KNOWLEDGE PROPOSAL: Liquid cooling systems and applications within data centre racks and systems.

Proposer Name and Organisation: : Mohammad Royapoor – CIBSE Data Centre Special Interest GroupTopic/ Title:

Date received:

1. Justification: Why is this guidance needed?

The Data Centre industry, for most of its history, has been adopting air cooled solutions in their facilities. However a combination of factors are moving the sector to adopt liquid cooling. Among these driving forces are:

1- High densities of next generation computational machinery, in particular those for AI deployment.

2- Data hall space optimisation and higher IT yield per unit area.

3- Ease of surplus heat reuse.

4- Achieving better efficiency at both:

a. Compute level: high-end systems perform better under liquid cooling because it allows chips to run at higher clock speeds (i.e. the thermal throttling is minimized).

b. Data hall level: Better PUEs are achievable with liquid cooling.

5- Sustainability and regulatory forces.

While these trends are informing the optimal shape of a high density DC, most of current liquid-cooling ready DC designs are developed in consultation with leading manufacturers. There is therefore the need for best practice professional institutions such as CIBSE to provide a technical memorandum to ensure its membership is able to perform designs with a holistic system approach and without any hidden bias arising from manufacture limitations. Such a TM would be looking at guiding designers to produce solutions that are highly adoptable to any rack densities, are product agnostic, remain scalable and flexible and does not risk future compliance or certification failure.

1. Format: What format will the guidance take?

|  |  |
| --- | --- |
|  | a traditional publication with words and diagrams to be produced for CIBSE’s Knowledge Delivery Platform, and in PDF |
|  | a data set |
|  | a digital tool or software application |
|  | something else (please elaborate) |

1. Content: If guidance, please list proposed chapter and section headings. If a data set, digital tool, software application, or something else, please detail your proposed plan.

Technical memorandum focusing sharply on the fundamentals of liquid cooling, heat transfer principles for compute machinery, categories of liquid cooling and state of the art in manufacturing solutions. Avoiding mission crip into fundamentals of refrigerant cooling or computer science aspect of DCs to remain relevant and avoid duplications.

1. Readership: Who is likely to read this guidance?

Data centre professionals, wider CIBSE readership particularly built environment mission critical mechanical designers, manufacturers of data centre white space equipments.

1. Authoring: Are authors in place? If so, please list them below.

No, authors are not in place, however a collection of practitioners exist in RED who can make significant contribution and the wider CIBSE community will also be consulted to identify the best possible talent for the work.

1. Timescale: When would you expect to complete the project? Please provide a rough timeline.

12 months

Fees: Will authors require funding? If so, how much?

Potentially yes, budget fee £2000.00

1. Landscape: Does any similar or complementary guidance exist, published by CIBSE or elsewhere?

No.

1. **Collaboration**: Are there any organisations that may wish to be involved in the production of this guidance? (For example: membership organisations, trade associations, contractors, consultants, government departments).

Potentially IMechE, IET and manufacturers.

1. Are there any organisations that may wish to sponsor the production financially?

Potentially (manufactures)

1. Categorisation: CIBSE has created a taxonomy of building services, the Knowledge Matrix. On the following pages, please tick the topics and sub-topics that will be covered in this project.

**Topic:**

Mechanical

Heating

Ventilation

Refrigeration and air conditioning

Extract/ exhaust systems

Smoke control

Pipeline distribution systems (natural gas, liquid fuels, medical gas, compressed air & vacuum)

Electrical

Extra low voltage

Low voltage

Medium voltage

High voltage

Local power generation & standby power

Earthing & bonding/ Lightning protection

Communications

Audio-visual

Electric vehicle charging

Public Health

Water

Drainage

Gas

Lighting

Daylight/ sunlight

Electric lighting

Lighting energy

Fire safety

Fire life safety

Fire protection

Fire detection

Fire notification

Building fabric

Façades

Access & maintenance

Transportation systems in buildings

Lifts

Escalators

Moving walks

Stairlifts and lifting platforms

Building intelligence

Controls

Smart buildings

Security

Physical security

Security systems (access control, surveillance, intruder alarm)

Cyber security

Digital

Building information modelling (BIM)

Digital engineering

Digital construction

Sustainability & ESG

Climate change mitigation

Climate change adaptation

Circular economy

Biodiversity & natural capital

Diversity & inclusion

Social value

Health, wellbeing and safety

Structure:

Introduction of project

Purpose (strategic/design context)

Project management (inc info requirements)

Drivers

Commercial

Contracts

BIM

Digital information management

Fundamentals

Physics

Design conditions/ data

Calculations and methods

Sustainability (key considerations)

Health, wellbeing and safety

Retrofit and refurbishment

Condition surveying

Modification/ adaptation

System selection

Selection (regulations, best practice, finance, operational energy, whole-life carbon)

Systems, plant, equipment (terminal equipment)

Systems, plant, equipment (network level, central plant, distribution)

System design principles

System sizing

System design conditions/ data

System sizing calculations

Health, wellbeing and safety

Modern methods of construction

Access and maintenance

Construction

Installation

Modern methods of construction

Health, wellbeing and safety

Records (drawings, operation and maintenance)

Controls

Strategy

Controls as specified, installed and commissioned

Commissioning

Plans

Procedures

Operation

Facilities management

Training

Maintenance

Health, wellbeing and safety

Performance (energy, carbon, water)

Performance (IEQ)

End of life

Reuse

Repurpose

Recycle

Demolition

Building Type:

**Residential**

Single dwelling

Multiple dwelling

Non-residential

Office

Education

Higher education

Healthcare

Retail

Leisure

Aviation

Road and rail

Government

Industrial

Logistics

Data centre

Heritage

Defence

Infrastructure

Utilities

Other

Intended Reader:

Owner

Occupier

Designer

Developer

Constructor

Installer

Commissioning engineer

Operator/ Facilities manager

Manufacturer

Apprentice

Student

Researcher

Expert witness

Other - please specify: