



AMG
Italian Energy Storage

Proyten IESS – Technical Overview



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In these slides, we report the basic information of AMG's systems Proyten-IESS. The system consists in a box / container that contains the batteries, and all the power buses, and the management and control panels. The inverters are external to the container and enclosed within a panel that can always be positioned outdoors.



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Main operating data

Rated Energy	1.4 MWh (100% DOD at C/10)
Nominal energy (Nominal Voltage · Nominal capacity)	1.5 MWh
Nominal Current capacity	2432 Ah (100 % DOD)
Rated constant discharge power	400 kW for 3 hours
Maximum instantaneous discharge power	500 kW
Rated power in charge	400 kW
Maximum instantaneous power in charge	500 kW
Standard charge / discharge hours	8 h / 3 h
Maximum heating power	64 kW
Heater average consumption during floating	10 kW
Maximum charge current	960 A
Maximum discharge current *	1920 A
Maximum charge power for controlled charge (EOC)	216 kW
N° of gateway (BMS master controller)	1



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Is a system born to store energy inside Sodium-Nickel chloride Batteries, in a containerized solution. Each system is equipped with up to 64 x battery modules (22.8Kwh/each), the electrical distribution and the electrical switchboard



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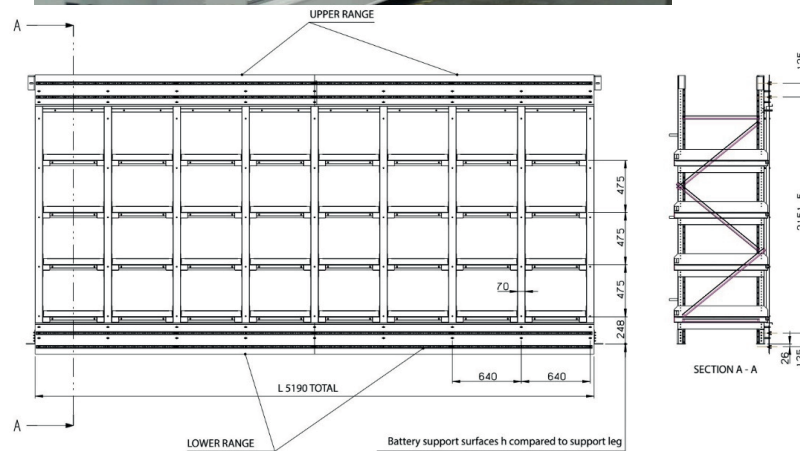
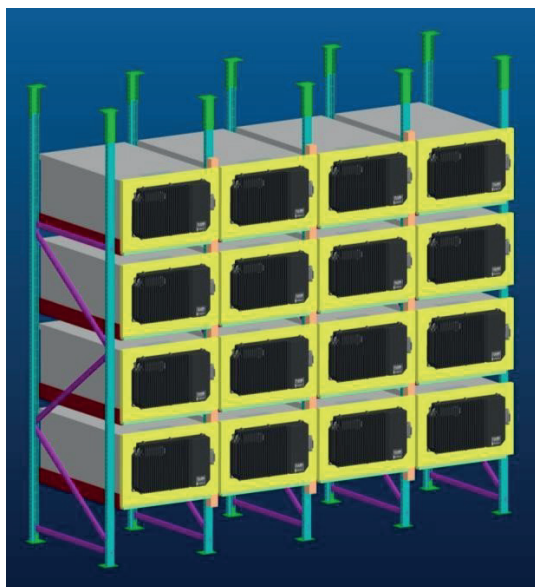
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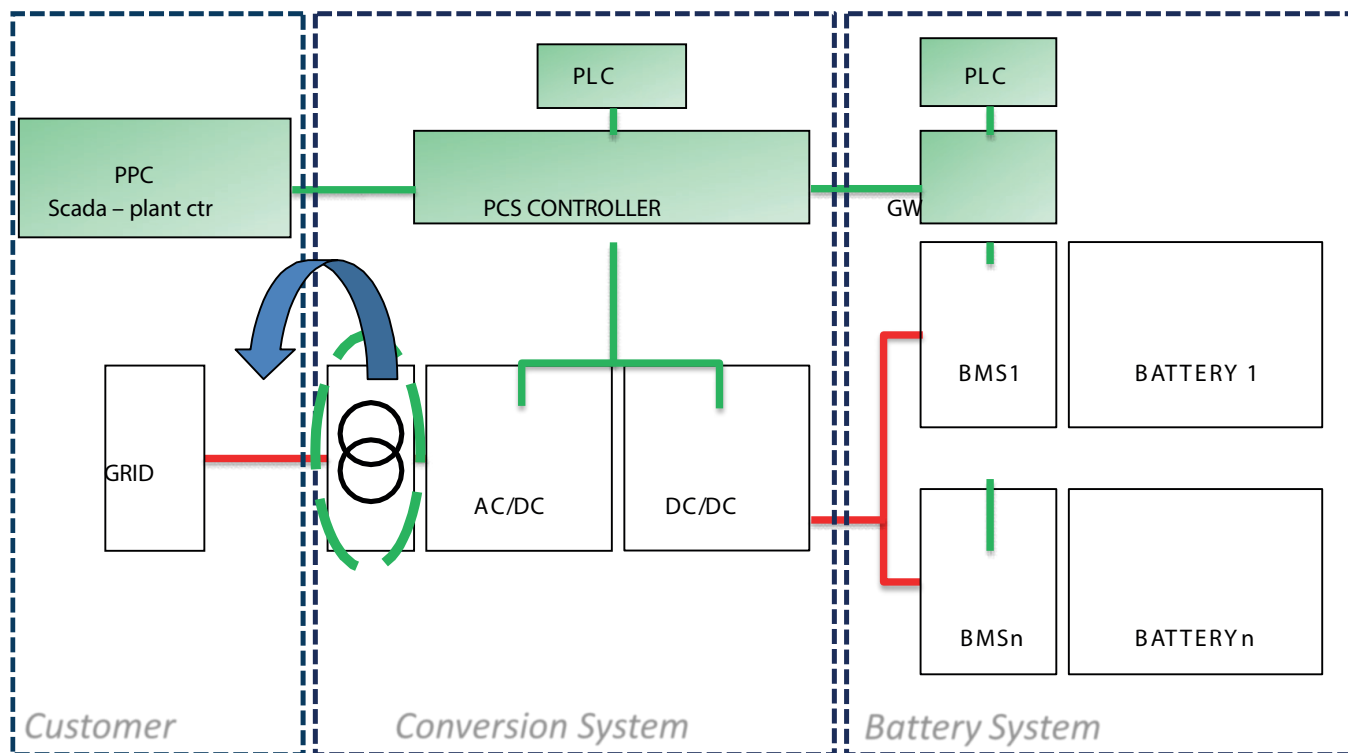
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Block diagram



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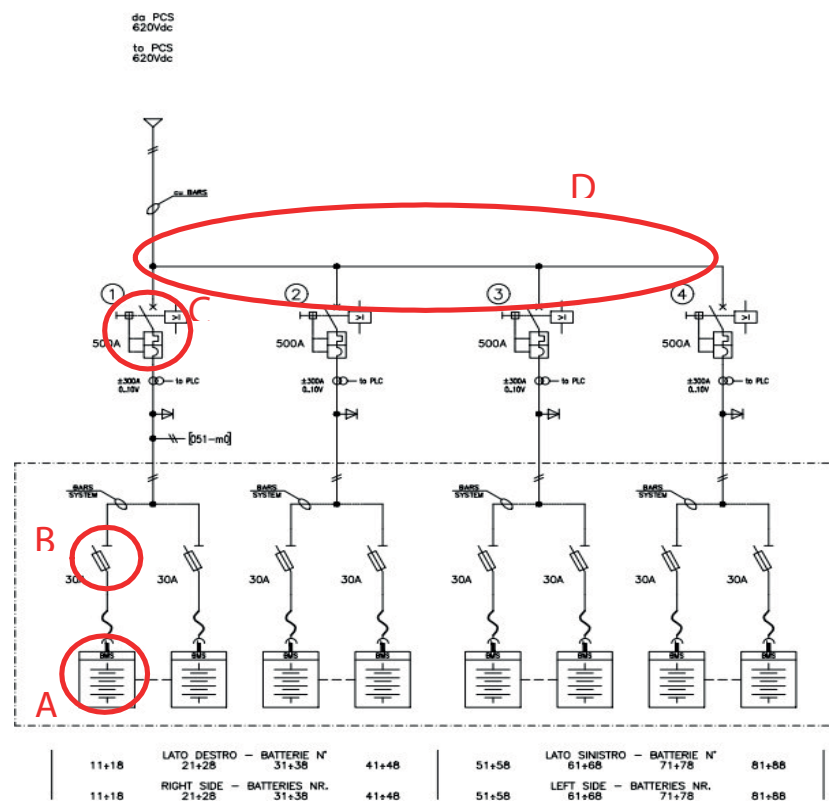


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Electrical characteristics

Protection levels

- A. Battery Protection (BMS contactors)
- B. External Battery Protection (fuse)
- C. Battery parallel Protection (16 batteries)
- D. DC BUS



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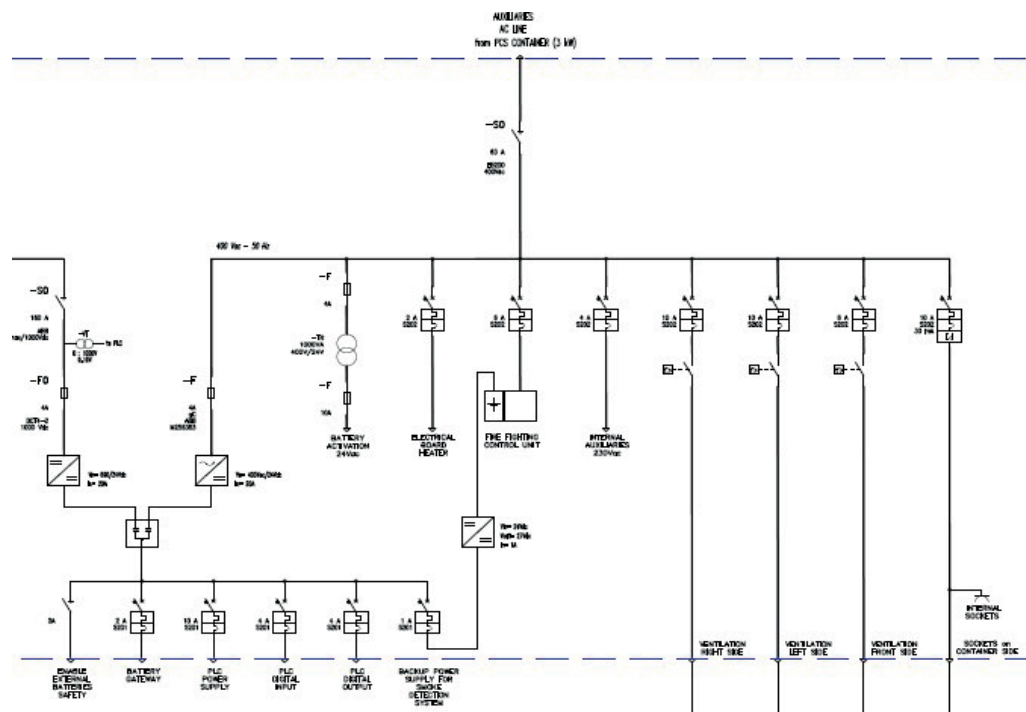
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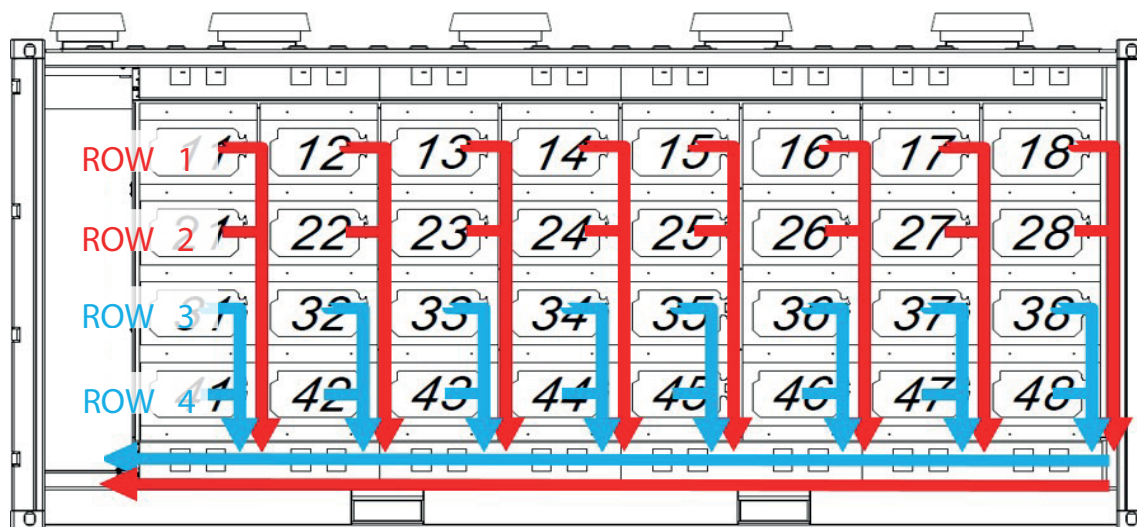
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Battery power connection



- Connection in parallel for 16 batteries (first and second rows, third and fourth rows)
- The parallel can be sectioned into 4 sub-systems



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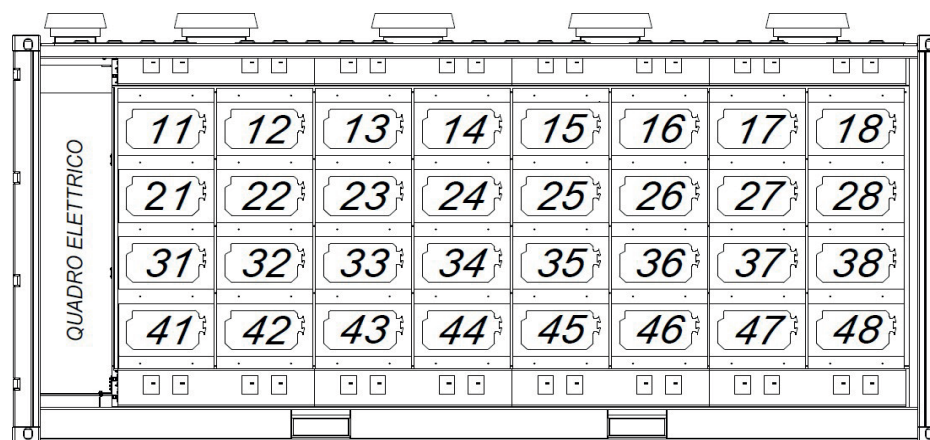




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Communication line



There are basically 2 communication connections to the system:

1. BESS Gateway to PCS Modbus TCP/IP connection: to the LAN 2 port of Gateway
2. BESS Gateway remote connection: to the switch inside the electrical switchboard

Can bus network connects all the batteries in the left and right container sides



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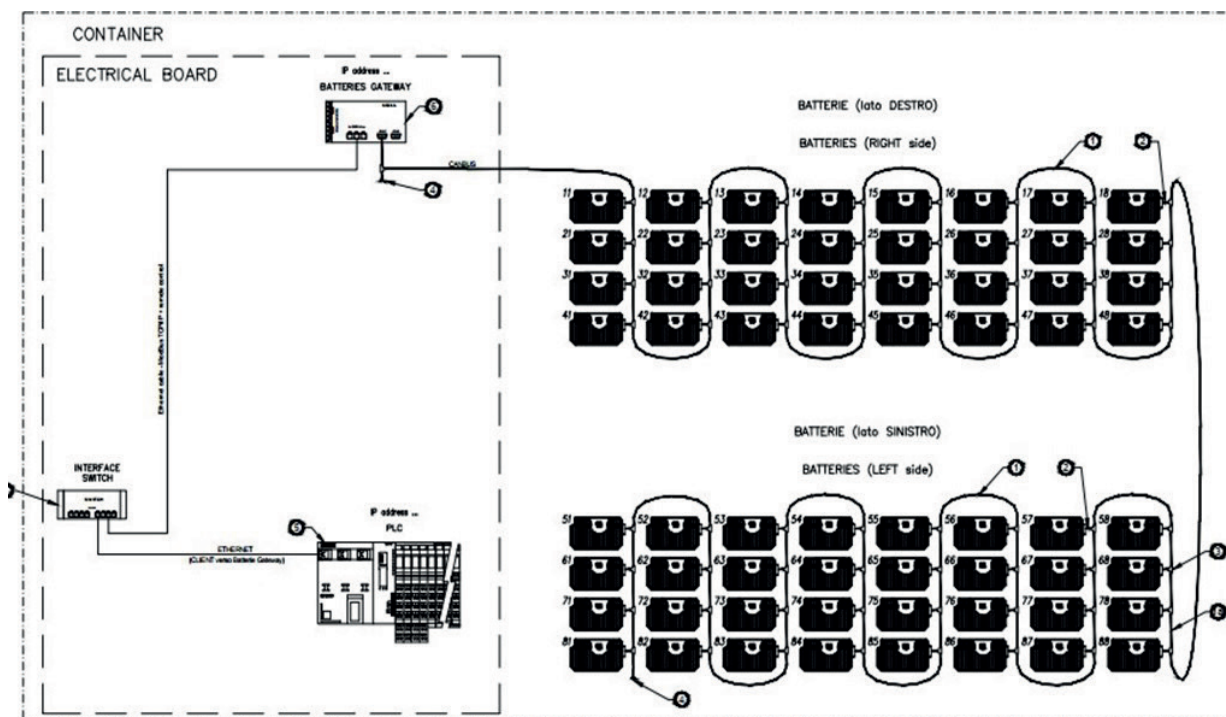
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Operating mode

BASIC OPERATING MODES:

- Warmup: system start with cold batteries
- Normal Operation:
 - Vmode -> operation in «VoltageControl»
 - Imode -> operation in «CurrentControl»
- SystemEqualization -> REACHEOC (mandatory sequence within interval seestablished by each GW)
- System STOP
- Emergency status



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NORMAL OPERATION THERE ARE 2 MODES IN NORMAL SYSTEM OPERATION:

Vmode - Operation in «VoltageControl»

In Vmode the PCS operates as a «voltage generator»:

- The DC bus voltage must follow the set point values decided by each Gateway while the current will be determined by the batteries (for example, during heating each battery absorbs a power ranging from 100W to 1000W while during the EOC phase each battery requires a current ranging from 0 to 5A).

The Gateway requests the Vmode to the PCS in order to:

- Heat the batteries that are below operating temperatures
- Perform a periodic full charge procedure (ReachEOC)
- Keep the batteries warm
- Protect the batteries when SOC, Voltage or Current values have been exceeded
- Follow the manual request to remain in Vmode



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NORMAL OPERATION I mode-Operation in «Current Control»

In I mode the PCS acts as a "bidirectional current generator".

The PCS must adjust the charging and discharging power of the batteries according to the voltage/current set points processed by each Gateway.

The Gateway constantly monitors all battery parameters and adjusts the PCS operating limits in order to ensure system security, maximizing power/energy availability.

However, there are several conditions that activate the Vmode mode (seen above); the main one is due to the continuous monitoring of the Gateway of the remaining time before the state that I mode ends and just report to Vmode.



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