SmartShelter™ Data Hall

500kW/50Hz IT Module

Technical Guide

Version 1.0

Schneider Electric

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1 Safety Information

Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

All electrical modification and maintenance to and within the Data Hall must be performed by a licensed electrician, and must follow all applicable local and national codes.

All cooling system modifications and maintenance to and within the Data Hall must be performed by a certified HVAC technician who is approved to work with refrigerant and water lines. All work must comply with local and national codes.

Refer to the safety instructions for each component of the Data Hall for specific safety requirements of said component. The instructions are provided with the Data Hall, and can also be found online.

The Data Hall is not intended for occupancy except for short-duration maintenance access.

No user-serviceable parts are behind panels that require tools to open.

Consult your local planning office for applicable codes and to review necessary permitting and guidelines for your specific site.

The Data Hall must not be installed near open flame per local codes and ASHRAE specifications.

2 Introduction

2.1 Context

The purpose of the document is to introduce and present the technical specification of the SmartShelter™ Data Hall Prefabricated Datacenter offered by Schneider Electric.

SmartShelter™ Data Hall solution provides a fully functional datacenter consisting of several prefabricated modules joined together in a way that maximizes the efficiency of the system components, thus providing the optimum value to the datacenter owner. The system includes a complete datacenter infrastructure including: cooling, power, enclosures, cable management, fire protection, monitoring, access control, etc., within a secure environment, comprising a modular and flexible approach.

The environment has been designed to provide the following qualities:
- Usability for IT and technical operations
- Security: Mechanical, Electrical, Cooling
- High quality, robust structure
- Reduced acquisition and deployment time

2.2 Main benefits

Prefabricated Datacenter Modules are the latest trend in the datacenter industry. They are intended to decrease deployment time, reduce cost, and improve the predictability and reliability of a new datacenter build.

All equipment in the Data Hall are pre-installed and tested in the factory, reducing field work and risk. The Data Hall does not include IT servers, switches, etc.

Schneider Electric is a worldwide market leader in the datacenter business. Schneider Electric's portfolio of integrated solutions includes prefabricated modules, UPS, power distribution, cooling, software, monitoring, and enclosures. Our installed base gives us a thorough knowledge of data center market evolution, future needs, and an understanding of business challenges. The goal of Schneider Electric is to earn your respect and become your trusted partner in the datacenter market.

2.3 Scope of work

This document covers the following topics:

- Module structure and design
- Electrical distribution
- Cooling
- IT Infrastructure (Enclosures, Power Distribution)
- Fire suppression and detection
- Monitoring

3 Prefabricated Datacenter Module

3.1 General Specifications

Solution for 500kW with chilled water perimeter cooling includes:

- External Structure
  - 7 IT modules - final assembled dimension after baying together to form a single room:
  - 13.70m (45.0') x 18.04m (59.2') x 3.58m (11.8') (LxWxH)
  - Individual module dimensions:
  - (2) 13.70m (45.0') 3.2m (126') x 3.58m (11.8') (LxWxH)
  - (5) 13.70m (45.0') 2.4m (94.5"') x 3.58m (11.8') (LxWxH)
- Power Distribution:
  - (2) 800A / 400V Prisma Panelboard, distributing power from the UPS protected input source to 160A Canalis Busway units located above the IT Enclosures.
  - (1) 400A Prisma Panelboard, distributing power to one input for air conditioners and house loads
  - (1) 250A Prisma Panelboard, distributing to second input on air conditioners
  - (2) 160A Canalis Busway units installed in each row of IT Enclosures
  - Rack PDU - (194) AP8881 Rack PDU 2G, Metered, Zero U, 11kW, 230V, (36) C13, and (6) C-19
  - Input Voltage 400 VAC 3 Phase
- Cooling:
  - (8) CRAH (Computer Room Air Conditioner) Perimeter Chilled Water units, TDCV2500G in an N+1 configuration
  - Cooling capacities are nominally rated for 14 degree C differential between hot and cold aisles, performance may vary based on load conditions.
  - Cooling Capacity is calculated based on 15 degree C water temperature and 35% glycol
  - Humidification included within two of the CRAC units
  - Chillers not included
- Racks – NetShelter™ SX Enclosures
  - (91) AR3300 NetShelter™ SX, 600mm x 1200mm x 2000mm (WxDxH)
  - (7) AR3350 NetShelter™ SX, 750mm x 1200mm x 2000mm (WxDxH)
- Automatic Fire Extinguishing System – Novec 1230 Extinguishing Agent
- VESDA – Smoke detection system
- Environmental Monitoring:
  - Netbotz 570 environmental monitoring system monitoring the following
    - Internal temperature
    - Internal humidity
    - Leak detection
    - External Door Status
    - Security camera monitoring
    - Fire System Status
    - Air Renovation System status

- Cable seals for power, piping, and data cable entries
- StruxureWare™ DC Expert Basic for overall Datacenter Monitoring
- Cable management: A single run of cable tray is provided above each row of racks with 2 perpendicular cross runs on each end running the length of the data hall

3.2 Structural design

The SmartShelter™ Data Hall Structural framework will be made of steel with a fully welded design frame to support the installed equipment. The walls and the roof will be constructed from modular insulated panels fit to size for the module. The total solution will be constructed from 7 individual modules assembled together on site.

3.2.1 Steel Frame design

The steel frame is fully welded design with a box structure on both ends and longitudinal frame joining them together. The base frame is constructed with IPE300 beams, the main pillars of the structure utilize IPE360 beams.

3.2.2 Wall design

Prefabricated wall and roof panels enclose the Data Hall, providing an ideal space to house a datacenter. Panels will be installed on the walls and ceiling and will be composed by a sandwich of materials with fire resistance and thermal insulating to resist high temperatures and provide a watertight enclosure. The sandwich will be covered by one layer of galvanized steel sheet (0,6 mm), joined by continuous weld panel to panel.

Main features:

- Thickness: 60 mm
- Weight: 15,4 kg/m2
- Thermal resistance, K1 (panel): 0,592 W/m2K
- K2 (container + panel): 0,402 W/m2K
- Fire resistance: EI60

3.2.3 Floor

The Data Hall is equipped with 1- 1/8″ (28.6 mm) thick marine plywood flooring on the interior. The finished floor is metal diamond plate.

3.2.4 Doors

The SmartShelter™ Data Hall includes four EI 120 standard doors. One door is set up as the main entrance. The other three doors are emergency exits with interior operation only. Doors are made of steel and painted for corrosion protection.

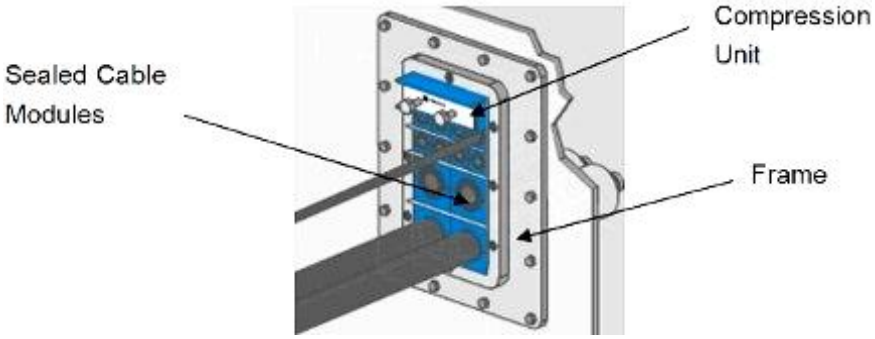
All Doors meet the following specifications:

LEAF
Steel plate finishes: 1.2mm (0.05”)
Total thickness: 63mm (2.48”)
FRAMEWORK
Steel profile 1.5mm (0.6”)
Elastomeric weather seal 1.9mm (0.7”)
FITTINGS & MECHANISMS
Steel bearing hinges: 3U
PVC & steel handle with lock door
Electric strike
Quick push panic bar
Self-closing system

DIMENSIONS	Width	Height
External dimensions	1280 mm (50,4”)	2380 mm (93,7”)
Internal dimensions	1100 mm (43,3”)	2200 mm (86,6”)

3.2.5 Cable Seals

Roxtec cable seals are installed at all cable and pipe penetration points. Cable seals provide thermal, fire, and water protection for the module. The cable seal is easily configurable to adapt to the number and size of cables and pipes that enter the module.



3.2.6 Air Renovation System

The Air Renovation System (ARS) is a ventilation unit designed to meet air renovation requirements to comply with local regulations in containerized Data Centers where IT equipment and UPS batteries are installed. 4 ARS units are provided to accommodate the total volume of the air in the final solution

In order to provide the proper airflow, an EC fan intakes outside air via a grille attached to G4 and G7 filers. In accordance with ASHRAE, IT spaces require air filtering (minimum F7 / MERV13).

UNIT COMPONENTS	ARS (CE)
EC Radial fan	✓
Air filter G4 efficiency (MERV 8)	✓
Air filter F7 efficiency (MERV 13)	✓
Air filter F9 efficiency (MERV 16)(1)	optional
Sand trap	optional
Electrical heater (antifreeze)	optional
Timer	optional
Door switch	optional
VOC control (Volatile organic compound)	optional
H_2 control sensor	optional
Combined H_2 + VOC sensor	optional
Change power supply	under request

✓ *Standard component*

✗ *Not available*

(1): Other filters under request

3.3 Technical Specifications

The module is designed to provide a controlled environment suitable for equipment and temporary personnel. The units are capable of delivery and installation on site without any permanent deformation or failure.

3.3.1 Shock-load

Data Hall module units can withstand normal transportation conditions without deformation or damage.

3.3.2 Wind load

The module can withstand non sustained wind speeds up to 160 km/hr.

3.3.3 Roof load

The module can withstand roof loads up to 244kgf/m^2.

3.3.4 Floor load

The module can withstand floor loads up to 1000kg/m^2 (205 lbs/ft^2) across the entire floor structure.

3.3.5 Internal environmental conditions

The internal conditions will be maintained at ASHRAE TC9.9 recommended temperature and humidity ranges.

3.3.6 Fire resistance

1 hour fire resistant construction (E60) for enclosure walls, doors, and floor is provided. The components are tested to the EN13501 standard for fire rating of building materials.

3.3.7 Painting

Data Hall frames have two primer epoxy and two final polyurethane coats in a RAL 9003 standard color. This surface treatment provides C4 corrosion protection with high durability (>15 years).

According to the ISO 12944 standard, a C4 protection works well in industrial and coastal areas as well as near chemical processing plants.

3.4 Lifting elements

Lift at the top corner fittings within 30deg of vertical (in the direction of the long side) by means of spreaders fitted with hooks, shackles or twist locks.

4 Electrical System

Following is the description of the electrical system provided inside the module.

4.1 Components

- Main Input Panel: (2) 800A, 400V three-phase electrical panel, TN-S type construction. These panels are intended to accept UPS protected power. There are 7 distribution breakers in each panel to distribute power to Canlis Busway
- Non-Critical Panel. (2) 400A, 400V three phase electrical panels distribute power to the air conditioners and other support loads that do not require UPS protected power**.**
- (14) 160A Canalis Busway KN series, providing power distribution from the UPS to each rack. Each rack is fed with 2 input sources one from each Busway installed above the row. A tap box including an iC60N breaker is included for each rack in every Busway.

- Rack PDU: (194) Metered rack PDU, SKU# AP8881. It has an input rating of 16A 3 Phase at 230V. Power is output through IEC 320 C13 (36) and C19 (6) outlets**.** 2 Rack PDUs per rack in a 2N configuration**.**
- Lighting: Phillips Light Fixtures providing 300 lux are installed in each aisle in the rack space.
- Emergency lighting: (4) Exit Sign/Emergency lighting block mounted above each door. (2) emergency light fixtures to be provided within each module.

4.2 Grounding

The module includes an integrated grounding system. The customer must supply a ground from the external system to a grounding bar on the outside of the module. All internal components will be grounded to this bar. The module is designed to connect to a TN-S type grounding system.

5 Fire Suppression System

The fire protection system is designed to prevent, detect and extinguish possible fires inside the rooms. This will be an automatic system innocuous for people, goods and friendly environment. It will include the following equipments:

- Fire Control Panel
- Smoke Detection System
- Fire extinguishing system based on Novec 1230

5.1 Fire Control Panel

The fire panel controls the fire detection and extinguishing system. The panel can monitor two distinct areas, can trigger at least 2 levels of alarms, and incorporate a delay to evacuate the room before activating the extinguishing system. The system can also be activated by a manual switch attached to the panel.

This solution will implement a Honeywell Notifier RP1R Supra fire panel with following features:

- Compact and dual microprocessor central
- Easy configuration via micro switches
- Two conventional detection zones for detectors, and a third configurable for auto or manual trigger button
- Stop push button and extinction wait button
- Day / Night function with configurable delay (30 - 300 sec.) And inspection time (1 - 10 min.0
- Possible delays disabled from the keyboard
- Flow switch inputs, low pressure, monitoring door open
- Two extinction circuits, the extinction circuit 2 can be independent for pre-activation
- Countdown timer indicating the seconds left to extinction
- 40 LED display for quick identification the event
- Relays for: warning, alarm in the process of extinction, extinction canceled, extinction circuit failure, and fault relay
- Operating mode: automatic, manual and canceled
- Dry contact input for remote programmable actions as: reset the system, evacuation, mute or delay On / Off
- Removable terminal blocks in all connections
- PC state visualization software with optional remote connection
- Complies with European standards EN54-2/4 and EN12094 / 1:2003
- CE marked

(Additional control panels and features available upon request)

5.2 Smoke Detector

Model SD-851E photo-electronic detectors use state-of-the-art optical sensing chambers. The ability to plug these detectors into a variety of base options extends panel compatibility and application flexibility. These detectors are designed to provide open area protection and are only to be used with compatible control panels.

A bicolor LED on each detector lights red to provide a local visible alarm indication, and may also be set to flash green to indicate correct operation of the detector.

5.3 Extinguishing system

The automatic fire extinguishing system will be able to extinguish fire quickly using clean extinguishing agents that don't damage the datacenter equipment.

Novec 1230 fluid is a fluoroketone that extinguishes via its cooling effect. It works as a gas but is a liquid at room temperature. Because it is not packaged under pressure, Novec 1230 fluid is easier to store and ship and requires less space than inert gas systems. (See Properties for additional information).

Features:

- Natural gas present in the atmosphere
- Suitable for occupied areas
- No toxic or corrosive decomposition products from agent
- Stored as a fluid
- No potential to deplete the ozone
- Global Warming Potential of 1
- Atmospheric lifetime – 5 days

Properties:

- Chemical name Dodecafluoro-2-methylpentan-3-one
- Chemical formula CF3CF2C(O)CF(CF3)2
- Compliance with ISO 14520, UNE 23570 and NFPA 2001 FK-5-1-12
- Molecular weight 316.04
- Boiling point at 1.013 bar 49.20 C
- Liquid density at 200 C 1,616 g/ml
- Critical temperature 168.660 C
- Critical pressure 18.646bar
- Vapour pressure at 200 C 0.3260bar
- Relative electrical resistance at 1atm
- Maximum filling density 1.48 kg/l
- Design concentration for heptane 5.9%
- Flooding factor for heptane at 200C
- Design concentration for surface fires class A 5.3%*
- Flooding factor for surface fires class A 0.7786kg/m3
- NOAEL 10%
- LOAEL >10%

5.4 VESDA System (Very Early Smoke Detection Apparatus)

VESDA very early smoke detection solutions provide the earliest possible warning of an impending fire hazard. VESDA buys time to investigate an alarm and initiate an appropriate response to prevent injury, property damage or business disruption. And because VESDA has the industry's widest sensitivity range and multi-level alarms, even minute levels of smoke can be detected before a fire has time to escalate.

VESDA VLF-500 aspirating smoke detector is included in each solution along with pre-installed piping for detection

6 Access and Security

All doors are protected with a key-operated lock. Doors are also equipped with a panic bar on the inside for easy egress.

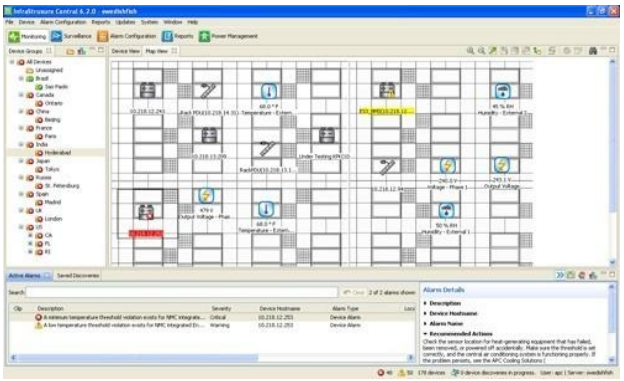
Optional biometric or proximity card access systems are available by customer request.

7 Monitoring System

The Data Center Module can be provided with an integrated monitoring system that will monitor the status of the module and report the overall health and any alarms associated with the equipment inside the module.

7.1 StruxureWare™ DC Expert

The module can include one StruxureWare™ DC expert appliance and the associated cabling and switches to communicate with all equipment in the module. StruxureWare™ Data Center Expert provides an efficient way for organizations to monitor their company-wide multi-vendor physical infrastructure: power, cooling, security, and environment. Real-time monitoring, user-defined reports and graphs, and instant fault notification and escalation enable quick assessment and resolution of critical infrastructure events that can adversely affect IT system availability. This centralized repository of critical information can be accessed by multiple users from anywhere on the network, creating a consolidated view of the physical data center infrastructure. This open and flexible architecture expands with changing business needs through additional device licenses, add-on surveillance, capacity management and change management modules, and through integration with enterprise and building management systems.



7.2 Environmental Monitoring

Each Module can include (4) Netbotz 570 rack mounted appliance that will monitor the environment and provide security monitoring for the module. The Netbotz 570 is a scalable system which will allow additional sensors and devices to be added to the system to scale to the final needs of the user.

The Netbotz 570 system will monitor the following information inside the module:

- (1) Temperature point mounted on the front of each rack
- (1) Humidity level in the cold aisle
- Status of all the external doors
- Security cameras at each external door location
- Dry contact alarm status on the fire panel and air renovation system

8 Internal Module Components and Design

8.1 Racks

NetShelter™ SX

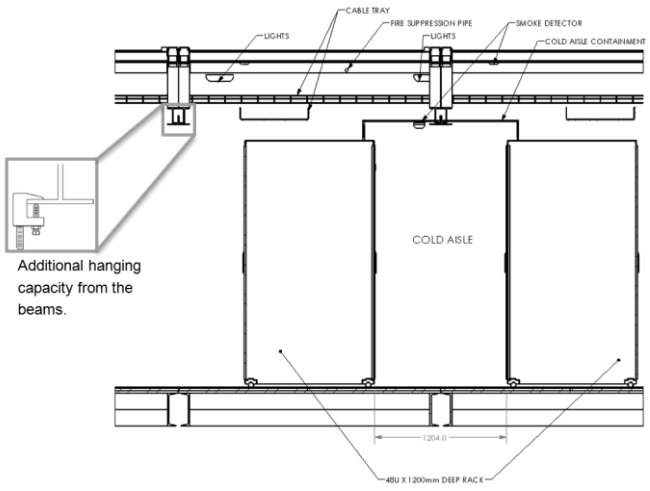
APC NetShelter™ rack enclosure maximizes flexibility with a progressive, non-proprietary feature-set as well as an extensive line of scalable accessory products to address current needs and adapt to future technology trends. APC NetShelter™® rack systems provide a progressive feature-set available in a vendor-neutral rack environment while allowing the user the flexibility to quickly adapt to emerging trends. Available in a variety of heights and widths, NetShelter™ racks and enclosures can adapt to many applications.

8.2 Rack Power Distribution

APC Metered Rack Power Distribution Units (PDUs) provide active metering to enable energy optimization and circuit protection. User-defined alarm thresholds mitigate risk with real-time local and remote alerts to warn of potential circuit overloads. Metered Rack PDUs provide power utilization data to allow Data Center Managers to make informed decisions on load balancing and right sizing IT environments to lower total cost of ownership. Metered Rack PDUs include real power monitoring, a temperature/humidity sensor port, locking IEC receptacles, and ultra low profile circuit breakers. Users can access and configure Metered Rack PDUs through secure Web, SNMP, or Telnet Interfaces which are complimented by StruxureWare™ Centralized Management platforms.

8.3 Cable Management

Cable management trays are provided for both data and power cables. If additional cable management is needed, the Data Hall is designed so the customer can hang additional hardware from the roof trusses. The cable management trays are of the wire-mesh variety. See below for an example of a beam clamp for hanging additional cable management from the beams.



8.4 Cooling

The Data hall includes (8) Uniflair Chilled Water Perimeter Cooling Units. The cooling units provide leading edge precision cooling solutions specifically designed to maintain temperature and humidity within extremely tight tolerances. Perfect for racked and non-racked IT loads, these products meet the diverse requirements of any data center environment. These intelligent units monitor the status of components and environmental parameter to ensure correct functionality during all modes of operation. When combined with hot or cold aisle containment solutions, the Uniflair LE products can further improve efficiency and achieve higher densities.

8.5 Air Containment System

The Data hall comes equipped with an air containment system that maximizes the efficiency and capacity of the cooling system. The system encloses the cold aisles with a ceiling panel system. The hot aisles are enclosed with doors on each end of the aisle and a return duct back to the perimeter air conditioning units. The system achieves complete separation of the hot and cold aisles.

9 Exclusions

The following list gives the limit of our scope of supply. All works listed hereafter are excluded from this proposal.

General:

- Any item not specifically listed in the proposal
- Freight to the final site
- Unloading of the module into its final position
- Project management services

Civil works:

- Any outdoor and indoor civil works (e.g. trenches, preparation of foundations, concrete slabs, fireproof walls, doors, holes, stairs, piping…)
- Any opening or drilling in the building existing walls and roof
- Any scaffolding, builders work or allied tradesman work
- Any ceiling or overhead plenum
- Installation of condensers on external slab
- Attachment of piping between condensers and module
- Chiller
- Any steps or ramps required for doorways

Data cabling:

- Any IT cabling and fiber optics installation

Electrical cabling:

- Any electrical installation work outside the prefabricated building solution
- Any digging, trenches and soil preparation for fuel tank and piping network installation
- The supply and installation of the incoming LV electrical supply from the Gensets
- The supply and installation of the incoming LV electrical supply from the normal source

Electrical equipment:

- Emergency gensets including fuel tanks

Others

- Specific compliance to any unique local building codes unless expressly noted

10 Appendix – Data Hall Layout

The layout image below is taken from the PFMIEG500C2E098B drawing PDF.