Portable Generators
Power Where You Need It
Tonight’s Topics

• Overview
• How Power is Generated
• Sizing a Generator
• Cost
• Safety
• Summary
Overview
WHAT IS A PORTABLE GENERATOR?

• PORTABLE GENERATOR DEFINED
  • PORTABLE - EASILY MOVED BY 1-2 PEOPLE
  • INTENDED TO BE USED AS A TEMPORARY SOURCE OF POWER

• BY COMPARISON, STANDBY GENERATORS ARE PERMANENTLY INSTALLED UNITS, HIGHER POWER THAN MOST PORTABLES, REQUIRE TRANSFER SWITCH AND INSTALLATION BY QUALIFIED ELECTRICAL PERSONNEL. CAN BE USED TO SUPPLY POWER TO WHOLE HOME
BASIC COMPONENTS OF PORTABLE GENERATORS

- INTERNAL CUMBUSTION ENGINE – SINGLE OR MULTI CYLINDER, AIR COOLED
- FUEL TANK
- GENERATOR UNIT
- POWER OUTLETS
- ILLUMINATED INDICATORS, MECHANICAL/ELECTRONIC ENGINE CONTROL, MONITORING, AND CIRCUIT PROTECTION HARDWARE
- MANY WITH WHEELS AND HANDLES
FUEL TYPES

- GASOLINE – MOST COMMON
- LP – NOT AS POPULAR
- DUAL FUEL – GAS & LP
FEATURES

- ELECTRIC START
  - MORE COMMON ON LARGER UNITS
  - BATTERY MAINTENANCE
  - GENSET HEAVIER OVERALL
  - STARTER MOTOR CAN FAIL

- PULL START
  - TYPICAL OF MANY UNITS

- CIRCUIT BREAKER PROTECTED – AC

- 1 OR MORE GFCI OUTLETS

- 12V DC OUTPUT – COMMONLY 10A
  - MAY BE PROTECTED VIA CIRCUIT BREAKER OR FUSE

- USB CHARGE OUTLET(S)

- AUTOMATIC CO SHUTDOWDN DETECTION
  - CR can no longer recommend any portable generator that doesn't pass their new CO safety technology test

- LOW OIL PRESSURE SHUTDOWN
POWER AND VOLTAGE RATINGS

• AC VOLTAGE (SINGLE PHASE)
  • 120
  • 240
  • 12V DC ON SOME MODELS
• POWER – WATTS OR KILOWATTS
  • UP TO ABOUT 15KW

• 15,000 WATT PORTABLE $3250
• 360 LBS
• L 48” X W 31” X H 38”
• 16 GALLON FUEL TANK (10 HOURS AT 7500 WATTS)
• 120 / 240 & 12VDC

LEAD TIME: 6 MONTHS
SURGE VERSUS CONTINUOUS POWER

• SURGE VS. CONTINUOUS POWER
  • SURGE – POWER RATING FOR MOMENTARY LOADS SUCH AS START-UP OF A REFRIGERATOR, POWER TOOLS, ETC.
  • CONTINUOUS – THE POWER A GENERATOR CAN DELIVER TO THE LOAD ON A CONTINUOUS BASIS
  • CAUTION – VERIFY THE POWER RATINGS
    • EXAMPLE - SOMETIMES GENERATOR SURGE RATING IS USED IN THE PRODUCT POWER DESCRIPTION
      • “2000W” PRODUCT IS ACTUALLY RATED 1600W CONTINUOUS
HOW POWER IS GENERATED
CONVENTIONAL ROTATING ARMATURE AND FIELD

**• PROS**
- LOW COST
- GOOD FOR POWER TOOLS, APPLIANCES, LIGHTING
- RELIABLE

**• CONS**
- ACOUSTICS - NOISY – ALWAYS RUN AT FULL THROTTLE
- HEAVY
- VOLTAGE REGULATION BASED ON SPEED
- OUTPUT IS NOT AS CLEAN AS INVERTER TYPE
  - TYPICAL THD (LOWER IS BETTER) IS 9% BUT CAN BE AS HIGH AS 15%
  - GET THE THD SPEC OFF THE WEBSITE FOR THE UNIT YOU’RE CONSIDERING TO PURCHASE
INVERTER TYPE GENERATORS

• NEWER DESIGN DEVELOPED AND INTRODUCED BY HONDA ABOUT 2010

• THEORY OF OPERATION
  • ENGINE TURNS A HIGH FREQUENCY 3 PHASE MECHANICAL GENERATOR
  • 3 PHASE POWER IS RECTIFIED TO DC
  • THE DC IS THEN FED TO AN INVERTER WHERE IT BECOMES AN AC POWER SOURCE
  • INVERTER OUTPUT IS FED TO USER OUTLETS
INVERTER TYPE GENERATORS

• PROS
  • CLEANER POWER FOR SENSITIVE ELECTRONIC LOADS
    • LCD TV, COMPUTERS
  • PURE SINE WAVE OUTPUT TYPICALLY STATED AT %5 OR LESS
    • SHOOTING FOR 3% THD
  • QUIET ENGINE
  • WELL REGULATED
  • MORE FUEL EFFICIENT
  • LIGHT WEIGHT
    • 50-60 POUNDS FOR 2KW
    • 100 LBS FOR 3KW
  • MULTIPLE GENSET PARALLELING CAPABILITY FOR SOME
INVERTER TYPE GENERATORS

• CONS
  • HIGHER COST
  • MORE COMPLEX DESIGN (MORE PARTS)
SIZING A PORTABLE GENERATOR

1700 WATT
47 LBS

12,000 WATT
380 LBS
BASICS

• OBTAIN THE CONTINUOUS POWER REQUIREMENTS FOR DEVICES THAT WILL BE USED DETERMINE THE SURGE POWER DEMAND FOR APPLIANCES WITH MOTOR LOADS
  • FRIDGE
  • FREEZER
  • POWER TOOLS
• CONTACT THE GENERATOR MANUFACTURER OR SALES OFFICE
• USE AN ON-LINE CALCULATOR BUT READ THE FINE PRINT ON ITS USE
• IF NO SURGE POWER DEMAND IS REQUIRED, USE CONTINUOUS POWER REQUIREMENTS
  • CONSIDER BUYING A BIT MORE POWER THAN YOU THINK YOU WILL NEED
<table>
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<tr>
<th>Tool/Appliance</th>
<th>Rated (running) Watts</th>
<th>Surge Watts</th>
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<tr>
<td>electric water heater (40 gal)</td>
<td>4000</td>
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<tr>
<td>hot plate</td>
<td>2500</td>
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<tr>
<td>saw- radial arm</td>
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<tr>
<td>electric stove (each element)</td>
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<td>saw- circular</td>
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<td>air compressor (1 HP)</td>
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<td>window air conditioner</td>
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<td>1600</td>
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<td>saw-miter</td>
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<td>well water pump</td>
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<tr>
<td>reciprocating saw</td>
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<td>1040</td>
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<tr>
<td>DVD player/ VCR</td>
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<tr>
<td>common light bulb</td>
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CONVENTIONAL VERSUS INVERTER

• CONVENTIONAL
  • 5.5KW - $670
  • 15LW - $3300

• INVERTER
  • 2KW - $525
  • 3KW - $900

• VERY WIDE RANGE ACROSS MARKET

• BRAND BASED
  • HONDA – HIGHER COMPARED TO LESSER-KNOWN BRANDS
SAFETY
FROM OSHA...

- CAUSES OF INJURIES AND FATALITIES
  - Shocks and electrocution to workers from improper connection to structures, such as residences, offices, shops and trailers
- CAUSES OF INJURIES AND FATALITIES TO USERS (OSHA) - Shocks and electrocution to users from improper use
GROUNDING

• NATIONAL ELECTRIC CODE
  • ARTICLE 250 APPLIES

• OSHA
  • 29 CFR 1926.404(f)(3)(i)
  • DEALS WITH REQUIREMENTS RELATING TO GROUNDING BASED ON GENERATOR CONSTRUCTION AND METHOD OF USE AND INSTALLATION
SAFETY CONSIDERATIONS

• CORDS MUST BE IN GOOD CONDITION AND SIZED FOR THE LOAD(S)
• NEVER FUEL A RUNNING GENERATOR
• READ THE USER MANUAL THOROUGHLY AND UNDERSTAND THE CONTENTS
• UNDERSTAND AND FOLLOW ALL GROUNDING REQUIREMENTS FOR YOUR GENERATOR

• CARBON MONOXIDE WARNING - DO NOT PLACE A PORTABLE GENERATOR CLOSER THAN 20’ TO A STRUCTURE OR AS INSTRUCTED BY THE SPECIFIC DOCUMENTATION FOR YOUR GENERATOR
  • EVEN WHEN 20’ OR MORE, DO NOT OPEN WINDOWS ADJACENT TO GENERATOR LOCATION
TO SUMMARIZE...
TAKEAWAYS FROM THIS CHAT

- WHAT IS THE GENERATOR APPLICATION?
- WHAT QUALITY (THD) POWER IS NEEDED?
- WHAT IS THE TOTAL POWER REQUIREMENT PLUS THE SURGE POWER?
- BUY A BIT MORE POWER THAN YOU THINK YOU WILL NEED
- DOES THE UNIT MEET SURGE POWER RATINGS?
- WHAT IS YOUR BUDGET?
- IS ENGINE NOISE A CONCERN?
- DO YOU NEED HIGH PORTABILITY?
- MANY PRODUCTS TO FIT MANY BUDGETS
- VARIOUS FEATURES AVAILABLE
USEFUL LINKS 1 of 3

• OSHA FACT SHEET ON PORTABLE GENERATOR GROUNDING
  • https://www.osha.gov/OshDoc/data_Hurricane_Facts/grounding_port_generator.html

• CARB COMPLIANCE

• INFO ON INVERTER GENERATORS
  • https://www.bestgenerator.org/inverter-generators-vs-conventional-generators-whats-the-difference/

• COMPARISON, REVIEW AND SELECTION GUIDE
  • https://generators.smps.us/inverter-generator.html
USEFUL LINKS 2 of 3

• CONSUMER REPORTS PROS & CONS OF INVERTER GENERATORS
  • https://www.consumerreports.org/inverter-generators/pros-and-cons-of-inverter-generators/

• CONSUMER REPORTS - NEW CARBON DIOXIDE SAFETY FEATURE ON PORTABLE GENERATORS

• LAZAR’S ELECTRIC GENERATOR GUIDE
  • http://www.generatorguide.net/
USEFUL LINKS 3 of 3

• TOTAL HARMONIC DISTORTION IN PORTABLE GENERATORS
  http://powerupgenerator.com/total-harmonic-distortion-portable-generators/

• PORTABLE GENERATOR SIZING GUIDE
Portable Generators

Thanks for checking in to the CORC TechNet this evening!

73 until next time!