



# 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



WA3U00

# 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 SHUTDOWN 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
  - 360 LBS
  - L 48" X W 31" X H 38"
  - 16 GALLON FUEL TANK (10 HOURS AT 7500 WATTS)
  - 120 / 240 & 12VDC
- \$3250**  
**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**

**TechNet**

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**12,000 WATT  
380 LBS**

Slide 15



# 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

## TOOL/APPLIANCE VS RATED POWER / SURGE POWER DEMAND

Tool/Appliance	Rated (running) Watts	Surge Watts
electric water heater (40 gal)	4000	0
hot plate	2500	0
saw- radial arm	2000	2000
electric stove (each element)	1500-2800	0
saw- circular	1500	1500
air compressor (1 HP)	1500	3000
window air conditioner	1200	1800
saw-miter	1200	1200
microwave	1000	0
well water pump	1000	1000
reciprocating saw	960	1040
sump pump	800	1200
refrigerator freezer	800	1200
furnace blower	800	1300
computer	800	0
electric drill	600	900
television	500	0
deep freezer	500	500
garage door opener	480	0
stereo	400	0
box fan	300	600
clock radio	300	0
security system	180	0
DVD player/ VCR	100	0
common light bulb	75	0


# COST

# 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](https://www.osha.gov/OshDoc/data%20Hurricane%20Facts/grounding_port_generator.html)
- CARB COMPLIANCE
- <https://woodstockpower.com/blog/what-is-carb-and-what-does-carb-compliant-generator-mean/>
- INFO ON *INVERTER* GENERATORS
- <https://www.bestgenerator.org/inverter-generators-vs-conventional-generators-whats-the-difference/>
- COMPARISON, REVIEW AND SELECTION GUIDE
- <https://generators.smeps.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
- <https://www.consumerreports.org/portable-generators/new-safety-feature-on-portable-generators-could-save-lives-consumer-reports-tests-show/>
- 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
- <https://www.electricalengineeringtoolbox.com/2017/07/how-to-size-portable-generator-for-home.html>



# Portable Generators

Thanks for checking in to the CORC TechNet this evening!  
73 until next time!