

Thermal Management Solution for Unmanned Pre-fabricated Container



A Vertiv™ Case Study



About The Company

'POWERGEAR', a leading Electrical Equipment manufacturer, famously known from last four decades for its consistency and exemplary track record of high quality in designing, manufacturing and supply of power generation equipment.

This ISO 9001, 14001 & 18001 certified organization is ranked as a top-notch manufacturer in traditional and renewable energy sectors of heavy-duty product such as Supply Bus Ducts, Renewable Energy Equipment (mainly Wind Energy based), panels, and Cubicles (E-Houses)/ Pre-fabricated Container.

These walk-in cubicles are typically applied to form a nerve-centre of control at Power Plants/ Manufacturing Plants/Oil and Gas/Marine Industries.

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Background

Unmanned pre-fabricated containers (prefab house) are meant to accommodate all the necessary equipment from power source, electrical distribution and active loads in as much as possible optimized space, since any increase in space can potentially lead to Total Cost of Ownership (TCO). Now in such scenario, densely populated enclosed space can be catastrophic and lead to complete system breakdown. Therefore the entire prefab infrastructure needs to be air conditioned to maintain optimum inside environment.

This success story explains - how Vertiv helps prefab houses in overcoming the critical cooling challenges with its Thermal Management expertise and showcases how Vertiv has designed and deployed Precision Cooling solution for remote and scattered located pre-fabricated containers.

Case Summary

Location: Tumkur, South India

Vertiv Solutions:

- A Precision Air Conditioning (PAC) solution of 120 kW DX Unit (Liebert® PDX series) + Liebert® HCR series condenser.

Critical Needs:

- Precision Air Conditioning solution to handle heat load of prefab house made of steel, along with proper thermal insulation
- Air conditioning system should operate 24 x 7 without standby unit (due to space constraint)
- Maintain the optimum temperature of 25 °C ±1 °C & relative humidity and 50% ±5% RH
- Air should properly distribute to confirm zero hot spots within container
- Speed deployment within eight weeks

Result

- Maintained Sensible Heat Ratio of '1' within prefab house, while considering the space constraints
- Ensured 24 x 7 conditioned environment and movability quotient for future relocation
- Met customer's projected timeline by rapid deployment

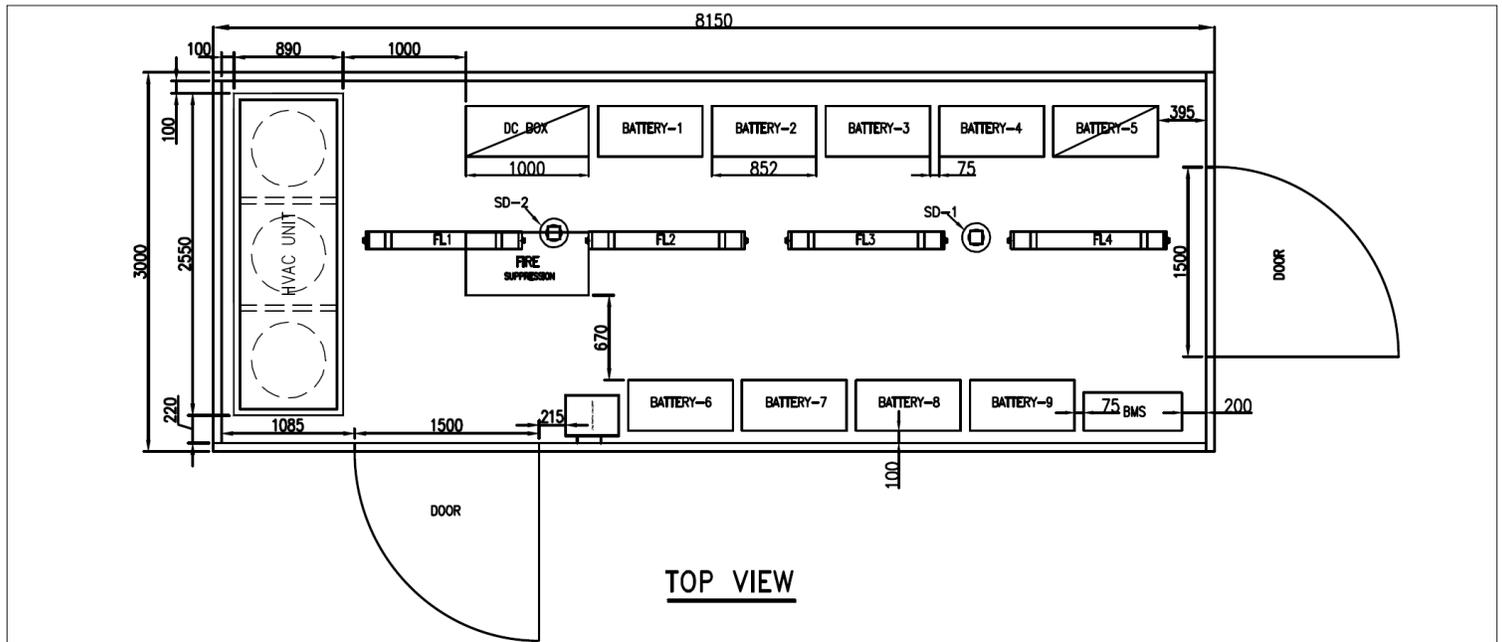
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Site Challenges

- Pre-fabricated steel-based container has distinct thermal properties than conventional brick wall-based site, mostly prefab houses are skid mounted, pre-assembled and climate controlled metal enclosures which serve as housing for various control equipment. In case of POWERGEAR - prefab house contains battery blocks which act as energy storage infrastructure for 'momentary' peak load.
- This storage energy is collected from Solar PV cells that further channeled to micro grid for entire plant operations. Hence, it was very crucial to physically verify all site peripheral such as container layout (refer Fig 1), design inputs, actual container placement, insulation material, battery block architecture, and condenser placement area.
- It was necessary to conduct heat dissipation rate assessment of the equipment within prefab container for the confirmation of pre-estimated heat load value (88,000 W).
- To deploy & commission the project within stipulated time at remote location, expert team has to audit, plan and monitor the entire project.

Fig 1: Layout of Prefab Container with Battery Blocks, other Equipment and Vertiv Thermal Management Indoor Unit



Solution Overview

- Along with the site considerations, Vertiv expert team has worked out detailed heat load calculation with the help of analysis programs such as Hourly Analysis Program (HAP). The team has also carried out “U” factor calculation for determining optimum heat load of the container. The PUF insulation provided by Prefab container vendor is 90 mm thick. The design team has considered all the safety factors while designing the cooling solution.
- The heat dissipation rate calculation not only reveals nature of heat load as 'Dry type' but also provided Sensible Heat Ratio (SHR) value as '1' that stipulate the solution must be based upon a unit with higher SHR and Airflow CFM values.

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- Vertiv thermal solution includes product range from 1.5 TR to greater than 30 TR in DX based series unit. Here the calculated net cooling demand is around 30 TR and required airflow is 21000 CMH (with dehumidified air quantity).
- Due to the space constraint and use of multiple or standby units arrangement were not feasible, a Liebert PDX series based comprehensive standalone solution has been deployed with dual compressor and the separate circuit that delivers cooling capacity up to 30 TR.

Fig 2: Vertiv® Thermal Management Solution for POWERGEAR'S Cubicles (E-Houses)



Business Value

With the immense experience in Modular & Prefabricated data centers, Vertiv has successfully deployed an expert cooling solution for prefab houses, and with the experienced and well-trained professionals, entire project has effortlessly progressed through design, installation and commissioning phases within eight weeks as proposed.

This uniquely designed PAC solution not only satisfied the cooling requirement of POWERGEAR 's pre-fabrication houses, but also addressed their space constraints, mobility, and other site concerns related to their cooling infrastructure needs, and ensured critical business-continuity which allowed customer to focus on their core business values without worrying about tedious infrastructure hassles.

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