1000 kW, 12 racks, Liquid-Cooled & Air-Cooled, Modular Data Center All-in-One AI Solution

Design Overview

Data Center IT Capacity
1000 kW

Target Availability
Tier I

Annualized PUE at 100% Load
Vienna France 1.12
(Scenario dependent)

Racks and Density
Total Racks: 12
Rack Density: 83 kW/rack

Data Center Overall Space
48.8 m^2

Regional Voltage and Frequency
400 V, 50 Hz

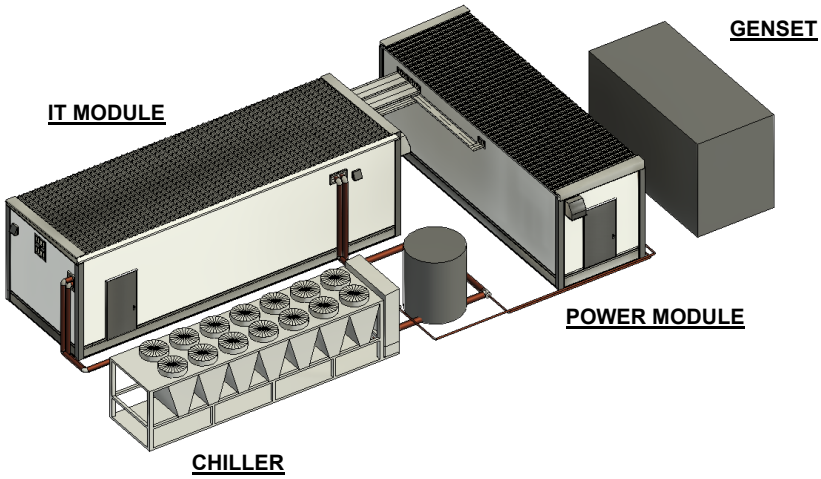
About this Design

- IT space and power distribution designed to accommodate AI clusters with density up to 83 kW per rack.
- Hybrid thermal management approach utilizing Uniflair™ air cooled chillers combined with Motivair™ Chilled Door Rear Door Heat Exchangers units and direct to chip liquid-cooled racks utilizing a Motivair coolant distribution unit.
- High-performance power system that integrates switchboard, UPS with Li-Ion battery cabinets, PDUs, and optional backup generation set featuring Galaxy™ VXL UPS and Lithium-ion Battery Cabinet and NetShelter™ Advanced Rack and PDUs for high density.

Introduction

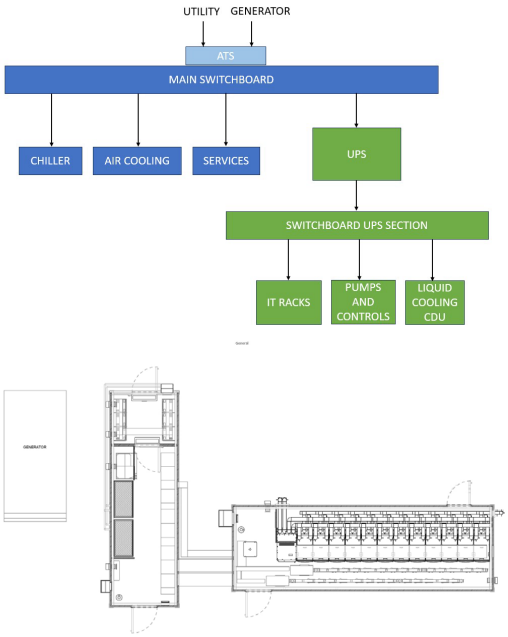
Artificial Intelligence brings with it enormous opportunity for businesses to develop and deploy new and exciting capabilities along with creating new challenges in how to deploy the supporting IT technology. Extreme power and thermal management, instantaneous load ramps, complex IT rack solutions, and scalability are but a few of the challenges facing AI data center designers. This is leading to the adoption of liquid cooling, server racks with liquid cooling manifolds and other forward-thinking technologies to enable AI.

This reference design will highlight some of these hardware improvements and how a modular data center can be used to deploy a versatile and scalable solution to support AI workloads.



Modular Power

Modular Power Block Diagram



The modular power system supplies power to the critical and non-critical components within the modular data center. The electrical architecture used in this design is a single path with UPS. The utility feed and backup generator in parallel delivers power to a 3200 A Prisma Switchboard in the lobby, which then feeds the cooling equipment, auxiliary devices, and a 1125 kW Galaxy VXL UPS that provides critical power to the IT room with 5 minutes of battery runtime. The UPS system consists of a Galaxy VXL with a 125 kW redundant power module, maintenance bypass, and Galaxy lithium-ion batteries all housed together in a power module. The critical load distributed by Canalis busways units located above the racks in the IT module. The modular power system is designed to support additional peripheral devices like a fire suppression system, access control systems, and environmental monitoring and control devices. This system integrates with EcoStruxure™ Power Monitoring Expert. Every component in this design is built and tested to these applicable IEC standards.

Design Options

This reference design can be modified as follows without a significant effect on the design's performance attributes:

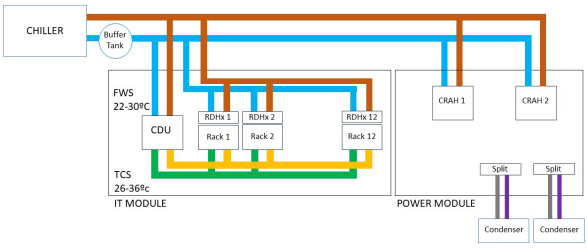
- Add EcoStruxure Power Monitoring Expert
- Provision for load bank
- Change UPS batteries
- Add/change standby generator options:
  - Location
  - Tank size
  - Fuel type

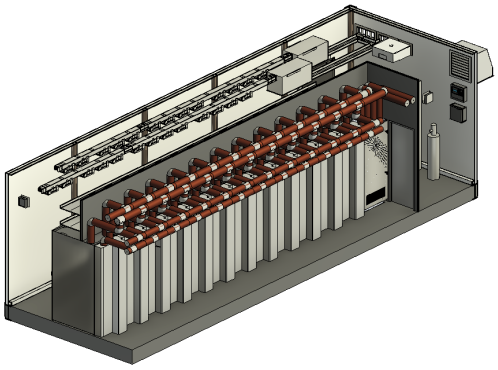
Modular Power Attributes

Name	Value	Unit
Total facility peak power (IT and cooling)	1688	kVA
Total amps (IT main bus, each)	2340	A
Input voltage (IT main bus)	400	V
Frequency	50	Hz
Switchboard kAIC (IT main bus)	50	kA
Generator redundancy (IT main bus)	N	
IT power path	Single	
UPS capacity	1000kW IT load 125 kW mechanical loads	kW
UPS redundancy	N	
UPS Modular Redundancy	N + 1	
UPS runtime @ 100% load SOH 80%	5 minutes	V
UPS output voltage	400	V

Modular Cooling

Facility Cooling Diagrams





Servers designed for AI not only feature multiple processors in proximity, but also incorporate advanced chipsets that enhance processing power and efficiency. This kind of density generates massive amounts of heat, which require advanced thermal management.

Liquid cooling technology is introduced to dissipate processor heat. Water or another liquid is routed to the chips through a Coolant Distribution Unit (CDU) to absorb the heat. The liquid from the secondary loop is then piped to a chiller unit and back to the CDU. The CDU and chilled water pump are backed up by the UPS so cool water will continue to flow to the servers during a utility power loss. There is an impact on infrastructure, requiring more pipes and manifolds to move the liquid through the racks and out of the building. The structural support needed for a separate chilled water loop, in addition to the usual cables for power and fiber, need to be included in the space of this data center.

In addition, chilled water CRAH units are utilized in the Power Module.

Design Options

This reference design can be modified as follows without a significant effect on the design's performance attributes:

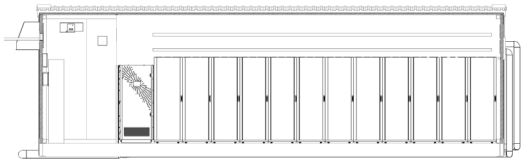
- Add EcoStruxure IT Expert
- Change storage tank size
- Rear doors to be backed up by UPS

Facility Cooling Attributes

Name	Value	Unit
Total max cooling capacity (chillers)	1150	kW
Cooling power supply	400 / 3 / 50 230 / 1 / 50	V / ph / Hz
IT module liquid cooling CDU type	Positive Pressure In-Row	
IT module liquid cooling CDU quantity	1	
IT module liquid cooling CDU redundancy	N	
IT module air cooling type	Chilled Door Rack Cooling	
IT module air cooling quantity	12	units
IT module air cooling redundancy	N+1	
Power Module cooling type	CRAH Chilled water room cooling	
Power Module cooling quantity	2	units
Power Module cooling redundancy	2N	

Modular IT Space

IT Space Diagrams



The IT capacity of this design is 1000 kW. The IT space design specifies all the physical infrastructure systems and respective spacing arrangements required to meet the overall design's performance attributes. This includes racks, rack power distribution, air cooling units, service panel and the hot-aisle containment system. The IT space supports power densities up to 83 kW per rack. Each rack is configured with a metered rack-mount PDU to enable remote monitoring of the units for efficiency and capacity management. The security of the room can be maintained at multiple points. For example, at the rack level, access can be controlled by a door lock and sensor. At the room level, security cameras can be utilized for monitoring.

Design Options

This reference design can be modified as follows without a significant effect on the design's performance attributes:

- Add NetBotz™ environmental and security management
- Change rack options (tall, wide, deep)
- Change power distribution options (rack PDU type: basic, switched)
- Add EcoStruxure IT Expert

IT Space Attributes

Name	Value	Unit
IT load	1000	kW
Supply voltage to IT	400	V
Maximum density	83	kW/rack
Number of IT racks	12	racks
Containment type	Hot aisle containment	m^2

Design Highlights

This reference design includes the latest in data centre power and cooling advancements from Schneider Electric including:

- Galaxy VXL UPS
- Galaxy Lithium-ion Battery Cabinet
- NetShelter SX Advanced Rack Enclosures
- NetShelter Rack PDU Advanced
- Motivair Coolant Distribution Unit
- Motivair Chilled Door
- Uniflair Free Cooling Chiller

Featured Components

Location	Equipment	Part number
Power module	Uninterruptible power supply Galaxy VXL 1125 kW with additional 125 kW power module for redundancy	GVXL1250KHS
Power module	Galaxy Lithium-ion Battery Cabinet IEC with 17 x 2.04 kWh battery modules	LIBSESMG17IEC
IT module	Busway for IT power distribution	Canalis KS
IT module	Rack NetShelter SX Advanced 48U x 750mm x 1270mm	AR9557SPB2
IT module	NetShelter Rack PDU Advanced, Metered, 3Phase, 43.5kW 400V 63A	APU11450ME
IT module	Motivair Coolant distribution unit	MCDU-50
IT module	Motivair Chilled Door	MCD-M14-48U750-TF-6
Outdoor	Uniflair Free Cooling Chiller	XCAF1212A

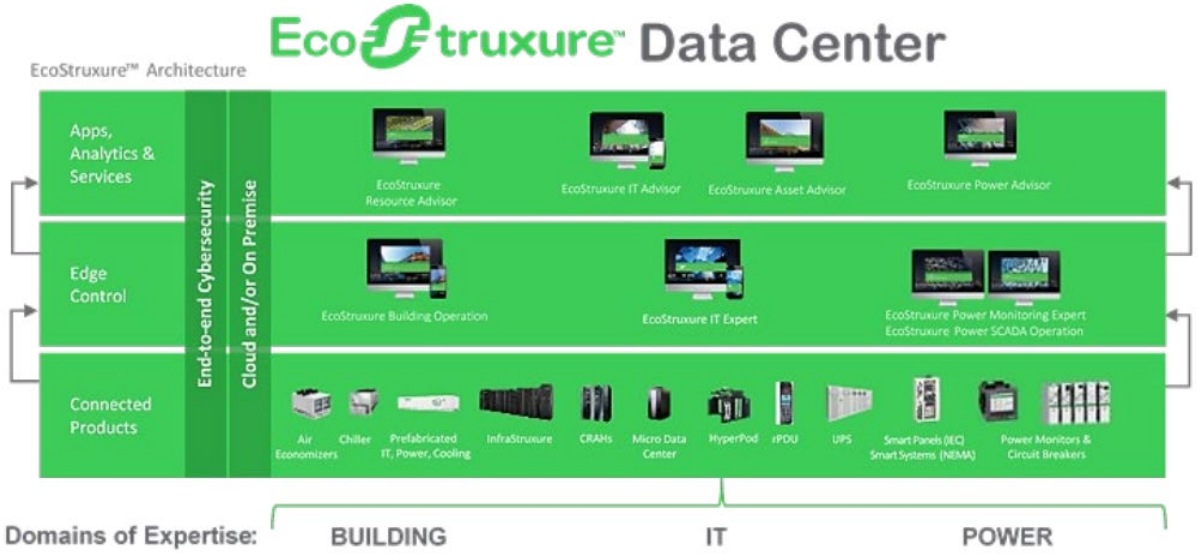
EcoStruxure Data Center

EcoStruxure is Schneider Electric's open, interoperable, integrated Internet of Things (IOT)-enabled system architecture and platform. EcoStruxure delivers enhanced value around safety, reliability, efficiency, sustainability, and connectivity for our customers. EcoStruxure leverages advancements in IoT, mobility, sensing, cloud, analytics, and cybersecurity to deliver Innovation at Every Level. It consists of three layers: connected products, edge control, and applications, analytics, and services. This includes Connected Products, Edge Control, and Apps, Analytics & Services. EcoStruxure has been deployed in 480,000+ sites, with the support of 20,000+ system integrators and developers, connecting over 1.6 million assets under management through 40+ digital services.

The connected products layer communicates with the edge control layer, which allows users to remotely monitor and control the connected products in real time. The edge control layer communicates with the application, analytics, and services, which will translate data into actionable intelligence and better business decisions. All three layers are secured with end-to-end cybersecurity. EcoStruxure can either be located on-premises (this will only consist of the connected products and edge control layers) or the cloud.

EcoStruxure Data Center is a combination of three domains of EcoStruxure: Power, Building, and IT. Each domain is focused on a subsystem of the data centre: power, cooling, and IT. These three domains combined will reduce risks, increase efficiencies, and speed operations across the entire facility.

- EcoStruxure Power monitors power quality, generates alerts, while protecting and controlling the electrical distribution system of the data centre from the MV level to the LV level. It uses any device for monitoring and alerting, uses predictive analytics for increased safety, availability, and efficiency, while lowering maintenance costs.
- EcoStruxure Building controls cooling effectively while driving reliability, efficiency, and safety of building management, security, and fire systems. It performs data analytics on assets, energy use, and operational performance.
- EcoStruxure IT makes IT infrastructure more reliable and efficient while simplifying management by offering complete visibility, alerting and modelling tools. It receives data, generates alerts, predictive analytics, and system advice on any device to optimize availability and efficiency in the IT space.



Visit *EcoStruxure for Data Center* for more details.

Design Attributes

Overview	Value	Unit
Target availability	Tier 1	Tier
Annualized PUE at 100% load	1.12	PUE
Data center IT capacity	1000	kW
Data center overall space	48.8 m^2	m^2
Maximum rack density	83	kW/rack
Liquid cooling IT load	80	%
Total nominal liquid cooling IT load	800	kW
Air cooling IT load	30	%
Total nominal design air cooling IT load	300	kW
Air cooling IT load delta T	12	°C
Nominal design ambient temperature	20	°C
Max. operating ambient temperature	40	°C
Min. operating ambient temperature	-15	°C

Modular Power	Value	Unit
Total facility peak power (IT and cooling)	1688	kVA
Total amps (IT main bus, each)	2340	A
Input voltage (IT main bus)	400	V
Switchboard kAIC	50	kA
Generator redundancy (IT main bus)	N	
IT Power path	Single	
IT space UPS capacity, per powertrain	1125	kW
IT space UPS redundancy	N	
IT space UPS runtime @ rated load	5 minutes @ 1125 kW 15 years	minutes
IT space UPS output voltage	400	V

Design Attributes continued

IT Module Liquid Cooling System	Value	Unit
TCS secondary loop supply water	26	°C
TCS secondary loop return water	36	°C
TCS secondary loop fluid	Ethylene glycol 25%	
FWS primary loop supply water	22	°C
FWS primary loop return water	30	°C
FWS primary loop fluid	Propylene glycol 30%	
CDU power supply	380/ 3/ 50	V/ph/Hz
CDU type	Positive pressure	
CDU quantity	1	
CDU redundancy	N	
CDU TCS pump redundancy	N + 1	
CDU nominal capacity	806	kW
Chiller power supply 1 (utility for comp.)	400/3/50	V/ph/Hz
Chiller power supply 2 (UPS for Ctrl, Pump, Fans)	400/3/50	V/ph/Hz
Chiller type	Free cooling chiller	
Chiller quantity	1	
Chiller redundancy	N	
Chiller FWS pump redundancy	N + 1	
Chiller nominal capacity	1200	kW
FWS economizer	Fuel economizer integrated in chiller	
FWS buffer tank support time	5	Minutes

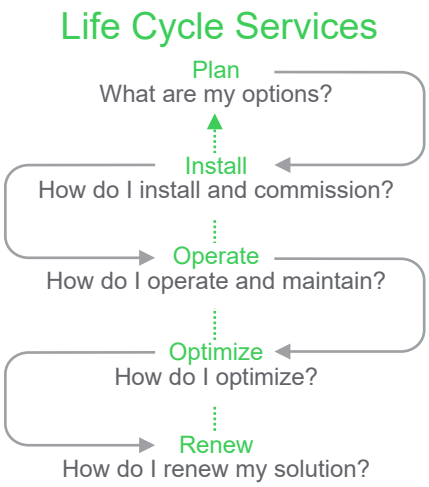
Design Attributes continued

IT Module Air Cooling System	Value	Unit
Cooler power supply 1 (utility for comp.)	230/1/50	V/ph/Hz
Cooler type	Motivair Chilled Door Rack Cooling System	
Cooler quantity	12	
Cooler redundancy	N + 1	
Single cooler nom. net sensible capacity	30	kW
Single cooler nom. design airflow	5530 m^3/h	m^3/h

Power Module Air Cooling System	Value	Unit
Cooler power supply	400/3/50	V/ph/Hz
Cooler type	CRAH chilled water room cooling	
Cooler quantity	2	
Cooler redundancy	2N	
Single cooler nom. design net sensible capacity	50.6	kW
Single cooler nom. design airflow	16 000	m^3/h
Single cooler nom. total cooling capacity	53	kW

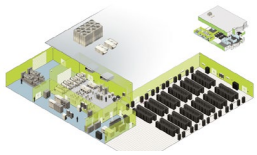
IT Space	Value	Unit
IT load	1000	kW
Supply voltage to IT	240	V
Maximum density	83	kW/rack
Number of racks	12	Racks
Containment type	Hot aisle containment	

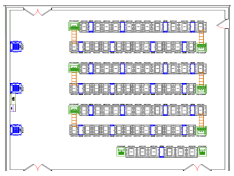
Schneider Electric Life-Cycle Services

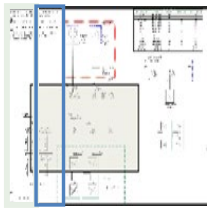


1. Team of over 7,000 trained specialists covering every phase and system in the data centre
2. Standardized, documented, and validated methodology leveraging automation tools and repeatable processes developed over 45 years
3. Complete portfolio of services to solve your technical or business challenge, simplify your life, and reduce costs

Get more information for this design:







Engineering Package

Every reference design is built with technical documentation for engineers and project managers. This includes engineering schematics (CAD, PDF), floor layouts, equipment lists containing all the components used in the design and 3D images showing real world illustrations of our reference designs.

Documentation is available in multiple formats to suit the needs of both engineers and managers working on data center projects. For the engineering package of this design please email us at referencedesigns@se.com