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?

|  |  |
| --- | --- |
| [x]  | 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

[x]  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

[x]  Controls

[x]  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

[x]  Purpose (strategic/design context)

[ ]  Project management (inc info requirements)

[x]  Drivers

[ ]  Commercial

[ ]  Contracts

[ ]  BIM

[ ]  Digital information management

[ ]  Fundamentals

[x]  Physics

[x]  Design conditions/ data

[x]  Calculations and methods

[x]  Sustainability (key considerations)

[x]  Health, wellbeing and safety

[ ]  Retrofit and refurbishment

[ ]  Condition surveying

[ ]  Modification/ adaptation

[ ]  System selection

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

[x]  Systems, plant, equipment (terminal equipment)

[x]  Systems, plant, equipment (network level, central plant, distribution)

[ ]  System design principles

[x]  System sizing

[x]  System design conditions/ data

[x]  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

[x]  Strategy

[ ]  Controls as specified, installed and commissioned

[x]  Commissioning

[ ]  Plans

[ ]  Procedures

[ ]  Operation

[x]  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

[x]  Data centre

[ ]  Heritage

[ ]  Defence

[ ]  Infrastructure

[ ]  Utilities

[ ]  Other

Intended Reader:

[x]  Owner

[x]  Occupier

[x]  Designer

[x]  Developer

[x]  Constructor

[x]  Installer

[x]  Commissioning engineer

[x]  Operator/ Facilities manager

[x]  Manufacturer

[x]  Apprentice

[x]  Student

[x]  Researcher

[x]  Expert witness

[ ]  Other - please specify: