



FACILITATORS

System Grounding

GOAL: The goal of this training is to familiarize participants with the importance of properly grounding customer satellite system installations.

OBJECTIVE: At the completion of this training participants should be able to:

- Explain how a ground works and the purpose of grounding a DISH Network satellite system.
- Explain proper Satellite System bonding and grounding techniques to include equipment and location.
- Identify applicable NEC codes and explain how they relate to satellite system grounding.
- Distinguish between properly and improperly grounded satellite systems and explain why each are categorized as such.

MATERIALS







NEEDED: Presentation Display
PowerPoint presentation
Facilitator's Guide
Examples of grounding devices

TRAINING

TIME: 60 Minutes

RELEASE

DATE: May 20, 2006

ICONS			
<i>Italics</i>	Instructions specifically for the facilitator		Topic related activity, game, or challenge
	Say: Script for the facilitator. This is what is conveyed to participants		Role-play exercise
	Ask: Question asked of participants: leading, open-ended, specific.		Additional topic information specifically for facilitators
	Attention: Key point, important fact, or point requiring special attention.		Objective or Knowledge Check activity

TITLE SLIDE - INTRODUCTION

Slide 1



SAY

"Today we are going to explore how an electrical ground works, why grounding our DISH Network satellite systems is so important, and what represents a properly grounded installation.

OBJECTIVES

Slide 2

Read the objectives to the class



ASK

"So, what is an Effective Electrical Ground?"

ANSWER:

Solicit answers from the class, advance the slide

WHAT IS AN EFFECTIVE GROUND

Slide 3



SAY

"An electrical ground is an intentional connection to earth of sufficiently low impedance and having sufficient current carrying capacity to prevent the buildup of voltages that may result in undue hazard to connected equipment or persons."

Additional Information:

For electricity to flow, it has to have a complete circuit path. Normally the black wire (hot) in a house carries electricity from the power company to lights and appliances. The white wire (neutral) completes the path from the appliance.



WHY GROUND THE SYSTEM

Slide 4



SAY

"According to the National Electric Code® (NEC®) the purpose of grounding is..."

Read the slide

"Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation."



SAY

"Nowhere is there any mention of protecting equipment, rather the intent of the grounding provisions of the NEC® is to ensure that electrical systems are as safe as possible to the humans that use them."

WHY GROUND THE SYSTEM – DISH NETWORK

Slide 5



SAY

"From DISH Network's perspective, proper Grounding..."

Read each bullet

- Reduces electrical shock from lightning, power surges, and contact with high voltage systems.
- Reduces static charges on equipment to ensure the proper performance of sensitive electronic equipment.
- Reduces Radio Frequency Interference which can degrade the display of video signals

Why Ground the System

– "Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation."

110.10(A)(1)(2)



Why Ground the System

DISH Network perspective

- Reduces electrical shock from lightning, power surges, and contact with high voltage systems.
- Reduces static charges on equipment to ensure the proper performance of sensitive electronic equipment.
- Reduces Radio Frequency Interference which can degrade the display of video signals





SAY

"Let's look at how each of these is accomplished with proper grounding."

HOW DOES A GROUND WORK – LIGHTENING & SURGE Slide 6

This slide contains animation click then it runs automatically



SAY

"For electricity to flow, it has to have a complete circle or circuit. The ground connection to Earth gives the excessive electricity or over current conditions a quick path away from equipment and people inside the house and allows it to dissipate through the earth. By the time the surge gets in the ground and travels a bit, it loses much of its strength and becomes harmless."

"Important: This does not guarantee complete protection from lightning/surge damage or injury. As it states, it reduces the likelihood of such damage or injury."

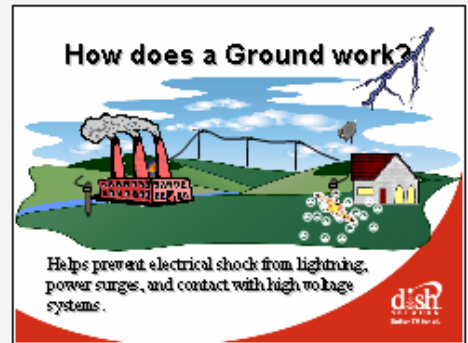
HOW DOES A GROUND WORK – STATIC Slide 7

This slide contains animation; click then it runs automatically



SAY

"Static can build up on the dish like it builds up in you when you walk across a carpet when the static electricity buildup exceeds what the antenna can store it discharges wherever it can. If this static gets to the receiver or LNBF, it could damage internal electronic components. A common symptom of this is a temporary interruption of signal which leads to a call from the customer requesting a technician to correct the problem."



Because the problem only occurs when the antenna discharges static electricity, the technician normally can not identify the cause while on site. Typically the technician will RA the receiver or LNBF. Did this solve the problem? Will this customer have the same complaint again? Do you think this customer will churn due to his/her frustrations? With a proper ground, the static is sent into the ground before it can build up and cause an issue."

HOW DOES A GROUND WORK – RFI

Slide 8



SAY

"Radio Frequency interference (RFI) occurs when Stray RF signals are picked up by the cables and if not grounded, can find their way onto a customer's TV. This can cause a disturbance or distortion of the satellite signal."

"Without a proper ground, the wires outside the house work like a big coat hanger antenna."



ASK

Has anyone ever had a customer complain about picking up Aircraft radio conversations on their TV?"

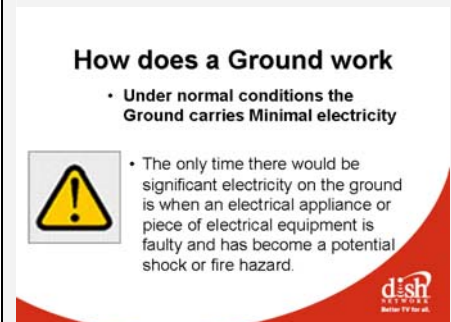
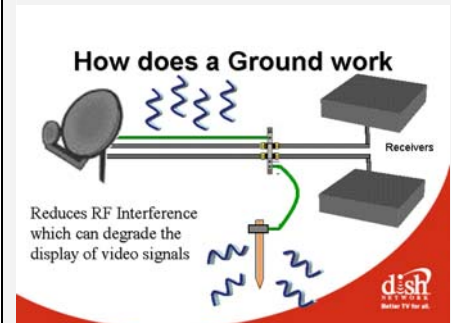
Have respondents share their experiences

HOW DOES A GROUND WORK – CURRENT SHUNT

Slide 9

Read the slide to participants

- Under normal conditions the Ground carries minimal electricity
 - The only time there would be significant electricity on the ground is when an electrical appliance or piece of electrical equipment is faulty and has become a potential shock or fire hazard.





SAY

"This is how the infamous 'Microwave oven causing signal loss' issue happens."



SAY

"The Microwave uses a lot of electrical current. If it is bad or going bad, it will release extra electricity into the ground system when running. This electricity eventually finds its way into the satellite ground and interrupts the signal."

"The customer is not getting bombarded with microwaves as some may think. However, the customer does need to replace their Microwave oven as soon as possible. This will correct the signal loss issue and make heating up hot pockets a little less hazardous."

ACCEPTABLE GROUNDING LOCATIONS

Slide 10



SAY

"Here are some acceptable grounding locations."

Click

1. A grounded interior metal water pipe (**STRESS**) **within 5 ft from the point of entrance into the building and in contact with soil**

Click

2. The exterior of a main power service entry enclosure

Click

3. A metallic power service raceway

Click

4. A properly installed grounding rod





SAY

"These are some of the more common grounding points. There are others as directed by the National Electrical Code."

GROUND BLOCK INSTALLATION

Slide 11



SAY

"DID YOU KNOW...? Not only should the Coaxial cable be grounded, but also the dish mast itself?"

"When connecting to an existing ground lead the DISH Network ground must be its own independent connector."

GROUNDING MULTIPLE DISHES

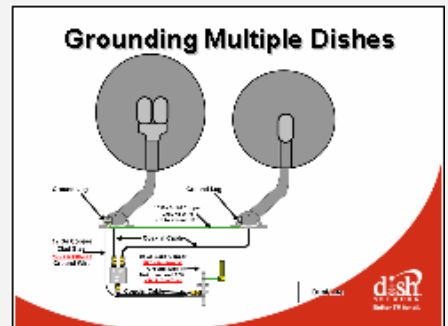
Slide 12



SAY

"Here is an example of a properly grounded multiple dish installation."

"Exception: Where it isn't practicable to limit the coaxial grounding conductor to 20 ft for one- and two-family dwellings, a separate ground rod not less than 8 ft long [820.100(B)(2)], with fittings suitable for the application [820.100(C)], must be installed. The additional ground rod must be bonded to the power grounding electrode system with a minimum 6 AWG conductor [820.100(D)]."



GROUNDING MULTIPLE DISHES Slide 13

Have examples of Grounding devices on hand and pass them around the class at this time.



ASK

"Which of these two Ground Blocks should be used on new installations?"

ANSWER:

"The one rated for 2250 MHZ. Ground blocks that are not rated for DISH Pro and DISH Pro Plus frequencies (like the one on the right) can cause Signal Loss on Even transponders in DISH Pro and in a DISH Pro Plus installation it could cause loss of signal on one tuner in a dual tuner setup."



SAY

"Note the CEA color coding on the approved grounding block?"

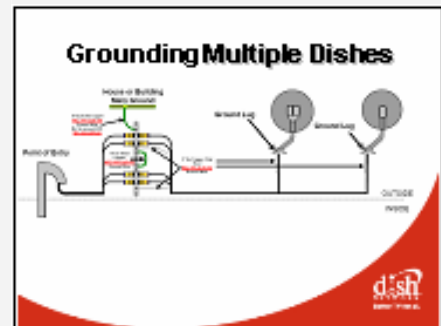
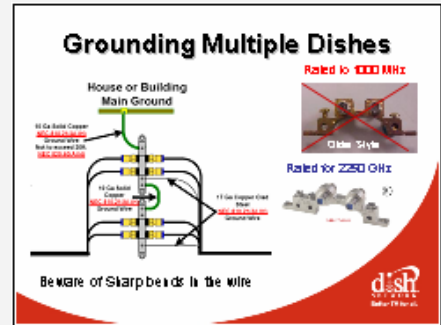
"For your information, three lug grounding blocks allow technician to easily connect two or more down-lead grounds together in a multi receiver installation.

GROUNDING MULTIPLE DISHES Slide 14



SAY

"Here we see an example of how one dish can be grounded to another. Note that in order to ground in this fashion you will need to have a Dual Ground Lug. Code does not permit a single wire lug to have two wires inserted."





ASK

"What type of installation would this be particularly useful?"

ANSWER

3Sat DISH Pro Plus Twin where the third satellite location is directly fed to the input of the DPP Twin.

GROUND STRAP Slide 15



SAY

"When installing a ground strap, it is important to select the appropriate metal type that corresponds to the surface it is attaching to. For example: A copper strap should attach to a copper pipe, a galvanized steel strap should attach to a galvanized pipe."



ASK

"Can anyone tell me why?"

ANSWER:

"To prevent corrosion."

"Bi-metallic or Galvanic corrosion is a very specific type of reaction between two different metals. This is similar to what happens to your automotive battery terminals if they are not cleaned."



ASK

"Has anyone ever seen this on their car?"

Solicit general responses





ASK

"What happens if the terminals are all corroded?"

ANSWER:

"It lessens or prevents electricity from flowing. This is what it does with a grounding point. It can cause the ground point to fail and no one would know until it was really needed."

GROUNDING CLAMPS

Slide 16



SAY

"These are used to attach to Grounding Rods, pipes, or ground busses."

NOTE: Be sure to use the proper size wire for the rating of the connectors

GROUND SPLIT BOLTS

Slide 17



SAY

"Split-Bolts allow technicians to share the house ground with the satellite grounding systems. High clamping force assures that a solid connection is made for maximum conductivity."

GROUND LUGS

Slide 18



SAY

"If a ground lug is used to attach a grounding wire to the Dish assembly, the paint where it is attached should be scraped off to ensure a good connection and bond."

Grounding Clamps

Acceptable clamps

- Check local electrical code for proper use!
- Check for UL Listing



dish
NETWORK
Better TV for all



Ground Split Bolts



Always check for UL stamp



Ground Lugs



Remember to scrape the paint



dish
NETWORK
Better TV for all

"Additionally, the bond point should not be a dual purpose bolt. For example you can not bond to the Elevation bolt."

MULTI-DISH SWITCHES

Slide 19



SAY

"Multi-dish switches are not UL listed devices. Therefore they can **NOT** be used as grounding points! Period."

"You also can not ground to splitters, diplexers, separators, or any other non-UL listed device."

TEST YOU KNOWLEDGE

Slides 20-39



SAY

"We will break up into two teams."

"One person from each team will come up to compete."

"For each round, we will see an example of an installation. The first person to correctly identify whether there is a problem and what it is; receives 1 point for their team."

"Everyone on the team will have a chance to participate. At the end of the game, the team with the most points wins."

"Please don't shout out the answers, everyone will get their turn."

Break the class into two teams. Ask one player from each team to come to the front of the class. Place an answering device such as a small stick or bell between. Advance the slide. When a contestant picks up the answer stick or rings the bell, they have 5 seconds identify the issue, without help from

The HINT icon (when clicked) will narrow the possibilities if participants are having trouble finding the problem.

No Switches

DISH Network switches are not UL approved as acceptable grounding device.



Test your knowledge!

What's wrong
with this picture?





SAY

"The following are actual installations. Viewer discretion is advised."

Advance when ready

ANSWERS

Slide 21

- This satellite system is grounded to the incoming electrical supply.
- Dish is too close to power entry. Must be at least 10 ft.
- Installer was at risk of shock Injury when installing.

Slide 22

- Here the technician installed a strap grounding device to a painted surface. This does not make a good electrical bond.

Slide 23

- A ground lug must be used in the areas circled, these locations must also have the powder coat removed to ensure contact between the lug and the foot plate

Slide 24

- You must use the same material type grounding clamp as the material you are grounding to – copper to copper and galvanized to galvanized

Slide 25

- PVC pipe is non-conductive; you can not ground to it

Slide 26

- Do not ground to a water faucet.

Slide 27

- The 17ga Copper Clad Steel messenger should not be included in the drip loop and the connectors are not compressed.

Slide 28

- DISH is Not grounded

Slide 29

- Box clamps should be located where it does not inhibit the access to the power meter.
- The ground wire should not be looped or make sharp 90 degree bends.
- Should secure ground loops

Slide 30

- Not a proper method of bonding two Ground Blocks together
- Ground loop too tight

Slide 31

- You can not combine grounds – DISH System ground must have its own contact point and clamp

Slide 32

- The switch is not UL listed so it can not be used as a grounding point.
- The ground blocks should be placed before the switch and they must be bonded together to a single ground source.
- Improper Ground Loops.

Slide 33

This appears to be a good grounded install. The loops may be a little tight.

Slide 34

- Not a proper way to bond Ground Blocks together
- Improper drip/service loops – too tight or non-existent

Slide 35

- Not a proper way to bond ground blocks together
- Not a proper ground source bond, must use a clamp and remove paint

Slide 36

- Not grounded prior to entry of the residence

Slide 37

- Looks good except the Ground connection should be of the same type of metal to prevent galvanic corrosion.
- The messenger cable should not be coiled with the ground loop

Slide 38

- Grounding device should not inhibit the access to the power meter. If the power company finds this situation, they will remove the ground altogether.

Slide 39

- System not grounded
- No drip-loops
- Sloppy install

SUMMARY – KEY POINTS

Slide 40-41

Select participants to read each line and paraphrase the bullet point.

After the last bullet point...



SAY

“We looked at what a ground is, what it does, and why it is important to ground a satellite system properly.”

“We looked at some correctly installed grounds and some incorrectly installed grounds.”

“We even got to see some of the devices technicians use to ground the satellite system.”

“All this should give you a better perspective of what is involved in an installation and help you provide better installation service to your customers.”



ASK

"Here is an extra credit optional assignment.

Research and answer the following question: Can Ground related Audio/Video distortion (Hum) be eliminated in a satellite system and still comply with NEC regulations?"

Explain why or why not.

Do not solicit immediate answers. Have participants who want to do the assignment; submit their written answers later in the week. If the participant answers correctly with valid explanations, they should receive a 100% on the Grounding Quiz.

ANSWER:

The answer is relatively simple. Ground Loops can not be prevented or eliminated through ground system manipulation and still comply with NEC. However, an isolation transformer can be used to block the ground noise from passing to audio or video equipment. These are sometimes referred to as "Ground Loop Isolators" and are fairly inexpensive.



KEY POINTS

- 17 ga copper clad steel may be used between the dish and Ground device
- From Ground device to Ground source, use #10 copper not to exceed 20 feet
- Locate ground block as close as practical to the point of entry not to exceed 20ft from the utility ground
- Ground to utility electrode or ground
- Run ground wire vertical or horizontal
 - Diagonal runs may cause arcing



KEY POINTS

- Include grounding as part of the site survey.
- DON'T cut corners – someone's safety is at stake!
- DON'T ground to water pipes or faucets
- DON'T bend ground wires sharply.
- DON'T ground to gas service pipes.
- Always comply with NEC, State, and local codes when grounding

