PRACTICAL ELECTRICAL BACK-UP POWER USING MEP GENSETS

AN INTRODUCTORY ARTICLE WRITTEN FOR MVMVC BY *CARL WALKER*

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Figure 1 MEP-003A 10 KW Diesel Generator - P*hoto by Author*

GENSET BASICS

MEP (Mobile Electrical Power) Generators - or Gensets - are very well built, affordable, maintainable, and practical sources of back-up power for the intrepid Military Vehicle loving homeowner. These various bits of green iron are in most cases far above the quality of big-box store generators available to the average consumer. MEP sets are typically designed for 24/7 operation in the field, providing uninterrupted power to units operating away from the power grid or in emergency situations where commercial power is unavailable, and require the most basic of Preventative Maintenance at reasonable intervals. Given the operational requirements for these units placed upon the manufacturers of MEP gensets, the typical useful life of these units is far beyond the small one and two cylinder splash-oiled commercial sets available at civilian outlets.

MEP Gensets come in sizes ranging from less than 1.5 KW (Kilowatt), to more than 200 KW. A suitable sized genset can be located for most applications – ranging from bare necessities while camping, providing heat and light in your home during winter power outages, up to running small farm or industrial operations. Given the 'hobby' and 'home backup' nature of this article, we'll concern ourselves with the units at the smaller end of the spectrum – typically less than 15 KW in size.

SAFETY

There are many safety hazards associated with the use of gensets – both civilian and military. Issues include – but are not limited to;

- Electrical shock hazard
- Fire
    - Combustion supported by the generators fuel source
    - Electrical fire
- Carbon monoxide poisoning
- Burns from hot exhaust components
- Entanglement with rotating machinery (Ouch!)
- Design
    - Older genset designs – as most surplus units are - likely will not have all the safety features, including interlocks and enclosures to shield the operator from various hazards, which a modern commercial unit would have. See Figure 3 for an example of an older genset without guarding over the electrical line output fuses

Be aware of all possible hazards when working with or around gensets and electrical equipment; your life and the lives of your family members depend on it. Be certain you understand all the hazards and how to best mitigate the possibility of injury or death before attempting any installation or operation of an electrical generating unit.

ELECTRICAL BASICS

MEP sets come in many output flavors; typically, you'll find 28V DC (Direct Current), 60 Hz (Hertz – or Cycles per Second) AC (Alternating Current), and 400 Hz AC. There are also some units that can provide more than one output frequency; 50/60 Hz output models are fairly common and more modern units that can provide 50, 60, and 400 Hz are also available. These latter units are fairly expensive and uncommon on the surplus market, given their output power is generated by an electronic inverter circuit – much like solar or wind power systems that generate AC to power household loads from DC batteries. All of these types of gensets have their uses, with some being considerable more applicable to the homeowner than others.

Units that produce 28V DC are handy to the MV owner – but usually only for charging batteries in their MVs. Sets that provide only 400 Hz output are to be avoided for all but the most specific applications that require 400 Hz power. Such applications are avionics systems, some ground based field deployable radar systems, and other specialized equipment. While a 400 Hz genset can successfully power a resistive heater or incandescent lights, it cannot be used to power motor loads or other electrical equipment containing transformers that are designed for other frequency inputs – such as 50 or 60 Hz equipment. Should you be considering the purchase of a surplus MEP genset, be careful to note its operational frequency, and avoid 400 Hz output units – unless your purchase is intended as an engine parts source for a 60 Hz cousin of the 400 Hz unit. Be aware that many MEP sets have 60 Hz and 400 Hz models that outwardly look almost identical – the only feature separating them being the model number and the frequency meter on the control panel. Double check what you intend to purchase.

Figure 2 MEP-003A 10 KW Genset - fresh from *Government Liquidation. Photo by Author*

In the United States, we use 60 Hz AC power; make certain the genset you’re considering for backup power provides this output frequency.

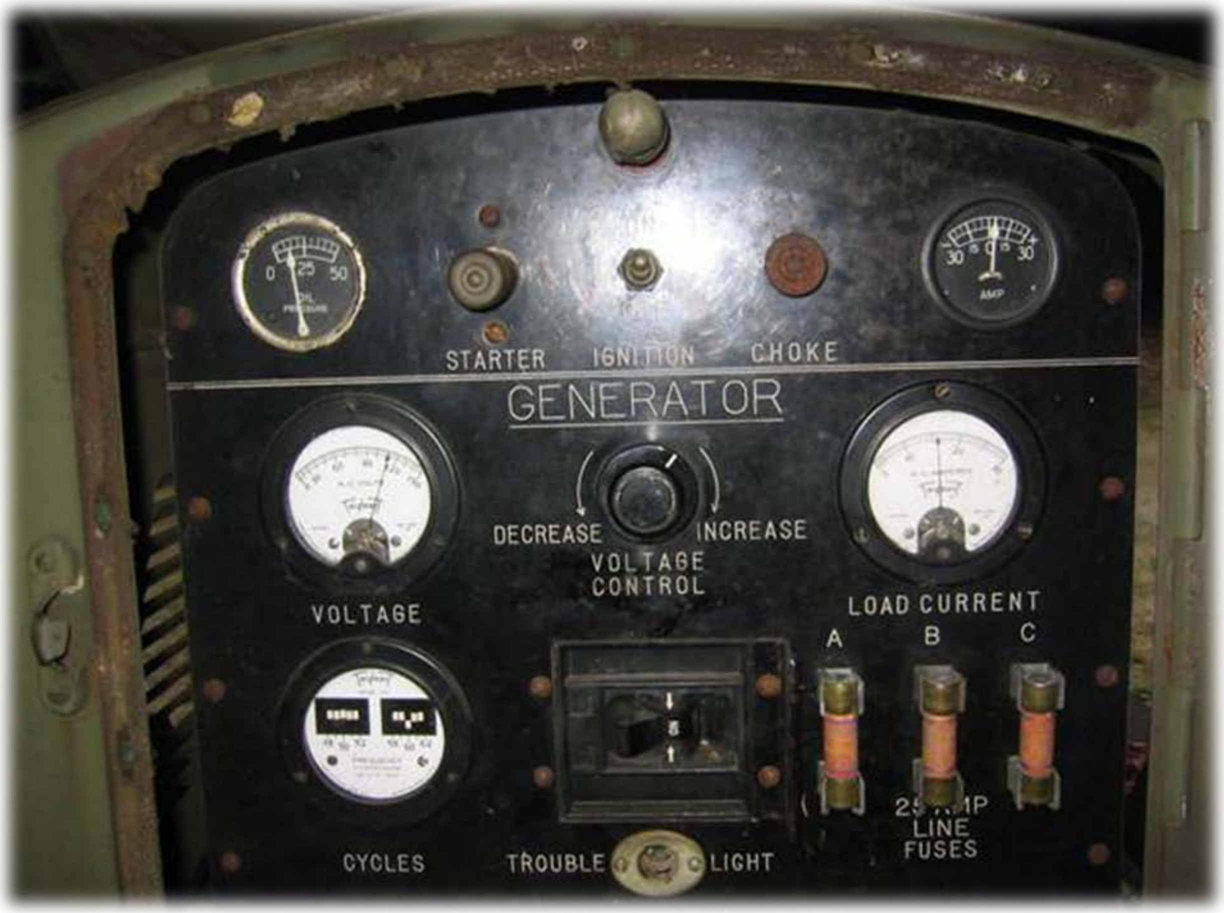

Figure 3 Model 'M5' early 1940's 3 KW genset control panel – note exposed line output fuses. ***Photo courtesy Phil Waterman***

AC PHASES

There are two basic types of AC power; single phase, and poly-phase power. Each of these designations has specific sub-types – two wire, three wire, four wire, etc. For the vast majority of applications, one of two types will be desired.

SINGLE PHASE, THREE WIRE, 240V AC

Single Phase, 240V AC is the typical power source found feeding the breaker box of homes across the US. It uses three wires – two 'hot', and one neutral. When seen in your electrical panel box, the two hot wires each provide power to distribution bars that feed half the circuits in the panel. If you measure with a volt meter from either of these distribution busses to the neutral bus, you'll find 120V AC – the typical household outlet voltage in the US. Measuring between both hot busses will provide 240V AC – typically used for larger loads, like your well pump, electric stove, electric water heater, or clothes dryer. ***This Single phase, three wire, 240V system is the one you'll want for most all household applications*.**

POLY – OR THREE – PHASE 208V AC

Poly-phase power systems are much more common in industrial or farm settings, where large loads – motors, air conditioning, heaters, and other industrial equipment - are all common. This is not a typical power source for the average home. Many industrial machine tools require three phase power for operation – which is one of my personal favorite application for utilizing three-phase capable MEP gensets. If you have a three phase application, MEP sets are a real bargain source of this power – either for back-up applications, or to provide three phase for a specialty application where only single phase power is available from the power company at your location – such as your garage workshop.

GENERATOR OUTPUT CONFIGURATION – OR 'RECONNECTION'

Many types of MEP gensets allow for multiple output voltage and phase connections, via a mechanism called 'reconnection'.

With MEP genset reconnection, the multiple windings present in the stator of the AC generator head are brought out externally from the generator head, and are 'reconnected' in various ways to produce one of several different 'flavors' of electrical output. This configurability typically takes one of two forms – either jumper wires installed on a terminal block, or via a reconnection selector switch. The TM for any given MEP generator will list the available output reconnection configurations the genset supports, and how those reconnections are selected.

Some MEP sets - the MEP-017 being one example - can provide either 120V two-wire, or 240V two-wire single-phase power using their stock reconnection switch configurations, but these configurations are *not what you'd want for most household applications*. Many of these gensets can be modified for single-phase three wire operation by the addition of a jumper wire. Sometimes, this modification comes at a cost of reduction in available output power – due to the way loads are distributed between the various windings in the generator head. While a 240V, two-wire output configuration might work just fine for powering your well pump motor, without the third wire to allow for a neutral connection, you have no way to develop the 120V that most household loads require.

Whenever possible, choose a genset that provides a 240V single phase, three wire reconnection setting – such as an MEP-002A or MEP-003A; you'll be able to load the generator to its full output capability, and not have to make modifications to suit home use.

ELECTRICAL CONNECTION TO THE HOME

It can't be stressed enough that dealing with the electrical connection of any genset to your household electrical service panel is no place to guess about what to do, or how to do it; consult and employ a qualified electrician to assist with this part of your project. Local code may require that you do so. Safety and sanity demand that no compromise be made in understanding or installation of a generator. Power provided by the power company or the generator itself will easily kill – its lethality nothing to be underestimated.

First, it's never advisable to open the main breaker and 'back-feed' power into an electrical panel. While many a person has done so during a time of emergency to get necessary items operational in a hurry during an outage, it's a source of potentially fatal accidents. An accidental closing of the main breaker at an inopportune time could electrocute a power company line worker, or damage your generator. It's just not safe to back-feed power without precautions.

What type of connection is safe? One of two ways of connecting the generator to your house are safe – a load transfer switch, or a panel with a proper mechanical interlock for connection of an alternate power source. Both of these configurations meet typical electrical code requirements, and conform to the requirements of the National Electrical Code.

Figure 4 Manual Transfer Switch - ***Photo courtesy Reliance Controls***

The transfer switch is typically installed to allow for powering a number of critical circuits from your generator when primary power is not functioning. It requires that your home have wiring work done to move these critical circuits from their location in the main power panel to the transfer switch panel. Typical circuits might include your oil burner, well pump, hot water heater, refrigerator, freezer, various lights, TV, and other circuits that would come in handy to survive the outage. Transfer switches typically have a limit of the number of circuits they support – 10 being common. Larger transfer switches with more circuit positions increase in price – and fast.

What's an approach that will allow for connection of a larger number of lower-powered circuits while containing costs? A mechanical interlock can be installed in a normal power distribution panel. These interlocks are a sliding bit of metal arranged so that the main breaker must be in the open position in order to activate another set of breakers – and these breakers connect the output of your generator to the panel power distribution bars. This insures that no Human error can occur allowing the generator power to back-feed out to the power utility. This is a very cost effective solution – with a store-bought interlocks costing between $30 and $50 at the electrical supply house. This approach is particularly suited to applications where there are many circuits that are lightly loaded that you would like to be operational from the generator. An example could be having many circuits that provide various lighting around the property – which would be hard to accomplish without a very expensive transfer switch with an atypical amount of circuits available.

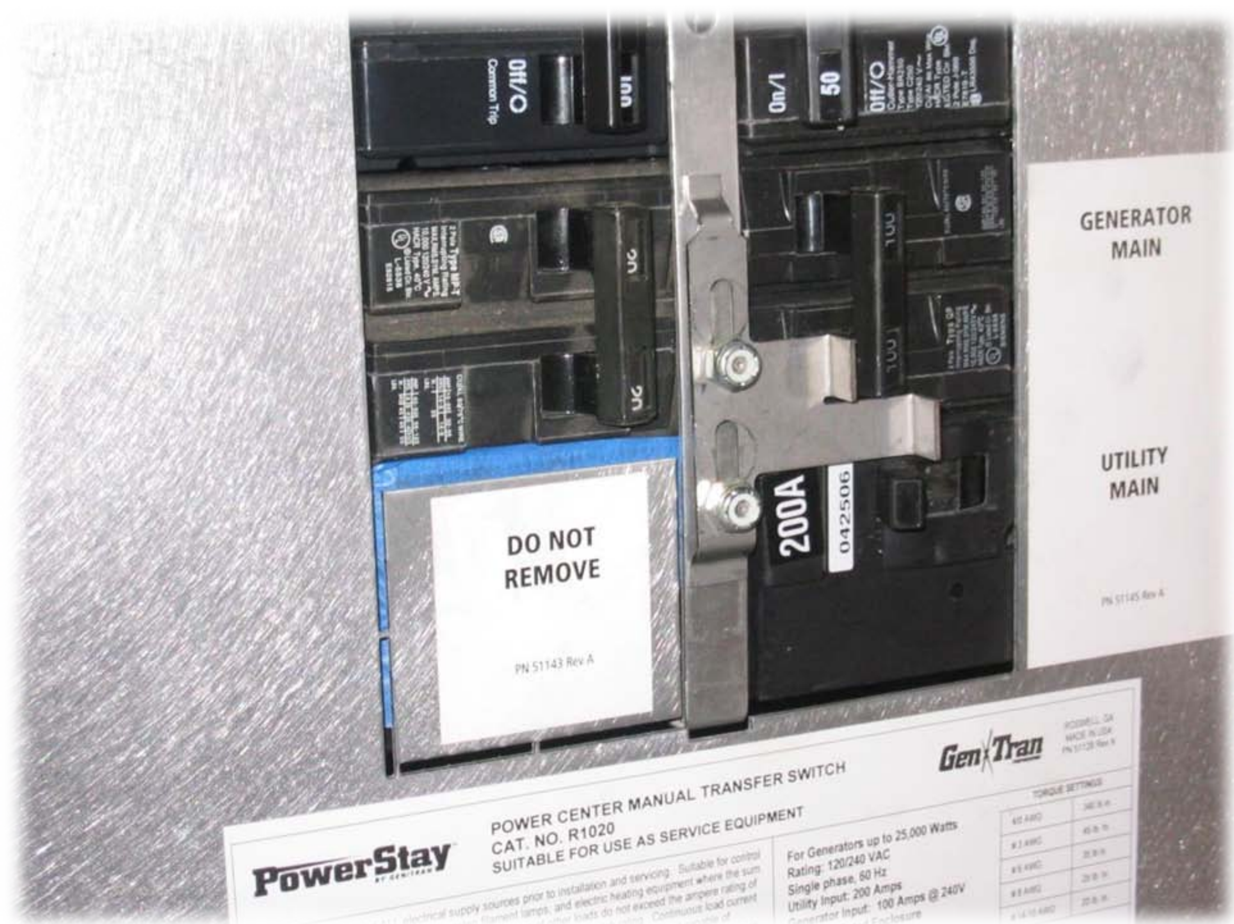

Figure 5 Manual Interlock installed on breaker panel – ***Photo courtesy Phil Waterman***

The drawback to the mechanical interlock configuration is it will be up to the user to insure the generator is not overloaded while in operation. With a transfer switch, one can calculate the maximum load presented to the generator by the circuits wired into the transfer switch – insuring no overload will be possible, preventing damage to the generator and any sensitive electrical equipment that might be connected to it. When using a mechanical interlock, it is up to the user to insure that loads that would cause the generator to provide more power than it is capable of be switched off at the circuit breakers; for instance, you might need to turn off the breaker for the clothes dryer and electric stove to insure the generator isn't overloaded while running the well pump in addition to all the other loads that are present. The additional manual work required of the mechanical interlock system is often warranted in an emergency situation, since given a little thought you can power up any circuit in your house that might be required to survive the outage.

Figure 6 Typical Weather Tight Generator Connection Box - *Courtesy Reliance Controls*

The generator connection to the house should be made with a weather-tight connection; typically, locking circular connectors and a weather tight box are mounted on the outside of the house near the electrical service panel. This connection should be made with properly sized wiring into the panel, so that voltage drop and heat generation due to losses in the wiring are kept to an acceptable amount. For non-permanent applications – where generator portability is required - the generator should be connected to the weather-tight inlet box via an umbilical cord made from heavy flexible oil and water resistant power cable of the proper size. Good electrical supply houses carry this wire. MEP generators typically do not have the circular outlets you'd find built into a civilian set for connection to the load – but rather an arrangement of 'split-bolts' that allow for permanent connection of the umbilical at the generator end.

Permanent installations can be accommodated without a flexible umbilical arrangement that's removable; consult with your electrician for permanently attached solutions that meet with the local code requirements.

LOAD BALANCING

No matter which method of connection you choose for applying the generator output to your household loads, it is very important for proper generator operation to balance the current drawn by the various loads properly between the output phases of the generator.

This can be easily accomplished by understanding the current drain of each of your 120V household loads, and making certain that the typical amount of power drawn from each phase is similar. For instance, a refrigerator that draws 500 W of power when operational should be connected to a circuit breaker on one phase distribution bar in your load panel, and your freezer that draws a similar amount of power should be connected to a breaker attached to the alternate phase in the panel.

It's worth noting that true 240V loads – ones that do not rely on the neutral connection, like a well pump or a welder that that has a transformer input – are inherently balanced, because they connect only between the two 'hot' wires from the genset.

Load balancing will help insure similar output voltages being present on each phase, while avoiding overloading and overheating of the windings in the generator head that might occur if much of the overall load were connected to a single output phase of the genset.

GENSET INSTRUMENTATION

A notable feature that separates MEP gensets from civilian counterparts – in addition to ruggedness and cost of construction – is instrumentation.

Typical gensets that one finds at the local home center sources do not have much in the way of instrumentation – either for the engine, or the generator. Many civilian sets will have safety features to protect the unit – like low oil pressure shutdown and circuit breaker protected generator output, but rarely will you find any indication of electrical load, running hours, or even oil pressure.

Not so with MEP sets. These sets, while still made for a particular price point, didn't suffer the effects of taking every dollar of cost out to compete next to other sets on the sales floor of a home center. MEP sets typically have instruments to reflect the health of the engine, including oil pressure, starting battery charging circuit – either indicating charging system amperes or system voltage, and running time (with a 'Hobbs' running time meter). Generator output instrumentation typically includes switch selectable voltage reading for all output phases, percent of rated load indication for each phase, and AC output frequency.

Unlike most civilian generators, you'll even find the AC output voltage adjustable on most all MEP units – an added bonus!

Figure 7 MEP-017A Control Panel Instrumentation - ***photo by author***

FUEL TYPES

WARNING: It's always a bad idea to fuel a running or hot generator set from a portable fuel can or other fueling arrangement where the fuel itself is prone to spilling. Fuel could contact hot engine components and combust in a rather spectacular way – causing injury or death to personnel. Don't ever refuel a hot or running generator.

There are three major types of fuel for powering generators; propane / natural gas, gasoline, and diesel. Each one has advantages and disadvantages. Choice of the best fuel source is dependent on the location of the user, and possibly the nature of the emergency requiring deployment of the back-up electrical source.

PROPANE / NATURAL GAS

Propane and Natural Gas are excellent sources of energy for operating generators. Typically, generators that run off either one of these sources of fuel were originally intended to be operated from gasoline, and have conversions made to them to make the engine run properly off the new fuel source. These conversions are typically a simple bolt-on item that allows mixing the combustible gas source with air, allowing the engine to aspirate this mixture into the combustion chamber via the normal intake path.

The advantage of Natural Gas as a fuel source is that it requires little in the way of effort to operate the genset once it is connected to the fuel source. The Natural Gas supply is typically very reliable in terms of availability.

The disadvantages to NG are that it is not portable – therefore restricting your genset operation to a fixed installed location. Disasters that affect the source and / or delivery of this fuel will be beyond the users control to mitigate.

The advantage to Propane as a fuel source is that it will not degrade while stored. If you have a tank of Propane, and that tank remains unused, it will be useful over many years – even decades. Propane can be obtained in fairly large fixed storage tanks that are filled by a fuel vendor's truck on-site. Propane can also be obtained and stored in smaller, portable tanks – typically ranging in size from 20 pounds of fuel to 100 pounds or more. Anyone that's filled a BBQ gas tank knows of their portability; tanks of larger size present their own handling and transportation issues.

The disadvantage to Propane is that when a large, fixed tank source is utilized, it's unlikely that it would be refilled by the fuel vendor in a timely manner during a prolonged disaster. Demands for the fuel could be wide-spread, and road restrictions or other transportation related issues could cause you to suffer long delays before the fuel vendor could replenish your supply. The well prepared user could make arrangements to operate their generator off portable Propane tanks, filling these portable tanks themselves by transporting them to the nearest open source of propane gas. This is problematic in terms of logistics, and in the case of a larger generator with greater fuel supply demands, the smaller tanks may not provide sufficient internal area to allow for the Propane to change from its liquid state to the gaseous state required to operate the engine. Portable tank transportation contains its own challenges in terms of vehicle space and weight of the tanks once filled.

GASOLINE

Gasoline is a nearly universal source of energy, available within a short driving distance of most residences. Using large quantities of gasoline to power a genset over a prolonged length of time has its own set of challenges.

Advantages of this fuel source are its ubiquity – it would be hard to imagine a location anywhere in the US where, under normal circumstances, a supply of gasoline could not be obtained.

Disadvantages to gasoline are, however, quite numerous. Ethanol blends of gasoline – forced upon us by well meaning but dim-witted and technically inept politicians – do not store well. The amount of time a supply of fuel can be kept on hand without degradation is quite limited, forcing the user to rotate the source of stored fuel to insure its freshness. Anecdotal evidence suggests that Ethanol treated fuel doesn't even store through the three months of winter without degradation that results in poor running characteristics for a genset – which clear immediately after replenishing the fuel with a fresh supply. Fuel stabilizers help prevent gumming, but do not seem to mitigate the volatility of the Ethanol blended fuel.

The alcohol in the mixture also can react with fuel system components that were designed before the development of these blended fuels – potentially causing metal parts to corrode, and breakdown of various sealing components - like gaskets and O-rings.

As everyone knows, storing even a relatively small quantity of gasoline can be dangerous; spills and the ever present danger of flammability or explosion weigh on the mind of the homeowner that needs to retain a supply of this fuel for emergency power.

Gasoline can also be difficult to obtain in some disaster scenarios. Consider those who live in hurricane-damage prone areas; it is not uncommon to have all ready sources of gasoline consumed by evacuating residents as they fuel up vehicles while fleeing the wrath of the oncoming storm. Once these supplies are depleted, they are often not resupplied for a long period of time – if they even can be resupplied; sometimes the infrastructure is so badly damaged that gasoline stations do not reopen for many weeks to months after a major storm. Coastal areas affected by major hurricanes have necessitated people travel 100 or more miles round-trip to obtain limited quantities of gasoline to operate their generators, only to require the same effort the next day to continue operation of the generator.

DIESEL

Diesel fuel oil is nearly as ubiquitous as gasoline in its availability to the average user. Most automobile fuel stations carry diesel, and many of us have a diesel powered military vehicle.

Diesel tends to store for longer periods than gasoline - without the volatility of chemical components that gasoline suffers from during storage. It does have some variability in terms of various blends that are used at different times of the year to retain its fluidity. Diesel blended for use during winter months contains additives that keep the fuel flowing at colder temperatures. It is important that fuel stored for use during winter months be of the proper blend in colder climates – lest you find yourself with a source of abundant fuel that doesn't flow. One must also be mindful of the fuel stored in the gensets tank as the seasons change; if you had filled the tank with a summer blend of fuel, it would be best to consume this and replace it with a winter blended source of fuel before the weather turns cold. Fuel blends are changed at filling stations by the vendor as the seasons change, so if you're consuming fuel on a regular basis, a change in the blend will occur 'automatically'.

Diesel can fall prey to fungus growth – especially in warmer climates. Anti-fungicide additives can be mixed with the fuel to avoid this possible pitfall, and should be considered for fuel that is intended to be stored over the summer months in warmer areas.

While most of the availability issues that plague gasoline during times of emergency will also affect the ability of the user to obtain diesel fuel, there are other sources sometimes available to the user that should be considered. For example, the owner of an MV with a large diesel tank – like an M35 – can readily use the vehicle tank as storage and transport for 50 gallons of fuel. This is considerably easier than lugging around ten of the five gallon yellow plastic cans of fuel. Many of us also have a fairly good source of fuel oil in our houses, provided we heat with oil. Number 2 or Number 1 heating fuel oil burns readily in a diesel genset – providing us with as large a supply of ready fuel in the event of emergency as we care to purchase and retain in our heating oil tanks.

Many diesel powered MEP gensets have, in addition to a 'day tank' that holds enough fuel to run for 8 hours or more at full load, an auxiliary fuel capability. This normally consists of an additional fuel pump, with an external connection designed to be attached to an external fuel supply tank. This type of 'hot' refueling is perfectly safe and acceptable because the built-in AUX fueling system prevents exposure to the possibility of fuel spilling on hot engine components. The AUX fuel pump is typically enabled once the hose from the fuel inlet is connected to your auxiliary fuel source, and control circuitry onboard the genset fills the day tank with the external source when it falls below a preset level, and turns off the auxiliary pump once day tank replenishment is complete. Operation of this tank refilling is automatic, requiring no operator intervention once activated. Given the vertical lift capability of the auxiliary pump, a 'drop hose' can often be fabricated to place in your heating oil tank using the filling neck outside the house. The same can be done with a drop hose in a deuce or other vehicle fuel tank, allowing for a constant filling of the day tank without the hassle of manually filling the tank with fuel cans. The well prepared genset owner will have obtained and modified fuel caps for each of these possible auxiliary sources by installing a straight-through barbed fitting in the various caps and allowing the instillation of a drop hose into the sourcing tank while sealing the tank entry point against rain and debris.

RPM

There are two basic engine speeds used to power modern 60 Hz generator units; 3600 RPM, and 1800 RPM. The speed variation is based on the number of electrical poles contained in the windings of the generator itself, with the 1800 RPM units having twice as many poles as the 3600 RPM units.

Most, if not all, of the small civilian generators use a 2-pole 3600 RPM design. This is to accommodate a lighter design with less copper in the windings, allowing for a reduction in cost and weight. Many of the smaller MEP gensets follow these designs and operate at 3600 RPM.

Somewhat larger gensets typically use 1800 RPM, 4-pole generator units. These larger, slower turning units have some advantages. While construction costs of a 4-pole unit are higher due to the additional copper used in the generator windings, and the unit's weight is increased, units that turn slower tend to last longer due to reduced rotational wear on all the bearing surfaces. There is also a large change in the ambient acoustic noise produced by the units. While all MEP sets are loud – most carry an operational warning about hearing protection requirements – the 'tone' of the noise produced by an 1800 RPM unit is considerably easier to live with compared to a 3600 RPM genset. As the smaller gensets are typically air cooled, much of the noise produced is not from engine exhaust, but rather from large air moving surfaces – either squirrel-cage blower wheels or blades attached to flywheels or generator ends. The 'song' produced by a 3600 RPM unit is much like a lawnmower – very annoying to be around when in operation. Personally, I find the note of the 1800 RPM units much easier to live with for longer periods of time.

PREVENTATIVE MAINTENANCE

MEP gensets typically prescribe PM requirements that are relatively easy to accommodate. The most obvious would be changing crankcase oil once per every 100 to 200 hours of operation – more frequently in dusty or other hazardous climates. Make certain you've got a reasonable stock of oil and filters to last through any period of use that you foresee as likely to require operation until you can get out and obtain additional supplies.

Oil in unopened containers will last indefinitely when stored with reasonable precautions. Many MEP sets of medium size use as much oil as the family car for crankcase lubrication – so make certain you've got enough to last. Most use canister-type oil and fuel filters; make certain you've got a number of these on hand, as they will not be something you can easily obtain at an auto parts store during time of emergency. If you find these canister type filters to be problematic, many gensets have aftermarket conversions available to allow using more commonly available spin-on filters. This modification is often worth investigating.

SIZE OF THE GENERATOR

The best operational characteristics are obtained when the generator is properly sized for the intended load.

MEP gensets are rated for 24/7 operation at high altitudes and ambient operating temperatures for the full load specified. As such, a 10 KW genset can be expected to deliver its full output without difficulty under almost any condition a homeowner can throw at it in the continental US. Ability to start high-power loads – like motors – is by most estimates some 200% to 300% of the generators nominal output rating. You'll likely find this to be quite a departure from civilian generator sets, which are often times rated by a rather optimistic marketing department.

Take inventory of the loads you need to run during an outage and determine the size of the genset you'll require to operate them effectively. As a point of reference, a 10 KW 240V MEP generator will supply a continuations 52A output, fully loaded. A 5 KW unit will provide about 26A.

One often considered issue of diesel generators is *wet stacking*; this phenomenon is caused by a lightly loaded engine building up unburned fuel in the exhaust system. While not to be totally discounted, wet stacking is much more of an illness that plagues water cooled diesel powered gensets, and not the smaller air cooled units - which tend to run hotter - that the average user might have. Once entering the larger class of gensets, one must remain mindful of this potential problem – often running large loads to keep the system clean if operation in a more lightly loaded state is frequently called for.

FUEL CONSUMPTION

Given the choice between an air cooled 5 KW unit and a 10 KW generator unit, most people would choose the larger unit in order to have more capacity. This is a valid argument – but fuel consumption also must be considered.

One might think that a 10 KW generator which is lightly loaded wouldn't differ all that much in fuel consumption from a more heavily loaded 5 KW unit; with MEP gensets, such is not typically the case. The reason is simple; the more powerful gensets have considerably more rotating mass. This is not only contained in the more powerful generator head, but you'll also typically find bigger engines on the bigger gensets. An MEP-002A 5KW unit is two cylinders, and an MEP-003A 10KW is four cylinders. Not surprisingly, the MEP-003A generator consumes almost twice the fuel of an MEP-002A genset when loaded with a like electrical load.

During an emergency, running longer on less fuel may be really important, depending not only on how much money it will cost you to continue operating it but also how quickly you may end up using a hard to replenish fuel supply. Choose wisely.

STARTING BATTERIES

Most MEP sets are 24V systems – just like your MV. Smaller sets use batteries that are uncommon – like the 4HN type that is roughly the size of a motorcycle battery, yet with twice the amount of lead-acid cells and producing 24V. Finding these original batteries to fit the stock battery mounts can be expensive. Typically, there's sufficient room to modify the holder and replace the original single battery with a pair of more commonly available units, such as lawn tractor batteries. This can also provide additional cranking power over the original source at a greatly reduced cost.

Larger units, like the MEP-003A, use the same vehicle batteries that are used for many MV truck applications – the 6TL in this example. These gensets use a pair of these 12V batteries for cranking power. Should you not wish to obtain a pair of 6TL batteries, a pair of smaller standard automotive batteries that will physically fit in the tray are normally sufficient.

If you have a 24V MV, most gensets can be started using an MV slave cable; this item should be on your list of MV rally 'must finds'.

SINGLE POINT OF FAILURE

Like most systems created by Man, there's typically a single point of failure that can occur which makes the entire system inoperative. Some are obvious; if you've got one generator and it breaks you're out of luck. Some are not so obvious – like fuel availability, as mentioned earlier in this article.

Consider the single points of failures and their likelihood of occurrence during an expected outage, and plan for a contingency.

Having two operational gensets available goes a long way to avoiding a possible single point failure that could leave you exposed during a prolonged outage. Having two gensets that use different types of fuel – one gasoline, and one diesel, for example, provide good assurance you'll be able to work around many fuel availability restrictions should they occur during your outage.

During the December ice storm of 2008, I only owned a single Briggs and Stratton powered civilian genset. During the one week that we were without power, that generator suffered two mechanical and one electrical failure. I was fortunate to have a good assortment of junk around that allowed for improvising repairs to keep this unit running and the heat going in the house during those 20 degree days. As anyone from the Monadnock region of New Hampshire that lived through that storm knows, there were not any generators to be had within a 500 mile radius – so nursing that unit along was the only thing standing between us and frozen pipes. After that experience, I decided that no matter the inconvenience of having to store and maintain additional units, I'd never be with only a single genset again. Generators are reasonably inexpensive to obtain – and are absolutely priceless when you need one and can't purchase it due to demand.

THEFT PREVENTION

MEP sets have a feature that differentiates them from their civilian counterparts; weight. As an example, a civilian 8 KW unit from a big-box store typically weighs in the neighborhood of 200 pounds. This can easily be removed by one or two reprobates with larceny in their hearts without too much trouble or notice. A small gasoline powered MEP 5KW unit, on the other hand, typically weighs 500 pounds. This directly increases the effort required to steal it, and therefore the risk of getting caught. Diesel 5KW units typically weigh more than 960 pounds, and 10 KW units tip the scales at just north of 1,240 pounds. These units typically require equipment – like a tractor or forklift – to move, greatly increasing the chance of getting caught in the process. Thieves looking for a generator to steal will typically seek a civilian set once they learn of the logistics required to remove an MEP from someone's property.

OTHER ODDITIES

Experience has shown that diesel powered MEP units are typically equipped with glow plugs and intake air pre-heaters, and that for proper starting in winter these units must be operational. When acquiring a diesel powered MEP, always disconnect the wires to the glow plugs and check each one with an Ohm meter to insure it has not failed. Failed plugs will typically indicate an open circuit. Replacements are available from commercial sources, for less than $20 each. You'll likely find the genset impossible to start without operational glow plugs once the outside air temperature falls below freezing – as the relatively low compression engine can't produce sufficient heat by its own compression to allow for proper ignition of the fuel while cranking.

It's really important to read the operator's TMs on your MEP genset; often, there are 'hidden functions' or operational quirks that are not at all obvious to the casual observer or operator. As example would be manual starting of an MEP-017A genset by using the pull rope. You select the 'Emergency Run' mode on the control panel, and start the generator with a pull of the starting rope. Given the 'Emergency Run' mode disables all protection from oil pressure failure and over temperature, one would typically want to change back to the 'Normal' mode of operation once the unit started to insure the engine was protected. Trouble is, if you switch from 'Emergency Run' to 'Normal' modes, the control logic will kill the spark to the engine. The only way to reset the logic and allow it to keep running is to briefly engage the starter switch once the 'Normal' run position has been selected. There's just no way to know things like this without reading the TM.

Manual 'Field Flashing' is also a commonly hidden feature. Flashing the field is used to restore output on a genset that isn't making AC power in some circumstances. On an MEP-002A or MEP-003A genset, the field is 'flashed' by turning the operation switch from the normal running position back to the starting position once the genset has started. How would you know this without reading the TM?

Many gensets have a weakness that isn't at all obvious; they should not be operated at idle for anything but the briefest periods of time. This is because as the engine speed decreases, both the output frequency and output voltage of the generator start to fall. The regulator circuit senses the drop in output voltage, and tries its best to correct the situation by increasing the DC excitation to the field winding of the generator head. This increase in field current as the regulator tries to correct the output voltage overloads the output transistor in the regulator module, causing it to fail. While this is a fairly easy and inexpensive repair, it is one failure that can be avoided by following the operation information in the TM – and some issues of PS magazine. Always bring the generator up to speed as quickly as possible after starting, and allow it to run at speed without load to warm up. Once warm, close the circuit breaker and operate the genset normally. When it's time to shutdown, open the circuit breaker and allow the generator to run at speed for a few minutes without load to cool down – then shut it off using the normal engine control. Some genset operating instructions specify turning the voltage adjustment rheostat all the way CCW before shutdown, and setting nominal output voltage before closing the circuit breaker when placing the unit into operation – check the latest TM for your set for more information. Mechanically inclined people have been brought up to idle an engine during warm-up and cool-down, but you must resist that urge with many MEP gensets.

Always read those TMs!

ON-LINE SOURCES FOR FURTHER INFORMATION

The following sources of on-line information are good for general advice, as well as PDF copies of TMs for the various generator sets.

http://www.steelsoldiers.com/auxillary-equipment/

http://www.smokstak.com/forum/forumdisplay.php?f=79

CALL FOR COMMENTS

If you've got comments about this article, lessons learned, or peculiarities you've discovered over the years about MEP gensets in particular or generators in general, we'd really like to hear from you. Please pass those comments on to your faithful newsletter editor.