

Equipment

Personal Equipment Checklists

Note that these lists are *not* meant to suggest that you need to bring all the listed items. You probably can't bring all this stuff unless you will have your own truck to transport you and your equipment. These lists are meant to be a reminder of the equipment you *might need*. Each individual needs to consider the conditions where they live and the kind of events to which they will respond, then plan a kit that includes the items appropriate to their needs.

You should prepare an emergency kit with those items you expect to need in an emergency. This kit should be ready to grab-and-go all the time. Take this kit along even for one-day public service events when you know you won't need it. You will probably want to adjust your kit at least twice a year to take care of seasonal changes, but be sure you have at least the basics in the kit at all times.

For each event, whether it is an emergency call-out or a planned public service event, you then add whatever other equipment you will need for that event.

Equipment:

- Identification cards (*REACT*, served agency, state or local Emergency Management Agency, other related organizations such as ARES, RACES, Red Cross, etc.)
- Copy of any radio licenses (including copy of license for any business radios licensed to the Team)
- Handheld radio (dual band if applicable)
- Spare battery packs (charged batteries and AA or AAA holder)
- Headset, speaker-mike.
- Quarter-wave (usually about 19") mag-mount or ground plane antenna (will function on VHF and UHF)
- Coax jumpers and connectors
- Connector adapters (BNC/PL259/SMA as appropriate)
- Duct tape
- Notebook, pen & clip board (preferably waterproof)
- Watch
- Maps of area (topographic *and* street if possible)
- Compass and/or GPS
- Copy of emergency plan
- Copies of message forms and log sheets
- Boundary-marking tape

Personal Survival Items:

- Minimum three day supply of personal medications (even if only going to be out for one day)
- Medical information, with blood type, any allergies, medications, or medical conditions, and name and contact information for your doctor or doctors
- Warm clothing & boots (bright colors for shirts and jackets)
- First aid kit
- Moist towelette packets

- Sun screen (winter and summer)
- Rain suit
- Space blanket
- Plastic ground cover tarp
- Hat
- Gloves
- Orange or Bright Green vest (color as used in your area)
- Spare glasses (or spare contact lenses and solution if you wear contacts)
- Spare shoe laces and some twine
- Wool blanket
- Fanny-pack and/or backpack
- Supply of water (such as sports/bicycle water bottle)
- High energy snacks
- Large trash bags
- Toilet paper or facial tissue
- Flashlight with extra batteries
- Whistle

Tools:

- Multi-purpose knife
- Screwdrivers (Phillips *and* flat)
- Pliers
- Side cutter
- Crimping tool (with wire stripper)
- Assortment of crimp connectors, nails, brads, tacks
- Crescent wrench
- Fence pliers (includes hammer)
- Electrical tape
- MultiMeter / VOM

For Public Service Events:

- Cooler with food & drink
- Lawn chair
- Umbrella (sun or rain)

Optional Items:

- 3 wire AC extension cord with 2-to-3-pin adapter
- AC to 12vDC power supply
- Soldering iron with solder
- Beam antenna with tripod, mast, and guy rope
- Nut driver set
- Folding set of Allen/Torx wrenches
- Zip cord
- Hard hat
- Safety glasses
- Cash
- Transistor radio
- Binoculars

HF Unique:

- HF rig (12v DC preferred) with:
- Microphone
- Key
- Headphones and/or external speaker
- Tuner for the oddball antenna
- 50 ft or more of RG58 or better
- NVIS antenna (not a mobile vertical!)
- 75m dipole with ladder line or 130 ft of wire
- Insulators
- 3 masts, 8 ft or more, preferably non-conductive
- Guy rope
- Tent pegs for guys
- Lead weight and 50 ft light line for tossing over branches
- “Loud” marking tape to warn passers-by of guy lines, coax, etc.
- Power source (one or more)
- 12v gel cell 75 a/h with charger
- Vehicle with 12v battery & gas

Portable “Shack”:

- Shelter tent
- Table and chair

Marking your Equipment. There are very few people who would plan to steal your equipment, but during an emergency there is a lot of confusion. If you have each piece of your equipment marked with your name and callsign it will be much easier to ensure that your equipment is returned to you at the completion of the event.

Standardized Connectors

During public service events or emergencies you could easily need to connect your radio to someone else's power supply or someone else may need to connect their radio to your power supply. A standard power connector goes a long way to facilitate this inter-connectivity.

There is no universally accepted "standard" power connector.

Many years ago ARES had recommended a molded nylon 2-pin Molex type connector (Radio Shack part number 274-222) as a 12-volt power connector for "low-powered" radios. The ARRL no longer recommends this as a standard connector due to the large number of amateur radios with current requirements exceeding the rating of this connector.

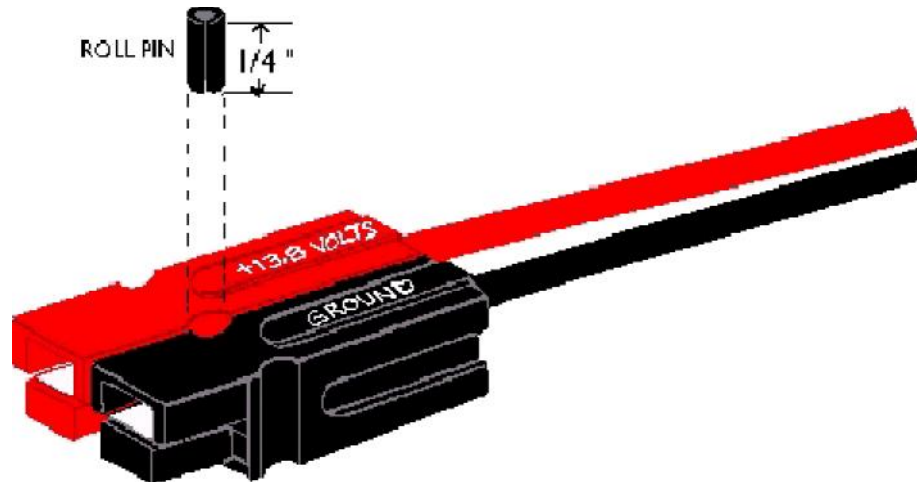
Many other groups, including the large and influential California RACES, recommend the Anderson Powerpole for its greater capacity and durability. This is the most commonly chosen "standard" 12v DC power connector today.

REACT does not specify any particular "standard" connector, but does urge Teams to conform to any existing local standard. If there is no local standard, the Anderson Powerpole is an excellent choice. There are valid arguments in favor of these connectors as well as arguments in favor of various other candidates. The instructions for the Anderson Powerpole "standard" connectors are included here for convenience. An additional consideration is also discussed at the end of this section.

Anderson Powerpole

State of California Office of Emergency Services (OES) prescribes the Anderson Powerpole as the standard dc power connector for use by state ACS/RACES personnel, and recommends its use by county and city ACS/RACES personnel as well. Using this standard, highly reliable connector allows quick and easy installation and substitution of radios, power supplies, batteries, and other equipment.

Either the 15-ampere or 30-ampere sizes may be used, and both sizes mate with each other. The plastic parts are the same for both sizes. The barrel area (which holds the wire) of the 15-ampere silver-plated contact is smaller than that of the 30-ampere contact, but the contact area is the same. The connectors dovetail together into a compact unit.



Housings should be mated according to the diagram above, viewing from the contact side (opposite the wire side), tongue down, hood up, *red* on the left, *black* on the right. Use a 3/32-inch-diameter roll pin, 1/4 inch long, to keep the housings from sliding apart.

Highly conductive silver-plated copper contacts allow minimal contact resistance at high currents. Self-wiping action on make and break keeps the conducting surfaces clean. Contact dents keep connectors mated in high-vibration applications and provide quick-break, snap action upon disconnect.

Noncorrosive stainless-steel leaf springs maintain constant contact pressure, which is ideal for frequent connections/disconnections and intermittent overloading. The durable, high impact-resistant, polycarbonate housing with UL94V-2 flammability ratings comes in many colors for circuit traceability and coding.

Identical connector halves are genderless, making assembly quick and easy and reducing the number of parts stocked. *Because the connectors are genderless, it is possible to connect individual connectors of opposite polarity, causing a short circuit. This problem is minimized by proper assembly of connector pairs (as specified above) and standard color coding.*

Molded-in dovetails allow for a customized harness in a variety of configurations. When the connectors are disconnected, no metal parts are exposed.

The 15-ampere contacts are designed for 16-20 AWG wire and the 30-ampere contacts are designed for 12-16 AWG wire. The contacts can be soldered or crimped to wires. A crimping tool is available from Anderson. After a contact has been attached to a wire, it should be installed into the housing so that the housing spring mates with the underside of the contact.

To remove a contact from the housing, use Anderson insertion/extraction tool #111038G2. You may also substitute a very small blade (jeweler's screwdriver or Xacto knife) to depress the spring, allowing the contact to be removed.

Here are the Anderson part numbers:

15 A	Complete Connector	Housing Only	Contact Only
Black	#1395G1	#1327G6	#1332
Red	#1395	#1327	#1332
30 A	Complete Connector	Housing Only	Contact Only
Black	#1330G4	#1327G6	#1331
Red	#1330	#1327	#1331

The connectors can be panel mounted with clamp receptacles, consisting of two aluminum plates (Anderson part #1462G1), notched to hold the plastic housings when they are dovetailed together.

Safety Note: The HS-8 (8-pole) connector housing has an operational design deficiency, in that a red/black pair could be inserted into the *center* of the connector, with unfortunate results. Bill Frisbee W3EMH has developed a simple solution: take the right block of four and rotate them 180 degrees, so the blacks are all in the center, and incorrect insertion is not feasible due to the inverted connectors. Alternatively, and as shown in the PowerWerx Gallery from KM6YH, they can all be rotated 90 degrees, so all blacks are on the same side. Both solutions require only minor mechanical skills and are quite recommended. If your group uses the 8-pole connector housing in any applications, you are strongly encouraged to select *one* of these solutions and include it as part of your “standard.”

The plastic housings come in other colors also. Red and black are suggested for standard DC connectors (red as positive and black as negative).

Anderson Power Products Web Site is <http://www.andersonpower.com/>

The 15 and 30 amp rated connectors shown are at <https://www.andersonpower.com/us/en/products/powerpole/pp15-to-45.aspx>

These connectors are available from many sources at different prices, don't be afraid to shop around.

One Final Alternative

The one “connector” that *everyone* has available is plain wire. This is, after all, the one connector that originally came with every 12vDC powered radio. It remains the lowest common denominator, not just for organized groups, but also for spontaneous volunteers and any potentially donated equipment.

Plain wire isn't as elegant as either of the other connectors, but don't forget that it is there if you need it. In an emergency, a wire stripper and a roll of electrical tape are the ultimate “adapter” to resolve otherwise incompatible connections.

No matter what standard is (or isn't) adopted in your local area, always make sure that you have the basic connector for your equipment with enough wire on it so you can make a connection without totally relying on someone else having a matching connector.

Local Standards

If there is a “standard” connector adopted in your area, equip your radios, power supplies, and batteries with these connectors. Additionally you should have adapter cords (patch cords) made with these connectors that have large auto battery clips and cigarette lighter plugs as the power source. (Cigarette lighter plugs should only be used as a short-term temporary connector for low powered equipment.)

A standard connector is most valuable *if* the power source is equipped with the appropriate connector. If there is already a standard in your area, work to ensure that the EOC and other locations have that connector on their power supplies. Donate the connectors if that’s the only way to get them in place. If they already have a connector, then either accept that as the standard or be sure you have the necessary adapter.

Knowing Your Equipment

Nothing is more embarrassing during an event than to have to ask someone else to show you how to operate your own equipment. To avoid that situation you should perform all these steps *before* going out on an event:

- Try all configurations of power source, transceiver, antenna, fuses, and patch cords you have.
- Label pre-programmed memory channels by name and frequency, preferably on the radio or in a plastic pouch attached to the radio. The radio may be used by operators who have never seen it before.
- Make a card with tuning procedures and operating precautions *and laminate it!*
- Photocopy key pages from the operating manual and place in an envelope attached to each radio. Include enough information so another operator can use your radio without further instructions.
- Make sure *you* can set up the radio on *all* frequencies/modes the radio will operate.
- Ensure you know how to set, turn on, and turn off the subaudible tone encoder.
- For VHF/UHF radios - make sure you can operate “reverse pair” in case the repeater is down and someone else is unable to program their radio.
- Does your radio have the ability to lock on or lock out a frequency? Make sure you know how to activate or deactivate that function.

Team leaders should try to become familiar with the radios used by each of their Team members. Asking the member to show you how the rig works is also a great way to make sure that the individual knows how his own rig works. Consider having a "Training Night" where various members bring in their radio and show everyone how it works.

Equipment Maintenance - When you keep some equipment in standby or “on the shelf” waiting for a callout the equipment may not be used for months. It’s easy to overlook routine maintenance that you should perform regularly. You should keep in mind:

NiCad batteries self-discharge at approximately one percent of their capacity per day. Newer rechargeable batteries self-discharge a little slower, but *all* rechargeable batteries do self-discharge even when not connected to any device. If you leave them on the shelf for over three months they can go to zero charge or be in such a poor state that individual cells in the battery pack may reverse polarity, thereby ruining the entire pack. The best way to avoid problems is to use every battery pack you have every month. One complete discharge/charge cycle will keep the battery pack healthy well beyond “normal” life span.

“Button” cells used for memory backup in programmable radios typically go dead in three to five years. Replace them when it’s convenient for you, not when it’s too late.

Connectors, switches, and potentiometers can develop corrosion from disuse, especially if dissimilar metals are present. Operate, unplug/replug, and clean them regularly.

Pre-installed antennas at served agency locations and vehicles can be damaged and detuned. Check them regularly for changes and physical damage.

Printer ink cartridges dry out from disuse. Develop a stock rotation plan so spares don’t get too old.

Dry cell batteries, flares, first aid supplies, fuels, food, and water all have shelf lives. Develop a stock rotation plan for them.

Portable Antennas

Of all possible portable antennas, the type that will be easiest to transport, store, and put up is the wire antenna. These antennas can be made in various configurations based on the frequency range to be covered. For VHF/UHF the “J-pole” antenna, made from 300 ohm TV type twin lead or the larger 450 ohm twin lead, will produce gain over a quarter wave yet store in a very small space. For HF the mono band or multi-band dipole will be very effective.

HF Considerations

One of the most effective “local coverage” HF antennas is the NVIS or Near Vertical Incident SkyWave. This is a generally half wave dipole mounted less than 1/8 wave (at the operating frequency) above the ground. This antenna is most effective on the 40m and 75m amateur bands.

When you put up HF antennas, you must consider the potential impact of the antenna on people and equipment in the area. You must have sufficient poles, rope, anchor weights, boundary marking tape and such to put the antenna far enough up to not be a hazard to people or equipment in the area.

An effective NVIS antenna for 40m and 75m can be made from a 1:1 balun and two lengths of wire (62' each for 75m and 34' each for 40m) per side. Add to that a four inch separator at the ends of the 40m elements and an end insulator at the ends of the 75m elements, and you are complete.

There are extensive materials about NVIS antennas and operation available at many websites. Most of the early technical work on NVIS was accomplished by the military and military manuals that cover NVIS operation are readily available online. Keep in mind that the antenna length numbers in the military manuals (and some amateur descriptions based on those military manuals) are optimized for military radio frequencies and not for the amateur radio bands. The ideal antenna for NVIS operation is basically a half-wave dipole at a height between 1/8 to 1/4 wavelength above ground. NVIS antennas built to the military dimensions or shortened dipoles will still work for NVIS operation but will require an antenna tuner.

VHF/UHF Considerations

Many times you will be in situations where the 1/4 wave antenna will not be as effective as necessary. During those times a three to five element Yagi antenna can be very helpful.

Keep the antenna at least one full wavelength (at the operating frequency) away from conducting surfaces if at all possible.

Keep coax runs as short as possible.

Use the lowest loss coax you can.

Discone antennas perform well over a wider range of frequencies than most other simple antenna designs.

VHF antennas based on a 1/4-wave design will generally function well as a 3/4-wave at UHF.

Generators

Ensure you have the best possible ground line hooked up to the generator ground post *before* you start the generator.

Check the engine oil level before you start the generator and each time you need to refuel.

Refuel the generator when it is cool if at all possible. *Always* shut down the generator before refueling it. Fuel vapor from refueling creates a great fire hazard around a running generator. If several generators are serving one site, try to keep them separated so they may be refueled independently. If several generators are located together, plan to shut them down together for refueling all of them.

Ensure that there is adequate ventilation around any generator.

Store the extra fuel away from the generator.

Remember, even the smallest generator has enough voltage and current to kill you. Use extreme caution with this equipment.

Use only three wire extension cords to bring power to the operating area. An extension cord with a Ground Fault Interrupter (GFI) included is an excellent investment for greater safety.

Ensure that the extension cord has the required capacity for the projected load *and* cord length. Remember that a 100 foot extension cord is still 100 feet long even if you are only going 30 feet with it. The minimum wire gauge is determined by both the amount of current being used and the length of the cord:

Cord Length	Device Amperage Rating	Minimum Wire Gauge
25 Feet	1 – 13 Amps	16 Gauge (Light Duty)
25 Feet	14 – 15 Amps	14 Gauge (Medium Duty)
25 Feet	16 – 20 Amps	12 Gauge (Heavy Duty) or 10 Gauge (Extra Heavy Duty)
50 Feet	1 – 13 Amps	16 Gauge (Light Duty)
50 Feet	14 – 15 Amps	14 Gauge (Medium Duty)
50 Feet	16 – 20 Amps	12 Gauge (Heavy Duty) or 10 Gauge (Extra Heavy Duty)
100 Feet	1 – 10 Amps	16 Gauge (Light Duty)
100 Feet	11 – 13 Amps	14 Gauge (Medium Duty)
100 Feet	14 – 15 Amps	12 Gauge (Heavy Duty)
100 Feet	16 – 20 Amps	10 Gauge (Extra Heavy Duty)
150 Feet	1 – 7 Amps	14 Gauge (Medium Duty)
150 Feet	8 – 10 Amps	12 Gauge (Heavy Duty)
150 Feet	11 – 15 Amps	10 Gauge (Extra Heavy Duty)

Do not put multiple cords together to get the length you need. The wire gage used in virtually all extension cords is the minimum allowable for that length/load; thus if you connect two fifty foot cords to get 100 feet, they will not have the proper capacity to carry the full rated load unless you have chosen extra heavy duty extension cords. Also the connection between the two extension cords has a chance of coming loose, being unplugged (especially if anyone trips over or steps on the cord). The connection between two extension cords can also be a danger if it becomes wet.

Generators: Care And Operation – A Few Observations From Past Experience

[By Anthony Whobrey KC4JTV]

Personal safety

Even a small generator can present hidden danger; be careful with even the smallest unit.

Never use a generator without a known good ground connection. Many of the newer units have safety features that will not function without a ground connection.

The only proper way to hook a generator to your house wiring is with a properly installed transfer switch. Unless you have frequent power outages, or a standby unit large enough to power your entire home, it will be difficult to justify the expense of a transfer switch.

Consider the purchase of a number of heavy-duty extension cords; keep them with your generator. A few companies offer “generator cords” designed to plug into the 240-volt outlet of your unit; they have four to six 120-volt receptacles for use inside your home.

Always place the generator outside your home before use. I have seen portable units running inside a garage or breezeway; this is trouble in the making. Placing the unit away from your home will reduce the noise and also prevent dangerous exhaust fumes from entering your quarters.

Never try to refuel a running generator. It needs to be shut down anyway to check oil (and coolant, for larger units) levels. Store oil and extra fuel in a location away from the operating unit.

Other Considerations

Voltage regulation — Many of the smaller generators and even some larger ones have poor voltage regulation. Your furnace blower or reading lamp probably won't care, but do you really want to run your \$ 2000 HF rig off a \$ 299 generator? The same goes for any expensive electronic gear. Consider powering your station from a battery, which can be recharged by the generator or your automobile.

Fuel — It is a good idea to have fuel reserved for your generator only. Use a couple of cans, one for your generator and the other for lawn equipment, kids' go-cart etc. Rotate the two every time you buy fuel. This will ensure a fresh supply for the generator.

Practical testing — Starting the unit every month or so is a good idea. Consider running the unit under load at least twice a year. Operation with about 2/3 of the rated load for 90 minutes or so will get the engine and stator windings up to a high enough temperature to drive moisture out of the unit. If you have a small air-cooled unit this is probably overkill, but with any unit over 10 kW or so, and any size water-cooled unit, it is a valid point. A generator that won't pick up the load is useless.

Equipment Operations

DTMF

Consider equipping your radio with a DTMF (Dual Tone Multiple Frequency) microphone. Some radios don't come with it. A DTMF microphone is useful if you need to bring up an emergency autopatch, or if you need to remotely control a repeater.

Consider employing simplex autopatches for field units to access phone lines during emergencies. Note that the use of any telephone interconnect is prohibited in some radio services, including GMRS.

Some radios, especially handhelds, come with a DTMF decoder that also turns the radio into a DTMF pager.

CTCSS

Almost all modern VHF and UHF radios are equipped with CTCSS. If your radio is not equipped with CTCSS (Continuous Tone Coded Squelch System), consider getting an encoder. You can use CTCSS as a kind of off-hours monitor. When the radio receives a signal without the CTCSS subaudible tone, the receiver will not open and you will not hear audio. When the radio receives a signal with CTCSS tone, it will open the squelch and you can hear the transmission.

CTCSS is useful for:

- Monitoring a common calling channel for emergency alerts (activate the CTCSS before calling).
- Blocking out interference from distant stations on the same frequency.
- Activating remote links on some repeater systems to extend coverage beyond just a local repeater, and with the CTCSS tone send the audio onto links to remote repeaters.

CTCSS operates in two modes, Tone Encode and Tone Decode

- Tone Encode is a transmitter function that sends the subaudible tone every time the radio is keyed. Tone Encode is necessary to access most repeaters and is necessary to communicate with other radios that are using Tone Decode. Tone Encode can be used by itself for these purposes. When a radio is set up to use *only* Tone Encode, that radio will receive any signals on the frequency regardless of whether or not those signals have the matching tone. Tone Encode is generally the preferable setting to use during emergency communications.

- Tone Decode is a receiver function that prevents the radio from receiving any signal that does not have the matching tone. Tone Decode would not be used without also using Tone Encode. Any radio equipped with Tone Decode should also be equipped with some easy method to temporarily disable the decoder so the operator can check the frequency before transmitting. A few amateur radios omit this necessary control function. Operators using Tone Decode must be trained to *always* check the frequency before transmitting.
- Nearly all FRS and GMRS radios are equipped with CTCSS, which the advertising and the user manual will often describe as a "Privacy Code" -- be aware that using the tone or "Privacy Code" on one of these radios does NOT provide any privacy. Anyone else listening to the same channel can hear everything you say simply by turning OFF the privacy code on their radio!
- Most FRS/GMRS radios and many commercial (Part 90) radios do not offer any choice between Tone Encode and Tone Decode. The CTCSS Tone function is either ON or OFF. When the Tone is ON, the radio uses tone encode *and* tone decode. When the Tone is OFF, the radio does not use either.

AQS

Some radios support the Amateur Quiescence System (AQS). It uses a sequence of tones to perform digital signaling at the beginning of each transmission representing a sequence of numerical digits. You can use it to selectively call another station and quiet the receiver in the meantime.

Some manufacturers use different names for this same feature. Not all radios implement all the same functions such as group calling. Review the manual to see if the methods are compatible.

Passband and Notch Filters

Learn the passband and notch filters, and the IF shift features of your radio. You can use them to work around adjacent frequency interference on SSB and CW.

Passband and IF shift are useful if there is a wide signal interfering that is adjacent to your receive signal. A notch filter is useful for CW, if there is an adjacent CW signal.

Hospital Safety Requirements

Hospitals have strict regulations on permitting electronic devices to operate within the building. Stray interference generated by electronic devices can affect the sophisticated and often computer-controlled medical equipment. Have your equipment checked by the safety officer or designated hospital staff person. This includes not only radios, but also other equipment you plan to use inside a hospital such as power supplies and computers.

Having equipment and operating sites approved *in advance* is especially important for teams supporting the National Disaster Medical System (NDMS).