Caterpillar Update

7x24 Chapter Meeting

Will Barnes – NC Power Systems

November 12, 2019

Agenda

- Caterpillar Update
  - Product Offerings
  - High Power Density
  - Generator to Generator Paralleling
  - Start Signal Integrity
  - Enclosures
  - Fuel Systems

Will Barnes

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- **Background**
  - 8 years US Naval Nuclear Propulsion, Instructor S8G Nuclear Power Plant
  - 11 years Cummins Northwest - Technician, Service Manger, Industrial Sales
  - 3 years NC Power Systems - Industrial Sales
  - 5 years Pacific Power (MTU) - Industrial Sales – CHP, biogas, landfill
  - 4 years Energy Systems (Generac) – Industrial Sales, Branch Manager
  - 1 year NC Power Systems – second tour
- **Experience**
  - Projects from 5 KW low voltage to Multi Megawatt Multi Unit MV paralleled systems
  - Project sites from the North Slope of Alaska to the McMurdo Research station, in 26 of the 50 states, and Washington DC

Change

- Product Improvements / Innovations
- National / International Codes – UL, IBC, Emissions…
- Local Codes – Noise, fuel storage, permitting, plan review, FAS…

Diesel Generators

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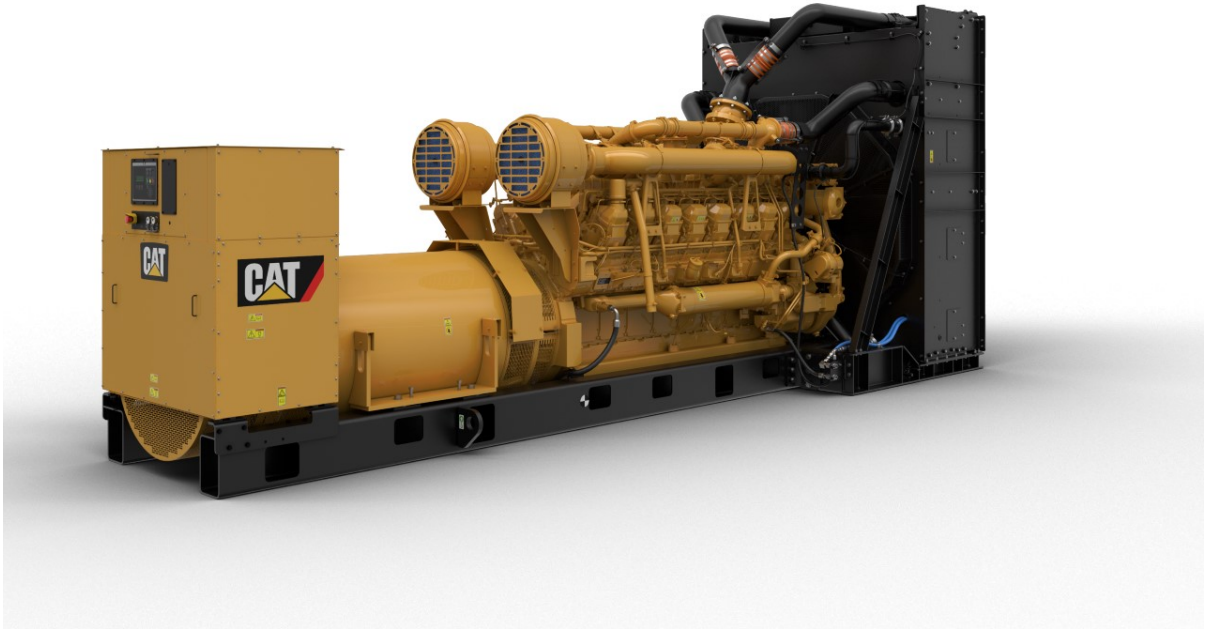
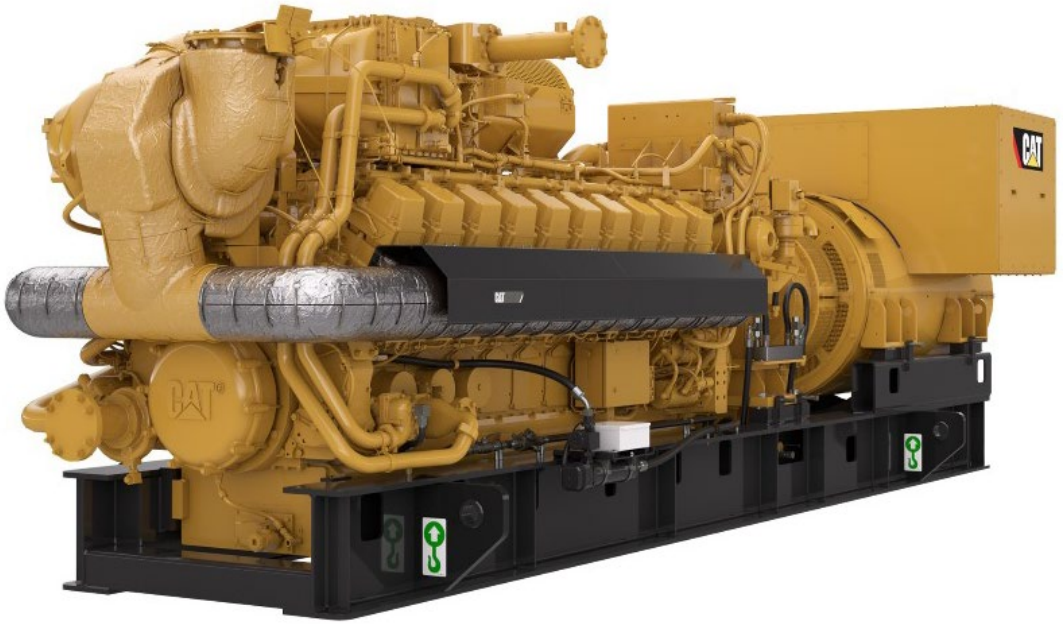
- Single engine 40-4MW
- Paralleled – virtually unlimited
- NFPA 110
- UL2200
- IBC Certified
- Low and medium voltage



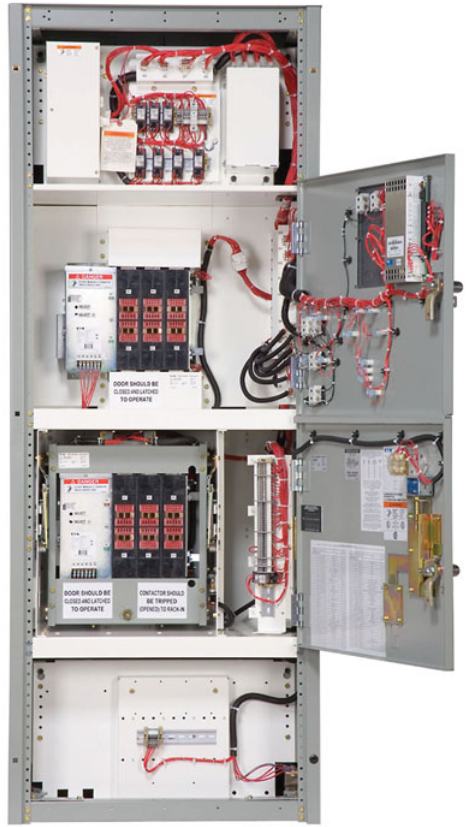
Gas Generators

- Natural Gas
  - 40-450 standby rated
  - Up to 14MW other configurations
    - High, medium, and low speed
- Propane
- Other Gasses
  - Biogas
  - Landfill Gas
- CHP



Automatic Transfer Switches

- 100-5000A
- Open Transition
- Delayed Transition
- Closed Transition
- Service Entrance Rated
- Bypass Isolation
- Compatible with 3rd Party Switches



High Power Density

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- Advancements in Engineering, Materials, and Methods
- More Power (KW) , less footprint
- Reduced installation costs
- Same Warranty and Durability for the Application

C27 750KW vs C18 750KW

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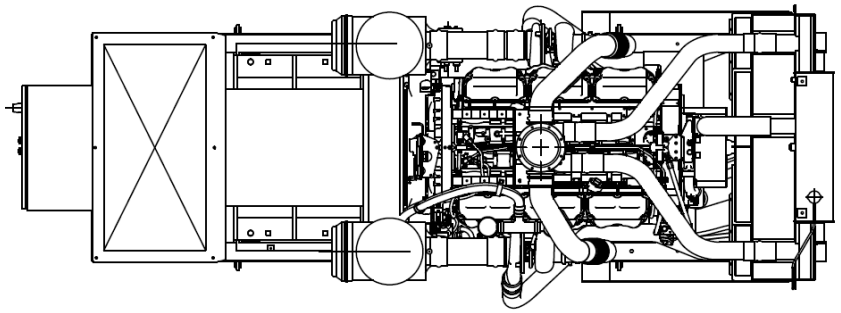
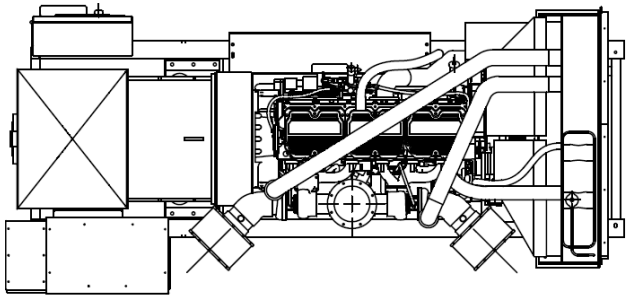
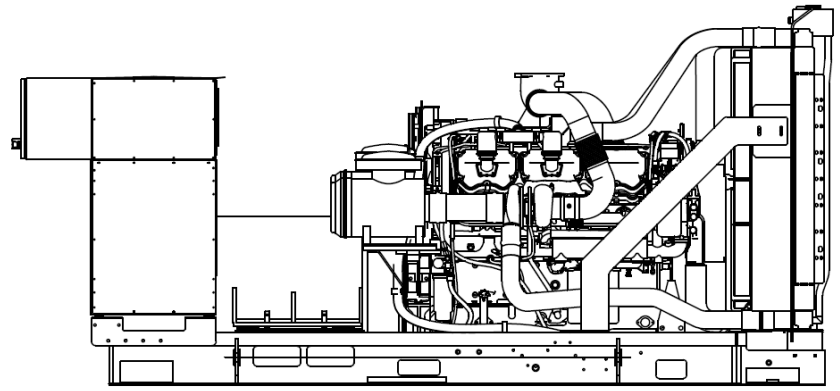
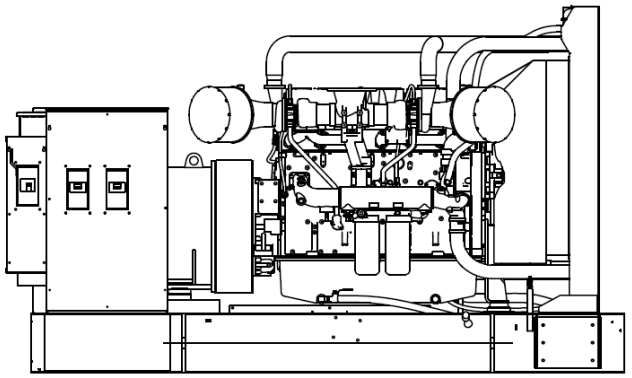


	Length	
184”		138”
	Width	
68”		69”
	Height	
85”		92”





	Weight	
14,600 lbs		10,721 lbs
	Airflow	
42,377 cfm		31,783 cfm



3512C 1500KW vs C32 1250KW

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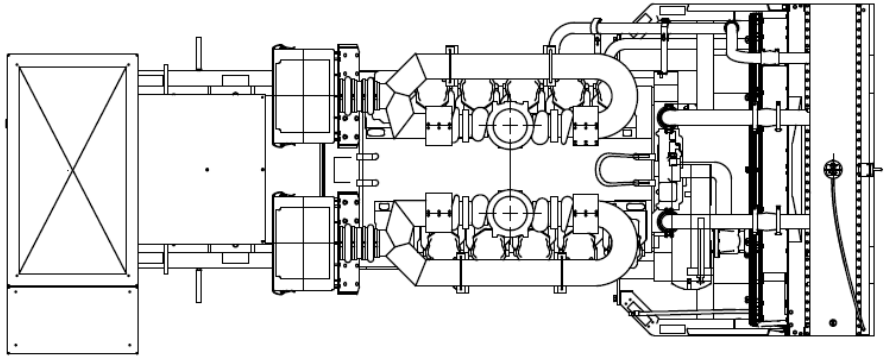
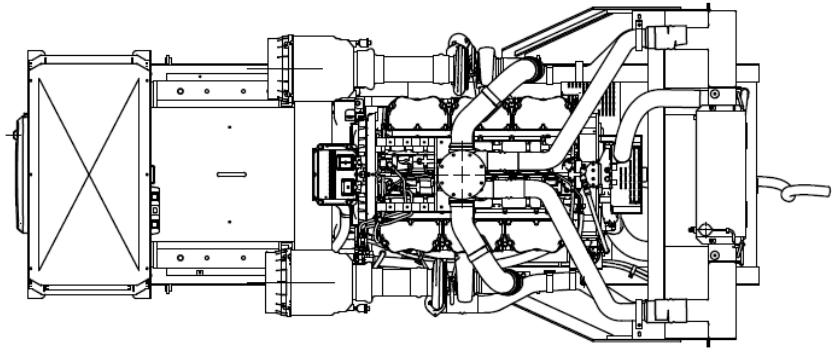
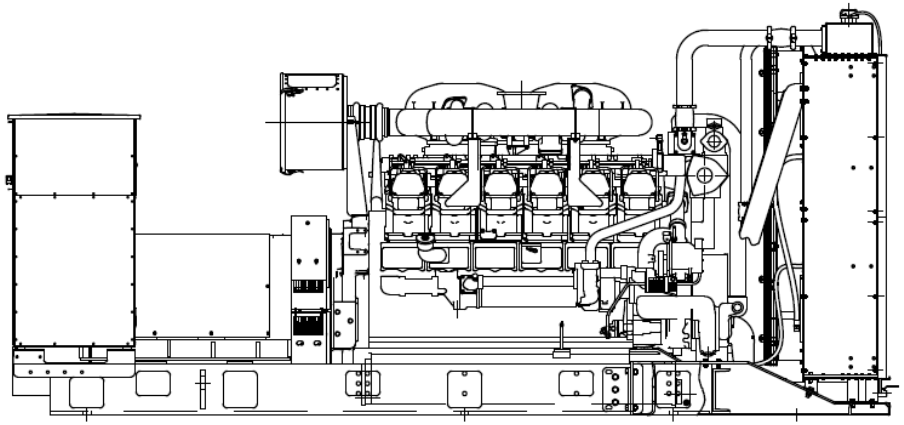
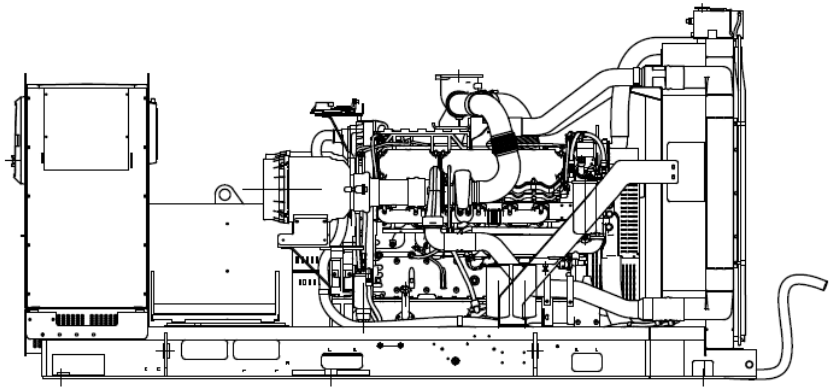


	3512C	C32
Length	233”	173”
Width	90”	86”
Height	110”	87”
Weight	30,790 lbs	16,755 lbs
Airflow	73,278 cfm	50,571 cfm

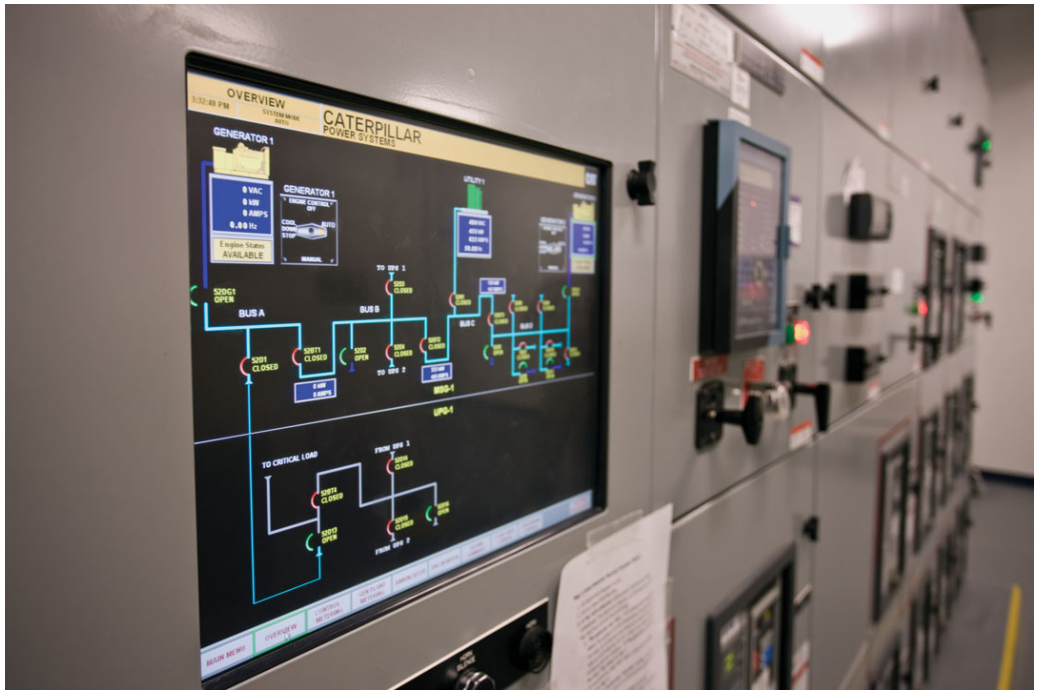




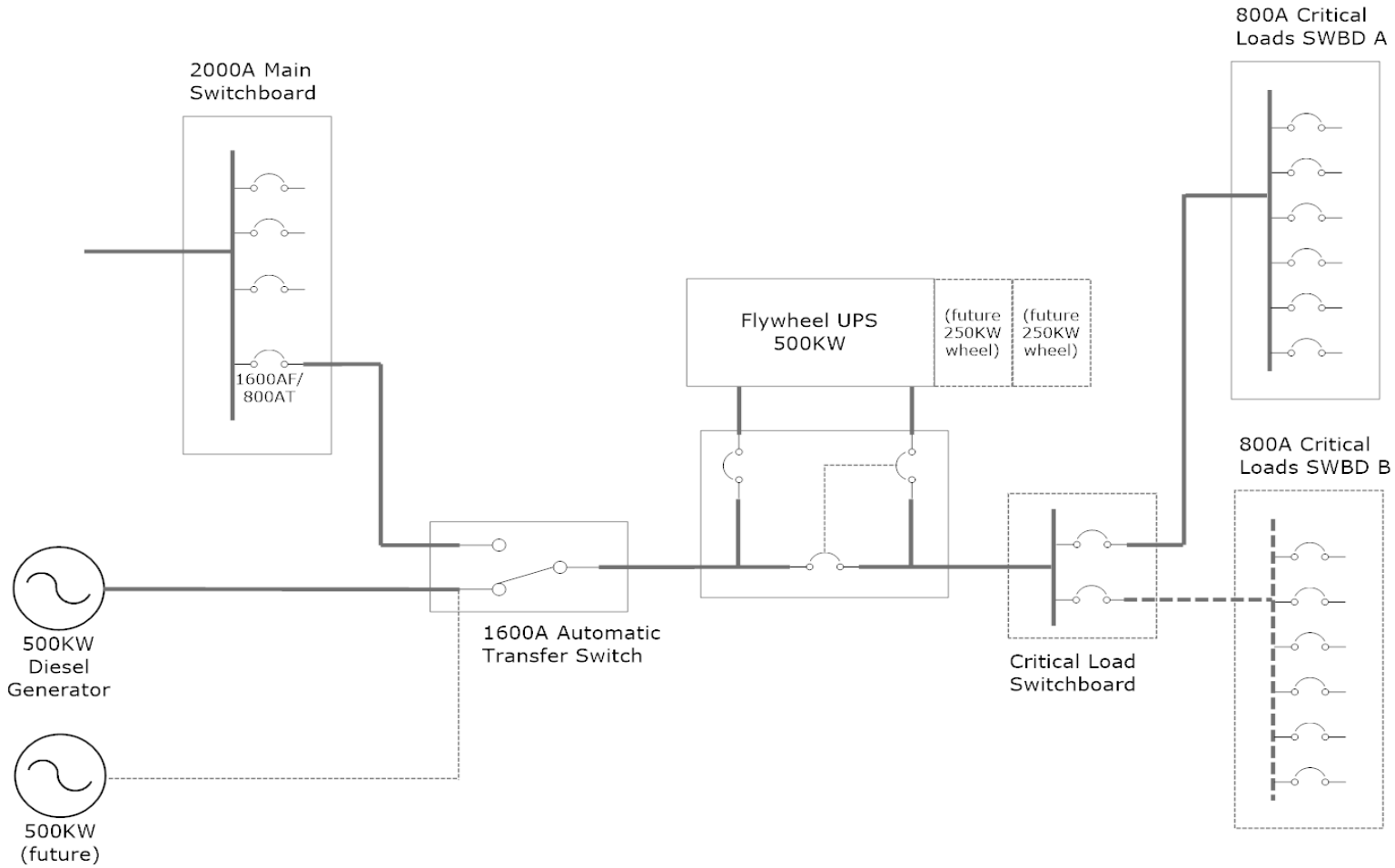


Generator Paralleling

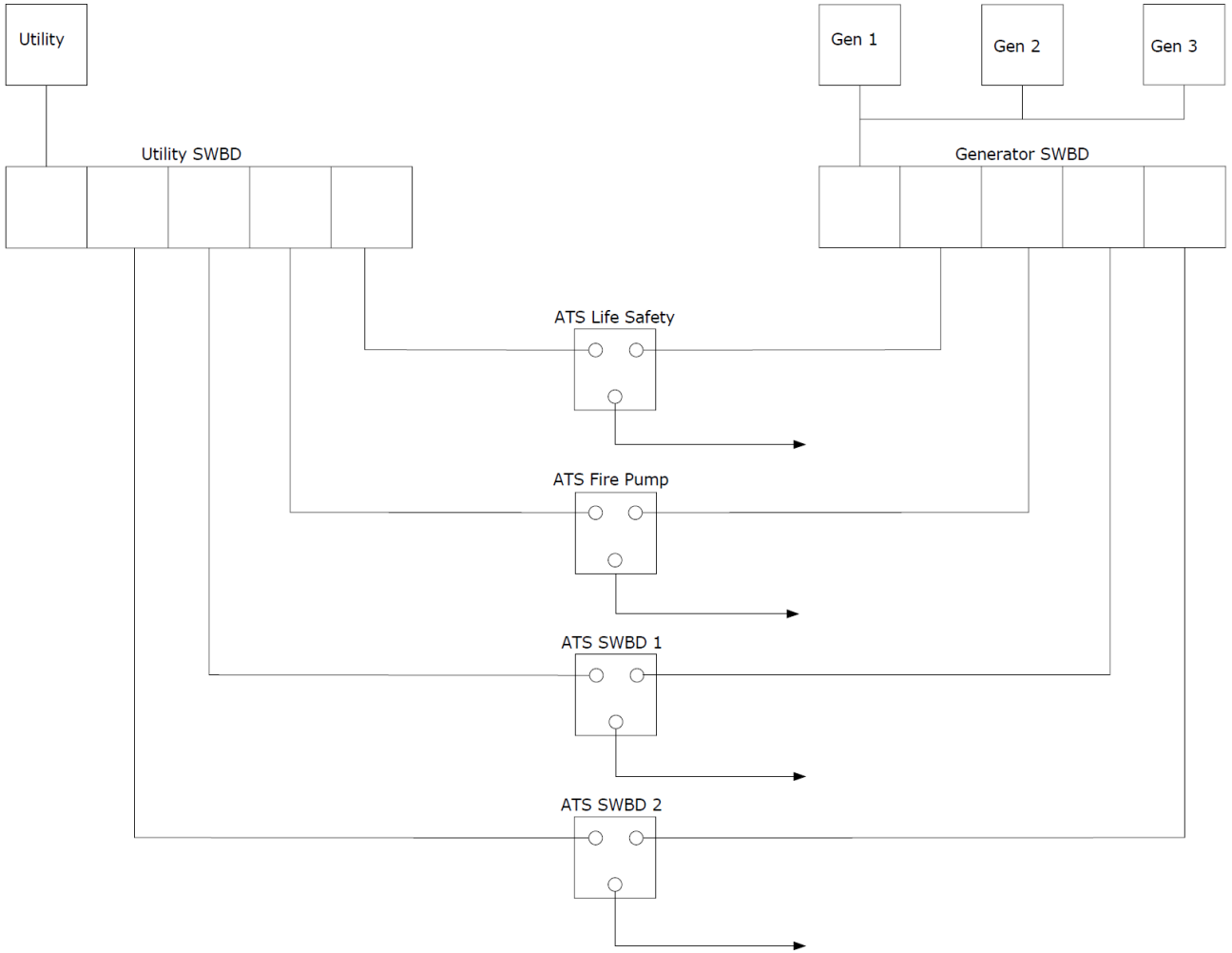
- Traditional Free Standing Gear
- Caterpillar EMCP 4 gen-to-gen
  - Increased reliability / redundancy vs single engine solutions
  - Lower equipment cost/kw
  - Vs Generac MPS



Future Expansion Example

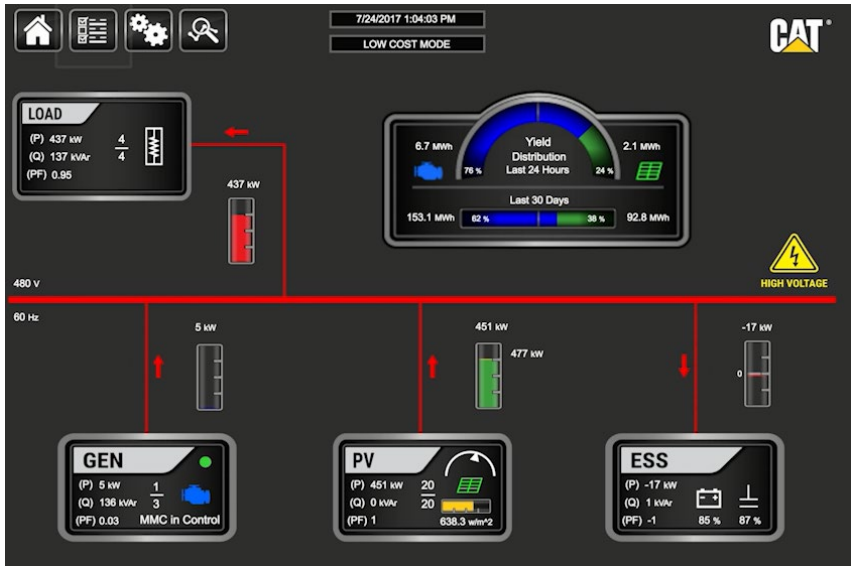


$$$ / KW Example


Utility
Gen 1
Gen 2
Gen 3
Utility SWBD
Generator SWBD
ATS Life Safety
ATS Fire Pump
ATS SWBD 1
ATS SWBD 2

Microgrid

- Compressive Management of Multiple Energy Sources
  - Utility
  - Solar
  - Wind
  - Battery Storage
  - Diesel Generator
  - CHP
  - Central Plant



Start Signal Integrity Monitoring

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Article 700.10 (D) (3) Emergency Systems (*)

- Released 2017 National Electric Code
  - Generator Control Panel Wiring Methods. Control conductors installed between the transfer equipment and the emergency generator shall be kept entirely independent of all other wiring and shall meet the conditions 700.10 (D) (1). The integrity of generator control wiring shall be continuously monitored. Loss of integrity of the remote start circuit(s) shall initiate visual and audible annunciation of generator malfunction at the generator local and remote annunciator(s) and start the generator(s).

- Tentative Interim Amendment (TIA 17-17)
  - Generator Control Panel Wiring Methods. Control conductors installed between the transfer equipment and the emergency generator shall be kept entirely independent of all other wiring and shall meet the conditions 700.10 (D) (1). The integrity of the generator ~~control wiring~~ remote start circuit shall be ~~continuously~~ monitored for broken, disconnected, or shorted wires. Loss of integrity ~~of the remote start circuit(s)~~ shall ~~initiate visual and audible annunciation of generator malfunction at the generator local and remote annunciator(s) and~~ start the generator(s).

- (*) Information replicated from the NFPA 70 2017 Edition National Electric Code. Reference Article 700 Emergency Systems for definition of Emergency Systems

NEC Adoption

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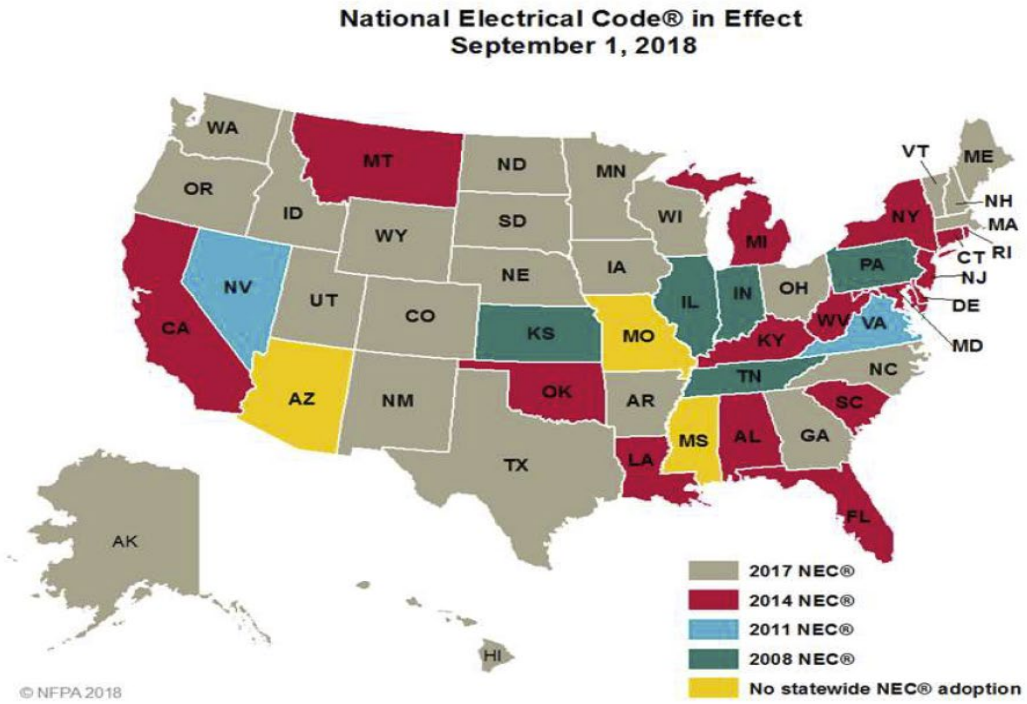
Actual Impact

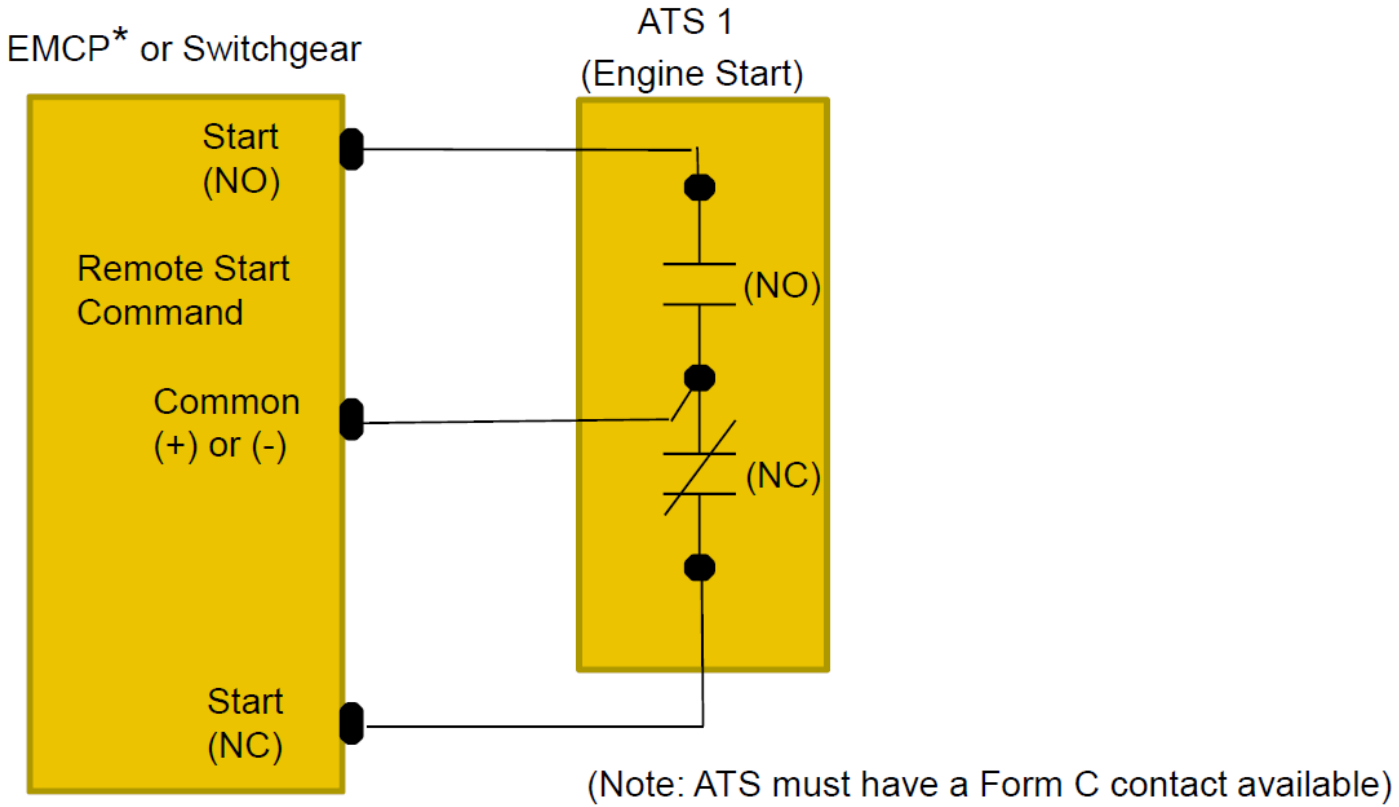
- Depends on consulting engineers and what they write into specifications
- Depends on the AHJ (Authority having Jurisdiction)



- *The 2016 California Electrical Code, California Code of Regulations Title 24, Part 3 is based on the 2014 edition of NFPA 70®, National Electrical Code®.*
- *The 2011 New York City Electrical Code is based on the 2008 edition of NFPA 70®, National Electrical Code®.*

Start Signal – Single ATS

(3 wire monitoring)

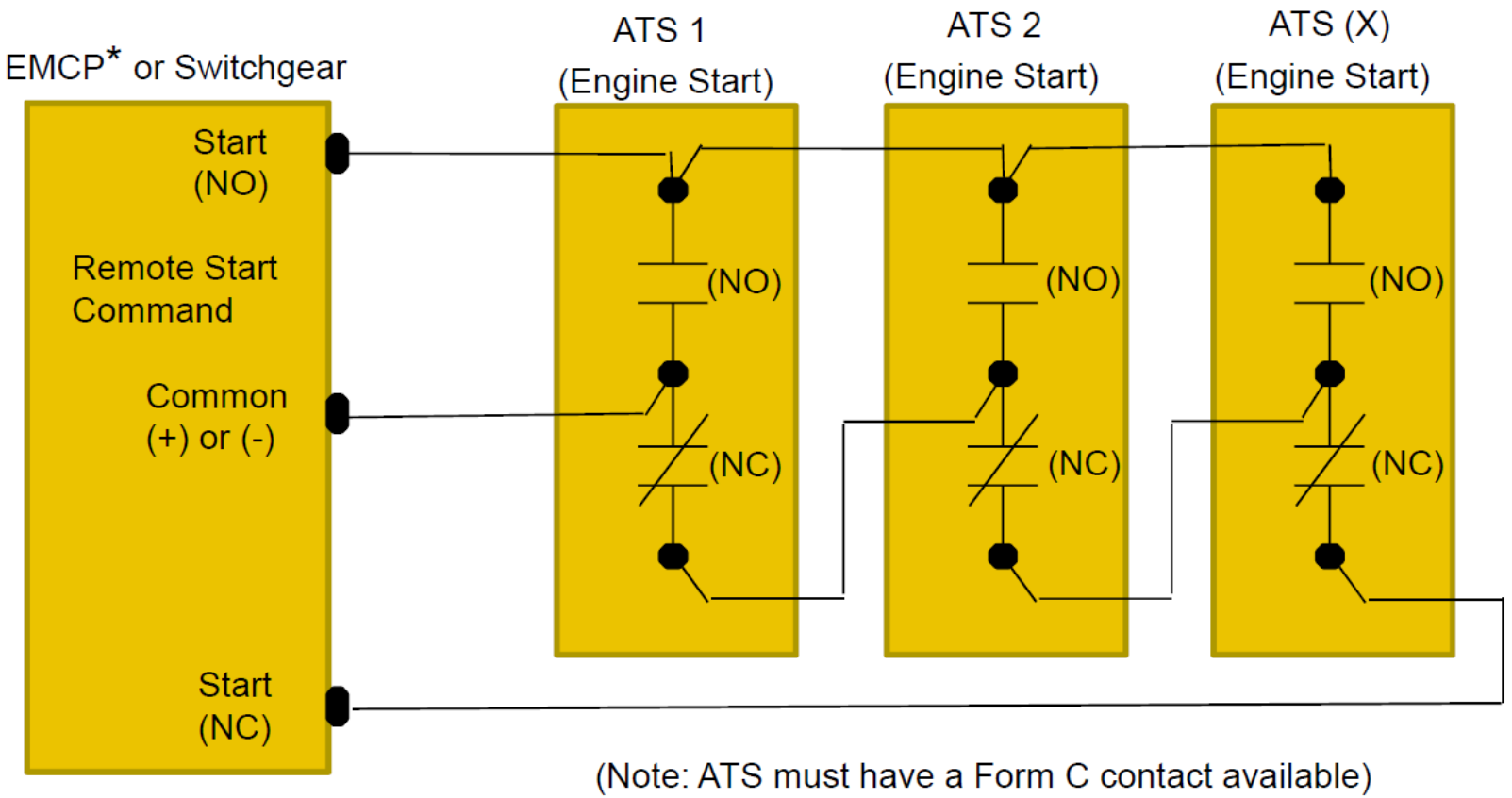


(Note: ATS must have a Form C contact available)

* Requires EMCP 4.2, 4.2B, 4.3, 4.4
(reference requirements on programming slide)

Start Signal – Multiple ATS

(3 wire monitoring)

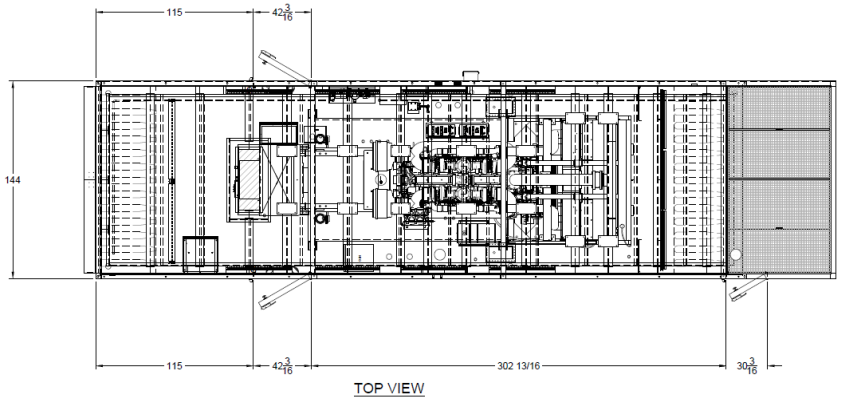


(Note: ATS must have a Form C contact available)

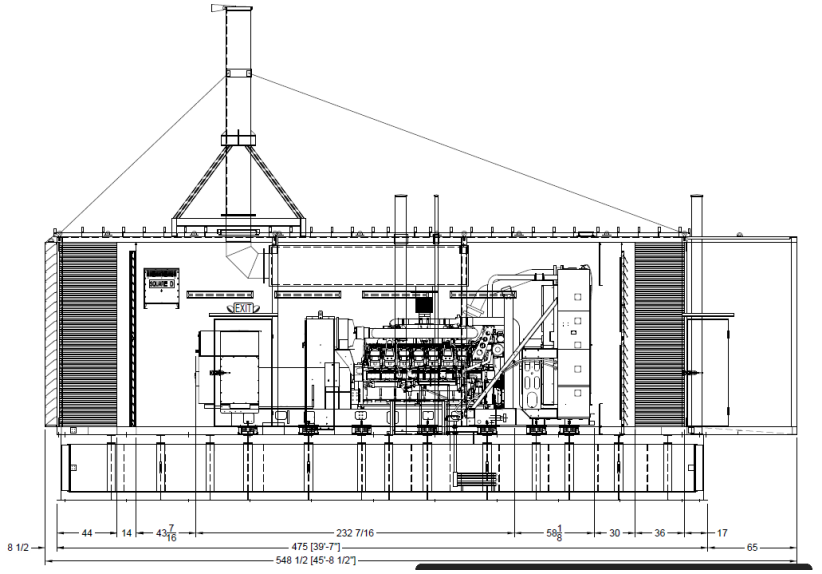
* Requires EMCP 4.2, 4.2B, 4.3, 4.4
(reference requirements on programming slide)

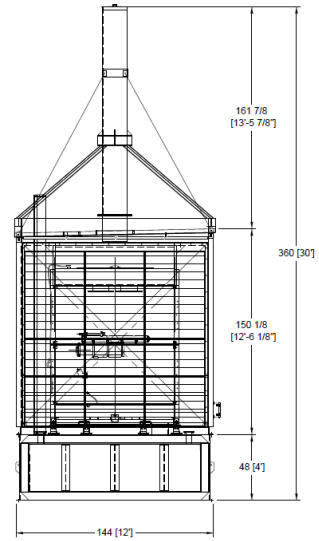
Outdoor Enclosures

- Factory vs Custom
- Skin Tight vs Walk In
- Design Parameters
  - Sound, Snow, Cold, High Ambient, Elevation, Wind, Run Time
- WA FAS
- Lead times
- Cost vs Pre-Engineered building



TOP VIEW





Diesel Fuel Systems

- UL 142 vs UL 2085
- Level Detection Methods
- IFC Requirements
- Pressure testing
- Remote Fill Stations
- Initial fill requirements
- Fuel Polishing
- Inconsistent Requirements

Fuel Tank Vents

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Class II

Class II liquids include diesel fuel, paint thinner, camphor oil, mineral spirits, and kerosene. The NFPA considers their flash point to be equal to or greater than 100 degrees Fahrenheit but less than 140 degrees Fahrenheit.

5704.2.7.3.3 Vent pipe outlets.
Vent pipe outlets for tanks storing Class I, II or IIIA liquids shall be located such that the vapors are released at a safe point outside of buildings and not less than 12 feet (3658 mm) above the finished ground level. Vapors shall be discharged upward or horizontally away from adjacent walls to assist in vapor dispersion. Vent outlets shall be located such that flammable vapors will not be trapped by eaves or other obstructions and shall be ~~at least~~ **not less than** 5 feet (1524 mm) from building openings or *lot lines* of properties that can be built upon. Vent outlets on atmospheric tanks storing Class IIIB liquids are allowed to discharge inside a building ~~if~~ **where** the vent is a normally closed vent.

5704.2.7.4 Emergency venting.
Stationary, above-ground tanks shall be equipped with additional venting that will relieve excessive internal pressure caused by exposure to fires. Emergency vents for Class I, II and IIIA liquids shall not discharge inside buildings. The venting shall be installed and maintained in accordance with Section 22.7 of NFPA 30.

Fuel Tank Features

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Remote Fuel Fill Station

Fuel Tank Filling

- Float switches / alarms
- Electric Level Indication
- Mechanical Level Indication

Questions?

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What are you trying to do ?

How can I help you ?