



# SURGE PROTECTION FOR CAR WASHES

*Automated car wash facilities are an easy way to help customers maintain their vehicle's value as they keep it looking nice. Maintaining facility operations can be quite a challenge, especially as thunder storms pass through the area.*

This article is designed to assist car wash owners and managers in maintaining operation of their facility while reducing opportunities for transient surge damage. While we cannot make absolute guarantees, we have found that implementation of these recommendations will go far in significantly reducing or eliminating future damage issues.

## OVERALL:

Most areas of the country experience increased thunder storm activity during transition seasons (Spring to Summer/ Summer to Fall). With these storms come an increase in transient surge events (lightning strikes) occurring at or near car wash facilities.

While electric utilities take extra steps to protect their distribution system, utility

customers can benefit greatly by checking internal wiring at their facilities and by installing additional surge protection devices.

Recommendations in this summary are designed around protecting an automated car wash. Feel free to call or email with questions about your business.

## SAFETY:

Several of our recommendations will require opening circuit breaker panels and car wash control panels of various voltages. It is very important that all safety measures are followed during inspection and or installation of recommended surge protection devices. This is especially true if your car wash has a

277/480 Volt electric power, since severe arc flash burns can happen with 480 Volt electric service.

At minimum, safety measures must include securing a licensed and qualified electrical contractor that utilizes all required safety protection devices (gloves, face shields,

protected clothing and related equipment).

**The contractor must be familiar with working on 277/480 Volt three phase equipment with complete knowledge of additional safety steps required for this voltage.**

We strongly recommend that the contractor de-energize panels and control equipment prior to

carrying out inspections or device installations.

We also recommend labeling of electrical panels and control panels for employees to “Keep Out” of these panels unless the employee is certified to work in these panels using all required safety equipment.

## PROTECTION OF THREE PHASE PUMPS/MOTORS

Typical automated car wash facilities have a significant number of large three phase pumps and motors that operate together as part of the car wash system. This three-phase equipment requires three energized conductors to operate properly.

During routine distribution line maintenance, blown fuse links, car versus pole or local storm events, your electric utility may experience a “loss of phase” event where one of the incoming electrical “phases” from the utility feed to your car wash facility becomes de-energized.

During a “loss of phase event”, it is important that all three-phase pumps and motors turn off until the lost phase is re-energized. Any three-phase equipment that attempts to continue to run during a “loss of phase” event, can be damaged or destroyed.

**Recommendation: All three-phase pumps and motors should have a “loss of phase” protection module that turns off the pump/motor during a “loss of phase” event.**

Your electrical contractor should inspect each three-phase device (typically inside their start/stop contactor panel) to verify that all have “loss of phase” protection modules installed and operational.

**Note: The “loss of phase” protection may be built into the logic of the car wash control system rather than at each individual pump or motor. The manufacturer of your car wash system may be able to advise you, or your electrical contractor should be able to learn more by reviewing equipment schematics or by visually inspecting each 3-phase device.**

## VARIABLE SPEED DRIVES:

Older car wash systems may have controls that turn motors/pumps off or on. Newer systems may make use of variable speed (frequency) drives.

If your car wash systems make use of variable speed/variable frequency drive units, you may want to contact the equipment manufacturer to see if they offer a “ride through” kit. This kit includes inductive chokes that help protect and maintain the drive, allowing it to “ride through” momentary power interruptions.

Based upon what you learn from the manufacturer, if available and if supported by the manufacturer, install “ride through” kits on all variable speed drive pumps and motors. If “ride through” kits are not available consider installing surge protection on each variable speed drive.

**Side Note:** If your systems do not have variable speed drives, congratulations! One less thing to worry about!

## BATTERY BACK-UP SYSTEMS:

Based upon our experience with car wash systems and commercial facilities, we are aware that occasionally there is a brief (several second) interruption of power. These blinks, or momentary power interruptions, occur when something happens on the distribution line serving your facility(s).

Blinks are caused by a device called a recloser, which is an automatic resetting circuit breaker.

Reclosers will operate during electrical system disturbances such as car vs. pole, tree branch into line, lightning strike on line and other system events.

While power blinks are somewhat harmless, they can quickly reach "nuisance stage" if they significantly disrupt the car wash process at your car wash facilities.

### *We offer the following suggestions:*

1. Install a battery back-up at your main computer control equipment in your data/control room. If you already have a back-up system, or systems installed at this (or other locations), be sure to test regularly and replace internal batteries every 2 years.
2. If blinks cause significant issues (damage or loss where equipment was in the cycle) with your car wash controls, contact the equipment manufacturer for their recommendations (if any) specific to

installing a battery back-up system or systems at key points within your car wash system.

Please note that the goal of recommendation #2 above is to involve the controls manufacturer since it can be damaging to have controls continue to operate if power is lost for more than a few seconds. The intent is to carry the wash controls through a momentary (2 or 3 second) event, not a long-term event.

## GROUNDING:

Having proper grounding at each of your facilities is very important. Many customers (and contractors) will often recommend driving additional ground rods at the electric meter (or individual pieces of car wash equipment) in their attempt to solve a problem. We often find that this creates even worse surge exposure conditions.

We offer the following recommendations regarding grounding of your car wash facilities:

### **Main Electrical Power Feed:**

Article 250 and related articles of the National Electric Code (NEC) state that a ground rod should be driven and should have a ground

resistance of 25 ohms or less. If not 25 ohms, the code states that a second ground rod should be driven 6 feet away and bonded together with #4 copper wire. After driving and connecting the second ground rod, there is no additional need to measure or achieve 25-ohm rating.

### **Recommendations:**

1. Visually inspect to verify existence of grounding system (if possible) at the main electrical service entrance. You may find that driven ground rods are covered by concrete. If this is the case, you might have the electrician use a clamp-on ground tester to verify existence of the ground.

2. A visual inspection noting a ground conductor (or conduit) from metering system to “earth” is otherwise sufficient. (We want to avoid driving of additional ground rods which may lower the resistance sufficiently to allow your car wash location to become the “system ground” for the entire area. In other words, if your ground resistance is the lowest in the neighborhood, it could draw surge currents to your facility which is certainly “not good” as storms approach.
3. Visually inspect the soil around the driven ground rods at the electrical power feed to your facility to make sure that it is “dry”.
4. We have found several occasions where a leaking hose bib or AC condensate drain creates a “swampy ground”. This damp ground often creates the lowest ground resistance in the area and until falling rain balances all area grounds, the impacts on your facility from this issue can be significant.
5. Verify that all “utilities” entering the property (power, cable, telephone, etc.) are bonded together (i.e. single point ground”). Cable and telephone service grounds should be bonded to the copper ground conductor that extends from the meter enclosure to the ground rods. This can usually be verified by visual inspection. There should not be separate ground rods for these or other utility systems.
6. Ground any fencing on the property at the corners that are farthest away from electrical equipment or conductors. The goal is to provide a path for any transient surge energy to dissipate into earth ground rather than jump over to facility equipment.
7. Signs and other large billboard structures adjacent to your car wash facility electrical power feed can also draw transient surges towards your facility. This structure may have its own meter and stand-alone electric service.

While this is far from optimum, installation of hard-wire surge protectors at the car wash facility main electrical power feed and sub-panels will be of great help in mitigating future opportunities for surge damage.

**Note:** If the billboard structure owner were to install additional grounding, we would recommend that ground rods be driven away from the base on the “far side” of the tower base (where the “near side” would be adjacent to the car wash or electrical main. (Call if you have questions.)

## ELECTRICAL PANEL INSPECTION:

A critical part of the electrical power feed to a customer facility is the “one-time” bonding of the neutral and ground conductors. This bond typically takes place at the service entrance (meter enclosure) and creates a zero-volt reference between the neutral (operating current) and safety ground (ground rods).

If additional neutral/ground bonds are made inside electrical panels at your car wash

facility, this will create opportunities for neutral (operating current) to also flow on safety ground conductors.

In addition, these extra bonds can create additional risk of damage as transient surge energy ricochets and loops its way around your electrical panels seeking the easiest path to earth ground.

## We recommend the following for each electrical panel:

1. Ask your electrical contractor to carefully inspect each electrical panel (and sub-panels) to confirm that:
  - a. All bare copper ground wires are connected to the same terminal block which should be bonded directly to the circuit breaker panel enclosure.
  - b. All white neutral wires (other than white conductors connected to double or three pole breakers) should be bonded to the same neutral terminal block; however, in sub-panels this terminal block MUST "float" (i.e. not be bonded to electrical panel enclosure).

As stated above, if grounds and neutrals are mixed, together, or neutrals not mixed but the neutral terminal block is bonded to the circuit breaker panel, you risk having operating current(s) traveling on both the neutral and safety ground conductors. This can cause touch voltage issues and can further increase risk of damage to appliances and electronic devices during a transient surge event.

If mixing of neutrals/grounds is found, this should be corrected prior to installation of surge protection.

## Why is this important?

2. We recommend that appropriate labeling be added, warning employees to "**Keep Out**" of energized panels.

## SURGE PROTECTION:

Installation of surge protection at your car wash facilities will help provide a path for transient surge energy to quickly pass to earth ground, rather than find a path to ground through facility equipment or controls. We offer the following recommendations.

1. During inspection of electrical panels to verify proper neutral/ground float/bond, please have your electrical contractor check and document phase to phase and phase to neutral voltage for each panel. It is very important that they confirm actual voltages in order to determine specific surge protection needs.

Voltage options would be:

Voltage	Phase Reading	A-B	B-C	C-A	A-N	B-N	C-N
120/208Y		208	208	208	120	120	120
120/240D	(High leg Delta)	240	240	240	120	208	120
277/480Y		480	480	480	277	277	277

2. Once you confirm panel voltages, please create a list of electrical panels, and note their voltages using the identifiers above and based upon this list:
  - a. Install an appropriate hard-wire surge protector at each circuit breaker panel.
  - b. Install an appropriate hard-wire surge protector at the power feed to each car wash control cabinet.
  - c. Install an additional hard-wire surge protector at any 2 pole or 3 pole circuit breaker that provides power

to equipment located outside of the main car wash building. This would include vacuums, irrigation/water wells, security/parking lot lights, drive up kiosks, flag pole lighting etc. Our goal is to help protect against transient surge back-feed into the building from outside equipment.

- d. Carry out an audit of 120-volt single phase duplex receptacles, including their location and what equipment served. Based upon this list, carefully review the nature and potential sensitivity of the connected device to determine if it qualifies for additional surge protection. Install a Panamax M2 surge protector at critical duplex 120-volt receptacles.

the main control/computer room should be protected by M2 surge protectors.

4. Make sure that all coaxial cable (internet) and telephone demarcations are bonded at the electrical service entrance. The coaxial feed should connect through a power block that has screw (Type F) connectors and a terminal to allow for connection to the electrical ground. Telephone demarcations (small grey box) should be bonded to the electrical ground. If you still use telephone service, we will be glad to have further discussion as to how to protect this type of line.

We look forward to working with you as you review your car wash facility to help protect it from transient surge damage events.

3. At minimum, all 120-Volt equipment in

## ABOUT KENICK, INC.

KENICK, Inc. has been providing surge protection products and solutions to the electric utility industry for over 32 years. Their manufacturing facility includes a state-of-the-art research laboratory, allowing them to test surge protection products to see how they respond to small, medium, large and “oh my gosh... what was that!!” transient surge events.

## ABOUT THE AUTHOR

Peter Jackson has been responding to the needs of electric utility clients and their customers for over 25 years. His knowledge and expertise in mitigating transient surge damage events has been gained through hundreds of field reviews and their successful outcomes.

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# Questions?

Please contact Peter Jackson if you have questions about this article or a particular issue that you need help with.

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