use when purchasing your surge protection system.

Service Entrance Surge Protection
Service entrance surge protection devices will either be a TVSS or a secondary surge arrester. It is not possible to compare the capabilities of a TVSS to a secondary surge arrester because they are tested differently. State Farm® is not recommending one type over another. We will offer suggested specs for both.

- **Tested Product:** It is very important that the device has been tested. Look for a secondary surge arrester that is tested according to the recommendations of IEEE C62.11 or a TVSS that has been tested in accordance with UL 1449, 2nd Edition.
- **Fuse Protection:** Look for a TVSS device that has thermal fuse protection. If the device is a secondary surge arrester, make sure it is fused.
- **Clamping Voltage (Rating):** TVSS service entrance surge protectors will typically have a clamping voltage higher than 330 volts.

  We do not currently have a recommendation for a minimum clamping voltage for TVSS service entrance surge protectors. For information purposes only, it appears most of the established manufacturers of these devices have a clamping voltage no higher than 800 volts.

  The lower the clamping voltage the better the protection.

  Service entrance surge protection devices classified as secondary surge arresters will not have a clamping voltage because they are not tested to UL 1449. Purchase a device that is tested according to the recommendations of IEEE C62.11. Talk with the manufacturer about the device's capabilities. Since there is no standardized test method for secondary surge arresters, each manufacturer may test their product differently, making a performance comparison between products difficult or impossible.

- **Surge Protection on All Electrical Wires:** Verify the surge protection is on all electrical wires. TVSS devices should indicate protection for Line to Neutral (L-N), Line to Ground (L-G), and Neutral to Ground (N-G). Secondary surge arresters mounted on the utility side of the electrical panel will have only L-N protection.
- **Telephone and Cable TV Protection:** Install surge protection on the incoming telephone and cable TV lines as well as the electrical line. It is possible to accomplish this with one surge protection device or separate surge protection devices at each utility line.
- **Working Indicator Light:** Most all service entrance surge protection devices have indicator lights that will signify if there are any problems with the protection. Be sure the device you buy has this feature. Most of these devices, if the surge protection capabilities are destroyed, will still conduct electricity. The indicator lights are a way to check to make sure the device is still protecting.
- **Good Warranty:** Find an established manufacturer with a good reputation. Their warranty should cover any damage to the equipment that is protected by their product.
- **Joule Rating:** The joule rating indicates how much energy a surge protection device can handle. Because testing to determine joule ratings has not yet been standardized, the joule rating cannot currently be used for comparing products.

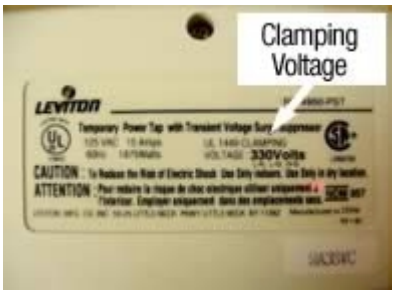
*** Point-of-Use Surge Protectors***

1. **Tested Product:** These types of surge protectors all fall under the category of TVSS. Purchase only devices that have been tested to UL 1449, 2nd Edition.

2. **Thermal Fuse Protection:** Look for a device that has thermal fuse protection.

3. **Clamping Voltage (Rating):** Purchase TVSSs with a listed clamping voltage of 330-volts, the best rating given under UL 1449. It will not be difficult to find TVSSs that plug into outlets and have a clamping voltage of 330-volts. However, we could not find surge protection outlets with clamping voltages less than 400-volts.

   The clamping voltage can be found on the surge protector's rating plate (see below)



4. **Surge Protection on All Electrical Wires:** Make sure the surge protection is on all electrical wires. The device should indicate protection for Line to Neutral (L-N), Line to Ground (L-G), and Neutral to Ground (N-G). A clamping voltage of 330-volts should be listed for all three wires.

5. **Fax/Modem and Coax Protection:** When purchasing a point-of-use type surge protector for a computer, VCR, or TV, look for a device with telephone and coax cable jacks for protection of those lines if the item being protected has those types of hookups. Remember, power surges can enter through the electrical, telephone, or coax lines.

6. **Loss of Power After Catastrophic Failure Feature:** Look for point-of-use surge protection devices that no longer conduct electricity once the capacity to protect against power surges has been lost.

   Surge protection devices are designed to sacrifice themselves for the equipment they are used to protect. Once they have had too many surges, they no longer protect. However, if they still conduct electricity, a homeowner may never be aware the device has lost its ability to protect. With this feature, once the protection has been destroyed by a power surge, the surge protector outlets will no longer be powered.

7. **Ground Wire Indicator Light:** A convenient feature to have is a plug-in type surge protector that has a light that will indicate whether or not the outlet it is being plugged into is properly grounded. Grounding is required for the surge protection device to work most effectively.

8. **Good Warranty:** Find an established manufacturer with a good reputation. Their warranty should cover any damage to the equipment that is connected through their surge protection device.

9. **Joule Rating:** The joule rating indicates how much energy a surge protection device can handle. Because testing to determine joule ratings has not yet been standardized, the joule rating cannot currently be used for comparing products.

Proper Grounding Imperative

Without proper grounding a surge protection device's ability to protect is greatly diminished or impeded. For more information about this, read the article, *The Importance of Proper Grounding*. **This is important information to have if you are designing or building a new home or remodeling.**

Do not connect a plug-in type point-of-use surge protection device to an electrical outlet by using a two-prong extension cord. The surge protection device's ability to protect against power surges will be diminished. And many surge protection device warranties will not cover any damage if this is done.

Planning of Electrical Circuits

If you are building a new home or remodeling, properly organizing the electrical circuits can reduce exposure of power surges to sensitive equipment. Don't place wall outlets that are going to be used for computers, TVs, microwaves, and stereos on the same circuits powering large appliances with motors, such as refrigerators or freezers.

Costs

Service entrance surge protection at the main electrical panel or electric meter requires installation by a qualified electrician. Installing it at the electric meter also requires the approval of the utility company. Service entrance surge protection (for the electrical system only) can also be accomplished with plug-on devices that snap into the electrical panel just like a circuit breaker.

Costs for service entrance surge protection can start at $80 (material and labor) for the plug-on type devices inside the electrical panel. For those mounted on the outside of the main electrical panel or installed at the electrical meter, the range is $150 to $500 (material and labor).

Costs can range from $20 to over $100 for better quality point-of-use type surge protection devices that plug into electrical outlets.

Surge protection outlets, which require the services of a qualified electrician, cost around $40 (material only) as compared with a typical electrical outlet that costs around $2 to $4 (material only).

Conclusion

Why hasn't damage from power surges been a problem before now? Power surges have always existed. Appliances and products going into our homes, however, have changed.

Sensitive electronic circuitry is appearing in more and more appliances in the typical American home. Also, the amount of electronic equipment in the home is increasing -- DVD players, satellite TV, video games, stereo systems, and personal computers are becoming commonplace.

The electronic circuitry is getting more dense and compact, making the circuitry more vulnerable to damage from power surges. Equipment and appliances are becoming more interconnected with one another and more connections will be made with phone lines and coax cable lines. Electric utility companies are deregulating at a time when there will be more demand for electrical power. All this increases the chances of damage from power surges.

The cost and number of electronics and smart appliances in the home will continue to increase. Combining this with the potential increase in power surges means damage from power surges will cost us more in the future.

The cost is not borne solely by insurance companies. The consumer loses also. Most power surges do not originate from lightning strikes. Damage from power surges created by the utility company or generated within the home is either not covered or has coverage limitations in most insurance policies.
Even for damage caused by lightning, coverage is often limited (depending on type of insurance coverage) because of the depreciation on the piece of equipment and the deductible. Because of the potential financial loss to the homeowner, a good surge protection plan should be considered, no matter where you live in the country.

Understanding the problem and knowing what options are available to you puts you ahead in the protection of your property.

State Farm believes the information contained in the Disaster Survival House is reliable and accurate. We cannot, however, guarantee the performance of all items demonstrated or described in all situations. Always consult an experienced contractor or other expert to determine the best application of these ideas or products in your home.

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