BLANCHARD POWER SYSTEMS

Blanchard Power Systems

- Caterpillar Dealer for State of South Carolina
- In business since 1982
- Eight locations in the state
- Over 400 employees
- 1000+ installations in South Carolina

Reciprocating Engine-Driven Generator Sets

- Diesel and Gaseous Fueled
- 8kw to 15,710kw
- Standby, Prime and Continuous Duties
- $300-$400/kw Installed Cost
- $ .07 - $ .08/kw-hr to operate
- Relatively easy to install

BLANCHARD POWER SYSTEMS

Installation Considerations

- Generator Sizing/Use
- Location of Generators
- Foundations/Mounting
- Air Requirements
- Exhaust Requirements
- Fuel Systems/Storage
- Starting Systems
- Controls
- Generator End
- Enclosures
- Switchgear
- Maintenance

Generator Sizing/Use

- Co-ordination/Load Studies
- Sized for specific loads or entire building
- Certain types of loads cause over-sizing
  - UPS Systems
  - Large Motors
  - VFDs
- Use is largely dependent on Utility Contract

Location of Generators

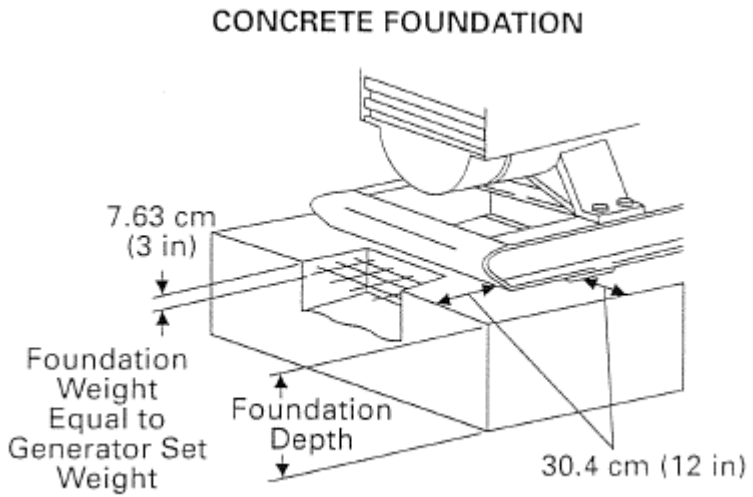
- Indoor versus Outdoor Installation
- Noise considerations
- Required room for maintenance
- Platforms for large units
- Prevailing winds for exhaust
- Permitting issues

Foundations/Mounting

- Surface must be firm and level – soil, gravel, rock, etc.
- With Concrete:
  - Must support static and dynamic loads
  - Leave 12 inch maintenance area on all sides
  - Estimated foundation depth formula

$$FD = \frac{W}{D \times B \times L}$$

FD = foundation depth in meters (feet)
W = total weight of generator set in kilograms (pounds)
D = density of concrete in kg/m^3 (lb/ft^3) (2402.8 kg/m^3, 150 lb/ft^3)
B = foundation width in meters (feet)
L = foundation length in meters (feet)

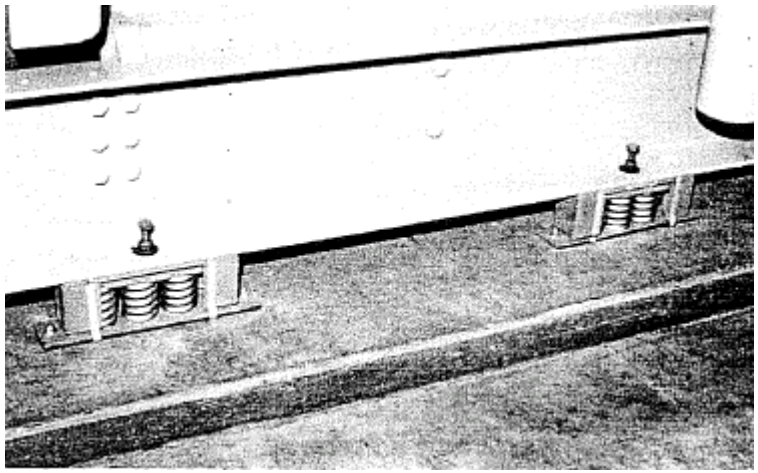


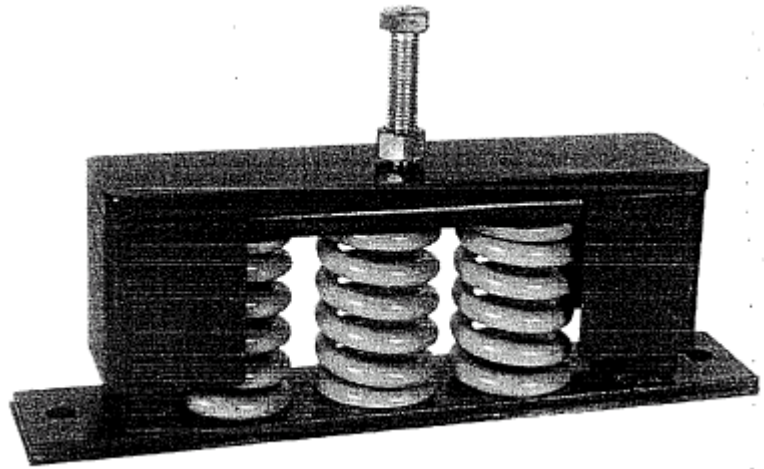
Structural Steel Bases

- Maintains alignment between engine and generator
- Aids in installation and relocation
- Isolates set from a flexing foundation
- May contain fuel tank for diesel generator sets

Vibration Isolators

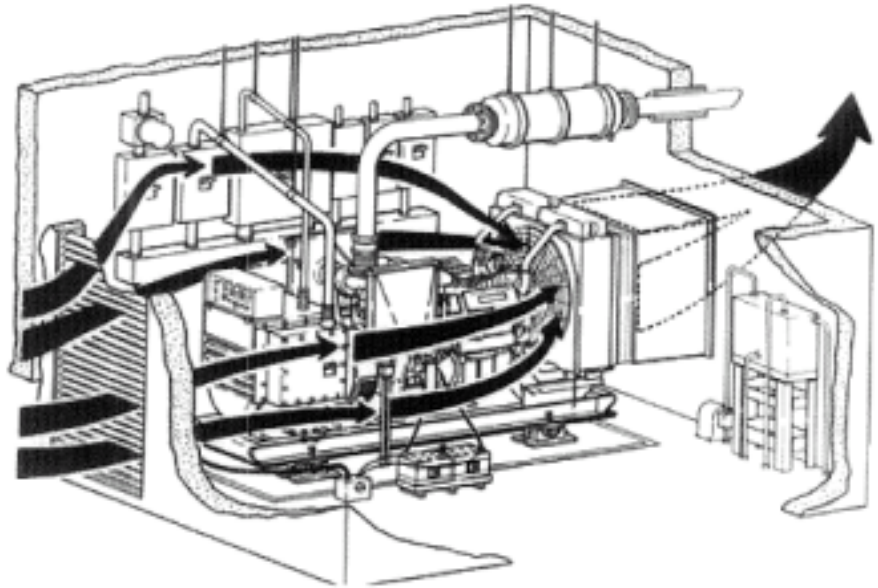
- Proper isolation reduces noise and vibration damage
- Rubber type typically adequate – 90% effective
- Spring type are best – 96% effective





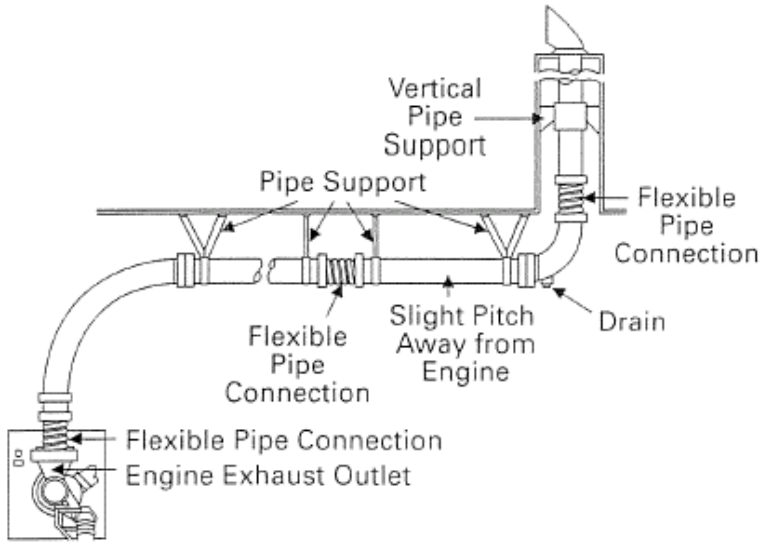
Air Requirements

- Cool, dry, clean air required for combustion and cooling
- Air should flow from generator to engine to radiator
- Air inlet should be 50% larger than air outlet
- New EPA requirements are forcing more air usage



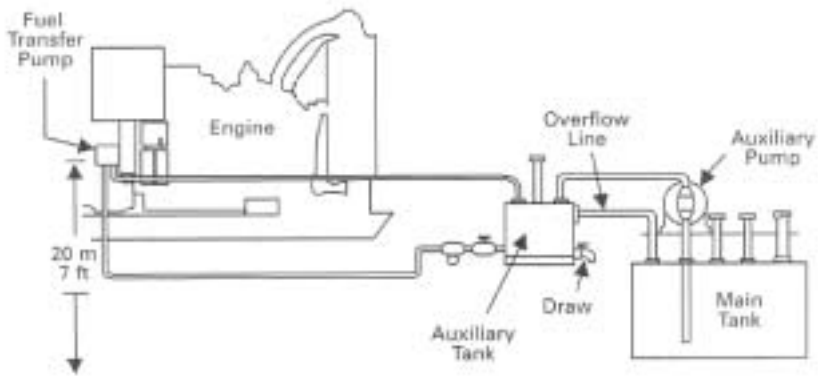
Exhaust Requirements

- Exhaust piping must be isolated from engine for:
  - Weight, vibration/movement, and heat expansion
- Length and turns in piping causes back pressure
- Rain caps or screen to keep birds out
- EPA requirements may force use of catalytic converters



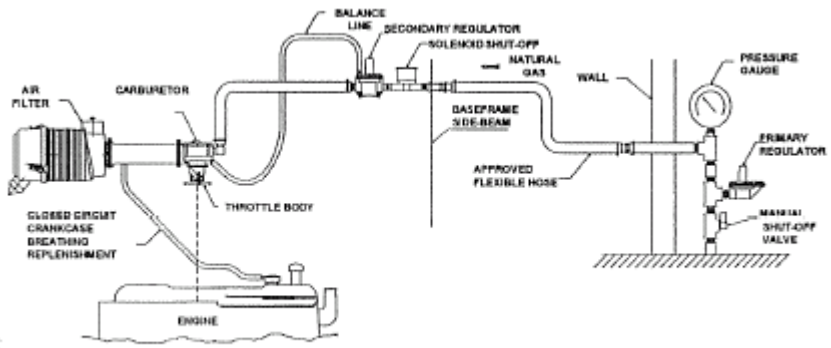
Fuel Systems/Storage

- Diesel
  - Bulk fuel stored in large tank
  - Typically transferred to small day tank
  - Diesel fuel will react with many materials
  - No galvanized, aluminum, or zinc in piping/tanks
  - Tanks require maintenance
  - Fuel must be filtered and often cooled



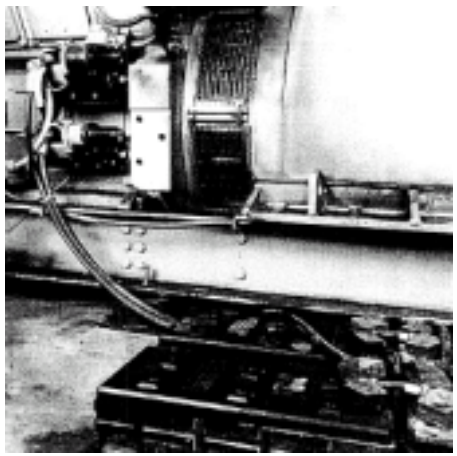
Fuel Systems/Storage

- Gaseous
  - Gaseous fueled engines require spark plugs
  - Horsepower depends on quality of gas
  - Natural gas, propane vapor, landfill gas
  - Gas pressures from .75psi for <100kw
  - Gas pressures from 3-5psi for >100kw
  - Gas company may provide primary regulator
  - Engine has shutoff valve and secondary regulator



Starting Systems

- Electric starting is most common
- Batteries provide energy to starter
  - Lead-acid versus Nickel-cadmium
- Batteries placed near starting motor
- Batteries require maintenance
- Battery chargers versus charging alternators
- Jacket water heaters insure quick starts
- Air starting



Controls

- Control panel provides auto start/stop capabilities
- Programmable safety shutdowns
- Readouts for many critical data points
- Warning lights for protection
- Diagnostic capabilities
- Limits the starting cycles
- Provides for a cool-down cycle

Controls

- Governor controls engine speed
- Isochronous versus droop systems
- Electronic versus mechanical
- Electronic isochronous allows load sharing:
  - Governor's reaction time is very fast
  - Can compare real-time position to other unit
- Electronic systems can limit fuel at startup
- Stable operation (plus/minus .25% frequency)

Generator End

- Single bearing versus two bearing
- Permanent magnet excitation
- Internal anti-condensation heaters
- Generator-mounted circuit breaker boxes
- Stator and bearing temperature detectors
- RFI filters

Enclosures

- Provide protection from weather
- Reduce sound level depending on design
- Much cheaper than erecting a building
- Self-contained with power distribution for accessories

Switchgear/Transfer Switches

- Switchgear provides controls for single/multiple sets
- Automatic paralleling to Utility or other generators
- Provides protective relaying and circuit breakers
- Transfer switches provide connection of load to either generator or utility
- Automatic vrs manual
- Open vrs Closed transition

Maintenance

- Batteries
- Oil drain
- Oil filters
- Fuel filters
- Coolant
- Air cleaners

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Questions?