

Out of Sight, Out of Mind

Preventative Maintenance and Troubleshooting Thoughts

WBA Broadcasters Clinic

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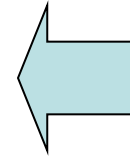
Killers on the Loose!

- Transients
 - Lightning strikes
 - Power line related
- Temperature
 - Insufficient cooling
 - Poor air filtration/routing
- Internal arcing
 - Dust/debris

Key to Lightning Protection

- Conduct strike pulse current to ground through a low impedance path
- Prevent this destructive current from flowing through your electronic equipment

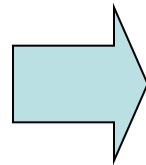
Get Well Grounded...



- Buss bar for AC grounds
- Tied to station reference ground
- All primary equipment connected

Bulkhead ground for coax cables

- Best done where cables enter building
- Connected to station reference ground
- Keep ground leads as short as possible



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Get Well Grounded...



The best building grounding in the world doesn't help much if it doesn't go anywhere when it reaches the outside world!

Maintenance

- Grounding is important
 - Not just the installation, but the actual type of connection.
 - If you do it right, you won't have to redo it at night!

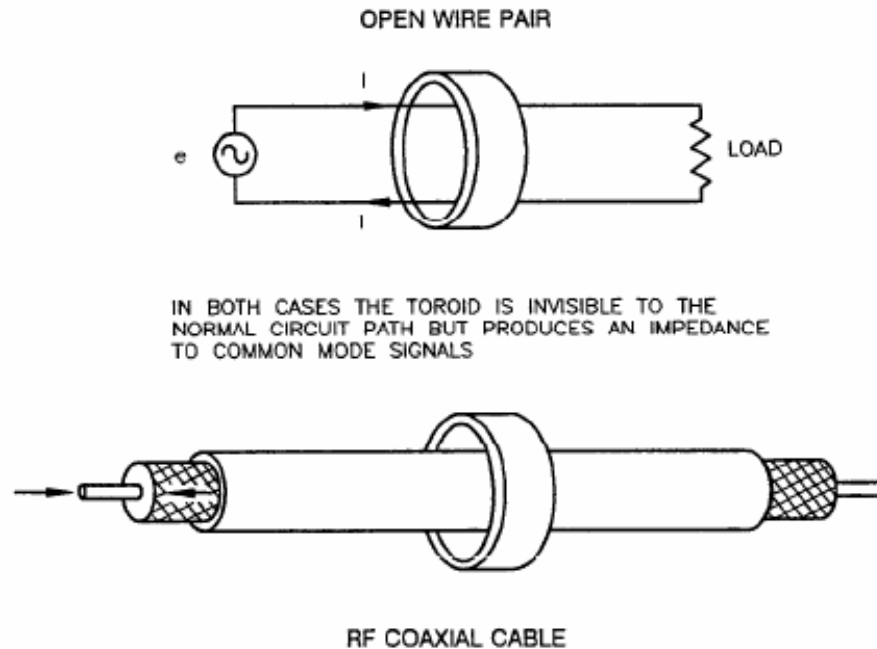


Always Use Protection



AC Power line protectors are a must – and they **MUST** be connected to your station reference ground.

Keep your Shields UP!



Ferrites are good for reducing common mode signals

- Lightning surges
- Induced RF (especially at co-located AM and FM sites)
- Power line and power supply noise

Figure F-4 Use of Toroids to Impede Common Mode Signals

Keep your Shields UP!



Ferrites can also be a troubleshooting tool

- If there is an imbalance between feed and return currents (common at AM transmitter sites), a ferrite on the coax will get warm – or even hot!

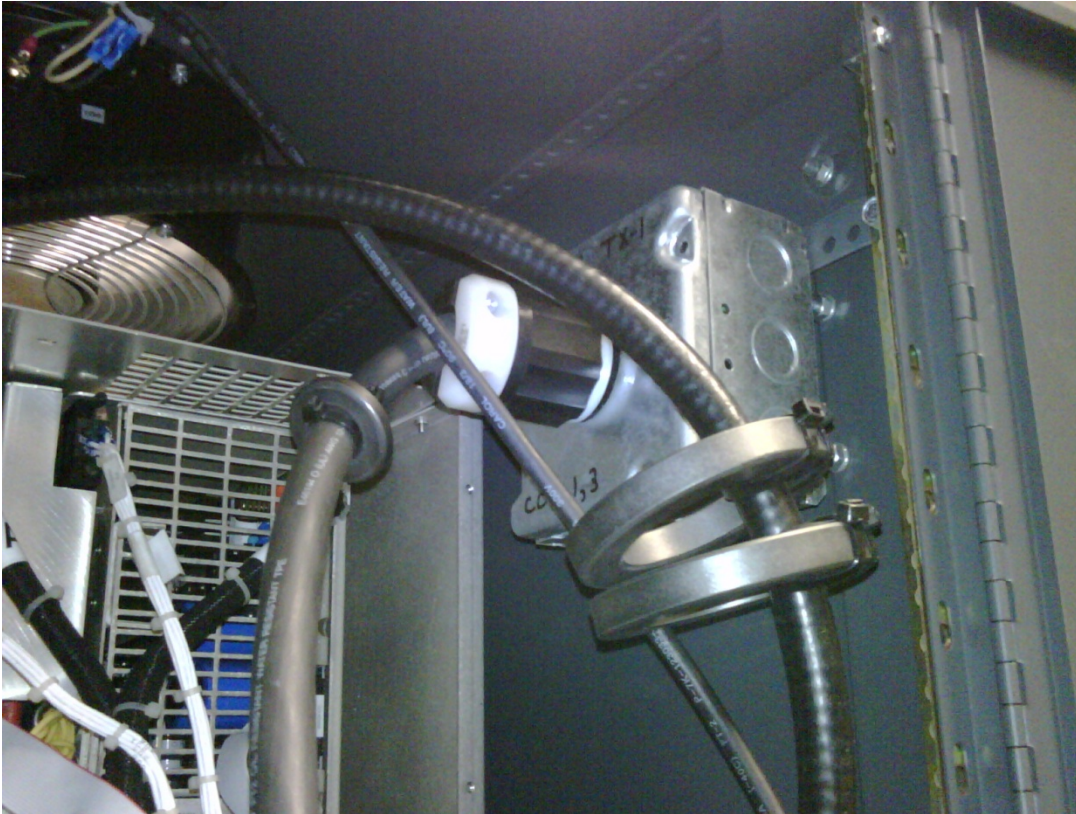
Ferrites on coax help reduce lightning susceptibility

- They should always be installed between the coax ground at cable entry and the equipment being protected



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Keep your Shields UP!



Ferrites on AC cabling can protect against surge related power supply damage

- Should have all feeds and a ground return cable through the ferrite

- In some cases, such as with purely balanced power supplies, it's desirable to make chokes (wrap each AC conductor around a separate ferrite). In this case, ferrite composition needs to be considered

Ferrite Choke Locations

- ON the coax near the transmitter
- ON the coax near the input to the antenna tuning unit (ATU)
- ON audio cables near their termination point
 - only twisted pair, shielded cables should be used
- ON the AC to the transmitter
 - all AC phases and AC ground go through the same ferrite
- ON the remote control cables
 - only twisted pair, shielded cables should be used
- ON AC cables to any external equipment

Routine Inspections

A regular visual inspection of the ATU and lightning protection components helps to prevent damage caused by failures like this.



Routine Inspections

Keep rodents and animals out, as well as providing protection from the elements.

Inspect seals and lock assemblies annually.

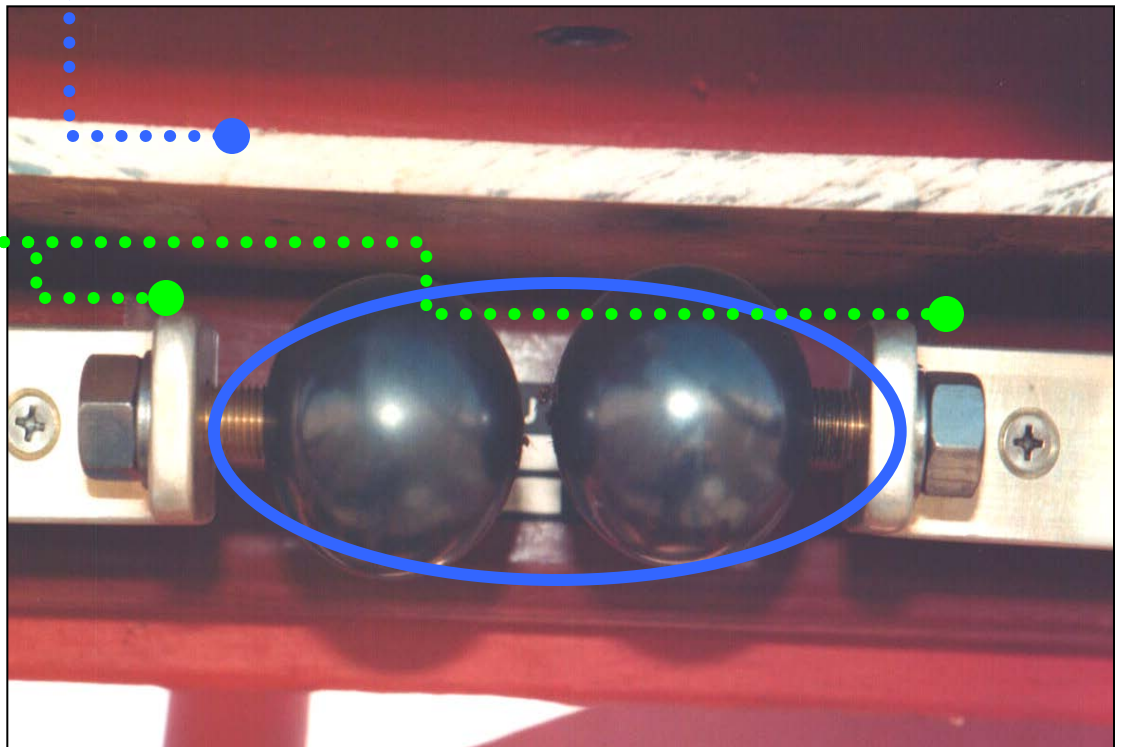


Antenna Spark Gap

Rain shields should be fitted to outdoor gaps

Lead screws allow for easy accurate adjustment

Carbon balls require little or no maintenance



Spark Gap Inspections

Ball gap spacing

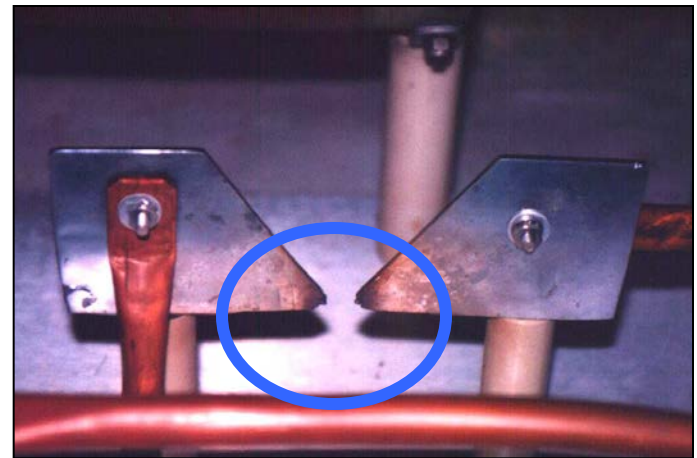
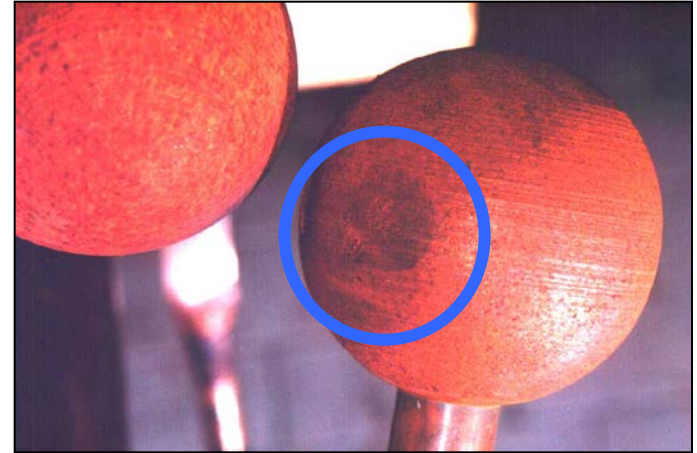
- 1/2" and larger, can be calculated

Steel balls

- require frequent maintenance
- File or turn as needed

Horn gaps

- difficult to calculate
- some require major rework after a strike



If It's Not Live, Ground It

- Electrolysis caused by static and lightning strike dissipation can cause the guy anchor to fail.
- Ground all guy wires to prevent major antenna system failures.
- Save the anchors



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If It's Arced, Replace It

Once a guy wire insulator has arced, it's no longer an insulator – it's a conductor waiting to happen!

Arcing insulators rapidly change the load the transmitter sees, and stress the system.



Airflow Considerations

- Airflow is also important
 - As much air as possible should flow through equipment
 - Don't defeat the purpose by reversing direction



Clean equipment is happy equipment



Poor airflow, or insufficient cooling, can be expensive!!!

Clean equipment is happy equipment



Air filters – on incoming air and equipment – are there to keep things clean

- They must be cleaned or replaced regularly
- Equipment should NOT be operated with air filters removed, unless a provisions are in place for additional filtering of incoming air. This is rarely advisable
- Do NOT replace air filters with a different type without consulting the equipment manufacturer
- Some air fliters require spraying with a sticky substance (FilterKote™) for proper operation

Clean equipment is happy equipment



On an AM site, there are other things that should be cleaned occasionally

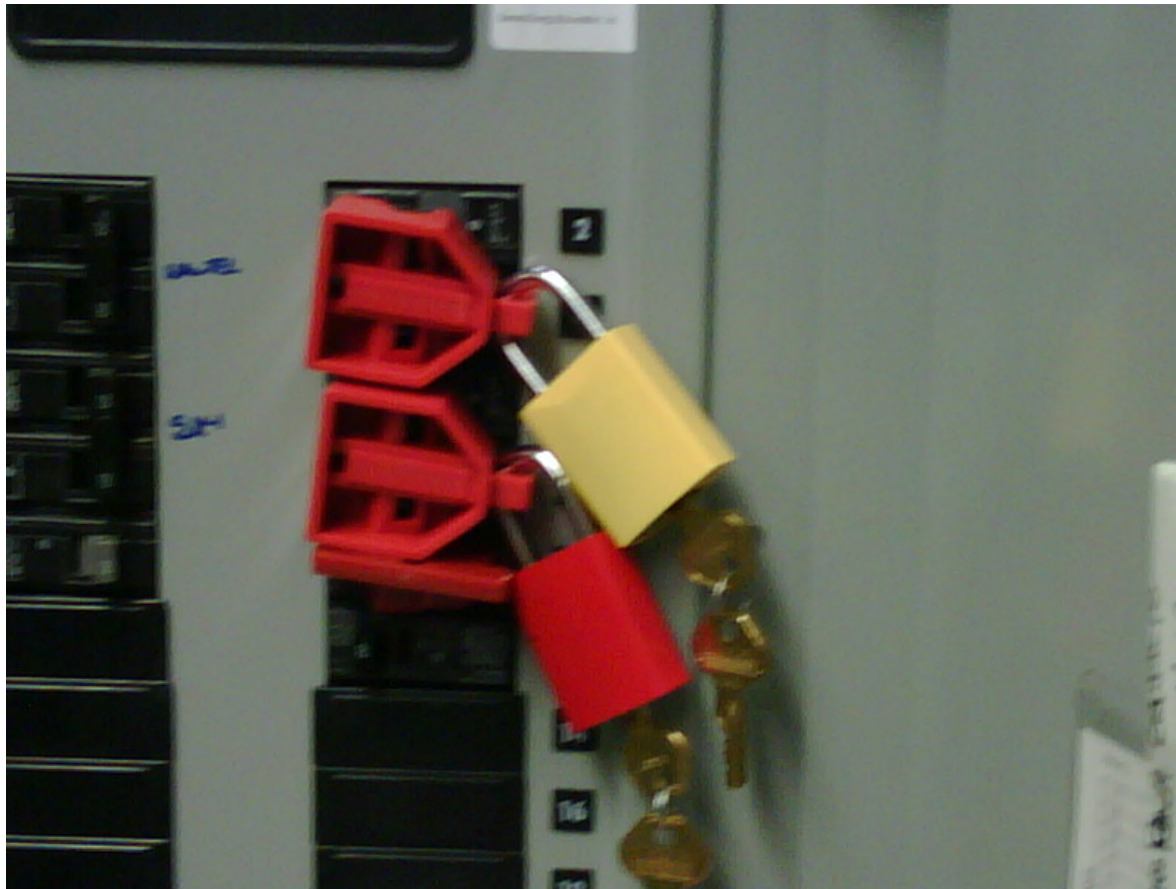
- The owner of this 50 kW AM site wondered why the transmitter shut down with VSWR every time the humidity was high

Ensure everything is discharged

- A ground stick can scare the pants off you if it hits a live circuit... but not nearly as badly as if YOU had hit that circuit.



Safety is Key



Lockout/tagout – it can save your life

Safety is Key

- Arc Flash
 - Can happen on any circuit handling over 125kVA
 - 50kW AM on 240VAC
 - Any AM transmitter 100kW or higher
 - 40kW FM on 240VAC



Troubleshooting/Maintenance

- All legacy equipment (anything over 15 yrs old):
 - Check power supply wiring for cracked insulation
 - Check circuit breakers for mechanical integrity and operating temperature.



Troubleshooting/Maintenance

- Fan life is spec'd at zero backpressure and 40 deg. C
 - Life doubles for every 10 deg. C that ambient is decreased
 - Lifespan decreases if fan is stressed (negative pressure)



Troubleshooting/Maintenance

– If a transmitter has a cover panel,
LEAVE IT IN PLACE!

- Safety
- Airflow
- Circulating currents



Unless there is a note specifying it's to be removed!

NV20/NV15 INSTALLATION MANUAL

UNPACKING AND POSITIONING

8. Remove the grey, plastic power supply shipping panel in the lower, front compartment of the transmitter cabinet (covers the module power supplies). The panel is secured using M4 hardware.

Safety Considerations

- Locking out a breaker while working on equipment ensures nobody else will be turning it on... while you're still in the rig.
- Transmitter interlocks are a safety feature, not an inconvenience to be bypassed and left bypassed.
- Measure before touching! Some systems have multiple AC mains connections (such as separate feeds for exciters).
- De-energize everything – breakers off, then ground stick.
- Airflow interlocks protect equipment

Trim Around the Edges

Especially at AM sites, weeds and brush can create challenges

- Brush and trees can degrade, or even destroy, ground radials
- In some areas, high grass can also hide other hazards (snakes, for example)
- Keeping the area around towers free of weeds can also save other problems
 - In some cases, we've seen kudzu or ivy growing up an AM tower, resulting in VSWR trips every time it rained
- In addition to safety and reliability of signal, there is a security issue, as tall grass and growth can help to mask the presence of intruders

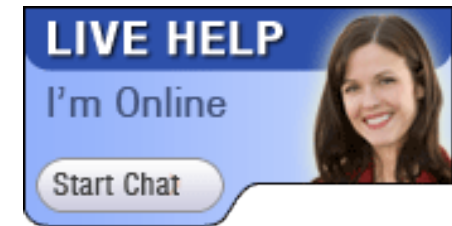


Wrapping it all up...

- Keep it grounded
- Shield as needed
- Move that air
- Keep things clean
- Check hardware regularly
 - AC and HVDC connections
 - Grounds
 - RF connections (for AM)
- Temperature checks on breakers and line

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Thank You

