GENERATOR 101 DESIGN CONSIDERATIONS
Brands We Service

- Allison Transmission
- mtu
- ElectroMotive
- Mercedes-Benz
- GE Energy
- Detroit Diesel
What does it need to do?
APPLICATION
Service Duty

**Standby**
Varying loads for the duration of the outage

**Prime**
Varying loads for unlimited hours

**Continuous**
Steady load for unlimited hours
STANDBY
For heavy-duty diesel generator sets used in the event of a utility power failure. The generator set may be operated at rated power for the duration of the utility outage. The generator set will operate with an average load factor of less than 85% of the rated power & will operate for less than 500 hours per year.
PRIME

For heavy-duty diesel generator sets used as a power source. It is subject to normal varying load conditions, with an intermittent load capability of 10% (up to the standby power rating), for no more than 1 hour in every 12 hours operation. When averaged over a 24 hour period, the average load factor must not exceed 75% of the prime power limit. Under these conditions the generator may be operated for an unlimited number of hours per year.
CONTINUOUS

For heavy-duty diesel generator sets used as a power source. It is subject to non varying load conditions, a 100% load factor, with no overload load capability. Under these conditions the generator may be operated for an unlimited number of hours per year.
Loads

Linear Loads

Motor Loads

Starting method?
Acceptable voltage dip?
Sequential or Simultaneous start?

UPS Loads

Miscellaneous Loads
Engine Type

Fuel System Types

- Diesel
- Natural Gas
- LP / Propane
Diesel Fuel

**Advantages**
- >125kW less cost than NG/LP
- Independent of utility
- Wider product range
- Relatively safe
- Indoor & outdoor storage
- Reliable delivery network

**Disadvantages**
- Temperature sensitive
- Limited storage life
- Emissions
Natural Gas

**Advantages**
- <150kW same cost as diesel
- No on site storage
- Clean burn for emissions
- Infinite supply
- Generally not temp sensitive

**Disadvantages**
- Dependent on utility
- Very high cost on large units
- Highly volatile
- Installation costs
LP / Propane

**Advantages**
- <150kW same cost as diesel
- Independent of utility
- Clean burn for emissions
- Long term storage

**Disadvantages**
- Only available up to 125kW
- Highly volatile storage
- Separate fuel tank
Diesel Fuel Tanks

**Sub Base Tanks**

- Easiest solution
- UL142 Standard Double Wall
- UL2085 Fire Rated Concrete

**Day Tanks**

Free standing, with or without pumps
NOTES:

THE SMALLEST CAPACITY TANK IN EACH MODEL MAY BE ORDERED STANDARD OR AS A DRY TANK.
TANKS MAY BE ORDERED AS SECONDARY CONTAINER OR CLOSED TOP BASKET.

DIMENSIONS:

- 3/8" N.P.T. PUMP INLET
- 1/10/120 VOLT PUMP AND MOTOR LOCATION FOR DRY TANK OPTION ONLY (SEE CHART).
- 3/8" N.P.T. PUMP INLET
- GASKET GREED WIDTH
- STUD UP WIDTH
- STUD UP LENGTH
- STUD UP WIDTH
- STUD UP LENGTH
- 3/8" N.P.T. PUMP INLET
- 1/10/120 VOLT PUMP AND MOTOR LOCATION FOR DRY TANK OPTION ONLY (SEE CHART).

FITTINGS:

1. 1/4" NPT CYLINDRICAL FOUT PER MPA GI
2. 1/4" NPT FOUT FOR STANDARD FUEL GAP AND RISER
3. 1/4" I.D. HOSE - STAINLESS
4. 1-1/4" NPT FOR STANDARD NORMAL VENT AND RISER
5. 1/4" I.D. TUBING FUEL SUPPLY AND "T" RECESS
6. 1/4" I.D. TUBING FUEL RETURN AND "T" RECESS
7. 1/4" NPT FOR LOW LEVEL ALARM SHUT OFF
8. 1/4" NPT FOR TANK VENT/ PUMP CONTROL (TANK)
9. 1/2" NPT FOR OVERFLOW - 2 GPH PUMP MAX
10. 3/8" NPT FOR DRY TANK FILL (TANK ONLY)

METRIC CAD FILE

DIMENSIONS IN [ ] ARE ENGLISH STD. EQUIVALENTS 29-300 1/4 IN. DIA. HOLES
FUEL SUPPLY SYSTEM SPECIFICATIONS

1. BLACK IRON, BRASS, OR COPPER PIPE SHOULD BE USED FOR ALL FUEL PIPING. PIPING FROM MAIN TANK TO DAY TANK SHOULD BE MIN. 1” NPT PIPE. FOLLOW ENGINE MANUFACTURER’S RECOMMENDATION FOR PIPE SIZE. LIFT & RUN FROM DAY TANK TO ENGINE GENERATOR. DAY TANK OVERFLOW LINE SHOULD NEVER BE PLUGGED. PIPE DAY TANK OVERFLOW BACK TO MAIN TANK WITH SAME SIZE OR LARGER PIPE THAN DAY TANK SUPPLY LINE.

2. DAY TANK VENT PIPE SHOULD BE AT LEAST FIVE FEET HIGHER THAN OTHER PIPING IN SYSTEM. VENT SHOULD BE PLUMBED TO OUTSIDE OF BUILDING AND SHOULD BE PROTECTED FROM WATER, DEBRIS, AND INSECTS.

3. WATER & SEDIMENT SHOULD BE DRAINED FROM THE TANK EVERY SIX MONTHS.

4. RECOMMENDED OPTIONS — #300 SOLENOID VALVE, #375 FOOT VALVE, #395 REVERSE FLOW FLOAT SWITCH & PIPING, #315 FUEL STRAINER, #320 VENT CAP, #403 REVERSE FLOW PUMP & MOTOR

FOR GENERAL REFERENCE ONLY.
Emissions

Tier 3

Tier 4
Controls

Digital Panels
- Fully programmable
- LED display
- Keypad control and access
- Password protected

Remote Annunciators

Communications
- RS232, RS485, MODBUS, Ethernet
- Remote monitoring and control via software
Where is it going?
Location

*Indoor*

Cooling

Unit mounted radiator

Remote radiator
1. Exhaust thimble (for wall or ceiling)
2. Silencer
3. Supports
4. Flexible sections
5. Duct work for cooling air outlet
6. Mounting base
7. Controller
8. Electrical conduit
9. Water trap with drain
10. Fresh air intake
## Location

### Indoor

<table>
<thead>
<tr>
<th>Exhaust Silencer</th>
<th>dBA Reduction</th>
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</thead>
<tbody>
<tr>
<td>Hospital / Super Critical</td>
<td>35-40dBA</td>
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<tr>
<td>Critical</td>
<td>25-35dBA</td>
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<tr>
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<td>Industrial</td>
<td>15-20dBA</td>
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<tr>
<td>Custom Applications</td>
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</tbody>
</table>
Location

Outdoor

Enclosures

Weather

Sound Attenuated

Skin Tight / Skid Mounted
Enclosures

Weather

Basic, weather protective
Internal or external muffler
No added sound insulation or baffling
Minimal sound reduction on exhaust
Enclosures

Sound Attenuated

Weather protection PLUS sound reduction

What are the site requirements?

Typically has internal muffler

Options - Lights, heaters, louvers, etc.
Sound Requirements

Local Codes

Codes vs. Reality

Sound Measurement

Usually measured at 23 feet
Needs to be PACKAGE sound
Accessories

Battery Chargers
Block Heaters
Circuit Breakers
Sized to current output of generator
Extended Warranties
Transfer Switch

Open Transition
"Break Before Make"

Programmed Transition
aka Time Delay Neutral, Center Off

Closed Transition
Momentary paralleling with utility on transfer to normal
"Make Before Break"

Bypass Isolation
Remove ATS without interrupting utility
MTU Onsite Energy recommends monthly testing with at least 30% load, until the engine reaches normal operating temperatures and an annual test for a minimum of 2 hours at 100% load to confirm proper operation.

Operating the engine under load until it reaches normal operating temperature is critical in order to rid the engine and generator of any accumulated condensation, and to avoid the build up of fuel condensate in the exhaust system.

EXAMPLE of WET STACKING
Tier 4 Indoor Installation Example