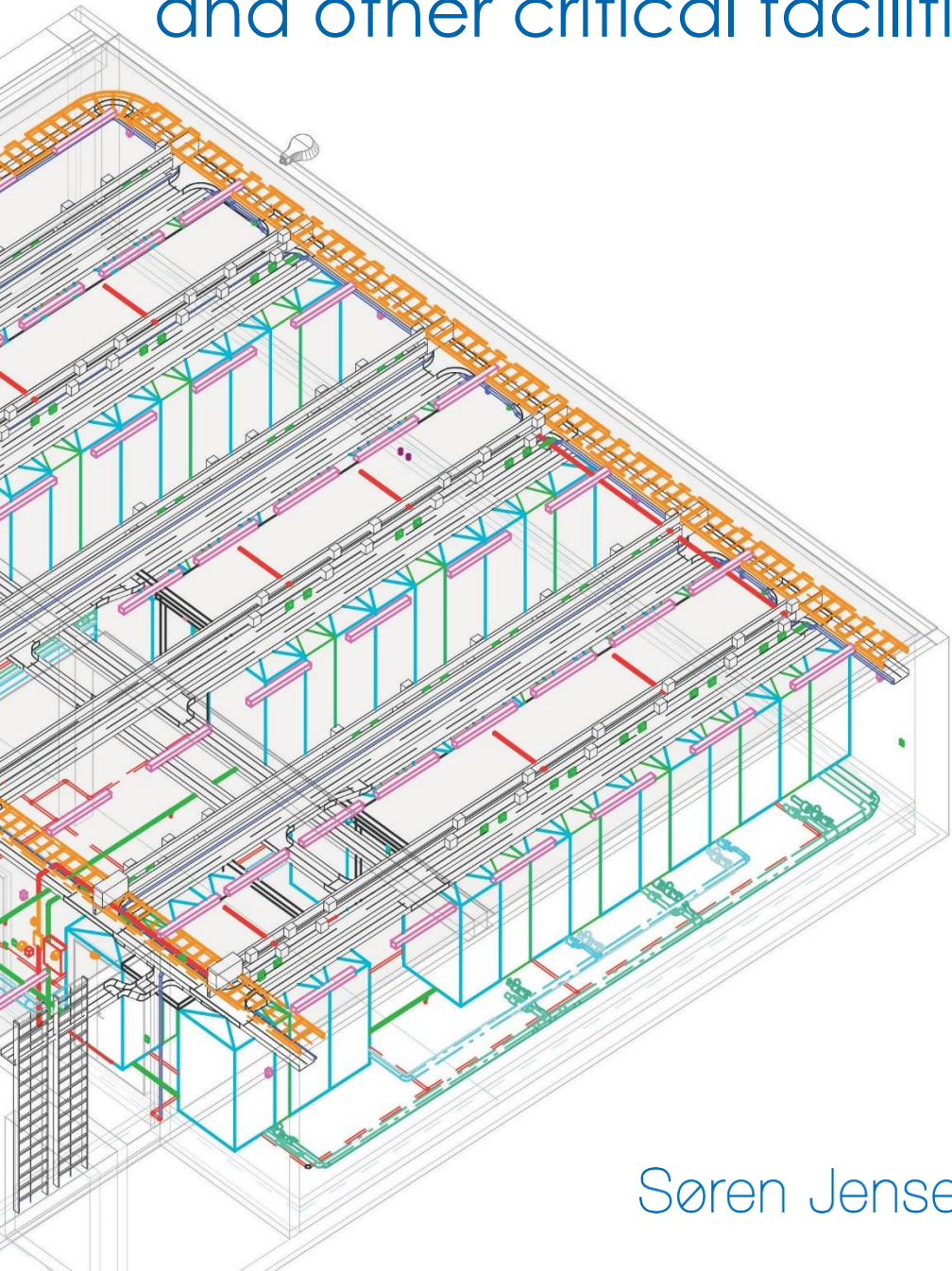


Data Centres and other critical facilities



Søren Jensen

Introduction

Søren Jensen - General Information

Søren Jensen is one of the dominant consulting engineer firms in Denmark, and we specialize in design, development and providing solutions for most challenging and complicated buildings including data centre and other critical systems.

We take pride in always working in an innovative and proactive way, to find the best solutions. This is the reason that we can name some of the largest organisations amongst our clients; Data Centres, Hospitals, Universities and Industries.

All of our projects are developed in close collaboration with our customers and partners, starting with our specialist "Critical Systems" team, which mainly deals with providing solutions for data centre and other facilities where there are very high demands for operational safety and uptime.

In order to ensure our clients receive the very best solution for them, our team are always up to date with the very latest industry standards and developments.

Our continual professional development program equips the team with the tools and knowledge they need to give the best advice for our clients needs.

We are Accredited Tier Designer (ATD and ATD Pro) and Accredited Tier Specialist (ATS) approved by the

Uptime Institute. We consider all tasks holistically and integrate many different disciplines into our solutions. We always recommend modular solutions as these are preferable in terms of performance and operation.

Our solutions will always be optimal from an environmental and economic point of view because sustainability is always included in the decision-making process including energy consumption and CO2 emissions.

Data Centre Design and Classification

All of our solutions are designed to the relevant Industry Standards:

- Uptime Institute Data Centre Site Infrastructure Tier Standard: Topology
- Uptime Institute Data Centre Site Infrastructure Tier Standard: Operational Sustainability
- Telecommunications Infrastructure Standard for Data Centres: TIA 942
- DS/EN 50600-x
- ASHRAE recommendations

Skills

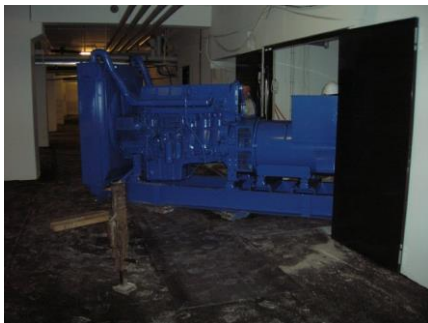
Electrical

Power

Søren Jensen has great experience in the design and construction of redundant and fault tolerant power installations for data centres and other critical systems.

Power installations are provided with redundancy in relation to the agreed tier level.

UPS systems, generators and switchgear are designed as N+1 and 2N systems according to requested uptime.



Building Management Systems and DCIM

Our solutions always include recommendations for a central Building Management System (BMS-system and DCIM system), which combines control systems and building monitoring systems, so that the necessary operation and maintenance work can be carried out and the risk of unexpected power failure and downtime can be avoided.



Telecommunications

Data centres require a very large amount of cables, connections and patching. It is therefore critical that cable management systems allow for routing and organisation of the cabling in a structured and logical manner.

To connect the data centres to the global networks and internet, redundant, high capacity and low latency data connections are necessary.

Security

An important part of data centres and many other critical systems is controlled access to the premises and sensitive areas/rooms. This is solved by using active access control, alarm systems, video surveillance and passive mechanical barriers; correct materials and design solutions.

Mechanical

Cooling

We have designed several different cooling solutions, air-cooling, fresh air cooling, groundwater cooling, adiabatic cooling and many others. We always strive to implement the greenest cooling solutions. At the moment direct water-cooling solutions are getting dominant, direct CPU liquid cooling and immersion cooling driven by sustainability requirements and ASHRAE and OCP recommendations.

Ventilation

In rooms where there is a demand for the supply of fresh air for permanent work spaces or supplementary air in the form of local point ventilation, it is important to establish a system based on fresh air equipped with heat recovery.

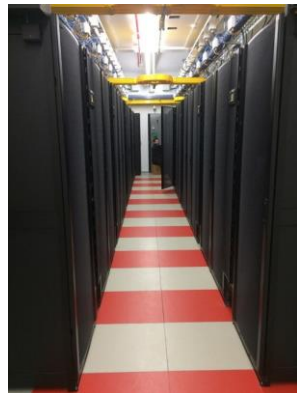
We always recommend the use of VAV-controlled ventilation systems, as this provides the most energyefficient plant operation. In addition CFD calculations are used to check and optimize the ventilation in each room based on the simulated air movements in the room.

Water and Drainage

When using adiabatic cooling in the data centre it is of great importance that the water supply is constant.

In Denmark, there are seldom any challenges in relation to the provision of an efficient and constant water supply. But in areas with the possibility of failure of the water supply it is recommended that private water wells shall be established. The location and extent of these wells will always be planned in close coordination with geotechnical investigations of the area.

In the case of adiabatic cooling, there will be a discharge of excess water to the surroundings, or municipal utilities. This excess water can, as a result of operation, have a relatively high mineral content and a relatively high temperature and therefore it is recommended to clarify the discharge requirements with the local authorities during the planning stage.



Saving Energy & Green Profiling

Alternative Energy

Despite the use of energyefficient solutions, data centres consume an enormous amount of energy.

Serious considerations should be given to the use of alternative sources of electrical supply, for example:

- Wind turbines
- Solar cells

The alternative sources of supply do not necessarily have to be placed immediately in the vicinity of the data centre but could be placed elsewhere and then connected to the main distribution system.

The alternative energy supply will not necessarily provide a cheaper operational cost, but it will provide a greener profile.

Alternative Cooling

Our solutions will always look at the use of alternative and sustainable solutions for cooling.

Besides the frequent use of free cooling from the air outside, we have much experience with the use of sea water and groundwater to provide the desired cooling capacity via heat exchangers.

The establishment of these facilities must always be resolved in close collaboration with the environmental authorities a process in which we are very familiar with.

Waste Heat Recovery

In Denmark heating is generally based on district heating or natural gas.

In systems with excessive heat production such as data centres, we generally recommend the use of heat pumps so that the maximum amount of energy is recycled.

By strategically arranging the data halls containing warm sections, we increase the possibility to regain much of the heat energy that comes from the servers.

The waste heat from the servers can, via heat pumps, be transferred to the district heating network and used to supply heating in nearby areas (buildings, cities).

This energy recovered will not only be able to give the facility a "green profile", but it will also benefit the overall life-cycle cost of the project.

Life Cycle Assessment (LCA)

New climate requirements, introduced in Denmark's building regulations (BR18) per 01.01.2023, is intended to ensure a sustainable transition for the construction industry. In Søren Jensen we prepare life cycle assessments and ensure sustainable decisions in the early phases of projects. We have experience in preparing LCA according to the voluntary sustainability class and DGNB. We focus on early strong collaboration across all construction parties to reduce the environmental impact and resource consumption.

Other Services

Fire-Engineering

We have our own team of fire engineers here at Søren Jensen. A fire engineer is always included on every project from start to finish.

It is critical to carry out a Fire Risk Assessment and produce documentation of the site conditions with regards to the operational reliability of the system, and the restrictions associated with the use of water and other extinguishing agents that can cause damage to installations or components.

Structural

The structures required for data centres demand a special focus on rational and repetitive construction principles to minimize construction time and cost.

Søren Jensen are experts in finding optimal structural solutions that take the architecture, the developer's environmental profile, technical installations, climate and material availability, into account.

Off Site Manufacturing is a special focus point at Søren Jensen.

Søren Jensen employs several of Denmark's most highly qualified structural engineers who can ensure a rapid authority approvals process as well as the quality of the calculations and overall solutions.

Certification scheme

The building regulation BR18 in Denmark has introduced new requirements in relation to building permits. Certified consultants in the field of structural and fire engineering are responsible for the structure being designed according to current standards and guidelines.

In relation to this, structural and fire classes have been implemented, which categorizes buildings based on a series of items.

At Søren Jensen we have experienced and qualified certified consultants (certified structural engineers and certified fire engineers) covering all structural and fire classes.

Building Information Modelling

All projects in Søren Jensen are developed as a single 3D building model using the REVIT software package.

The building model contains all the relevant building components meaning that we can perform accurate B-sim and CFD simulations of internal spaces for various installation and structure related scenarios, to find the most optimal solution.

Continuous collision and quality assurance checks are carried out in connection with the design to ensure buildability. This ensures a quick and seamless delivery.

All parts of the building will be equipped with maintenance instructions to ensure a safe and controlled operation and maintenance of the building and it's installations is ensured.

Project Management

Søren Jensen has great experience in project management of very large building projects as The New University Hospital in Aarhus (DNU) and Aarhus University.

- Comply necessary experience to owner during building process phases.
- Ongoing necessary risk analysis and risk management
- Securing the expected quality, time and economy by planning
- Sustain and maintain correct and effective communications and controls to catch any quality -, time - or economical challenges
- Change Management
- Decision planning (correct decisions and timing)
- Project controlling

Civil Works

When constructing a datacenter, the outdoor areas and the logistics in underground utilities plays an important role.

Søren Jensen has great experience in designing the infrastructure such as access roads, parking lots and outdoor areas. All the underground utilities such as duct banks, handling drainage and foul water, supplies for power etc. are a natural part of the services provided by Søren Jensen.

The contact to the municipalities and their supply companies is important when designing the access roads, water drainage systems etc.

Søren Jensen has the experience in incorporating the demands from the municipalities in the design of the civil works.

Site selections and due diligence

Søren Jensen has been involved in several site selections for datacenters in Denmark. The site selections consists of:

- Doing surveys for the site with topographic services
- Geotechnical investigation and report
- EIA screening of the site regarding the specific project.
- Contact to the authorities and utility providers.
- Checking on power supply and connections for redundancy
- Checking for wetlands and regulated waters
- We investigate the terms for receiving a building permit

Project Management, Health & Safety

Søren Jensen has been involved in the construction phase for several datacenters and other large construction sites. Here we have managed the whole construction project on behalf of the client as well as having Residential Engineers (RE) onsite taking care of each discipline.

Søren Jensen also holds a project controlling company who takes care of all the economy of the project.

In the Health & Safety (H&S) perspective we have engineers who are specialized in taking care of H&S in the design phase. Here the plan for H&S in the executing will be made as well as a Hazard Analysis for the construction phase will be made. After the design phase these documents are handled over to the responsible for H&S from the contractor with a given instruction.



References

Project 1

In collaboration with our international partner we have designed a hyperscale data centre (>100.000 m²) placed in Europe.

We have a leading role in archiving a building permit for the project, localisation and the engineering design. We also provide resident engineering services.

Period: 2017 - present
Client: Non-disclosed



Project 2

In collaboration with our international partner we have designed a hyperscale data centre (>90.000 m²) placed in Europe.

We have a leading role in archiving a building permit for the project, and in the redesign of the mechanical and electrical installations.

Period: 2015 - present
Client: Non-disclosed

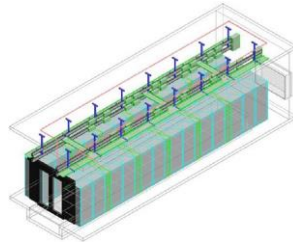


Teracom A/S

Transforming 6 existing buildings into tier II-III datacentres.

- 40-80 racks each building
- Chiller and free cooling
- Modular scalable, tier scalable
- Construction ongoing

Period: 2016 - present
Client: Teracom A/S



Aarhus University

As preferred engineers at Aarhus University for 5 decades, we have designed a number of data halls, datacentres, clean room laboratories, accelerators and other critical systems.

In an existing building we have designed a data centre for cloud computing and research. The tier level is II and the capacity is 375 kW with 55 racks. The cooling system is ventilation with fresh (ambient) air.

Period: 1930 - present
Client: Aarhus University



Aalborg University

When Aalborg University decided to consolidate, several minor data rooms to central data centres Søren Jensen were the lead designers.

As the primary data centre DC1 we designed a Tier III, 300/450 kW, 60/90 racks data centre.

For the backup data centre, we designed DC2, Tier II, 160 kW, 20 racks data centre.

Period: 2011 - present

Client: Aalborg University



JN Data

For JN Data Silkeborg Søren Jensen have designed and developed a new data centre to host IT for several financial institutions in Denmark. The data centre was, when designed in 2010, one of the largest data centres in Northern Europe.

The data centre has four data halls containing up to 400 racks. The tier level is II-III and capacity of 4 MW. The cooling system is chilled water with free cooling.

Period: 2010 - 2016

Client: JN Data A/S



The Danish Centre of Particle Therapy (DCPT)

DCPT is the only centre for accelerator physics in Denmark. The vision is to create a centre that will be one of world leaders within the field of research and treatment of cancer by means of particle based radiation treatment.

We were part of the team that came 2nd for the design incl. build of the 9 000 m² centre.

We had the role of sole company providing engineering services to the bidding team

Period: 2015

Client: Region Midtjylland



Energi Midt

Energi Midt is a Danish power utility provider located in Silkeborg. In 2010, we were asked to design a complete new greenfield building for administration.

As part of the building, the customer wanted a new data centre for servers for digital IP television distribution (streaming) and a hosting centre for related customers.

The data centre has two data halls each 150 m², tier level II-III, capacity 200 kW and 110 racks (low density 48V DC equipment in one of the halls).

Heat surplus recovered by heat exchangers and used for heating the rest of the building during cold periods.

Period: 2007 - 2011

Client: Energi Midt



Other references

- Deloitte Headquarter in Copenhagen, 80 kW scale to 160 kW
- DS Norden Headquarter, Bryghuset in Copenhagen, 20 kW
- Allerhuset (headquarter) in Copenhagen, 40 kW scale to 80 kW (cooling with harbor water)
- BKS, 2*20 kW
- NOKAS, 2*20 kW
- Danske Commodities, 200 kW
- Envision
- Incuba Science Park, 60 kW

Curriculum Vitae

Frank Jensen

CVEO and Co-owner Søren Jensen
Consulting Engineers

Education

- 2005 Ph.D. (Cantab), University of Cambridge, United Kingdom
- 2000 BScEng (Hons) in Civil Engineering (Structural), Engineering College of Aarhus, Denmark

Key qualifications

- Architectural Engineering planning & design
- Structural Engineering planning & design
- Project Management incl. mega-projects

E-mail: info@sj.dk

Telefon: +45 4194 9418



Carl Ove Larsen

Director (LoB)

Education

- 2008 Sewerage undertaker, Learnmark Horsens, Denmark
- 1996 HD (O), Aarhus Business Collage, Denmark
- 1987 BSc Eng, VIA university College Horsens, Denmark
- 1980 Technical operation assistant, Aarhus Technical College, Denmark



Key qualifications

- Project Management
- Civil Engineering
- Construction Management
- Design Management
- Large scale construction projects

E-mail: col@sj.dk

Telefon: +45 2429 8492

Alex Jørgensen

Senior Specialist, Engineer Master Degree



Education and Certifications

- 2018 ATD Professional nr. 945, Uptime Institute
AS1 Advance Mechanical & Tiers, Uptime Institute
AS2 Advanced Principles in Critical Facility
Management, Uptime Institute
- 2015 Accredited Tier Specialist no. 869, Uptime Institute
- 2014 Accredited Tier Designer no. 945, Uptime Institute
- 2009 BTEC CDCD Certified Data Centre Design Centre,
Copenhagen, Denmark
- 1989 Master of Science in Engineering, process Control,
Aalborg University Center, Denmark

Key qualifications

- Project management, technical design and supervision with ICT (Information and communications technology)
- Electronic installation, including a complete data centre, local area networks (lan), telephone systems, access control, security, video surveillance, and integration of systems etc.
- Technical specialist within data centre, ICT and electronic engineering



E-mail: amj@sj.dk
Telefon: +45 4194 9403

Henning Pedersen

Electrical



Education and Certifications

- 2018 Accredited Tier Designer ATD Professionals, Uptime Institute (no. 1725)
AS1 Advance Mechanical & Tiers, Uptime Institute
AS2 Advanced Principles in Critical Facility Management, Uptime Institute
- 2016 AS3 Advanced Electrical & Tiers, Uptime Institute
Accredited Tier Designer no. 1725, Uptime Institute
- 2009 BTEC CDCS Certified Data Centre Design Centre, Copenhagen, Denmark
- 1987 BSc Eng., Electrical engineering, Engineering College of Aarhus, Denmark

Key qualifications

- Electrical engineering, technical design and project coordination of high voltage and low voltage installations.
- Datacentre overall design according to building design, LV-design, ELV-design, and cooling regarding Tier specifications from Uptime Institute
- Datacentre detailed design of LV- and ELV-installations
- Technical survey report
- Structural management
- Technical supervision
- Critical system designer



E-mail: hlp@sj.dk

Telefon: +45 4194 9412

Iben S. Sønderkov

Electrical

Education and Certifications

- 2022 Bachelor of Technical Management and Marine Engineering, Fredericia Maskinmesterskole (FMS), Denmark
Elective curriculum: Data Center's and Industrial Management.
- 2021 Service Engineering,
Fredericia Maskinmesterskole (FMS)
- 2018 Electrician, Syddansk erhvervsskole (SDU), Denmark



Key qualifications

- Electrical Engineering design, high current as well as low current.
- Refrigeration design
- Datacenter design



E-mail: iss@sj.dk

Telefon: +45 2429 8500

Kenneth Kongstad

Electrical

Education and Certifications

- 2022 Accredited Tier Designer (no 4495),
Uptime Institute
- 1991 Industrial electrician, Danisco-Assens,
Denmark
- 1988 Electronic Primary Education, Odense
Technical School, Denmark



Key qualifications

- Building automation (CTS / BMS)
- Designing, project monitoring and supervision on new as well as expansions of existing IBI, BMS -Systems
- Integration of technical installations to one or several user interfaces.
- Securing correct designing and regulating of water, air and automatic Automatic of hybrid- and natural ventilation
- Integration to ADK / AIA and ITV, as well as other technical building systems
- IT-networks
- CE-marking according to Machinery Directive
- Ongoing updating with latest technology through networking, supplier, and conferences.

E-mail: kko@sj.dk
Telefon: +45 4194 93



Jesper R. Jakobsen

Structural

Education and Certifications

- 2013 Master of Science, structural engineering specializing in concrete, Aarhus University, Denmark
- 2011 Bachelor in structural engineering, VIA University Collegé Horsens, Denmark
- 2006 Carpenter, Holstebro Technical School; Denmark



Key qualifications

- Design of steel structures
- Design of load-bearing structures
- Building permit application for load-bearing structures

E-mail: jrj@sj.dk

Telefon: +45 2429 8489

Morten W. Søndermand

Civil

Education and Certifications

- 2015 Graduate Diploma in Business Administration, HD(O) Organization and management, Aalborg University, Denmark
- 2013 Degree in Business Economics, Academy Profession (AP), Erhvervsakademi Aarhus, Denmark
- 2006 Bachelor of Engineering, specializing in civil, Ingeniørhøjskolen Aarhus, Denmark

Key qualifications

- Designing of rainwater and sewage projects
- Project management
- Site development, summer cottage sewerage, sewerage, flood protection
- LAR (Local rainwater drainage)

E-mail: mws@sj.dk

Telefon: +45 2449 8896



Mathilde B. Laursen

Integrated Energy Design

Education and Certifications

- 2017 Master of Science in Civil and Architectural Engineering specializing in Integrated Energy Design, Aarhus University, Denmark
- 2015 Bachelor of Engineering, Energy and Indoor Climate, Aarhus University, Denmark

Key qualifications

- Planning and designing of HVAC systems
- Planning and designing of pipework
- Indoor Environment analysis and simulation
- Energy calculations
- DGNB certification
- Integrated Energy Design



E-mail: mbl@sj.dk

Telefon: +45 2429 8515

Aarhus

Åboulevarden 13
8000 Aarhus C
tlf.: +45 86 12 26 11
e-mail: info@sj.dk

København

Frederiksborggade 1, 3. tv
1360 København K
tlf.: +45 86 12 26 11
e-mail: info@sj.dk

www.sj.dk

