Technician License Course

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Chapter 5

Lesson Plan Module – 12

Power Sources

-and-

RF Interference (RFI)

Power Supplies

- Most modern radio equipment runs from 12 volts dc.
  - Actual preferred voltage is 13.8 volts.
- Household ac power is 120 volts ac.
- Power supplies convert 120 volts ac to regulated, filtered dc.
  - If you use a lab-type 12 volt power supply, be sure it is adjustable to 13.8 volts.

Types of Power Supplies

- Linear:
  - –Use iron transformers
  - –Heavy (physically)
  - –Do not emit RF, generally immune to strong RF
- Switching:
  - –Electronics instead of transformers
  - –Lightweight and small
  - –Can emit RF if not properly filtered
    - –Check product reviews

Power Supply Ratings - Voltage and Current

- Continuous duty – how much current can be supplied continuously.
- Intermittent duty – how much current can be supplied for short surges, such as on voice peaks.
- Regulation – how well the power supply maintains a constant output voltage.

Power Supply Ratings – Protective Features

- Overcurrent
- Overvoltage
- Overtemperature
- Safety Ratings

Batteries

- Create current through a chemical reaction
  - –Individual cells connected in series or parallel
  - –Cell chemistry determines voltage per cell
- Battery types
  - –Disposable (primary batteries)
  - –Rechargeable (secondary batteries)
  - –Storage

Battery Charging

- Some batteries can be recharged, some cannot.
- Use the proper charger for the battery being charged.
- Batteries will lose capacity with each cycle.
- Best if batteries are maintained fully charged.
  - –Over-charging will cause heating and could damage the battery.

Battery Charging

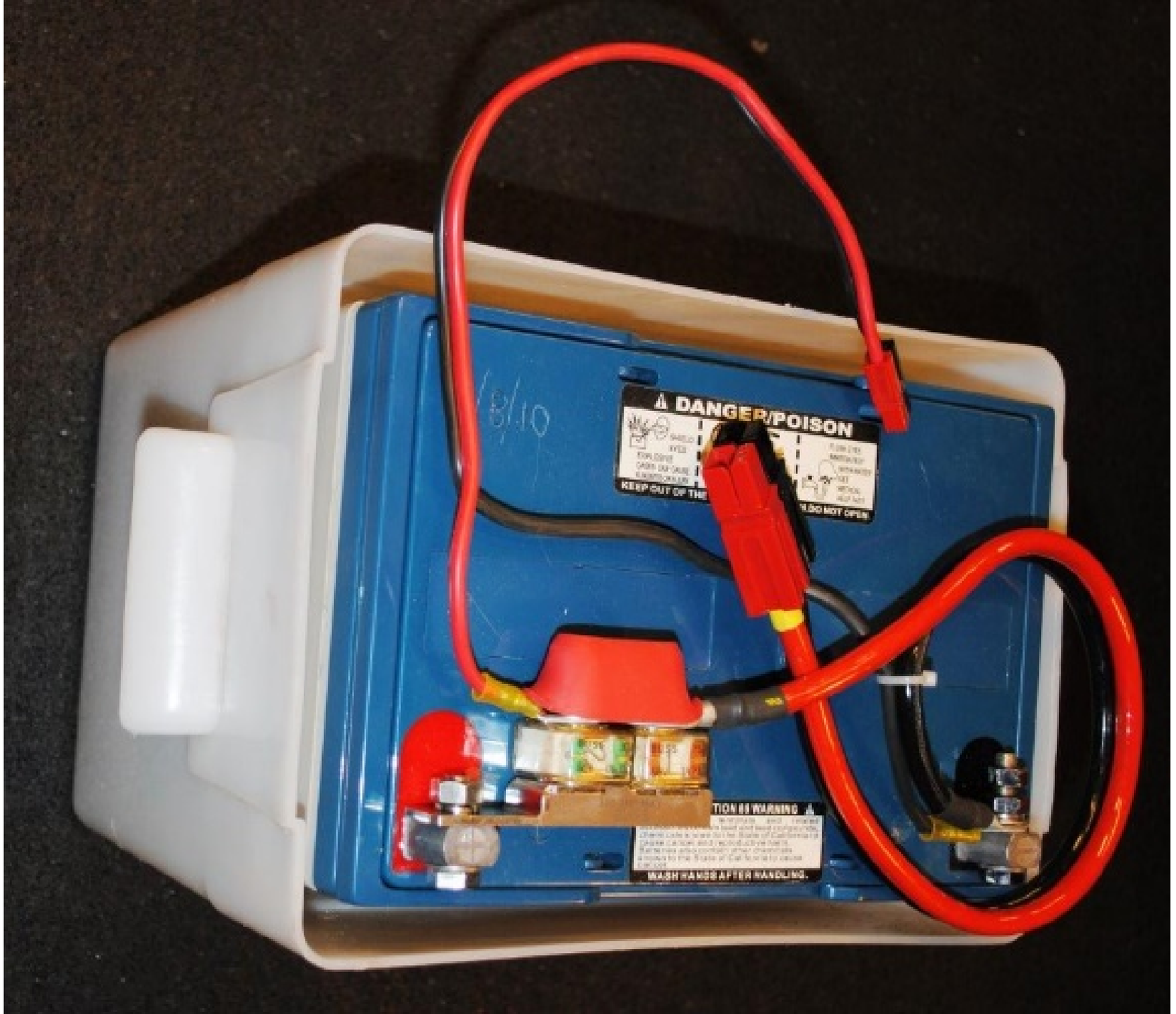
- Lead-acid batteries release explosive hydrogen during charging or rapid discharge so adequate ventilation is required.
- Automobiles can be a good emergency power source by recharging batteries
- A 12-volt lead-acid station battery can be recharged by connecting it to an automobile’s electrical system

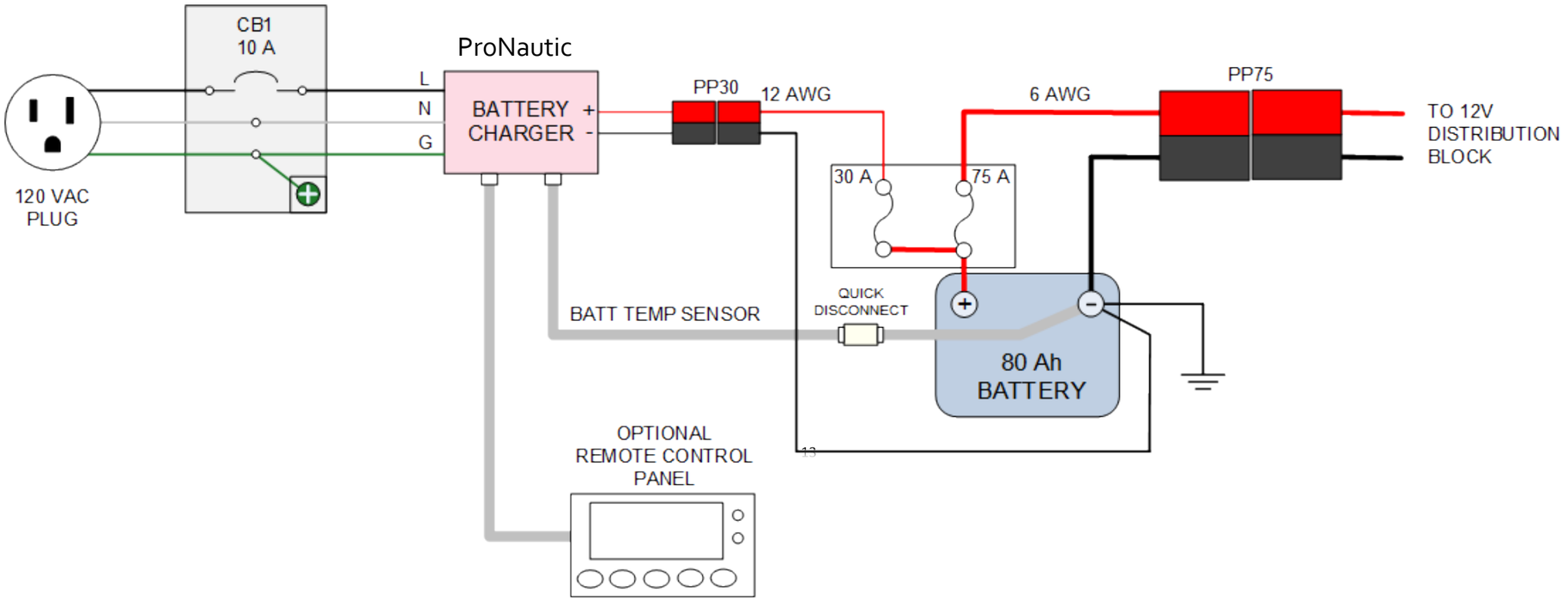
Battery Charging

- Monitor battery temperature
- Make sure battery is well-ventilated

Battery Hazards

- Many batteries hold lots of energy – shorting a battery could cause a fire.


DANGER/POISON
KEEP OUT OF THE
DO NOT OPEN
WASH HANDS AFTER HANDLING.


CB1
10 A
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BLOCK
120 VAC
PLUG
30 A
75 A
QUICK
DISCONNECT
BATT TEMP SENSOR
80 Ah
BATTERY
OPTIONAL
REMOTE CONTROL
PANEL

Alkaline Batteries

- The design of the two exposed terminals of a 9V battery in proximity to one another can easily be short-circuited by coming into contact with any conductive material
- Materials are not particularly harmful. Spent batteries should be placed in regular trash. But put tape over the terminals to be safe. Trash fires have been started by alkaline batteries.
- This style of battery is largely obsolete for new designs, although they will continue to be available for some time to use in legacy equipment/

NEWS

TRENDING Flight MH370 | Canucks | Ukraine | Quebec Election | Rob Ford | Justin Trudeau | Tim

Colgate recalls Motion electric toothbrush after nine reports of the product exploding

NP POSTMEDIA NEWS | November 3, 2011 | Last Updated: Nov 3 10:35 AM ET
More from Postmedia News

A grab from Colgate's website Colgate

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Health Canada is warning Canadians to stop using a model of electric toothbrush after several were reported to have "exploded."

15

Did you know?

Alkaline batteries vent a small quantity of hydrogen gas during normal discharge

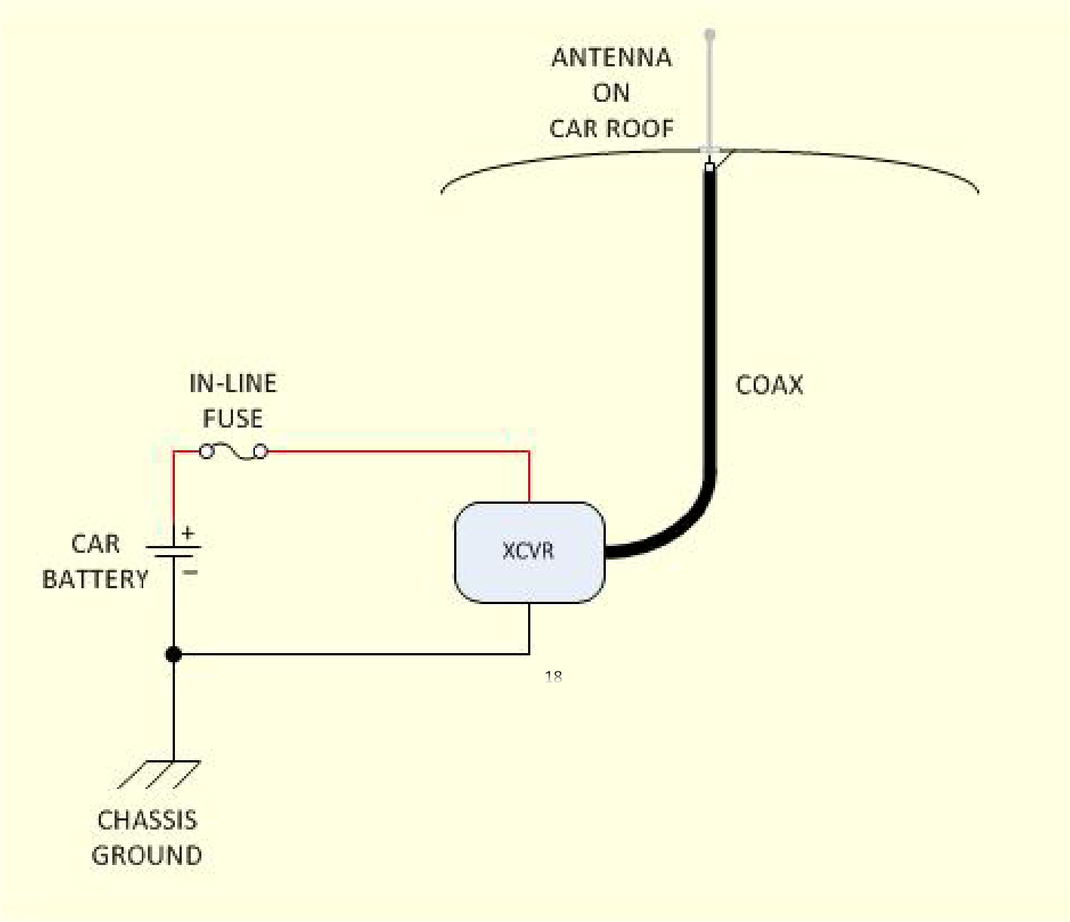
Overcharging

- Many lithium battery chemistries are even more susceptible to damage than lead-acid batteries when overcharged.
- Always use the recommended charger for any rechargeable battery. If in doubt, ask for advice.

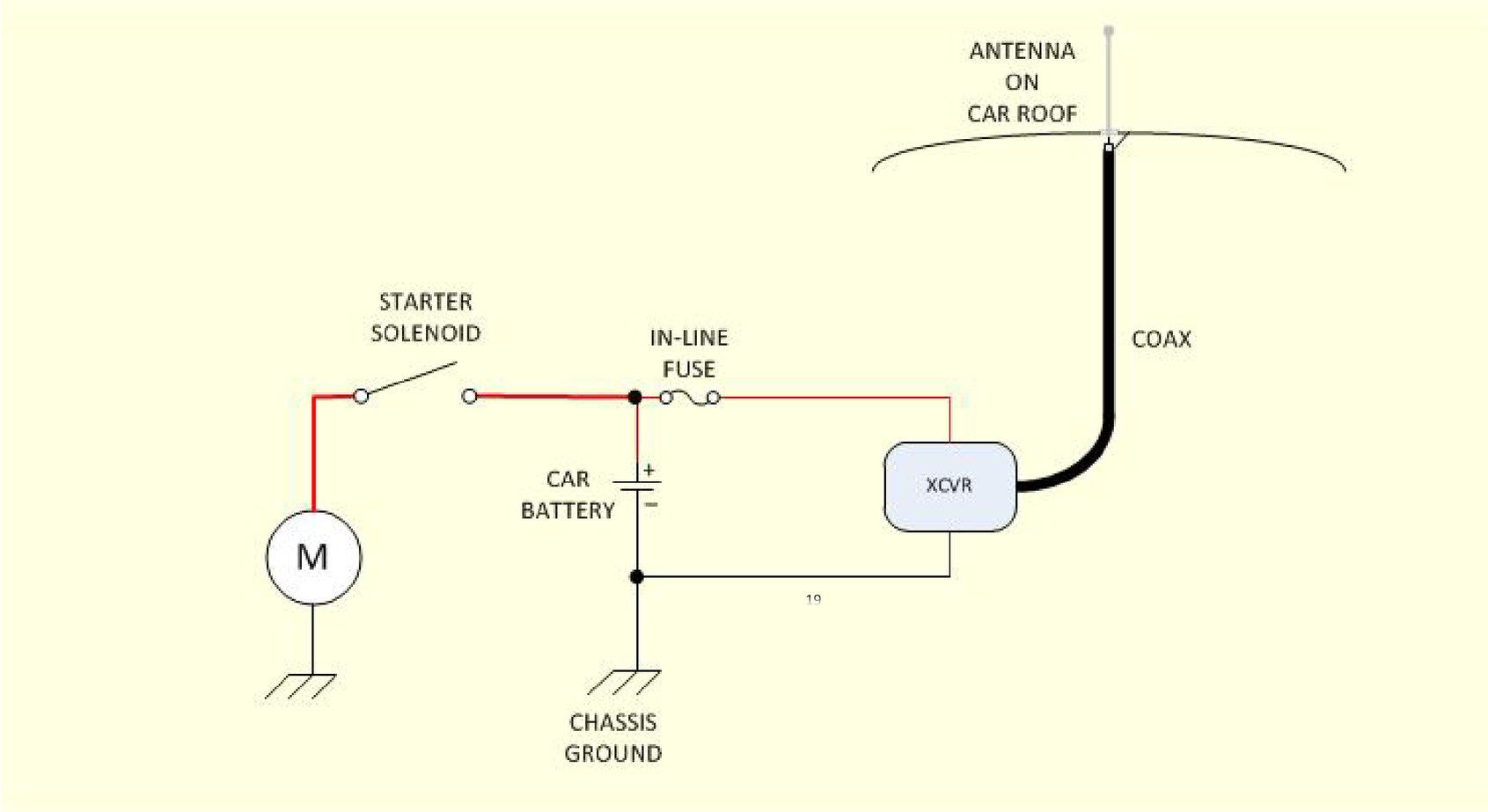
Mobile Power Wiring Safety

- Special requirements for safe car wiring:
  - Fuse both positive and negative leads.
  - Connect radio's negative lead to negative terminal or engine block ground strap.
  - Use grommets or protective sleeves to protect wires.
  - Don't assume all metal in the car is grounded; modern cars are as much plastic as metal.

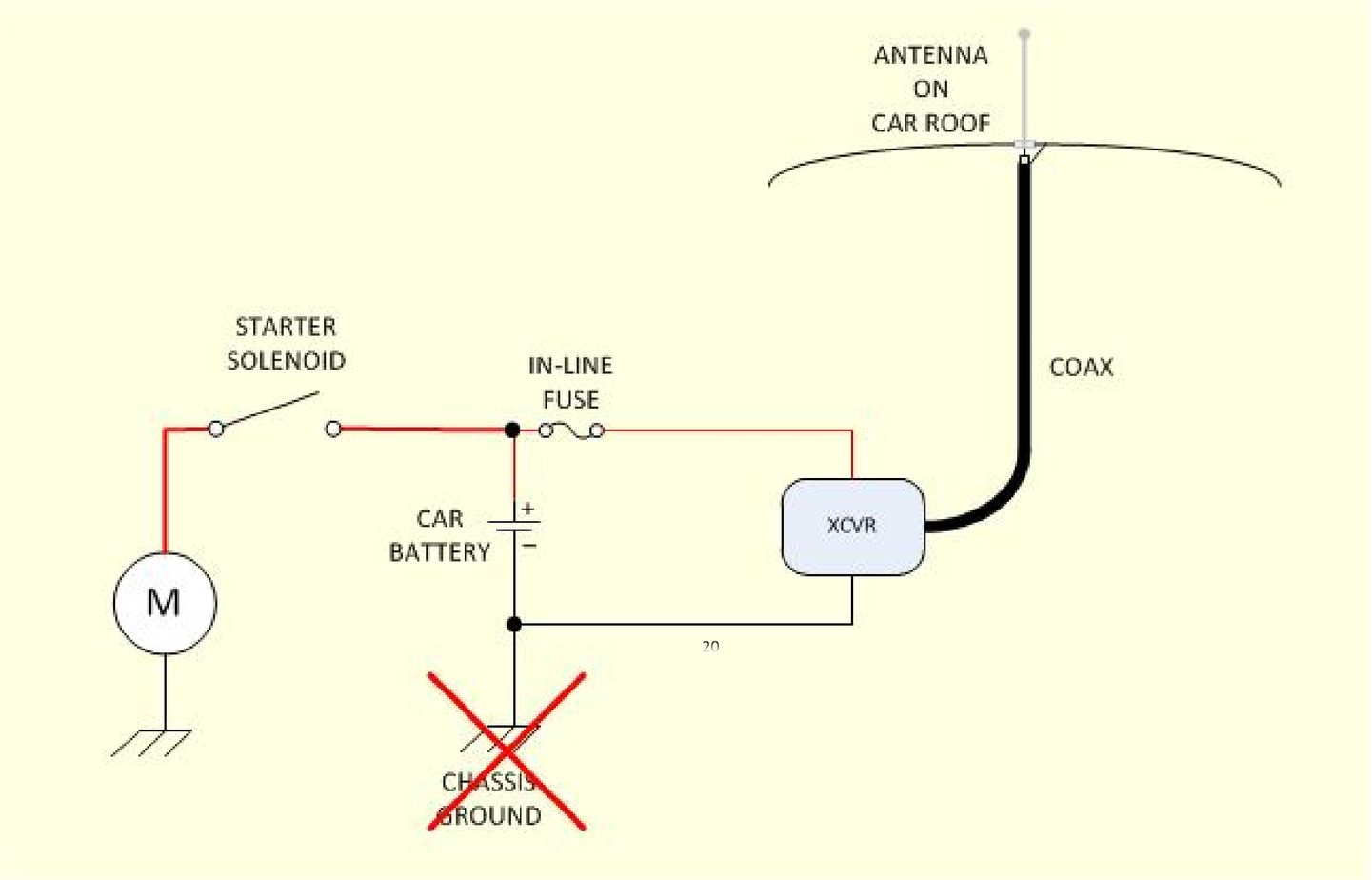
Mobile Power Wiring Safety



Mobile Power Wiring Safety



Mobile Power Wiring Safety



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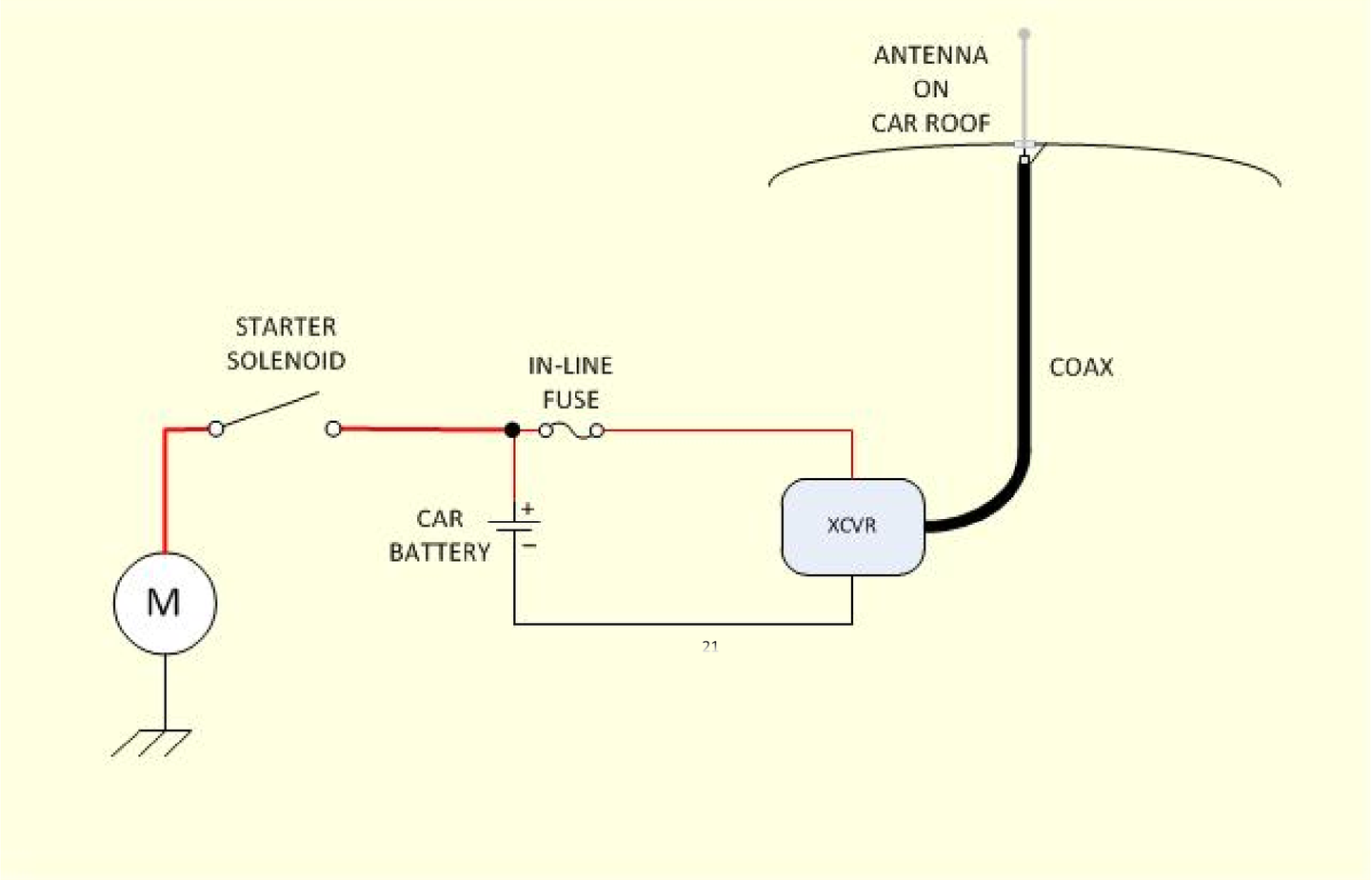
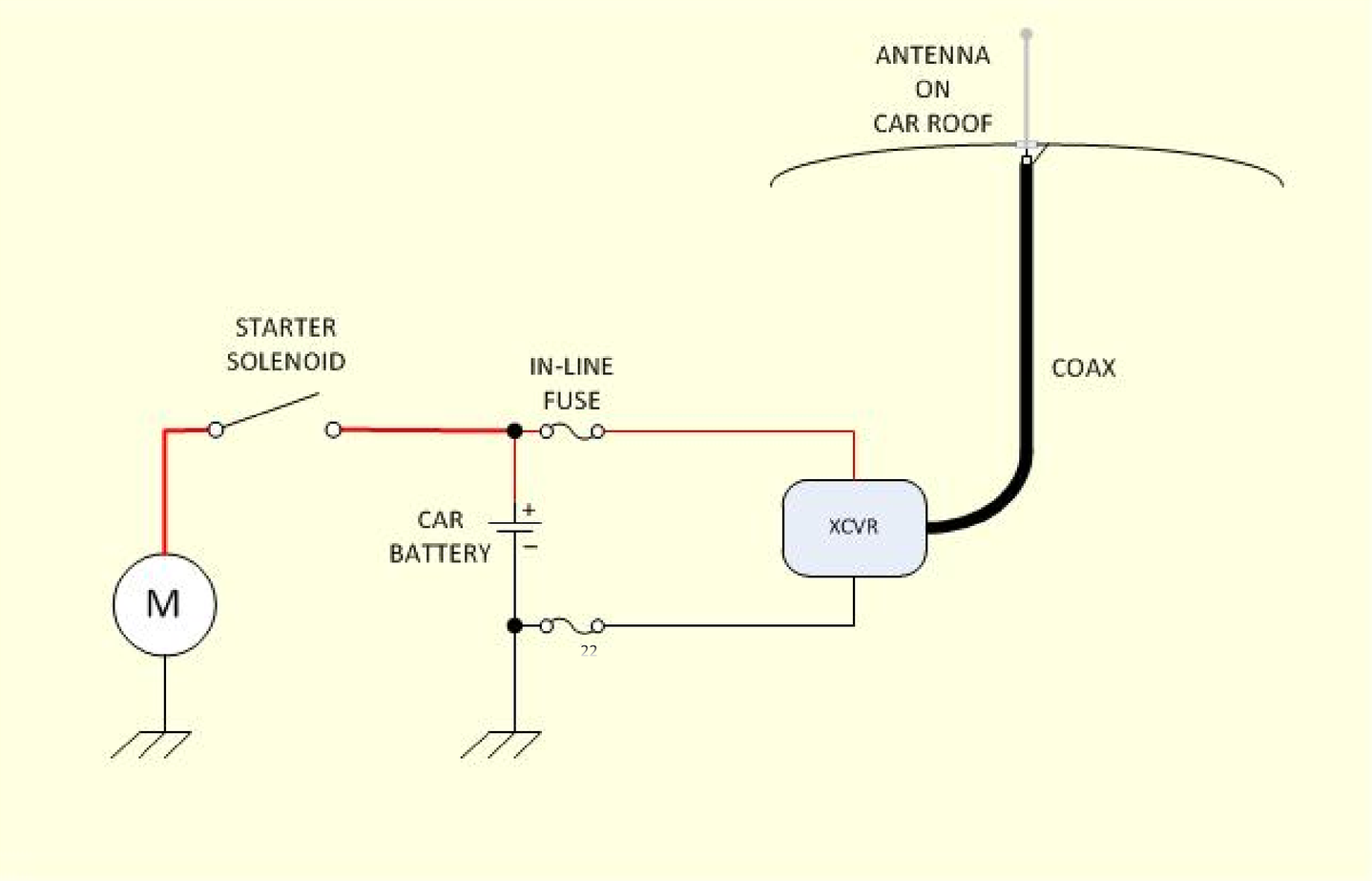


Mobile Power Wiring Safety



This is not only an issue in mobile radio installations!

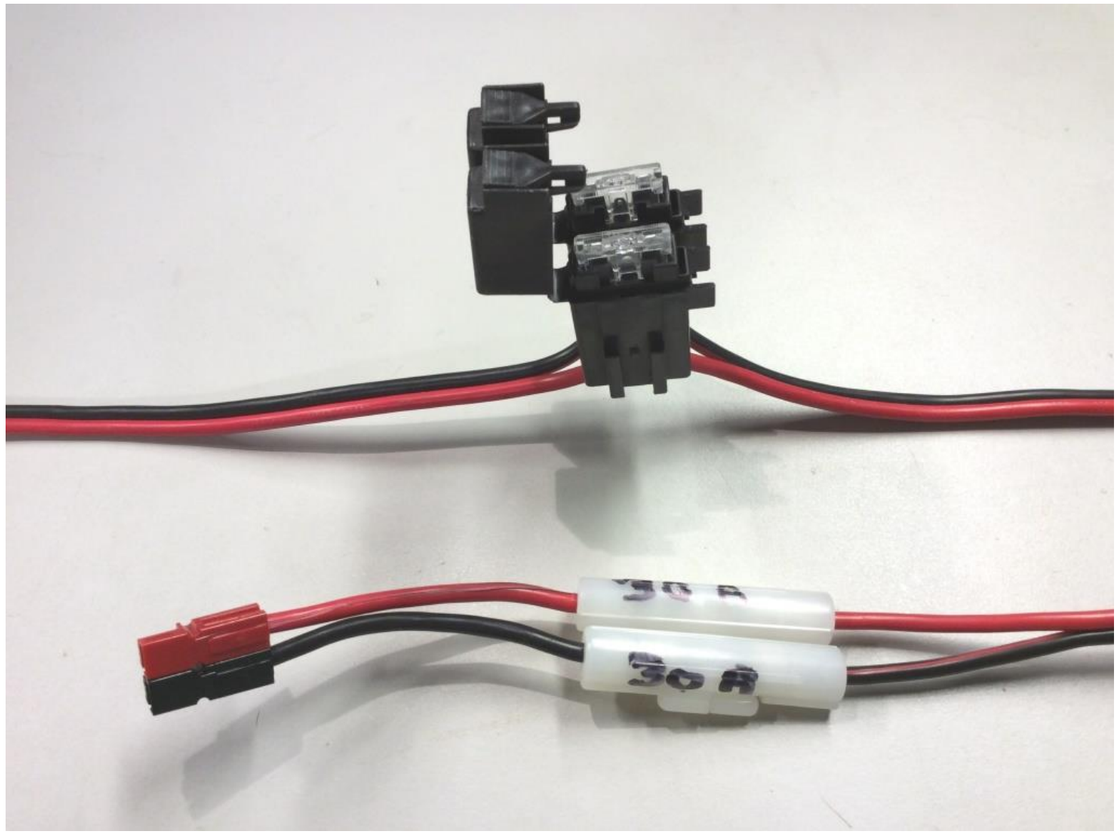
- Any time you have high- and low-current devices sharing a common power supply, this problem can occur if the two devices share a signal ground in common.
- Consider a HF rig with any of the following accessories:
  - External keyer
  - External automatic antenna tuner
  - Signalink or similar sound card interface
- If the high-powered radio loses its 12V power supply negative connection, that 20A transmit current is going to flow back to the battery via the accessory.

12V outlet strips – two design weaknesses to be concerned with

- Can plug a low-current device into a high-current fuse by accident
- Negative leads of low-current devices are not fused!

A better idea …

Inline fuses close to power source connector



Powerpole distribution blocks

Handheld Transceivers

- Battery packs – packages of several individual rechargeable batteries connected together.
  - NiCd (nickel-cadmium)
  - NiMH (nickel-metal hydride)
  - Li-ion (lithium-ion)
- For emergencies, have a battery pack that can use disposable batteries (AA size).

Radio Frequency Interference (RFI)

- Signals that interfere with radio reception.
- Interference can be FROM your station to others or TO your station from another source.
- Solving the problem might take a little detective work!

Types of RFI

- Direct detection – offending signals get into the electronic circuits to cause interference.
- Overload – strong signal that overwhelms the ability of the receiver to reject it.
- RF Current – can be picked up by cables of consumer equipment.
- Transmitted harmonics – must be filtered out at the transmitter.

Filters

- Filters attenuate (reduce) signals
- High-pass – reduce low-frequency signals
- Low-pass – reduce high-frequency signals
- Band-pass – only pass a range of signals
- Notch – reduces a narrow range of signals
- Selecting correct filter requires understanding the source of the interference

Ferrite Chokes

- Creates impedance (opposition to ac) on cables and wires.
- Can be used to block RF current that causes interference to entertainment equipment, microphones, monitors, amplifiers, etc.
- Wind cable through ferrite core to create blocking impedance.

Cable TV Interference

- Usually the result of broken shielding somewhere in the cable.
  - –Loose connections
  - –Broken connections
  - –Corroded connections
- Usually solved by proper cable maintenance by cable supplier.

Noise Sources

- Electrical arcs (motors, thermostats, electric fences, neon signs)
- Power lines
- Motor vehicle ignitions or alternators
- Switching power supplies
- Computers, networks and TV sets

RFI Guidelines

- Operate your equipment properly.
- Eliminate interference in your own home.
- Use good station building practices to eliminate unwanted signals.
  - Shielded wire and cables
  - Shielded equipment
  - Good connections and filters

Dealing with RFI

- Take interference complaints seriously.
- Make sure that you're really not the cause (demonstrate that you don't interfere within your own home).
- Offer to help eliminate the RFI, even if you are not at fault.
- Consult ARRL RFI Resources for help and assistance.

Part 15 Rules

- Apply only to unlicensed devices
- Unlicensed devices may not interfere with licensed services, such as amateur radio
- Unlicensed devices must accept any interference they receive from licensed services
- RFI from and to unlicensed devices is the responsibility of the users of such devices

What the Rules Say

- Bottom line – If your station is operating properly, you are protected against interference complaints
- BUT – Be a good neighbor because they are probably not familiar with Part 15 rules and regulations

Electrical Safety Grounding and Circuit Protection (in the Home)

- Make sure your home is “up to code.”
- Most ham equipment does not require special wiring or circuits.
  - –Use 3-wire power cords.
  - –Use circuit breakers, circuit breaker outlets, or Ground Fault Interrupter (GFI) circuit breakers.

Electrical Safety Grounding and Circuit Protection (in the Home)

- Ground Fault Interrupter (GFI) circuit breakers.
- Use proper fuse or circuit breaker size.
- Don’t overload single outlets.

RF “Grounding”

- Not the same as ac safety grounding
- “Bonding” is more accurate
- Keep all equipment at the same RF voltage
  - Current will not flow between pieces of equipment which can cause RF feedback
  - Minimizes RF “hot spots” (RF burns)
  - Use solid strap or wire for best RF connection

Practice Questions

What is one way to recharge a 12-volt lead-acid station battery if the commercial power is out?

What is one way to recharge a 12-volt lead-acid station battery if the commercial power is out?

Connect the battery in parallel with a vehicle's battery and run the engine

Which is a good reason to use a regulated power supply for communications equipment?

Which is a good reason to use a regulated power supply for communications equipment?

It prevents voltage fluctuations from reaching sensitive circuits

Where must a filter be installed to reduce harmonic emissions from your station?

Where must a filter be installed to reduce harmonic emissions from your station?

Between the transmitter and the antenna

Which type of conductor is best to use for RF grounding?

Which type of conductor is best to use for RF grounding?

Flat strap

What could you use to cure distorted audio caused by RF current flowing on the shield of a microphone cable?

What could you use to cure distorted audio caused by RF current flowing on the shield of a microphone cable?

Ferrite choke

What is the source of a high-pitched whine that varies with engine speed in a mobile transceiver’s receive audio?

What is the source of a high-pitched whine that varies with engine speed in a mobile transceiver’s receive audio?

The alternator

Where should the negative return connection of a mobile transceiver's power cable be connected?

Where should the negative return connection of a mobile transceiver's power cable be connected?

At the battery or engine block ground strap

What could be happening if another operator reports a variable high-pitched whine on the audio from your mobile transmitter?

What could be happening if another operator reports a variable high-pitched whine on the audio from your mobile transmitter?

Noise on the vehicle’s electrical system is being transmitted along with your speech audio

How much voltage does a mobile transceiver usually require?

How much voltage does a mobile transceiver usually require?

About 12 volts

What battery types are rechargeable?

What battery types are rechargeable?

Nickel-metal hydride
Lithium-ion
Lead-acid gel-cell

What battery type is not rechargeable?

What battery type is not rechargeable?

Carbon-zinc

What type of circuit controls the amount of voltage from a power supply?

What type of circuit controls the amount of voltage from a power supply?

Regulator

What is a common reason to use shielded wire?

What is a common reason to use shielded wire?

To prevent coupling of unwanted signals to or from the wire

What would cause a broadcast AM or FM radio to receive an amateur radio transmission unintentionally?

What would cause a broadcast AM or FM radio to receive an amateur radio transmission unintentionally?

The receiver is susceptible to strong signals outside the AM or FM band

What may be a cause of radio frequency interference?

What may be a cause of radio frequency interference?

- Fundamental overload
- Harmonics
- Spurious emissions

What is a way to reduce or eliminate interference by an amateur transmitter to a nearby telephone?

What is a way to reduce or eliminate interference by an amateur transmitter to a nearby telephone?

Put a RF filter on the telephone

How can overload of a non-amateur radio or TV receiver by an amateur signal be reduced or eliminated?

How can overload of a non-amateur radio or TV receiver by an amateur signal be reduced or eliminated?

Block the amateur signal with a filter at the antenna input of the affected receiver

What action should you take if a neighbor tells you that your station's transmissions are interfering with their radio or TV reception?

What action should you take if a neighbor tells you that your station's transmissions are interfering with their radio or TV reception?

Make sure that your station is functioning properly and that it does not cause interference to your own radio or television when it is tuned to the same channel

What may be useful in correcting a radio frequency interference problem?

What may be useful in correcting a radio frequency interference problem?

- Snap-on ferrite chokes
- Low-pass and high-pass filters
- Band-reject and band-pass filters

What should you do if something in a neighbor’s home is causing harmful interference to your amateur station?

What should you do if something in a neighbor's home is causing harmful interference to your amateur station?

Work with your neighbor to identify the offending device

Politely inform your neighbor about the rules that prohibit the use of devices which cause interference

Check your station and make sure it meets the standards of good amateur practice

What is a Part 15 device?

What is a Part 15 device?

An unlicensed device that may emit low powered radio signals on frequencies used by a licensed service

What is a symptom of RF feedback in a transmitter or transceiver?

What is a symptom of RF feedback in a transmitter or transceiver?

Reports of garbled, distorted, or unintelligible transmissions

What might be the first step to resolve cable TV interference from your ham radio transmission?

What might be the first step to resolve cable TV interference from your ham radio transmission?

Be sure all TV coaxial connectors are installed properly

What kind of hazard is presented by a conventional 12-volt storage battery?

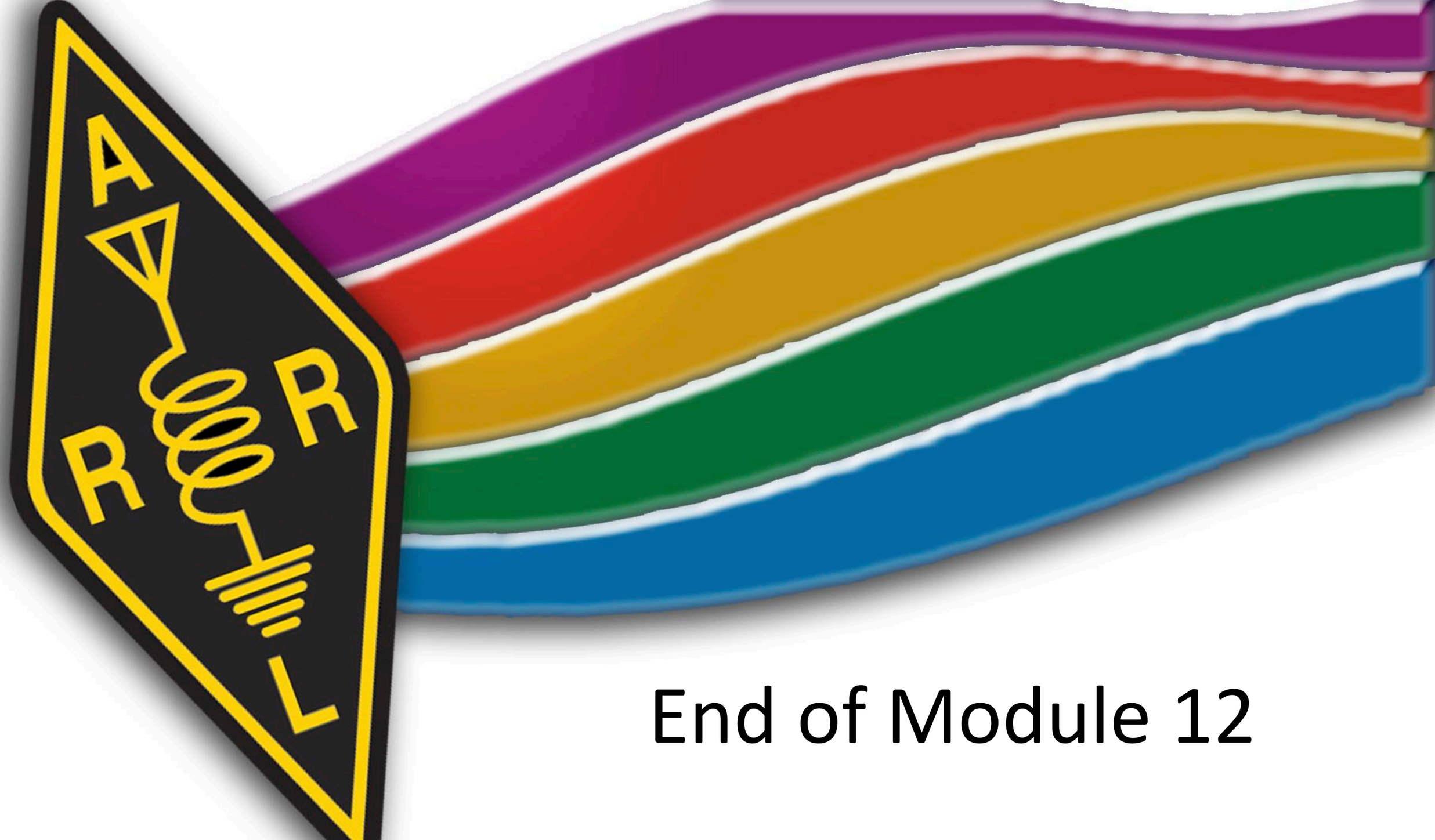
What kind of hazard is presented by a conventional 12-volt storage battery?

Explosive gas can collect if not properly vented

What can happen if a lead-acid storage battery is charged or discharged too quickly?

What can happen if a lead-acid storage battery is charged or discharged too quickly?

The battery could overheat and give off flammable gas or explode



End of Module 12