GROUNDING / POWER ISSUES ISWM UNIVERSITY 2015

James Daggon

What is "Ground"?

Article 100 National Electrical Code defines the term "grounded" as:

"Connected to earth or some conducting body that serves in place of the earth"

"The earth as a conductor is assumed to have a potential of zero"

#1 Ground is Ground right?

Measure near resistance

Measure extension cord

Measure distance VOLTAGE, then resistance!

#1 Ground is Ground right?

NO!

So, what to do?

So, what to do?

Single Point Grounding

So, what to do?

"A single electrode consisting of a rod, pipe, or plate that does not have a resistance to ground of 25 ohms or less shall be augmented by one additional electrode of any of the types specified by 250.52(A)(2) through (A)(7). Where multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8m (6 ft) apart" - Section 250.56 of the National Electrical Code

So, what to do?

In facilities with sensitive equipment it should be 5.0 ohms or less."

Recently added to Section 250.56 of the National Electrical Code

Single Point Grounding BEST: Connect to the Service Ground!

<u>2nd Best</u>: use multiple ground rods but CONNECT THEM TOGETHER+ TO SERVICE GROUND!

So, what to do? $R_t = (R_s/n) \times F$

Number of Rods	F
2	1.16
3	1.29
4	1.56
8	1.68
12	1.80
16	1.92
20	2.0
24	2.16

Single Point Grounding

Check the ground rod and bonding!

Single Point Grounding

	Earthing resistance		
Type of soil	Ground electrode depth (meters)		
	3	6	10
Very moist soil, swamplike	10	5	3
Farming, loamy and clay soils	33	17	10
Sandy clay soil	50	25	15
Moist sandy soil	66	33	20
Concrete 1:5	1	-	-
Moist gravel	160	80	48
Dry sandy soil	330	165	100
Dry gravel	330	165	100
Stoney soil	1000	500	300
Rock	-	-	-
http://www.newarkinone.thinkhost.com/brands/ promos/Earth Ground Resistance.pdf			



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Why Single point grounding: 1 – Safety!



Why Single point grounding: #1 – Safety! – As little as 50mA can kill! 20 **4 AMPERES AND OVER** Heart Paralysis, Serious Tissue and Organ Burning 15 .050 AMPS TO 4 AMPS 10 .1 - .2 Certain Ventricular Fibrillation 4 .05 - .1 Possible Ventricular Fibrillation .050 30 mA - Breathing Difficult, Fibrillation in small .030 children .015 15 mA - Muscles "freeze" in 50% of the population >10 mA - Let-Go Threshold .010 .005 5 mA - GFCI Trip Level 1 mA - Perception Level .001

#2 Neutral is the same as Ground right?



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#2 Neutral is the same as Ground right?



NO! Neutral is connected to ground only at the service entrance panel!

#3 Electricity always takes the path of least resistance.

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#3 Electricity always takes the path of least resistance.

NO! Electricity take EVERY path back to the source! (Current divides in a parallel circuit).

#4 Since a licensed electrician wires the outlets, they are always wired correctly, right?

Check the cables FIRST! #1 – Safety!















#5 There is really only one type of ground right?

Grounding	Туре
Digital	Relative
Analog	Relative
Signal	Relative
Power	Absolute

#6 Things like delicate computers, etc. are always grounded

because they have to be, right?

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NOT NECESSARILY! Test to be sure!

Power issues:



1

Over/under Voltage

1

Over/under Voltage

UL 1449 Voltage Let-Through ratings: 500,400,330 – Lower is better) 200 – 5700 joules surge protection (higher is better) 1 joule = 1 Watt-second 1 Kilowatt-hour = 3,600,000 joules

1

• Over/under Voltage



MOV – Metal Oxide Varistors

Over/under Voltage





2

Noise

Typical sources of conducted interference include switching power supplies, ac motors, and microprocessors. In short, just about any electrical and electronic device has the potential to generate conducted and radiated interference





3 • RFI/EMI



Answer: Both!

3

• RFI/EMI

Effectiveness goes down as the line goes up (higher is worse)



3



Shielded cable: Ground ONE end, or BOTH ends?





• RFI/EMI





 Noise – treat symptom, line filter

3

2

 EMI/RFI – use shielding, try to determine source frequency

Questions?

Thanks!