ITALIAN
COOLING
SOLUTIONS

HiRef

DataDomLine

MODULAR SYSTEMS FOR DATA CENTERS

DataDomLine

DATA CENTER SPECIALISTS

MODULAR DATA CENTERS

The implementation of a Data Center implies a very heavy investment, which must necessarily take into account growth trends over time. **Modular systems are the ideal solution to maximise the return on investment over time and guarantee low plant management costs**.

ZERO IMPACT CONTAINMENT

The simultaneous containment of air flows in the hot plenums and in the cold aisles allows for **instantaneous adaptation to load variations** and **effective modulation of the air temperature flows** required by IT equipment.

HEAT CONTAINMENT SYSTEMS

The design **compartmentalisation**, i.e. preventing cold air and hot air volumes from mixing, is the first step toward a highly efficient system. **DataDom Line** is a line of solutions suitable for this purpose.

EFFICIENCY ENHANCEMENT

After a careful analysis of the criticalities of the existing system, **HiRef - DataDom Line** proposes actions to **improve the efficiency of Data Center systems**, aimed at reducing running costs.

HOTSPOT HUNTING SYSTEM

This innovative system, an exclusive **DataDom Line** design, helps to identify hotspots inside the server room and implement all the necessary actions to **maximise the efficiency of the air conditioning system**.

MODULAR DATA CENTERS

DATA CENTERS AS INDOOR KITS

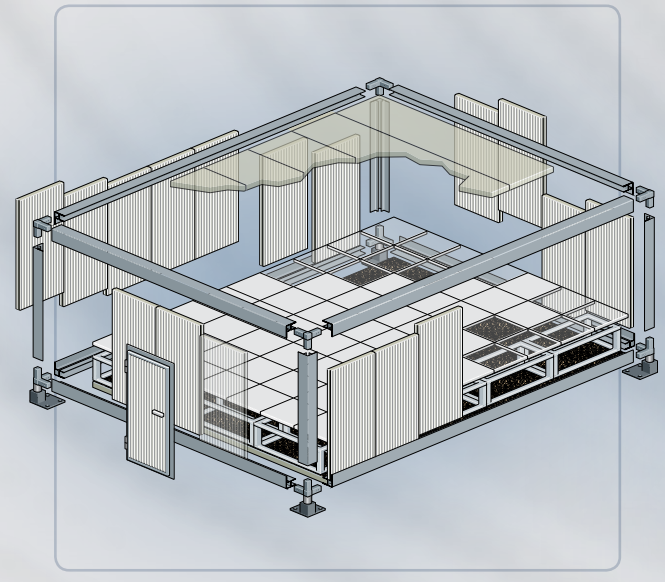
Kit solution with BOX-IN-BOX logic

The proposed dimensionally standardised projects, embodied by **isothermal containers** inside **any building**, is truly revolutionary and highly advantageous in investment terms.

The structural components of the enclosure are designed so that they can be **easily handled** inside buildings. Once the data center containment system has been implemented, **islands are set up for housing the servers** according to the best possible layout.

With its indoor kit, **DataDom Line** is at the **forefront of modular solutions** currently available on the market.

- **FULLY MODULAR KIT SOLUTIONS**
- **EASY TRANSPORT AND INSTALLATION**
- **STRUCTURES THERMALLY INSULATED FROM THE SURROUNDING ENVIRONMENT**



DATA CENTERS IN CONTAINERS

Prefabricated transportable solution

The basic supporting structure consists of **an ISO 20' or 40' container**. Inside it, an isothermal chamber is obtained - which contains the actual Data Center.

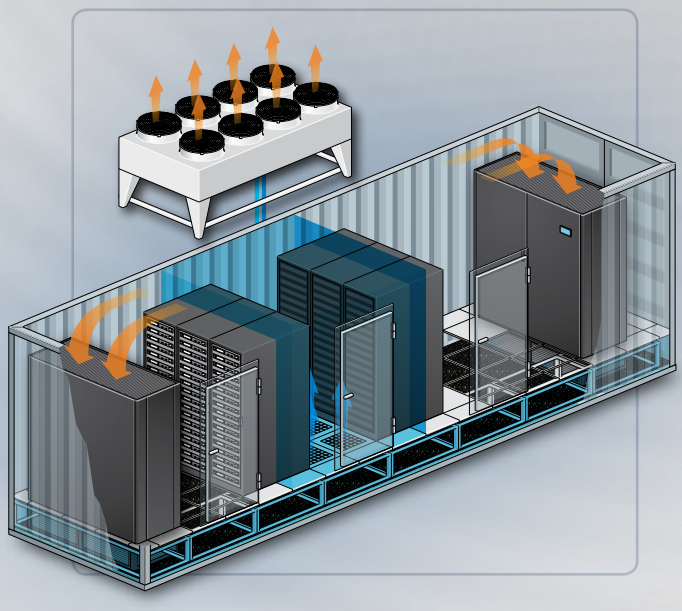
According to specific customer requirements, **the monobloc conditioning system**, dimensioning of the server housing racks and Data Center support systems (fire extinguishing, access control and lighting) is carried out. **An insulated compartment is also provided to contain the UPS and batteries**.

This type of Data Center can be implemented in **a completely *stand-alone version***, in a container with integrated back-up generator.

For "***disaster recovery***" applications, the entire Data Center container application is **REI certified** and meets the **STANAG and MIL** armouring **regulations**.

Finally, the solution is **RINA certified** for maritime transport.

- **STAND-ALONE VERSION**
- **ISOLATED UPS AND BATTERIES COMPARTMENT**
- **CONFORMS TO THE MAIN CERTIFICATIONS**



DATA CENTERS IN

SHELTERS

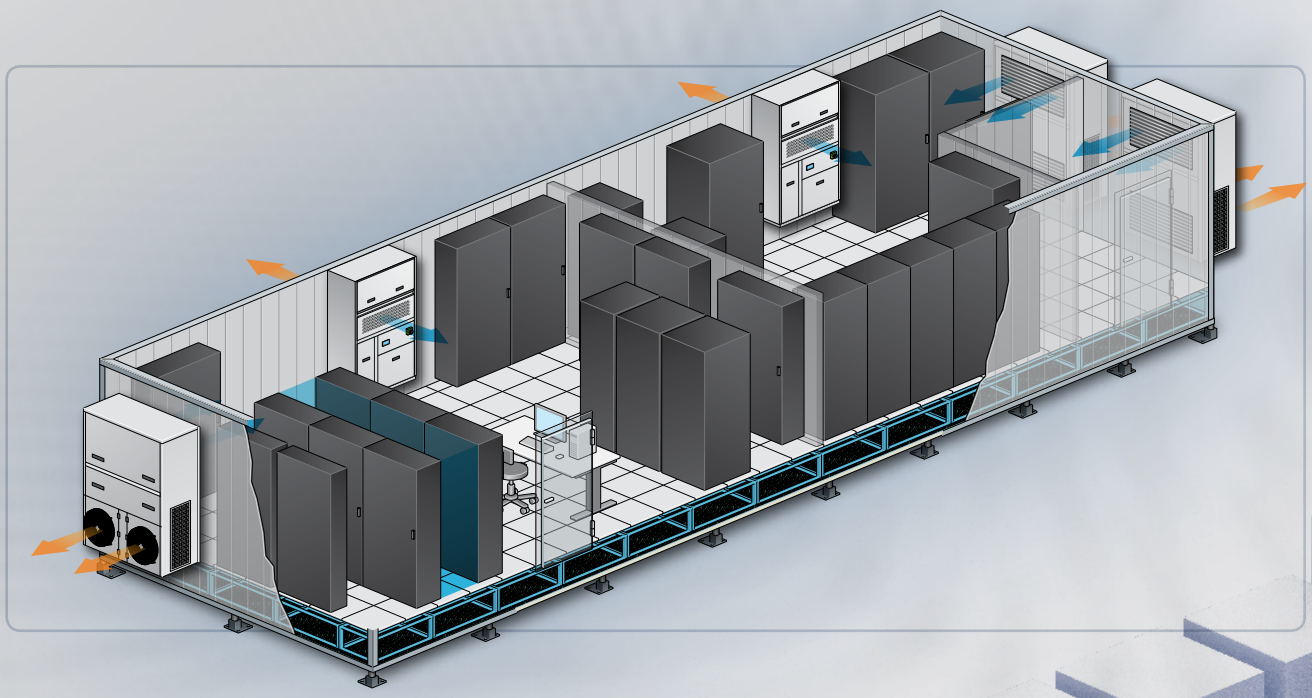
Outdoor solution independent from the existing building

The **DataDom Line** shelter system is **pre-assembled in transportable submodules** that are then assembled on site. Shelter solutions consist of an optimised layout of IT systems and their air conditioning system, a fire extinguishing system, an access control system and a lighting system.

An isolated area is provided to accommodate the UPS and batteries.

This type of Data Center is suitable for use in data recovery, Data Center swap and temporary Data Center applications.

- **STANDARD CONFIGURATIONS OPTIMISED FOR IT SYSTEMS**
- **ISOLATED UPS AND BATTERIES COMPARTMENT**



DATABOX®

Heat containment systems

The continuous increase in load density in IT environments requires not only increasingly efficient air-conditioning systems, but also efficient thermo-hygrometric control of the environment in which the systems are located.

The **DataBox®** structure for the data island is based on the concept of compartmentalisation of the cold aisle only or of total compartmentalisation. The main advantages of this solution can be summarised as follows:

- NO INTAKE AIR MIXING WITH DELIVERY AIR
- AIR TEMPERATURE AT AIR CONDITIONERS INTAKE IS HIGHER, CONSEQUENTLY, EFFICIENCY IS IMPROVED
- THE TREATED AIR VOLUME IS LOWER THAN IN NON-COMPARTMENTED SOLUTIONS
- LOWER AIR SIDE PRESSURE DROP
- GREATER CONTROL OF SET POINT TEMPERATURE

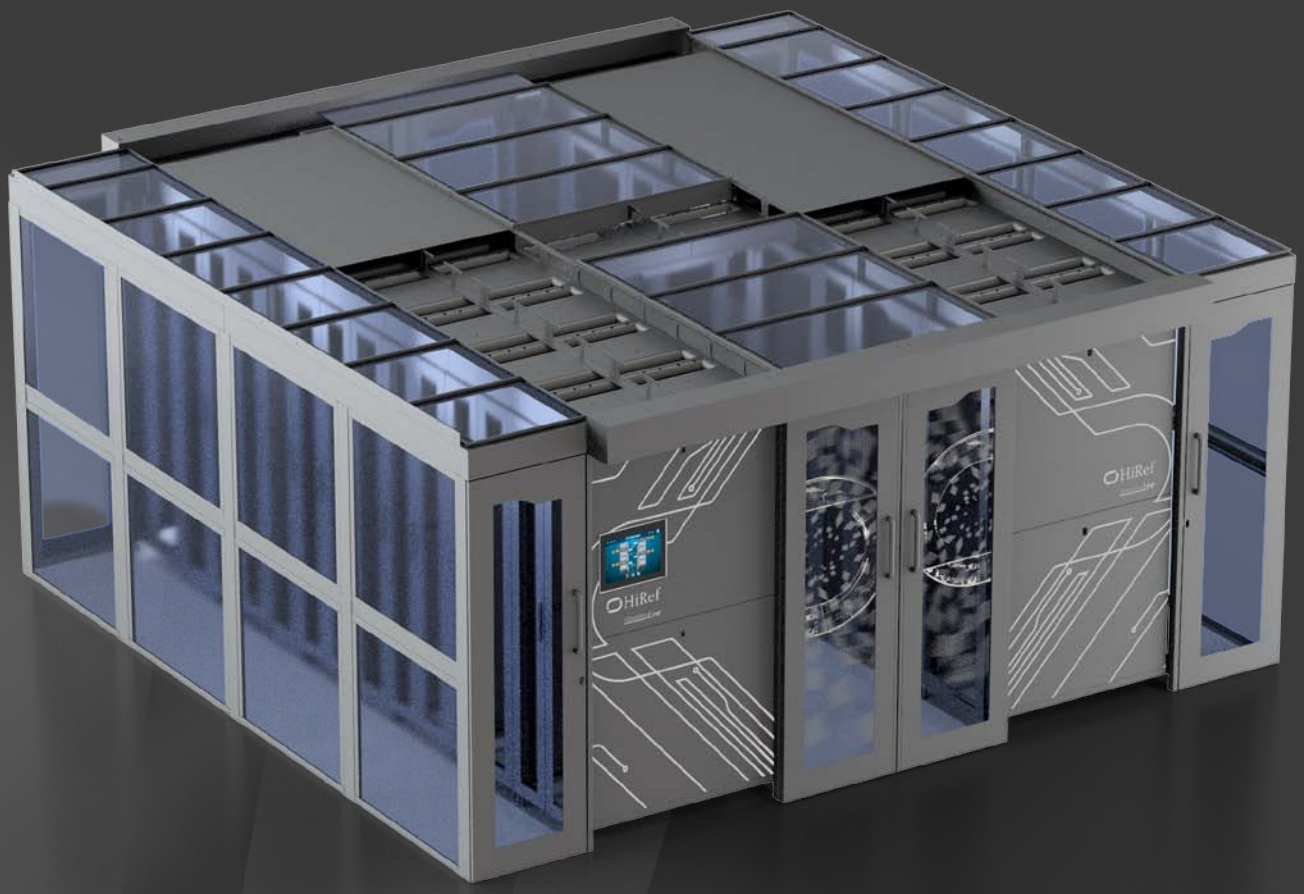
Containment system

COLD AISLE OR ZERO IMPACT

- GREATER CONTROL OF AIR FLOWS AND TEMPERATURES AT SERVER INTAKE
- AIR TEMPERATURE HOMOGENEOUSLY DISTRIBUTED OVER THE WHOLE RACK INTAKE HEIGHT
- AIR TEMPERATURE AT AIR CONDITIONERS INTAKE IS HIGHER, CONSEQUENTLY, EFFICIENCY IS IMPROVED
- AISLE SHARING BY IT SYSTEMS ENSURES EFFECTIVE TEMPERATURE CONTROL - AVOIDING THE OCCURRENCE OF "HOT SPOT POINTS"
- POSSIBILITY OF INCREASING THE RACK INTAKE SET POINT, ENHANCING THE POTENTIAL USE OF FREE-COOLING SYSTEMS

Containment system

WITH EXTREMELY HIGH EFFICIENCY ZERO IMPACT

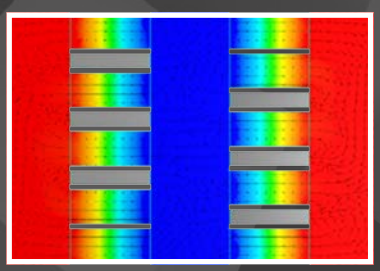


The "**ZERO IMPACT**" solution by **DataDom Line** meets the need for structures with a lower and lower thermal impact on the IT environment, while still preserving the system high efficiency.

Total containment or containment of the cold aisle only and the use of latest-generation "in row" air conditioning systems allow for instant adjustment to load variations and effective modulation of the flow rates and air temperatures required for the IT equipment.

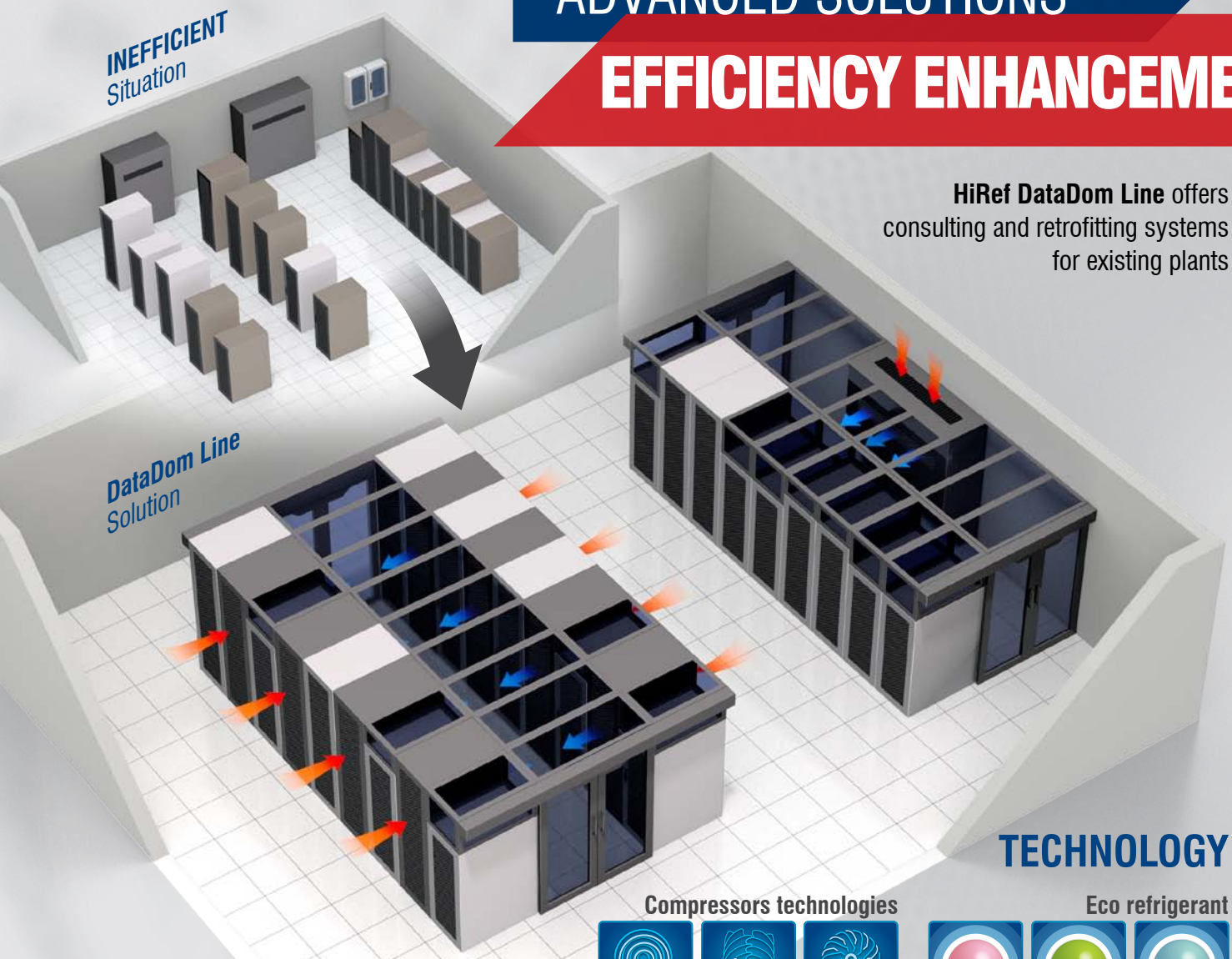
The proposed solution is stand-alone option not affected by external environment conditions.

DataBox® is characterised by limited footprint requirements. The modular system is flexible in terms of island layout and adapts perfectly to any subsequent expansion - without affecting the system efficiency and effectiveness.



- AIR TEMPERATURE AT AIR CONDITIONERS INTAKE IS HIGHER, CONSEQUENTLY, EFFICIENCY IS IMPROVED
- SHARING THE DELIVERY AND INTAKE OF IT SYSTEMS ALLOWS FOR MORE ACCURATE CONTROL OF AIR FLOWS AND THERMO-HYGROMETRIC CONDITIONS
- NO INFLUENCE FROM THE SURROUNDING ENVIRONMENT
- ADVANCED PRESSURE CONTROL WITHIN AISLES

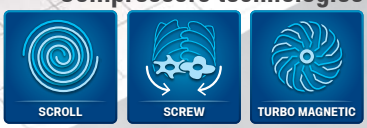
ADVANCED SOLUTIONS
EFFICIENCY ENHANCEMENT



HiRef DataDom Line offers consulting and retrofitting systems for existing plants

TECHNOLOGY

Compressors technologies



Eco refrigerant

Electronic Devices

Software control

Efficiency control

FULL ADAPTABILITY

DataDom Line is a consultant and supplier of retrofitting systems for existing plants

- **Existing server rooms upgrading**
- **New server rooms** inside pre-existing rooms
- "In row" **containment structures**
- **Customised containment systems** for cabinets of different sizes
- **Changes to existing shelters**
- **Disposal** of equipment at life end
- **Transfer of** Data Centers
- Data Center **expansion**
- **Retrofitting** of conditioning units with advanced systems

HOTSPOT HUNTING SYSTEM

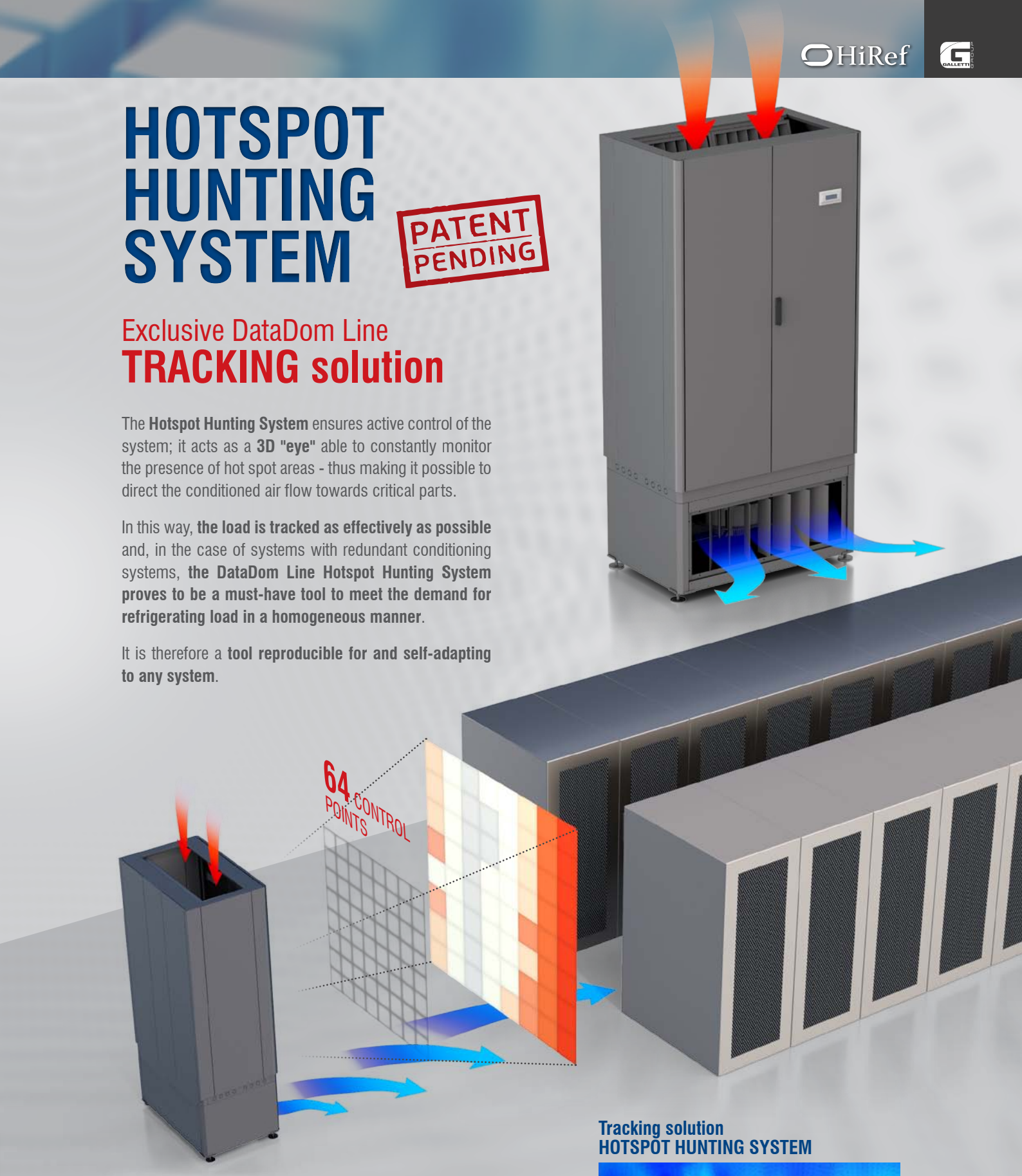
PATENT PENDING

Exclusive DataDom Line
TRACKING solution

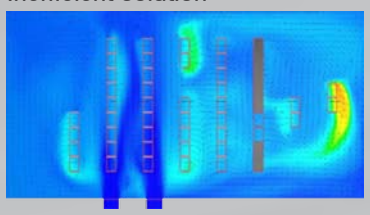
The **Hotspot Hunting System** ensures active control of the system; it acts as a **3D "eye"** able to constantly monitor the presence of hot spot areas - thus making it possible to direct the conditioned air flow towards critical parts.

In this way, **the load is tracked as effectively as possible** and, in the case of systems with redundant conditioning systems, **the DataDom Line Hotspot Hunting System proves to be a must-have tool to meet the demand for refrigerating load in a homogeneous manner**.

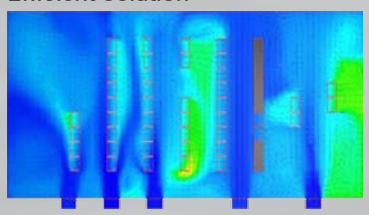
It is therefore a **tool reproducible for and self-adapting to any system**.



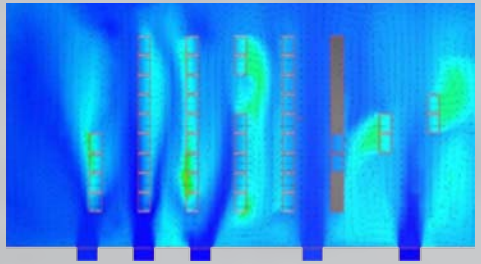
Inefficient solution



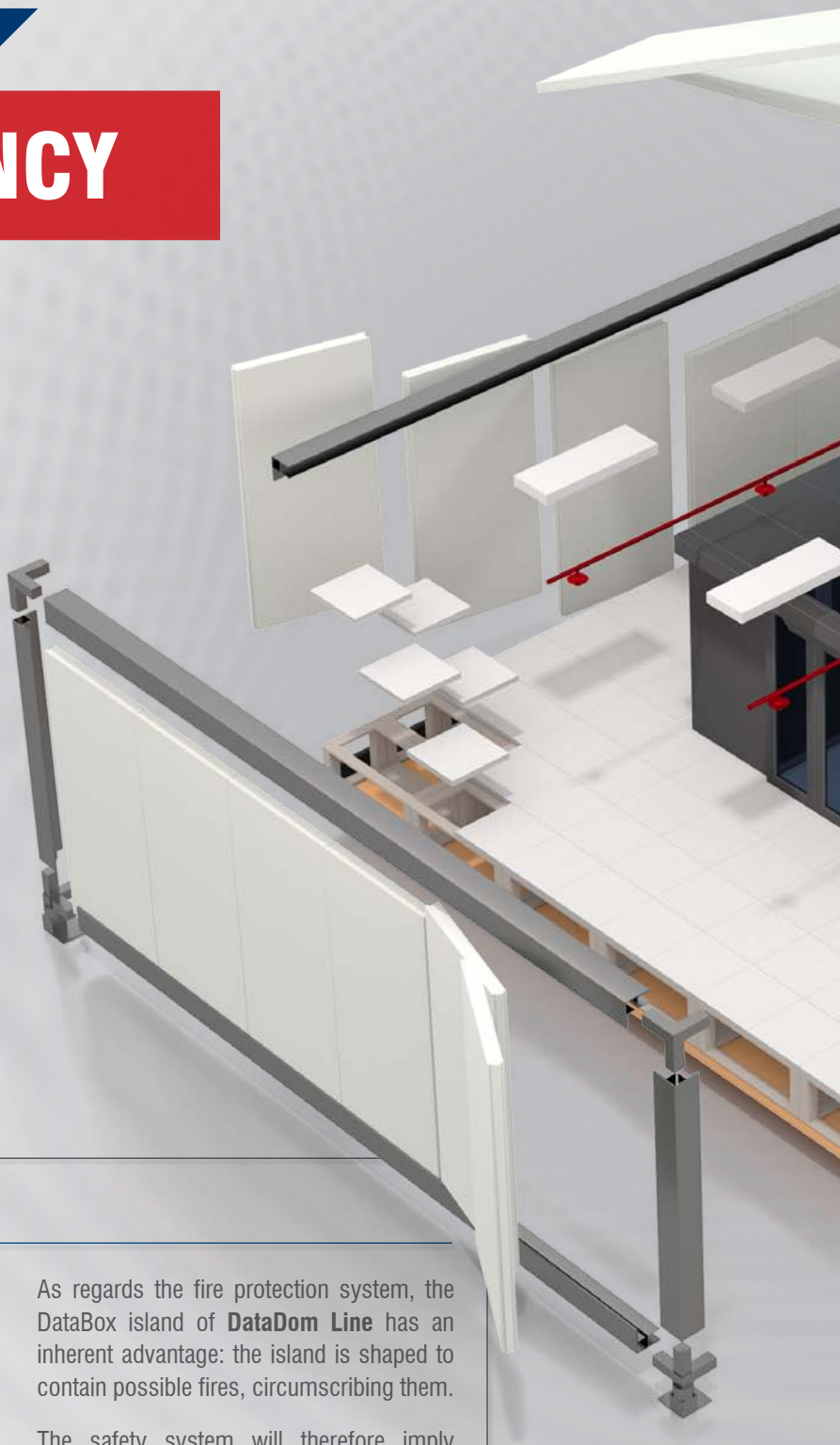
Efficient solution



Tracking solution
HOTSPOT HUNTING SYSTEM



PRODUCT EFFICIENCY



ISOTHERMAL EXTERNAL ENCLOSURE

Enclosure consisting of a self-supporting anti-seismic and thermally insulated structure.

Double flooring preset for cable routing to avoid inefficiencies in the outflow of air.

The **structure supplied as a kit** allows for quicker installation and makes handling easier also on sites with limited space availability.

INTEGRATED SYSTEMS

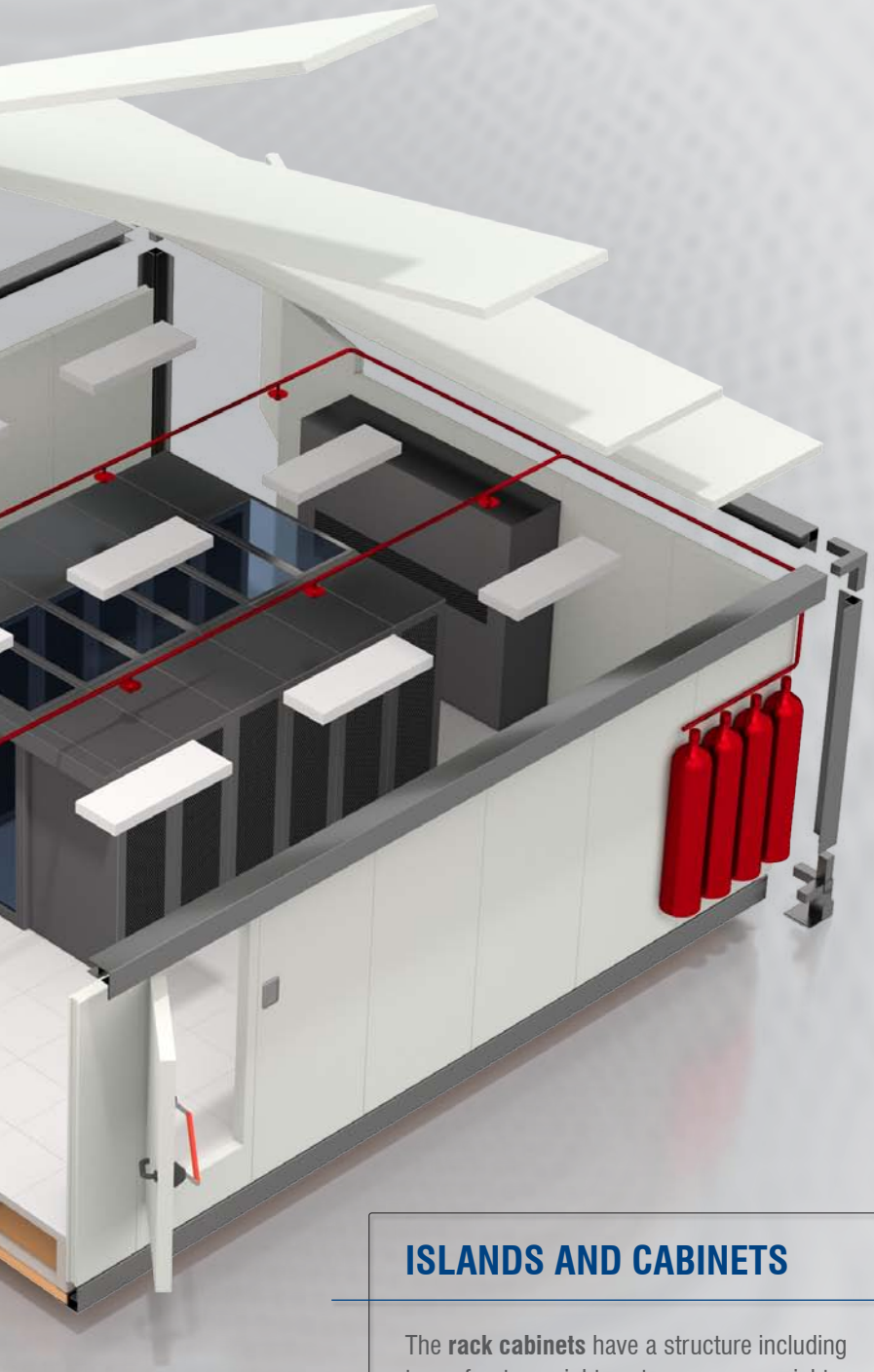
The power supply consists of monitored PDU systems, in a N+N redundancy logic configuration.

PDUs are configured for specific requests - according to the type of power supply, model and number of outlets.

The **DataDom Line access control system** is implemented through biometric control or proximity badges.

As regards the fire protection system, the DataBox island of **DataDom Line** has an inherent advantage: the island is shaped to contain possible fires, circumscribing them.

The safety system will therefore imply a significant reduction in the amount of material needed for fire extinction and enable a faster resolution of the problem.



ADVANCED AIR CONDITIONING SYSTEM

Air/water or water/water chillers in the **efficiency class A** for the production of chilled water.

Precision air conditioning systems with direct expansion or chilled water with different air flow configurations (In-Row, In-Rack, Perimeter: UpFlow, DownFlow, Displacement).

Each unit can be configured to use the **Free-Cooling system**.

ISLANDS AND CABINETS

The **rack cabinets** have a structure including two front uprights, two rear uprights, adjustable feet and a ventilated front door complete with key-lockable handle.

Double ventilated **rear door** with quarter-turn lock and three locking points.

Pre-setting for **anti-overturning system**.

Pre-setting for **earthing** on each removable element.

Static load bearing capacity	2200 kg
Degree	IP20 and IK10
Certificates	TÜV SÜD

The **island** can include either the containment of the cold aisle, or total containment in the configuration with **zero thermal impact.**

EFFECTIVE SOLUTIONS

STRUCTURAL ANALYSIS

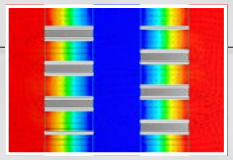
For structurally autonomous constructions it is crucial to assess the **reaction of the various components to vibrations or stress,** by also checking the damping and deceleration factors.

For **DataDom Line**, **HiRef** uses software that can simulate the structure reaction to stress. These tools are supported by qualified measurement systems.

ACOUSTIC ANALYSIS

Sound tests are carried out at every **DataDom Line** site.

On the basis of these data, according to the customer requests, **HiRef - DataDom Line -** is able to supply **soundproofing solutions according to specific surrounding environment needs**.



ANALYSIS OF THE DISTRIBUTION OF AIR FLOWS AND TEMPERATURES

The tests proposed for **DataDom Line** are supported by specifically targeted inspections, during which the power density of the IT equipment and the related thermal and fluid-dynamic conditions are identified.

The subsequent **thermodynamic analysis using CFD software** allows the distribution of air flows and related temperatures to be analysed.

This optimises both the choice of conditioning equipment and the **relevant distribution of refrigerating capacity** inside the room, by completely eliminating Hot Spots and allowing for higher room set-point temperatures.

ENERGY ANALYSIS

Through simulation software developed internally by HiRef, the proposed **DataDom Line** package is accompanied by a **study on annual refrigerating energy flows** required by the IT equipment and the consequent power requirements for air conditioning.

The result is the plant PUE value and an accurate evaluation of the investment pay-back time and NPV (net present value).

LIGHTING ANALYSIS

Lighting is an important running expense item, in terms of both energy absorption and maintenance.

The solution provided in the **DataDom Line** package exclusively adopts **LED technology** ensuring high energy savings.

EFFICIENCY WITH EFFECTIVENESS

EFFICIENCY RATIOS

SHR

It expresses the **ratio of sensitive refrigerating power to total refrigerating power**: it is an indicator of the effectiveness of the air conditioning system and its maximum value is 1.

PUE

It indicates the efficiency of electric power supply use by the Data Center. It quantifies the electrical power used by IT equipment in relation to auxiliary services such as air conditioning or UPS loss. It is calculated as the ratio of the electrical power absorbed by the Data Center to that absorbed by the IT equipment only. The average **PUE** on a global scale is about 1.9; the latest-generation Data Centers aim to achieve a PUE value between 1.1 and 1.2.

EER

It is given by the ratio of the refrigerating energy (or power) to the electrical energy (or power) consumption by the conditioning system at the rated operating point.

SEER

It expresses **the seasonal efficiency** of the conditioning system defined as the ratio of the total refrigerating energy delivered and electrical energy absorbed during one year. This ratio is strongly influenced by the geographical position of the site, the regulation logics and the thermohygrometric characteristics of the Data Center.

CAPEX/OPEX

They represent the outgoing cash flows for the implementation and for the management of the plant - respectively.

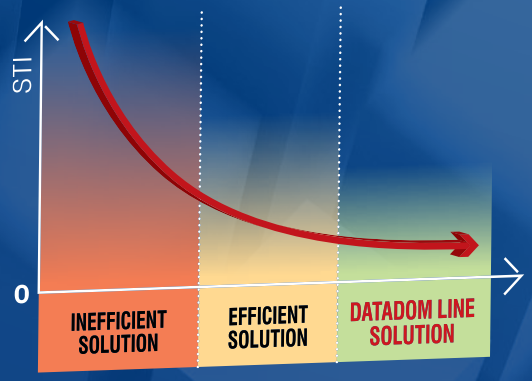
RATIOS OF EFFECTIVENESS

Guaranteeing the high efficiency of conditioning units only is not enough: **it is essential to provide the customer with an integrated**, **optimised** and **effective solution** for the complete Data Center.

STI Server Temperature Index

It allows to assess the **actual temperature distribution profile inside the room**, highlighting the average temperature of the air entering the servers.

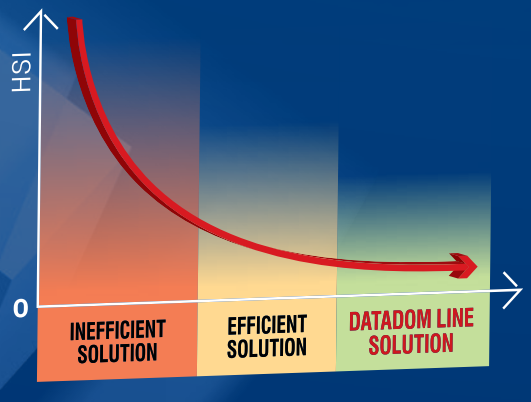
STI = T_{avge} at server inlet - T_{set} in the room



HSI Hot Spot Index

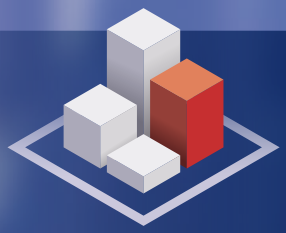
To complete the previous ratio, it **shows the presence of any hot spots** in the equipment area.

HSI = T_{max} in the room - T_{set} in the room



The **DataDom Line** solution adopts the STI and HSI efficiency ratios to verify the optimal distribution of air flows and temperatures inside the Data Center. This results in an energy efficiency and financial benefit.

OUR STRENGTHS



MODULAR, EXPANDABLE, ADAPTABLE

DataDom Line supplies are characterised by a **modular architecture**, fully adaptable to customer needs and **expandable at any time** according to requests.

EFFICIENCY, INNOVATION, EFFECTIVENESS

DataDom Line solutions apply the **best technologies on the market** and are supported by the wealth of experience and exclusive know-how of HiRef. The possibility of requesting a tailor-made solution, through CFD analysis software, allows for an optimisation of air flows and temperature distribution.

QUICK IMPLEMENTATION AND CLEAR COSTING

Availability as kits also means **easy assembly and fixed implementation timing**. The offer includes pricing per square meter for an **accurate evaluation of the required investment**. The energy efficiency and economic analysis tools, developed internally, allow **the expected return on investment (ROI)** to be calculated.

OUR PRODUCTION PLANTS

IT COOLING

Conditioning for telecommunications and Information Technology is proposed with particular emphasis on **"high density" solutions**, in which high performance must be combined with total reliability.

An internal Research and Development department designs solutions with applications in the field of refrigerants with low environmental impact and with the use of renewable energy sources.

- PRODUCTION AREA OF 7,500 M²
- 3 TEMPERATURE CHAMBERS
- END-OF-LINE PERFORMANCE TESTS
- RESEARCH AND DEVELOPMENT IN-HOUSE DEPARTMENT
- DESIGN DEPARTMENT

STRUCTURAL METALWORK

DataDom Line by **HiRef** adopts light plate metalwork with epoxy powder-based paint or brushed stainless steel finishing.

In a dedicated own factory, samples and customised work are carried out with part engineering performed in conjunction with the design department, staffed by skilled personnel with decade-long industry-specific experience.

- STEEL, STAINLESS STEEL, ALUMINIUM MACHINING
- HIGH-EFFICIENCY PLATE BENDING
- WELDING
- AUTOMATED PUNCHING
- INSULATION AND COVERING - LIQUID SEALS

From problems to SOLUTIONS

The development process of **DataDom Line** solutions is inspired by a careful analysis of customer issues. Guided by the logic of supplying not just products but solutions.

1

CUSTOMER REQUEST

Supported by dedicated inspections to thoroughly analyse the problem.

2

PROBLEM ANALYSIS

Performed by the Research and Development department through 3D modelling software and CFD analysis of the structural and plant engineering solution.

CONTROL PANELS

The **industrial-standard electrical switchboards**, **PLCs**, **supervision software** and **system management software of** the **DataDom Line** solutions are manufactured in one of HiRef's plants. The electrical control panels for small, medium and large applications are assembled according to specific customer needs.

- L.V. CONTROL PANELS
- L.V. INDUSTRIAL ELECTRICAL SYSTEMS
- INDUSTRIAL AUTOMATION SYSTEMS
- CUSTOMISED SOLUTIONS AND DESIGNS

SERVER RACKS

HiRef designs **DataDom Line** solutions in close collaboration with a company that specialises in designing and manufacturing lightweight structural metalwork **IT infrastructures**. The product range includes **rack cabinets** and related accessories, **compartmented islands** designed according to specific customer requirements and innovative systems **for integration with the management and monitoring logics** underlying various technologies.

- PANELS AND CABINETS FOR SMART MANAGEMENT OF DATA NETWORKS
- CABLING AND NETWORKING SECTOR
- RACK COMPONENTS
- HEAT COMPARTMENTALISATION SYSTEMS
- LIGHT STRUCTURAL METALWORK WITH PLATE STEEL SHEET VERSIONS IN AISI 304 OR AISI 316 STAINLESS STEEL

3

SOLUTION DEVELOPMENT

The solution is developed thanks to customised products and relying on a highly verticalised process.

4

TEMPERATURE CHAMBERS

The final result can be evaluated in terms of performance through tests conducted in controlled temperature and humidity conditions.

5

SOLUTION IMPLEMENTATION AND CONTINUING CUSTOMER SERVICE

Thanks to a widespread service and support network.

An overview of what we have **ACHIEVED**

ARUBA
Bergamo
Data Center

Refrigerating power
3000 kW

Implemented Solution
6x Chillers with 500 kW screw compressors

SEEWEB
Frosinone
Data Center

Refrigerating power
2500 kW

Implemented Solution
3x TSE284
1x Dry Cooler
1x XSW134
2x TCDR650
12x FCDR750
1x HiNode

CDLAN
Milan
Data Center

Refrigerating power
1200 kW

Implemented Solution
25x DX Rack coolers
2x TLC modulating units
8x DX CRAC perimeter-mounted units and plant management and supervision system

AUTOSTRADE PER L'ITALIA
Florence
TLC / Datacenter

Refrigerating power
2100 kW

Implemented Solution
14x chilled water CRAC perimeter-mounted conditioner units
200x Direct expansion TLC units and plant management and supervision system

INFN
ReCaS
Bari
Data Center

Refrigerating power
1000 kW

Implemented Solution
6x TSX124
6x TCDR1200
5x JAXR190
1x MPIDC029

RFI - GSMR High Speed
National
TLC / Data Center

Refrigerating power
10200 kW

Implemented Solution
1665x TLC units with direct expansion
24x Chilled water rack cooling units
10xDX CRAC perimeter-mounted units

INPS
Campus3
Rome
Data Center

Refrigerating power
500 kW

Implemented Solution
10x Direct expansion CRAC perimeter-mounted units

INGETEAM
Jordan
TLC

Refrigerating power
3100 kW

Implemented Solution
154x HTX170

TELECOM ITALIA
Acilia
Rome
Data Center

Refrigerating power
12000 kW

Implemented Solution
146x chilled water CRAC perimeter-mounted units with underfloor fans
8x Chilled water rack cooling units

LEPIDA
Parma
Data Center

Refrigerating power
1200 kW

Implemented Solution
3x Water/water chillers with 400 kW oil-free compressors
32x Chilled water rack coolers
5x DataBox®

RAI
Sala Tevere

Rome

Data Center

Refrigerating power

900 kW

Implemented Solution

35x Chilled water rack cooling units
3x DataBox®

MOBILIS

Algeria

TLC

Refrigerating power

8700 kW

Implemented Solution

1037x Direct expansion TLC units for high air temperatures

VODAFONE

Bergamo - Data Center

Refrigerating power

1200 kW

Implemented Solution

19x DX CRAC perimeter-mounted units
2x TLC units with direct expansion

OBJECTIVE

The goal was to **retrofit the existing system** (four server rooms and four TLC rooms) **to increase the installed power and make the site more efficient**. The main problem encountered was the distance of 60m between the internal air conditioners and their corresponding condensing units.

SOLUTION

The solution proposed, and implemented, includes 19 **units with** high efficiency **NADR492 inverters** with corresponding kits **for long distances**, which allowed to avoid the drawback of long refrigeration lines. The **remote condensers**, which could not be installed on the roof, were **wall-mounted with customised supports**.

In the TLC rooms, a **direct Free-Cooling system integrated** in the split air conditioners is also provided.

HOSTING SOLUTIONS

Florence - Data Center

Refrigerating power

400 kW

Implemented Solution

3x TADR602
1x NADR602
2x HTS056
1x DataBox®

OBJECTIVE

The Hosting Solutions company needed a new high-density Data Center (25kW/rack) to be built to a tight schedule in facilities without any pre-existing systems adjacent to an office area.

SOLUTION

A **DataBox®** modular indoor Data Center was built, **complete with the required systems and infrastructure**.

The infrastructure includes an isothermal chamber designed and built with **anti-seismic systems** to obtain homogeneous load distribution on the anti-vibration mounts located on the floor slab. This device fully isolates the chamber from the floor.

Inside the enclosure, **double flooring** has been implemented with **pre-setting for cable routing** and acting as an **air distribution plenum**.

A rack island configured with a cold aisle is installed in the chamber, with supply from **NADR682 modulating air conditioners with dual refrigerating circuits**.

Two access gates delimit the island.

Inside the cold aisle, conditioning will only concern server-populated racks thanks to the installation of an **intermediate door**.

The plant set up in the Data Center includes: **fire detection and extinguishing system**, **electrical distribution panel and rack power supply via monitored PDUs**, **air conditioning systems**, **lighting systems and access control system**.

KEY FACTORS

The **advanced design** of the Data Center, based on 3D models, is completed by air flows, structural, acoustic and lighting analyses. This has allowed the customer to **evaluate the efficiency and all the details of the solution on the basis of a foreseeable cost per m² before its implementation.**

HiRef DataDom Line implemented the solution in just 3 weeks, **also** managing **the transient state** to a fully operational Data Center, with optimized use of inverter units and intermediate doors in the aisle.

DataDom Line

HiRef

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