



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 INSTALLERS. THEY CAN BE USED TO SUPPLY POWER TO AN ENTIRE 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 OUTPUT (SINGLE PHASE)
 - 120
 - 240
- DC OUTPUT
 - 12V DC ON *SOME* MODELS
- FROM UNDER 1KW to 15KW POWER – WATTS OR KILOWAT



- Above right
- 15KW PORTABLE
- \$2700 to \$4300 SHOP IT!
- 360 LBS
- L 48" X W 31" X H 38"
- 16 GALLON FUEL TANK (10 HOURS AT 7500 WATTS)
- 120 / 240 & 12VDC

SURGE VERSUS CONTINUOUS POWER

- SURGE VS. CONTINUOUS POWER
 - MAX SURGE – POWER RATING FOR MOMENTARY LOADS SUCH AS START-UP OF A REFRIGERATOR, POWER TOOLS, ETC.
 - CONTINUOUS POWER – 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

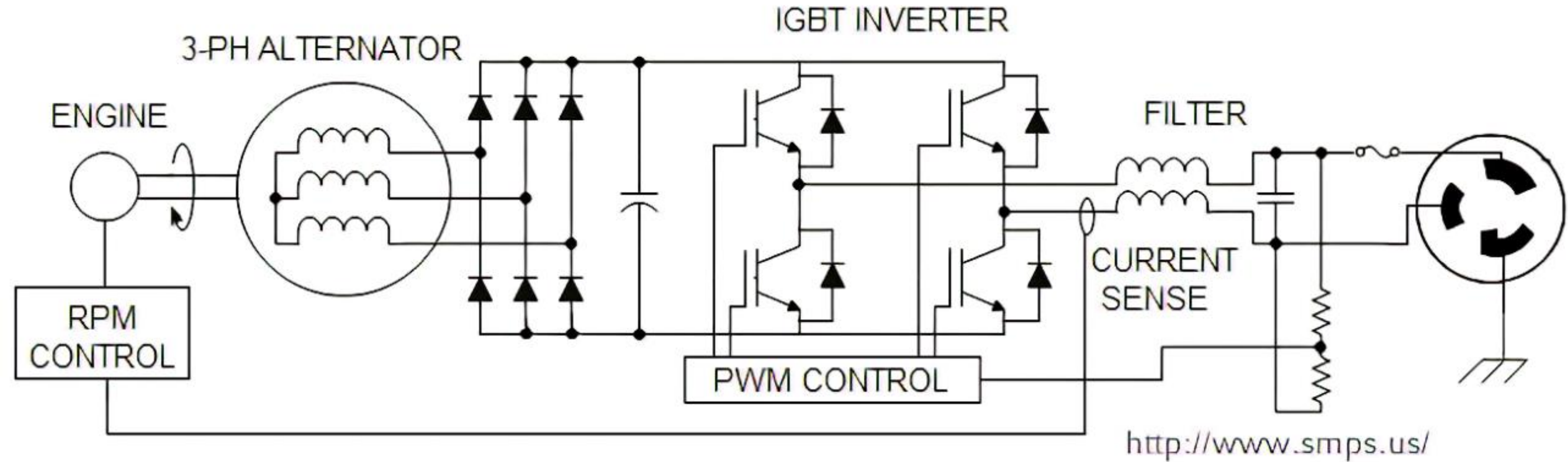
- **CONS**

- NOISY – RUN AT FULL THROTTLE
- HEAVY
- 4 STROKE ENGINE - VOLTAGE REGULATION BASED ON SPEED
- OUTPUT IS NOT AS CLEAN AS INVERTER TYPE
 - TYPICAL THD IS 9% BUT CAN BE AS HIGH AS 15% - LOWER THD IS BETTER
 - 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

BASIC INVERTER GENERATOR SCHEMATIC



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
 - GENSET PARALLELING AVAILABLE FOR SOME BRANDS/SIZES

INVERTER TYPE GENERATORS

- CONS
 - HIGHER COST
 - MORE COMPLEX DESIGN (MORE PARTS)

SIZING A PORTABLE GENERATOR



**1700 WATT
47 LBS**

TechNet

WA3U00



**12,000 WATT
380 LBS**

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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
 - 15KW - \$3300
- INVERTER
 - 2KW - \$525
 - 3KW - \$900
- WIDE PRICE RANGES 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 (immediately opens PDF)
- <https://www.bing.com/ck/a?!&&p=e15d6775e8a42b75JmltdHM9MTcwOTA3ODQwMCZpZ3VpZD0zZjJjNjlkNi01ZGY5LTZlMzctMTQ4Mi03ZGU0NWxOTZmOTEmYW5zaWQ9NTIwNw&ptn=3&ver=2&hsh=3&fclid=3f2c69d6-5df9-6e37-1482-7de45c196f91&u=a1aHR0cHM6Ly93d3cub3NoYS5nb3Yvc2l0ZXMvZGVmYXVsdC9maWxlc9wdWJsaWNhdGlvb3R1bWV3JvdW5kaW5nX3BvcnRfZ2VuZXJhdG9yLnBkZg&ntb=1>
- 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.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
- <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

- GENERATORS AND TOTAL HARMONIC DISTORTION
- <https://generatorsage.com/what-is-thd/>
- PORTABLE GENERATOR SIZING GUIDE
- <https://www.consumerreports.org/home-garden/generators/how-to-choose-the-right-size-generator-a4942266454/>



Portable Generators

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