Caterpillar Update

7x24 Chapter Meeting

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Agenda

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

**Background**

- 8 years US Naval Nuclear Propulsion, Instructor S8G Nuclear Power Plant
- 11 years Cummins Northwest - Technician, Service Manager, 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

- 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

• 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

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

Length
233”
90”
110”

Width
173”
86”

Height
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
Microgrid

• Compressive Management of Multiple Energy Sources
  • Utility
  • Solar
  • Wind
  • Battery Storage
  • Diesel Generator
  • CHP
  • Central Plant
Start Signal Integrity Monitoring

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).

NEC Adoption

Actual Impact

- Depends on consulting engineers and what they write into specifications
- Depends on the AHJ (Authority having Jurisdiction)
Start Signal – Single ATS
(3 wire monitoring)

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

(Note: ATS must have a Form C contact available)
Start Signal – Multiple ATS
(3 wire monitoring)

EMCP* or Switchgear

Start (NO)
Remote Start Command
Common (+) or (-)
Start (NC)

ATS 1
(Engine Start)

ATS 2
(Engine Start)

ATS (X)
(Engine Start)

(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
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

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 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
Remote Fuel Fill Station
Fuel Tank Filling

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

What are you trying to do?

How can I help you?