



NEC, NFPA 1194 Maintenance Tips

Current Trends & Topics

What does it mean to you?

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NFPA *(National Fire Protection Agency)*

- History & background
- Function
- Limitations & Participants
- Three Year Code Cycle

www.nfpa.org



Key NFPA Standards

- **NFPA 70:** Standards for *National Electric Code (NEC)*
- **NFPA 1192:** Standards for RV Manufacturers
- **NFPA 1194:** Standards for RV Parks & Campgrounds

These code books available online



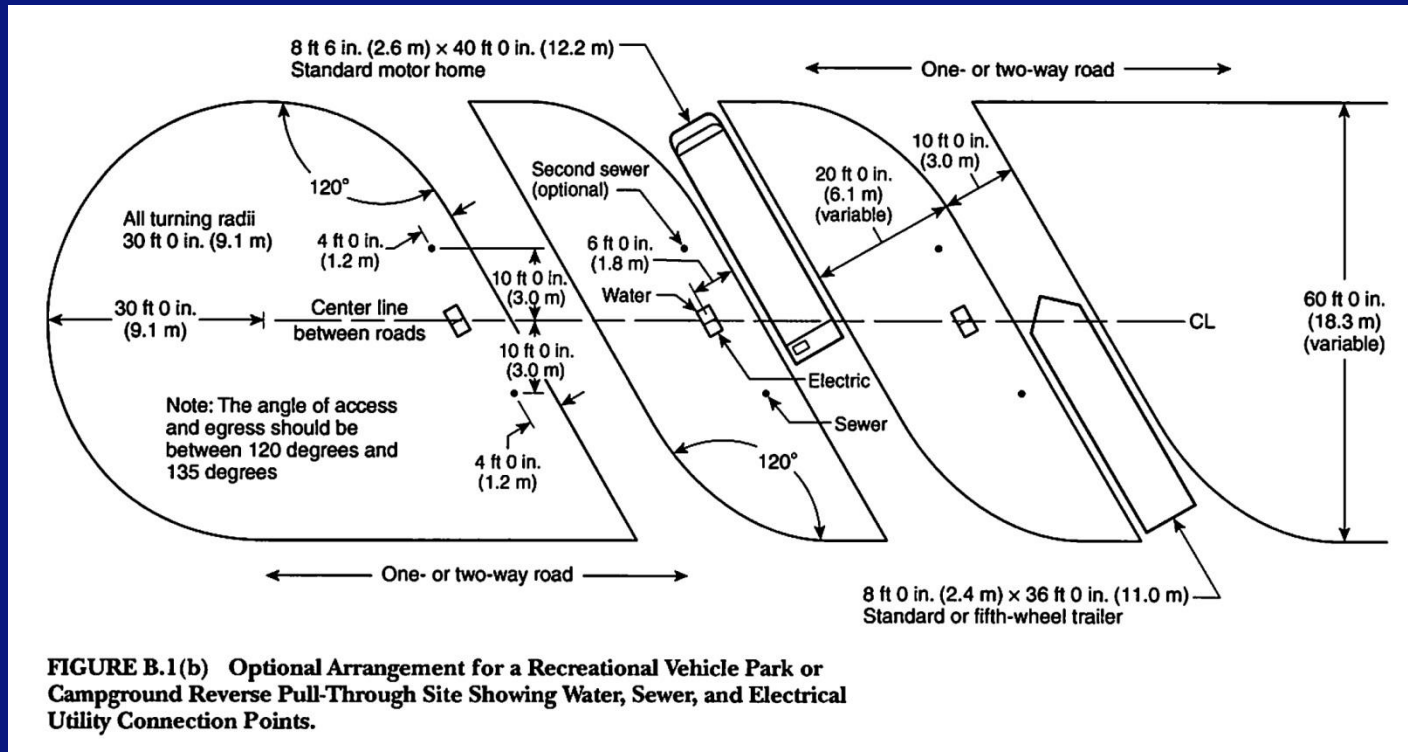
NFPA 1194 Key Standards

- **Chapter 4 General Requirements**
 - **4.3 Electrical Covered NEC 551**
 - **4.5 Park Trailers**

Single chassis with wheels. Less than 400 sq. ft.
- **Chapter 5 General Design Criteria**
- **Chapter 6 Fire Suppression.**
- **Chapter 7 Heath & Sanitation**

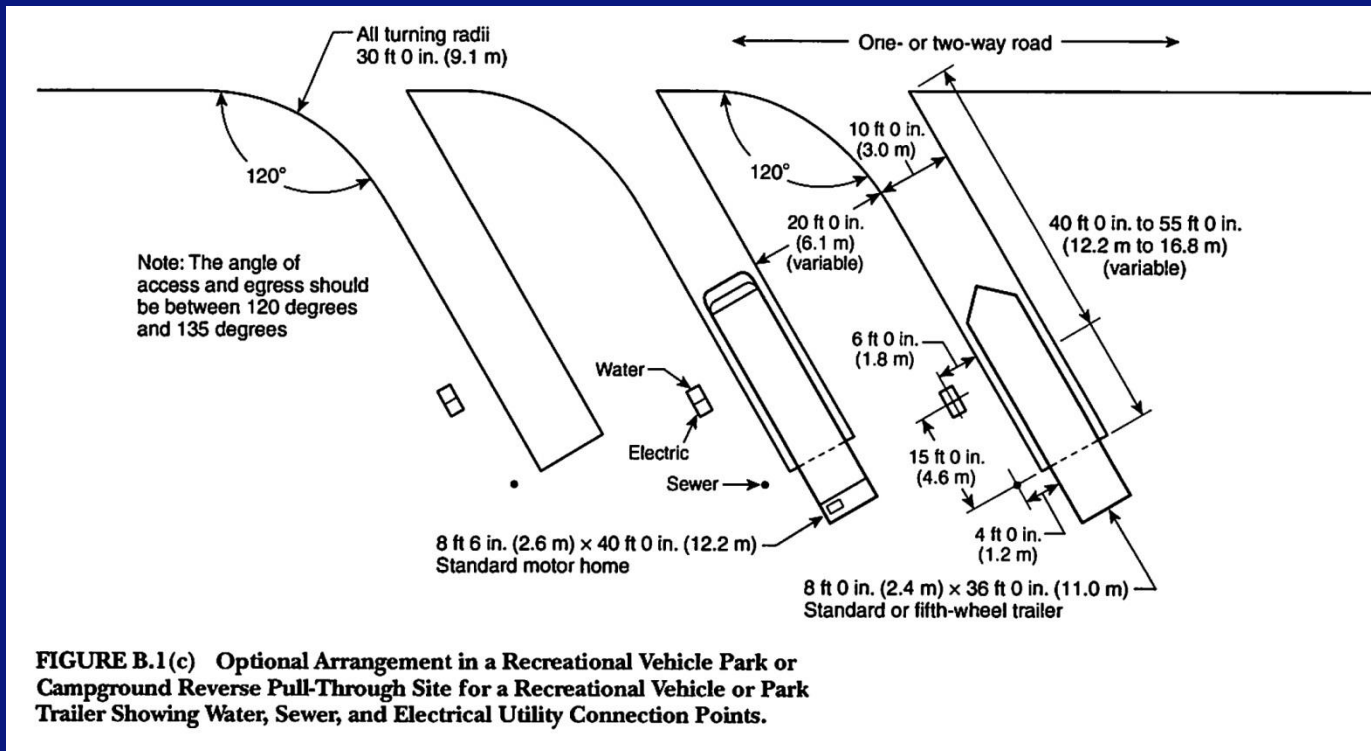
NFPA 1194

Pull Through Site Plan



NFPA 1194

Back In Site Plan





2020 NEC Article 551

Key Components

- **Receptacles 551.71**

MINIMUM REQUIREMENTS: 100% 20 amp GFI, 70% 30 amp, 40% 50 amp. If you have a 50 amp receptacle you must have a 30 amp receptacle. With TIA 20-8, GFCI protection on 30 and 50 AMP is SPECIFICALLY not required.

- **RV Site Supply Location 551.77**

Locate 5 to 7 feet from drivers side, Minimum receptacle height of 24"

- **Power Supply 551.44**

RV shall have only "1" power supply cord . Dual cords DO NOT meet code.

- **Distribution System 551.72**

- RV Site power must be served with single phase service (can use 3 phase to provide single phase).

- **Feeder Circuit Capacity 551.72(D)**

Neutral conductors shall have the same ampacity as the ungrounded conductors

- **Load Calculations 551.73**

50@12000va; 30@3600va; 20@ 2400va.



Demand Factor Table 551.73

Table 551.73 Demand Factors for Site Feeders and Service-Entrance Conductors for Park Sites

Number of Recreational Vehicle Sites	Demand Factor (%)
1	100
2	90
3	80
4	75
5	65
6	60
7-9	55
10-12	50
13-15	48
16-18	47
19-21	45
22-24	43
25-35	42
36 plus	41



Typical Load Calculation

Old 2014 NEC Code

- Using Table 551.73
- Assuming (17) 50 amp sites
- $17 \times \underline{9600va} / 240v = 680 \text{ Amps (100\%)}$
- $680 \text{ amps} \times .47 \text{ demand factor} = \underline{320}$

Amps



Typical Load Calculation

Current 2017 NEC Code

- Using Table 551.73
- Assuming (17) 50 Amp sites
- $17 \times \underline{12,000va} / 240v = 850 \text{ amps}$
=(100%)
- $850 \text{ amps} \times .47 \text{ demand factor}$
= 399.5 Amps



Key 2017 & 2020 NEC Changes

- **Grounding 551.75 & 250.32(A):**
Change language to 'Grounding electrodes SHALL NOT be required, but are allowed'
- **Load Calculations 551.73 :**
Increase 50 amp rating from 9600vA to 12,000vA (100%)
- **GFCI Protection:**
Not Required on 30 and 50 amp. This change is in a TIA and not in the printed NEC book

30 & 50 Amp GFCI Protection



1. *Revise 551.71(F) to read as follows:*

551.71(F) GFCI Protection.

~~All 125-volt, single-phase, 15- and 20-ampere receptacles shall have listed ground-fault circuit-interrupter protection for personnel. The GFCI devices used in RV-site electrical equipment shall not be required to be weather- or tamper-resistant in accordance with 406.9 and 406.12.~~

~~Informational Note: The percentage of 50-ampere sites required by 551.71 could be inadequate for seasonal recreational vehicle sites serving a higher percentage of recreational vehicles with 50-ampere electrical systems. In that type of recreational vehicle park, the percentage of 50-ampere sites could approach 100 percent.~~

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles used in the recreational vehicle site equipment.

Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.

Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 clarifies that the power supply cord to a recreational vehicle is considered a feeder.

https://www.nfpa.org/assets/files/AboutTheCodes/70/TIA_70_20_8.pdf

Issue Date: December 6, 2019

Effective Date: December 26, 2019



Key 2017 & 2020 NEC Changes

- **Reverse Polarity: 551.40D**

Commencing with the 2020 model year, all new RV's will have reverse polarity detectors on board

- **One Source 551.72F :**

Only 1 supply cord (30 or 50 amp) can feed an RV.

- **Connected Devices 551.72E:**

The use of auto transformers, AutoFormers, Buck/Boost transformers and similar devices shall not be allowed. The use of surge protection or other devices shall be listed equipment.



NFPA (*National Fire Protection Agency*)

What is an AHJ?

Authority Having Jurisdiction. An organization, office or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation or a procedure.

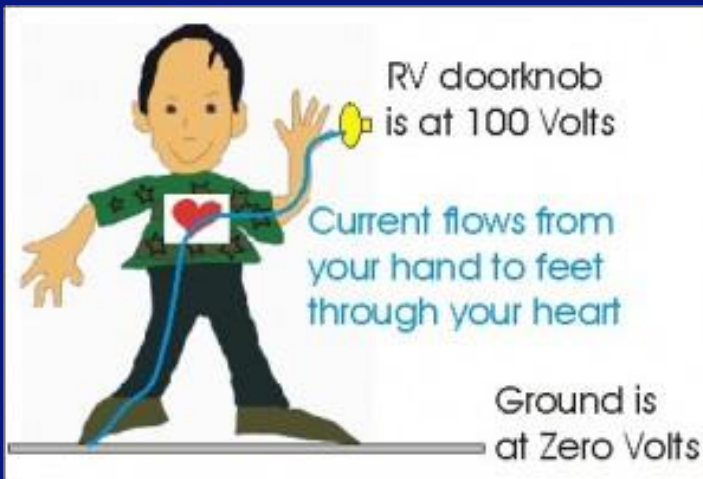
Any personal stories to share?



Other Standards to Watch

- **ADA** - Americans with Disabilities Act
- **Uniform Plumbing Code**
- **US Access Board**
- **Local PUC legislation for sub-metering electricity**

Electrical Safety



Hire a professional when you don't know exactly what you are doing!

- How many amps does it take to cause your heart to go into fibrillation? **5 milli amps = 0.005 amps**
 - What is more dangerous AC or DC? **Both can kill, but the EMT will use DC to restart your heart.**
 - Can 30 volts hurt you? **It takes just 30 Volts of Alternating Current (AC) to stop your heart.**
 - What should you do to protect yourself?
1. **Use only one hand to work or plug/unplug any power cables.**
 2. **Turn off breakers in the pedestal before plugging or unplugging campsite power.**
 3. **Turn off power before working on a circuit and TAG IT OFF to prevent someone from turning it back on.**
 4. **Never stand or kneel on wet ground while making electrical hookups.**



Electrical Safety

<http://www.noshockzone.org/category/rv-safety/>

- **RV Electrical Safety: Part I – Volts**
- RV Electrical Safety: Part II – Meters
- RV Electrical Safety: Part III – Outlets
- RV Electrical Safety: Part IV – Hot Skin
- RV Electrical Safety: Part V – Amperage
- RV Electrical Safety: Part VI – Voltage Drop
- RV Electrical Safety: Part VII – Wattage
- RV Electrical Safety: Part VIII – GFCI Theory
- RV Electrical Safety Part IX – In Review
- RV Electrical Safety: Part X – GFCI Testing
- RV Electrical Safety: Part XI — Extension Cords



Electrical Maintenance

How many have a program?

When should it be done?

Safety Reminder: Always disconnect power before servicing any equipment. If you are uncomfortable working with electricity, hire a licensed electrician.



Priority Actions

- Inspect
- Re-Torque
- Repair or Replace



Inspect

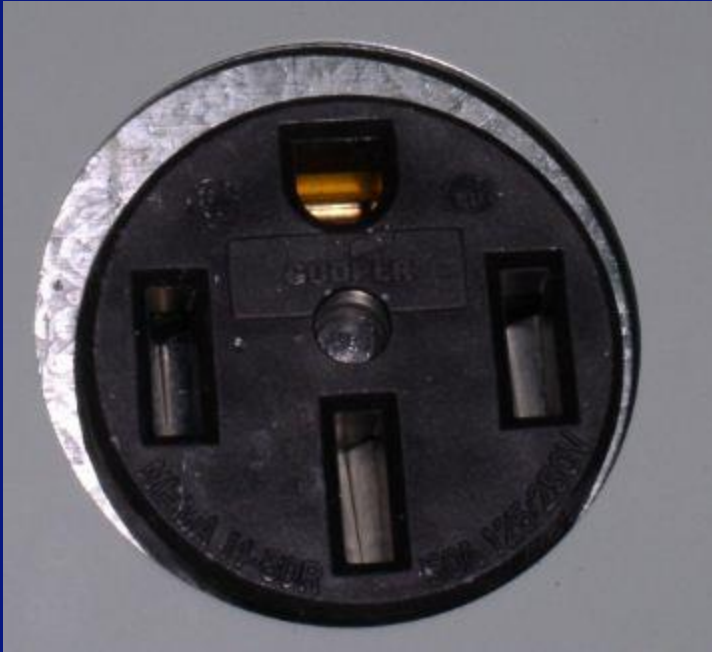
- Check pedestals, panels, transformers, utility equipment
- Corrosion, water evidence, loose covers, hardware, etc.
(Be sure all locking mechanisms are working & locked!!)
- Clean out debris from insects & critters. Ants can cause damage to wire insulation and destroy GFI receptacles.
- Repair or replace trouble immediately. Don't wait.



Inspect

- Receptacles, Circuit Breakers & Wire for arcing or hot spots. Clean or replace as necessary.
- Test GFI receptacles. Do not disable or defeat the purpose.
- “Actuate” all circuit breaker handles. Pedestals & Panels.
- All breakers should be left in OFF position

Maintenance



TURN DISCONNECTING SWITCH
OR CIRCUIT BREAKER OFF
BEFORE INSERTING OR
REMOVING PLUG. PLUG MUST
BE FULLY INSERTED OR
REMOVED.

MNP300219

1. Clean Receptacles
2. Instruct Customers to open breakers before plugging or unplugging
3. Why? Arcing = Coats contact surfaces with an insulating oxidation that forces more current through receptacle. More current = More heat.



Re-Torque

- The #1 thing you can you do to help ensure a safe and properly functioning electrical system is to re-torque “ALL” electrical connections once a year
- Check all connections and torque per manufacturers specification. See next slides.



Maintenance

NOT PROTECTED

IF FEED-THROUGH CIRCUIT IS UTILIZED, FIELD WIRE FROM "LOAD" TERMINALS

USE COPPER WIRE ONLY EXCEPT LINE, NEUTRAL AND EQUIPMENT GROUND TERMINALS ARE SUITABLE FOR **CU OR AL** CONDUCTORS.

ALTERNATE BREAKERS: G.E. TYPE THQL, ITE/SIEMENS TYPE Q, OR CUTLER HAMMER/BRYANT/WESTINGHOUSE TYPE BR.

USE ONLY 60 DEG.C (140 DEG.F) CONDUCTORS ON ALL FIELD INSTALLED LINE, LOAD AND NEUTRAL TERMINATIONS.

TEST PROCEDURE FOR GFCI RECEPTACLE

1. PUSH TEST BUTTON. RESET BUTTON SHOULD POP OUT FROM INNER-SURFACE. THIS SHOULD RESULT IN POWER BEING OFF AT ALL OUTLETS PROTECTED BY THE GFCI. VERIFY BY PLUGGING TEST LAMP INTO EVERY SUCH OUTLET. IF YOUR GFCI HAS AN INDICATOR LIGHT, THIS LIGHT SHOULD BE ON WHEN CIRCUIT IS COMPLETE. TEST WITH TEST LAMP TO DETERMINE CONDITION OF CIRCUIT AND PROPER OPERATION OF INDICATOR LIGHT. CAUTION - IF RESET BUTTON DOES NOT POP OUT OR IF TEST LAMP OR INDICATOR LIGHT REMAINS LIT WHEN RESET BUTTON DOES POP OUT, DO NOT USE ANY OUTLETS ON THE CIRCUIT. CALL A QUALIFIED ELECTRICIAN! 2. IF THE GFCI TEST OKAY, RESTORE POWER BY PUSHING THE RESET BUTTON BACK IN. THE RESET BUTTON MUST BE PUSHED FIRMLY AND FULLY INTO PLACE UNTIL IT LOCKS AND REMAINS DEPRESSED AFTER PRESSURE HAS BEEN REMOVED. IF THE GFCI FAILS TO RESET PROPERLY, DO NOT USE - CALL A QUALIFIED ELECTRICIAN TEST LAMP AND/OR INDICATOR LIGHT SHOULD AGAIN LIGHT PROPERLY. DO NOT USE - CALL A QUALIFIED ELECTRICIAN. TEST LAMP AND/OR INDICATOR LIGHT SHOULD AGAIN LIGHT.

SHORT CIRCUIT CURRENT RATING OF THIS POWER OUTLET IS 10,000 RMS SYMMETRICAL AMPERES, 240 VOLTS AC MAX. THE BREAKER SHALL HAVE MINIMUM INTERRUPTING RATING OF 10,000 AMPS RMS. ADDITIONAL OR REPLACEMENT CIRCUIT BREAKERS SHALL BE OF THE SAME MANUFACTURER AND TYPE DESIGNATION AND SHALL HAVE AN EQUAL OR GREATER SHORT CIRCUIT CURRENT RATING.

NOS. 6898,6899,6590 AND 6599.

OVER CURRENT PROTECTION

IF BREAKER TRIPS, HANDLE WILL BE IN INTERMEDIATE POSITION TO RESTORE SERVICE: 1. MOVE HANDLE TO "OFF" POSITION; 2. THEN TO "ON" POSITION.

LUG TIGHTENING TORQUE (LB-IN)

SCREW TYPE	WIRE SIZE	TORQUE
SLOTTED	14-10	32-35
	8-4	39-40
	3-20	41-46
		46-50

WIRE RANGE

CONNECTOR	COPPER		ALUMINUM	
	8/0-0	4/0-0	8/0-0	4/0-0
LINE-DE BARE/UL-100	14-8	14-10	12-8	12-10
LOAD-PLUMB/DUPLEX	14-10	14-10		
NEUTRAL	14-8	14-8	14-8	14-8
EQUIPMENT GND - G2	12-8	12-2	12-8	12-2

WHEN CABINET HAS PROVISIONS FOR A CONDUIT HUB, SELECT FROM THE CHART BELOW:

CONDUIT SIZE	CLOSURE CAP	3/4"	1"	1 1/2"	2"
CAT. NO.	501	507	510	512	515

⚡ DANGER

HAZARD OF ELECTRICAL SHOCK OR BURN. TURN OFF POWER BEFORE WORKING INSIDE THIS EQUIPMENT.

UTILITY SUPPLY GROUP, INC.
PLANT CODE: MW

MNP601612 L930&

RAINPROOF TYPE 3R ENCLOSURE

LOAD (TO POWER HEAD) BACK TO BACK WIRING

POST WIRING DIAGRAM

- CHECK ALL PRESSURE WIRE CONNECTORS. VIBRATION IN TRANSIT MAY LOOSEN.
- USE OXIDE INHIBITOR ON ALL ALUMINUM CONDUCTORS.
- USE **CU/AL** WIRE.
- USE ONLY 75 DEG. C (167 DEG.F) CONDUCTORS ON ALL FIELD INSTALLED LINE, LOAD AND NEUTRAL TERMINATIONS. USE 60 DEG. C (140 DEG. F) CONDUCTORS ON BRANCH CIRCUITS RATED 110A OR LESS.

STANDARD LINE CONNECTORS

SINGLE POWER HEAD MODELS:
2-250 KCMIL CU/AL

CONSULT FACTORY FOR ALTERNATE LINE TERMINAL ASSEMBLIES. (SERIES LT)

EQUIPMENT GROUND (GL-3)
12-2 CU/AL

UTILITY SUPPLY GROUP, INC.
PLANT CODE: MW

MNP700185

WIRE CONNECTOR TIGHTENING TORQUE
(APPLIES TO LINE, LOAD, NEUTRAL AND EQUIPMENT GROUND TERMINALS)

AWG WIRE	LB-IN	
	MIN.	MAX.
14-10	32	35
8	36	40
6-4	41	45
3-2/0	45	58

INTERNAL HEX SCREW

SOCKET SIZE	LB-IN	
	MIN.	MAX.
3/16 ACROSS FLATS	108	120
1/4 ACROSS FLATS	100	200
5/16 ACROSS FLATS	240	275

Lug Tightening Torque



Helpful Suggestions

- Use a 6-in-1 screw driver. Besides having a slotted and Phillips head blades, most have a 5/16" hex shaft that will work on most access screws on power outlets.
- Use a circuit tester to verify power at devices or trouble shooting hot leads. Use a GFI tester on GFI receptacles
- Put a little Vaseline on meter jaws and meter blades when installing meters.
- Meters install easier by starting at bottom jaws and gently pushing in top jaws.



Helpful Suggestions

- Pour concrete pad around direct burial pedestals. This will help keep level, surface moisture from post and weeding equipment from damaging protective powder coat finish. Use coating on pedestal contact area with concrete.
- Up size the neutral wires on receptacles to help dissipate heat.
- Change to GFI CB vs GFI REC to battle high replacement costs, nuisance tripping and malfunctioning
- If your meters are very old, consider a 5 year 20% meter replacement program. Assures all sites have newly calibrated, accurate meters every 5 years. Seal with different color seals.



Products for your 'Toolbox'





New Designs & Why





FAQ's and Open Forum Q&A

Q: Is a GFI circuit breaker better than a GFI receptacle?

A: Yes. GFI receptacles are inferior to circuit breakers because they are subject to moisture, insects and blowing dirt, causing failures and test/re-set problems. A circuit breaker GFI circuit is more enclosed from the elements and will outlast a typical receptacle for many years.

Q: How deep does a direct burial pedestal go into the ground?

A: Typically 24". Most products have a "grade" line identified on them.

Q: Where can I get some electrical layout assistance?

A: USG can provide you with the load calculations, wire sizing, circuit layouts, bill of material, voltage drop calculations and itemized quotation.



In Summary

- Be sure to use safe practices when working with electricity!
- It is never too late to start a maintenance program. Start one and be vigilant.
- Remember electricity is your #1 expense!!
- A healthy system will save you time & money in the long run.
- Questions & Comments?
- Thank you for attending!