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Farming, Primary production

What to know about the characteristics of the basic **"three different types of electrical devices"** and the corresponding inverter to acquire.
1. High *"surge starting current"* devices and *"heavy constant load"* devices.
2. Constant heavy current devices.
3. Standard continuous current consumption devices.

Secial Note:

Automotive specifications for (12v) battery unit tests defines **Cold Cranking Amps(CCA)** as a metering at -18^{o}C (0^{o}F) for 30 seconds without dropping below 7.2 volts.
Readings of 7.2v-300 amps from a unit is considered to be enough to crank an engine at these freezing temperatures.
The method of operation of current supply by a battery under conditions of "surge" or "load is" obviously not dissimilar to the CCA system, so can be used as a guide to "surge capability" in amps for the model of battery from its' data sheet.

A single Battery has limited ability to supply either "surge" or "load current" and hence to obtain the required number of batteries to use, the CCA rating for the model multiplied to the total connected number of battery of the battery-bank will be the total potential "surge" supply of current able.
A deep cycle battery being used in "float-charge" (long life-span cycle discharge/charge method) can only be allowed 300 watts maximum output (12v - 24 amps) constant. This point can be used to calculate the total "minimum number of batteries for the driving bank" scenario, alike the CCA mentioned previous.
"Work load current draw" should be calculated for (to assess a battery bank size with correct capability) by the 300 watts p/battery maximum constant output with "float-charge system method"(NOT deep-cycle system method) operational method , so CCA is a little irrelevant but a good guide to the performance of the battery chemistry during winter conditions.

A note about commercial beekeeping: The reason for using "cool rooms" with a "drop in refrigeration unit" is because; rather than causing the bees to make new beeswax honeycomb in the honey supers, previously constructed honey super frames are stored to swap with the completed honey frames.
This process called "robbing" the bees by swapping pre-used/constructed frames is done with the same frame sets over a few years, however, there are insect pests that require preventing from accessing or completing life-cycle on the frames in storage.
"Cool room storage of honey super frames" prevents eggs from both hive beetles and wax moths alike from hatching, again also as any biodegradable material or aging wax, there may be harmful bacteria cause decay or disease.
So when not in use, but pre-used, these frames are stored at low temperature and taken out an hour before swapping to prevent disease and invasive pest attack.
Again, this process may be used with a couple of hives of a recreational license beekeeper by having an extra domestic refrigerator(not cool room) and using 120ah storage 12v wind-solar hybrid system (at least 400w rated wind up 6 meters in windy areas).

1. Electric Motors (High current "Surge" devices)

Turbine Pumps, Winch, Drills, Washing Machine, press, fire pump, air compressor, cold room cooling unit

This first type of electrical device (electric motor driven tool) is the most tricky to assess for matching the inverter and power supply!
What you first notice or know of each of these electrical equipment "power" and "current draw" is the known rating in either "Watts" or "Amps" on their hull or product packaging box.
The "power consumption RATING" can be extremely deceptive if you do not understand electrical motors' requirements for current at BOTH "startup" and "during use"!

For much, many "small" spinning electric motor equipment works well at the rating it has coupled to an inverter with a mildly larger capacity ability to drive the size the equipment is.
For example, **a hair dryer of 300 watts** can be driven by a 500 watt constant output rated inverter. It has both a heat element and an electric motor. But as subtlety, it has a "weight" , or difficulty continuing the movement of moving parts called a "load". A "load" is a resistance to work. **Resistance to work requires to be overcome by supplying more electricity**, often called surge current "But not quite", Surge current is only current added at startup to allow the motor to overcome the load of the device being stationary.
Added loading current in the small device a hair dryer of 300 watts does not occur because there is not enough load resistance to add a special device to the electric motor called an **"electric motor controller"**.

The idea behind most tools handling jobs for humans with more strength than a human is obvious, but it requires energy supplied because "it requires doing work upon a load". When a resistance is met by an electric motor in a winch, it will slow down because though a winch is geared to a low effort ratio, the resistances remain enormous and the motor will need to be effective at moving various resistant loads.
Added to a winch, or a turbine water pump, slurry pump, even small hand wood-metal drills is **a device called an electrical motor controller that measures the revolutions p/second of the motor and allows more current to flow into the motor if it slows down**.

If many types of "during operation work loaded electrical tools slow down or are resisted heavily suddenly", the electric motor controller allows charge into the device to work against the resistance, and if resistance is too little and it over-speeds it will usually have a detection circuit to lower current input.

Turbine water pumps are an oddity because they require **both a huge surge startup and a load resistance current control** often supplying far more than the electrical motors rating. For example, if it were a 1Kw motor for the Water turbine pump, "it would require a 10Kw constant rating - 20Kw surge" inverter to start it and operate it if it were primarily a "lift pump" to push water uphill, much alike a slurry pump that has the problem of solid particles creating twice the weight of resistance against pumping that water usually has.

So the difference is "the surge rating is only for startup", and the tricky piece is "constant load current draw during work" that is far (different) heavier than the motors rating (even 5 times more) is only covered as the constant rating of the inverter to choose!

Any inverter chosen should have a constant rating of twice the "in load resistance" current draw.
This is only because inverters run at their maximum constant rating will burn out quickly because of component ware (metaphorically running alike a jogger can continue 3Km without stopping but a sprinter can only get 400 meters safely without stopping) !
For example, the 1Kw rated motor of a turbine water pump used as a "lift pump" or "fire pump" against gravity straight up "will require a 10 Kw constant operation inverter" (keep the inverter shaded and cool and with air-flow around it).
note: Clothes Washing machines are as treacherously heavy a device as an electric lift or fire pump!

One more important point, Many inverters are pure sine wave, some a modified sine wave, but most are built using "transformer-less current control with semi-conductors".
Choosing a deliberate "transformer coil industrial inverter type" will increase the reliability of the inverters' life span !
Pure sine wave inverter is not required if their are no LCD or LED controls, or other light-weight precision parts to the devices to be connected to the inverter.
Pure sine wave is used for precision equipment with circuit controls such as the PLL Phase Locked Loop in transmitters, televisions, LCD controls system with micro-processors or memory.
Modified sine wave (sometimes called True sine wave) inverters are used for heavy equipment such as heavy electric motors.

2. Welding Machines (High current "Use" devices)

Welding machines have neither a real need for "surge" or for "work load resistance", however , "they are extremely heavy current draw devices at their maximum electrode size" whether Arc, MIG or TIG or DC Aluminium.
Twice the rating of the current draw at maximum when in use with the suggestion of the "industrial Transformer type inverter" design (for reasons of electrical component life-span). Example: Normal industrial Arc stick welding machines beyond hobbyists that operate large hand operated electrodes are 7Kw to 10 Kw constant draw.
Large Hobbyists machines (and some domestically marketed large Metal Inert Gas machines , Tungsten Inert Gas) are 7Kw maximum current draw.
However Hobbyist or portable rural Arc stick machines are usually capable of 5Kw current draw constant in use for around 4.0mm electrode use.

Many of these machines have no LCD or serious precision micro-processor, so can use Modified sine (other names True sine wave or square wave) inverter.

3. Transmitters , Radios , Micro-processor Automation and LCD LED consoles, Misc. Sundry ("level" current "use" devices)

Diaphragm Pumps, lighting, fire-alarms, Automatic systems

The only difficulty these items have is knowing what the problem may ever be in adding or subtracting parts to their operational environment (electrical - more light bulbs , physical - higher longer head of water pipe on a small pump).
(a) The diaphragm type "solenoid pump" does have a continual pulsing surge but not much more than its operational current.
(b) Fire-alarms and Automated control systems often can have a small power system and a "physically small deep cycle battery" (as found on "early model" scooters and hover boards - not the Li-Po type).

Only the diaphragm type "solenoid pump" , and lighting can use a Modified sine wave inverter, the "delicate" control - micro computer systems must use a pure sine wave inverter.
Note: Any transmitters such as UHF CB, 27Mhz CB or any critical radio transmitter or receiver application or with micro-processor should use pure sine wave inverter.
An inverter twice the rating of the appliance is suitable and as referred before to inverter power quality output wave type.

** At minimum, for good life-cycle span of electrical equipment(i.e. welding machine, drill) that commits work or is a regulated power supply component(i.e. inverter) should rarely be operated at full current ability for any long period and not operated beyond 50% of current-"work-power" ability regularly or the size of the inverter will need to be increased to a size making the regular current draw 50% of inverter ability for constant supply.

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