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The Importance of Proper Grounding for Facility Operations and Safety

Karl von Knobelsdorff

Knobelsdorff Enterprises

CEO

KNOBELSDORFF
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The Importance of Proper Grounding for Facility Operations and Safety

WHAT IS BONDING & GROUNDING?

- **Bonded** – Connected to establish electrical continuity and conductivity you bond metal raceways together. You bond to a building steel; you bond the XO of a transformer to ground.
- **Ground** – Mother of the Earth
- **Grounded or Grounding** – Connecting to ground or a conductive body that extends to the ground.
- **Grounded Conductor** – A conductor that is intentionally grounded could be a neutral or a corner grounded system conductor
- **Equipment Grounding Conductor** – This is the green wire (NOT the ground wire)

- **Article 250:** Grounding and Bonding.
- **Grounding Electrode System:** Connects your facilities conductive materials to the earth (building steel, process piping, water piping to the rod, pipe, plate or Ufer electrodes).
- **Main bonding Jumper:** Connects the transformer XO neutral to the grounding electrode system, allowing fault current to return to the source.

ADDITIONAL GROUNDING REQUIREMENTS FOR HAZARDOUS LOCATIONS

- If your facility has hazardous locations as covered in NEC 501 and 502 there are additional grounding and bonding requirements that must be followed
- It is important to hire contractors that understands NEC or it leaves you at risk

IF YOU WERE TO GUESS, WHAT TYPE OF SYSTEM GROUNDING DOES YOUR FACILITY HAVE?

A. Solidly Grounded
B. Ungrounded
C. Resistance Grounded
D. Phone a friend

WHAT ARE THE DIFFERENT TYPES OF GROUNDED SYSTEMS?

- **Solidly Grounded Systems** – A system in which at least one conductor or point is intentionally grounded, connecting the current-carrying point of the electrical system to the ground.
- **Ungrounded Systems** – Not connected to ground or a conductive body that connects to ground.
- **Resistance Grounded Systems** – A resistor is installed in place of the main bonding jumper limiting the amount of ground fault current that can flow to a low value.

SOLIDLY GROUNDED SYSTEM

- Directly connected to the ground without any resistors
- The most typical type of grounding today on 120,208,240 and 480 systems
- When a fault from a current carrying conductor to ground occurs you have a path that is low impedance which will cause high current to flow which is when the bang and flash and smoke happens generally causing the overcurrent device to trip

UNGROUNDED SYSTEM

- No intentional connection to ground also known as a floating ground or widow maker
- Needs to have ground fault monitoring system installed many never did
- Used mainly in manufacturing and industrial facilities where they didn’t want process interrupted from a fault
- Can be dangerous as undetected faults can lead to equipment failure; a second phase fault on adjacent equipment can cause an extreme hazard to people

RESISTANCE GROUNDING

- High Resistance Grounded systems
  - Resistor installed between XO and ground path
  - Fault current Limited to <10 amps or less
  - Most common in industrial plants
  - When a ground fault occurs no boom just an alarm and you keep running
  - Must have no single-phase loads and power company transformer must have isolated HO and XO bushing

Lightning Protection Systems

- Some facilities will do a complete UL certified lighting protection system on top of normal facility grounding
- This will add additional air terminals downleads and ground rods and ground grids on the structure to offer a low impedance path to ground for lighting strikes

COMMON ISSUES FROM IMPROPER GROUNDING

- Power supply burnout
- Electronic equipment failure
- Inaccurate analog signal values (hazard monitoring included)

WHAT CAN HAPPEN WITH IMPROPER GROUNDING

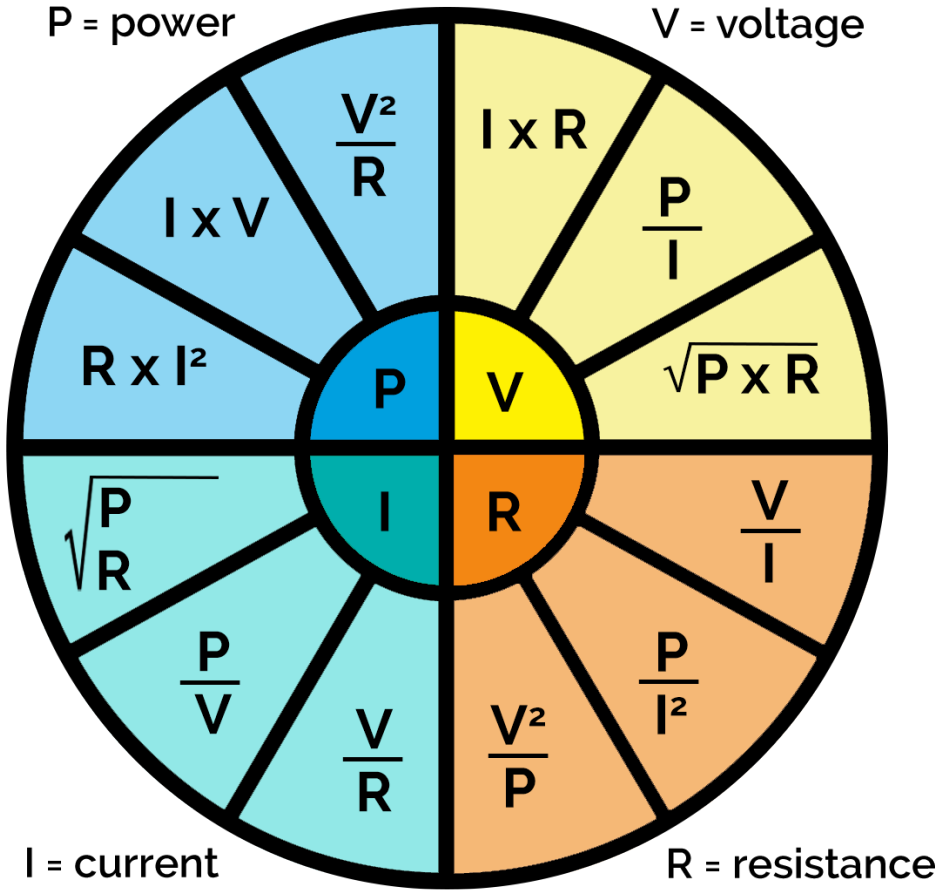
WHY DO WE CONNECT OUR ELECTRICAL SYSTEMS TO GROUND?

OVERVOLTAGE PROTECTION FROM HIGH VOLTAGE POWER & LIGHTNING PROTECTION.

WHAT HAPPENS WHEN YOU CONNECT A 20AMP 120v CIRCUIT FROM A NON GFCI PROTECTED SOURCE TO A METAL ROD THAT IS POUNDED INTO THE GROUND?

WORMS COME OUT OF THE GROUND

HOW IT HAPPENS: OHM'S LAW



WHAT MUST THE PRIMARY TRANSFORMER SERVING THE SERVICE WITH AN HRG ON IT HAVE AVAILABLE?

ISOLATED XO & HO BUSHINGS

WHEN ADDING AN ADDITION ON YOUR FACILITY, DO YOU NEED TO BOND THE BUILDING STEEL TO THE EXISTING STRUCTURE GROUNDING ELECTRODE SYSTEM?

YES

IF YOU HAVE A CORNER GROUNDED 480 SYSTEM AND YOU PUT A VOLTMETER FROM THE GROUNDED PHASE CONDUCTOR TO ANOTHER PHASE, WHAT WOULD BE THE VOLTAGE?

480 volts

NOW, FROM THE GROUNDED PHASE CONDUCTOR TO GROUND, WHAT WOULD BE THE VOLTAGE?

0 volts

AS A PLANT MANAGER...

- Don't assume the way you have always installed systems is the best way.
- If you're planning a new facility or expansion, seriously consider an HRG on your service
- Keep your people and property safe with a reliable system

NOW WHAT?

- Next time you have a project, understand the types of grounding systems you have and consult a professional on what you need for your project don’t assume what you have is correct.
- If you suffer from power supply burnout or electronic equipment failure that seems to be unexplained you likely have a grounding issue.

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Q&A

Thank you

Karl von Knobelsdorff, CEO

Karl@KEway.com

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