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ACS Door Heat Exchanger Sub-Project Updates: Requirements, Community Studies & Harmonization

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ACS Door HX Sub-Project Updates: Requirements, Community Studies & Harmonization

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ACS Door HX Sub-Project

ADVANCED COOLING SOLUTIONS

- Focus on efforts that enable adoption of and help demystify Door HX solutions through community-driven contributions
- ***Recent efforts***
  - ACS Door Heat Exchanger Requirements for Open Rack [*contributed*]
  - Community Studies [*on-going*]
  - Harmonization with ACF group [*on-going*]

Requirements for Open Rack

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- Defines technical requirements and potential applications for a rack-mount door heat exchanger to be used with Open Rack

Physical

DC Environment

Performance / Metrology

Monitoring & Control

Serviceability

Reliability & Quality

Environmental & Regulations

Requirements for Open Rack

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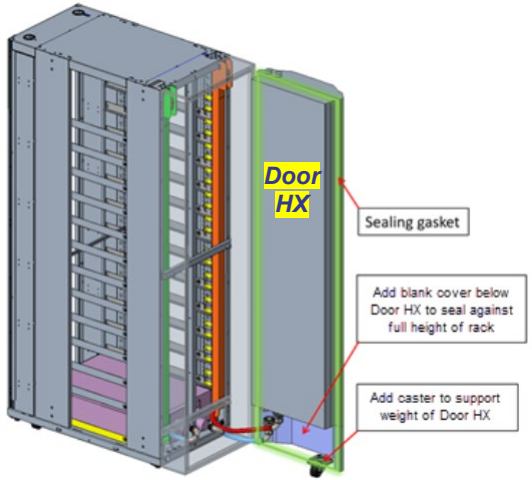
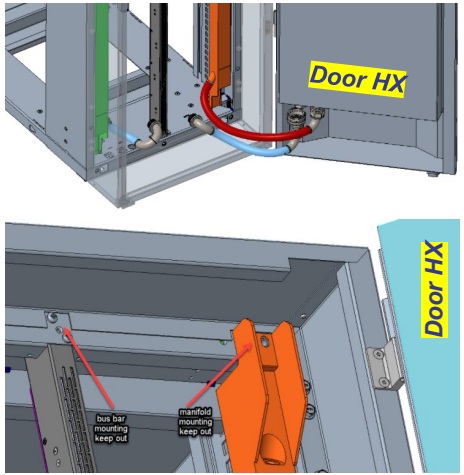
- [*Addition*] Mechanical and physical requirements specific to **Open Rack V3** with in-rack blind-mate manifolds and RPU (reservoir and pumping unit)



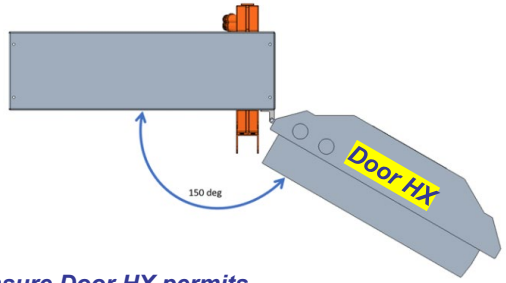
Provisions for airflow sealing and weight distribution

Hose lengths connecting ACS components



Keep outs required for mounting hardware

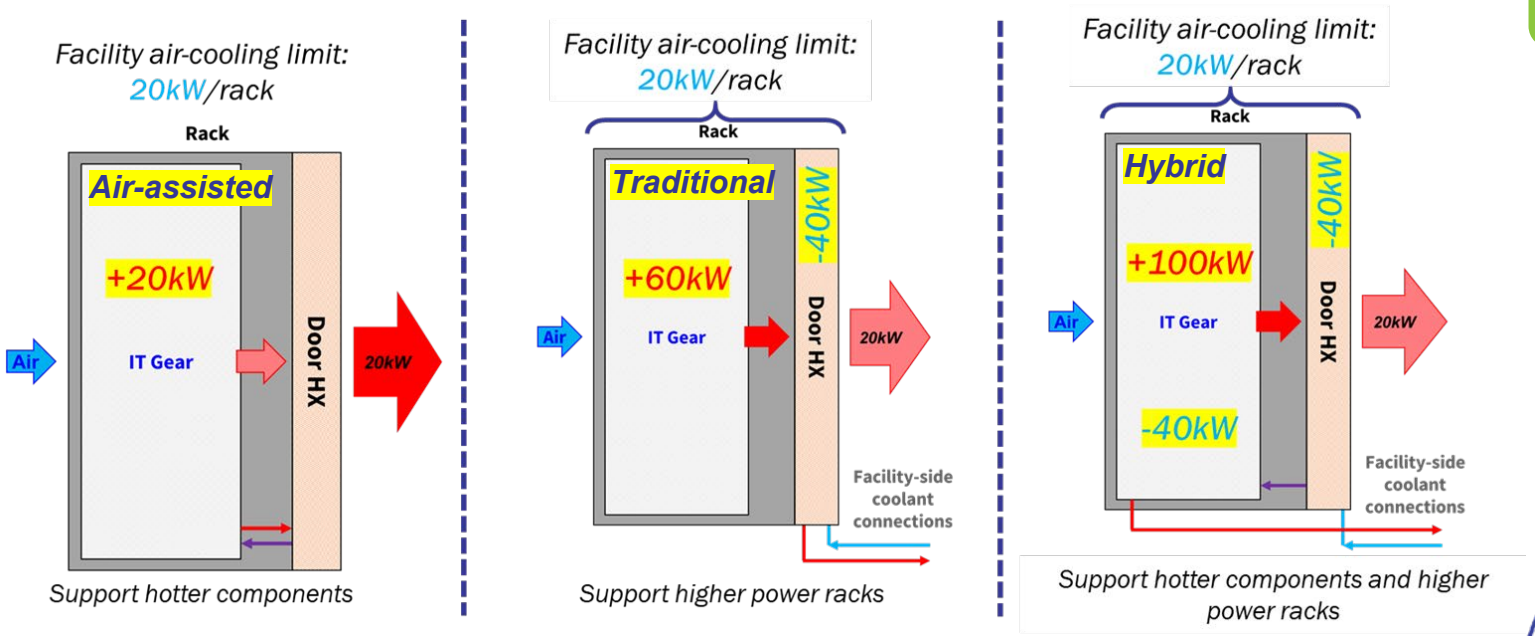
Open position to allow removal of manifold



Ensure Door HX permits access to or does not collide with other LC components

Potential Applications

- Dependent on type of facility: air-cooled or facility water enabled



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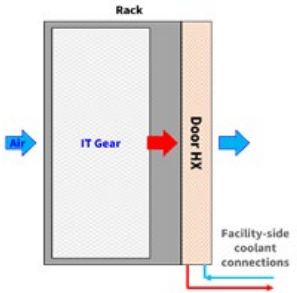
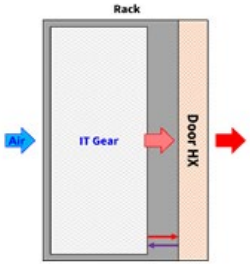
Community Study

Thermodynamic limitations of each technology

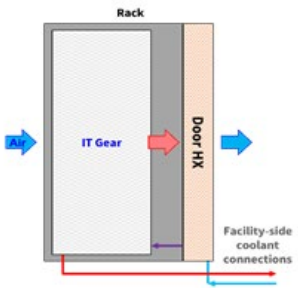
1. What happens when the power density of the racks is increased?
2. What are the limits of each solution?



Traditional



Air Assisted



Hybrid

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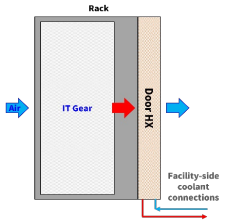
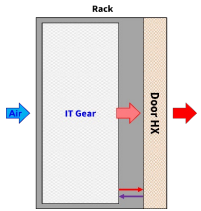
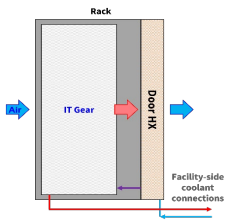
Thermodynamic limitations			
Technology			
	Traditional	**Air Assisted**	**Hybrid**
Consequences of server upgrades	More **power density** dissipated into the **air**	Greater **power density** dissipated into the **cold plates** and **air**	
Power density	**Medium density**	**High density**	**Very high density**
Limits	**Performance** limits on chip **heat sinks**	**Very high air flow rate** *Air velocities across servers and facilities*	**Air flow rate** *For cooling secondary components*
Challenge & Problem	Need to **reduce air** and **water temperature** Refrigeration **energy consumption increases**	**Upgrading of cooling facilities** **Maximum** regional **ambient temperature**	**Water connections** to the door
Efficiency	**Low** *Chiller required*	**Very high** *If only ambient air is used*	**High** *Using free cooling to cool the cold plates*

Community Study

Critical parameter bounds (short snippet)

Area	Specific Item	Air-Assisted	Traditional	Hybrid	Reference	Additional Comments
Air Temp.	Rack inlet	5~45°C (A4)	Door outlet air	Door outlet air	ASHRAE TC9.9 2015; A class definition	For a closed loop solution, does it make sense to go beyond A2 (10~35°C)? Considerations for maximum altitude of 3050m?
	IT outlet / Door inlet	Rack inlet air + 15 ~ 22.5°C (or fraction of the same)	Rack inlet air + Overall air deltaT	Rack inlet air + 15 ~ 22.5°C (or fraction of the same)	ASHRAE TC9.9 2016; DC power equipment thermal guidelines and best practices	Figure 7; Server deltaT projection at 35°C inlet temperature
	Door outlet	Rack inlet air + Overall air deltaT	Door inlet liquid + solution approach	Door inlet liquid + solution approach		
	Overall deltaT	IT: 15~22.5°C	*Depends on % of heat/IT load captured* *RDHX: 0°C (100% capture)*	*Depends on % of heat/IT load captured* *RDHX: 0°C (100% capture)*	ASHRAE TC9.9 2016; DC power equipment thermal guidelines and best practices	Figure 7; Server deltaT projection at 35°C inlet temperature

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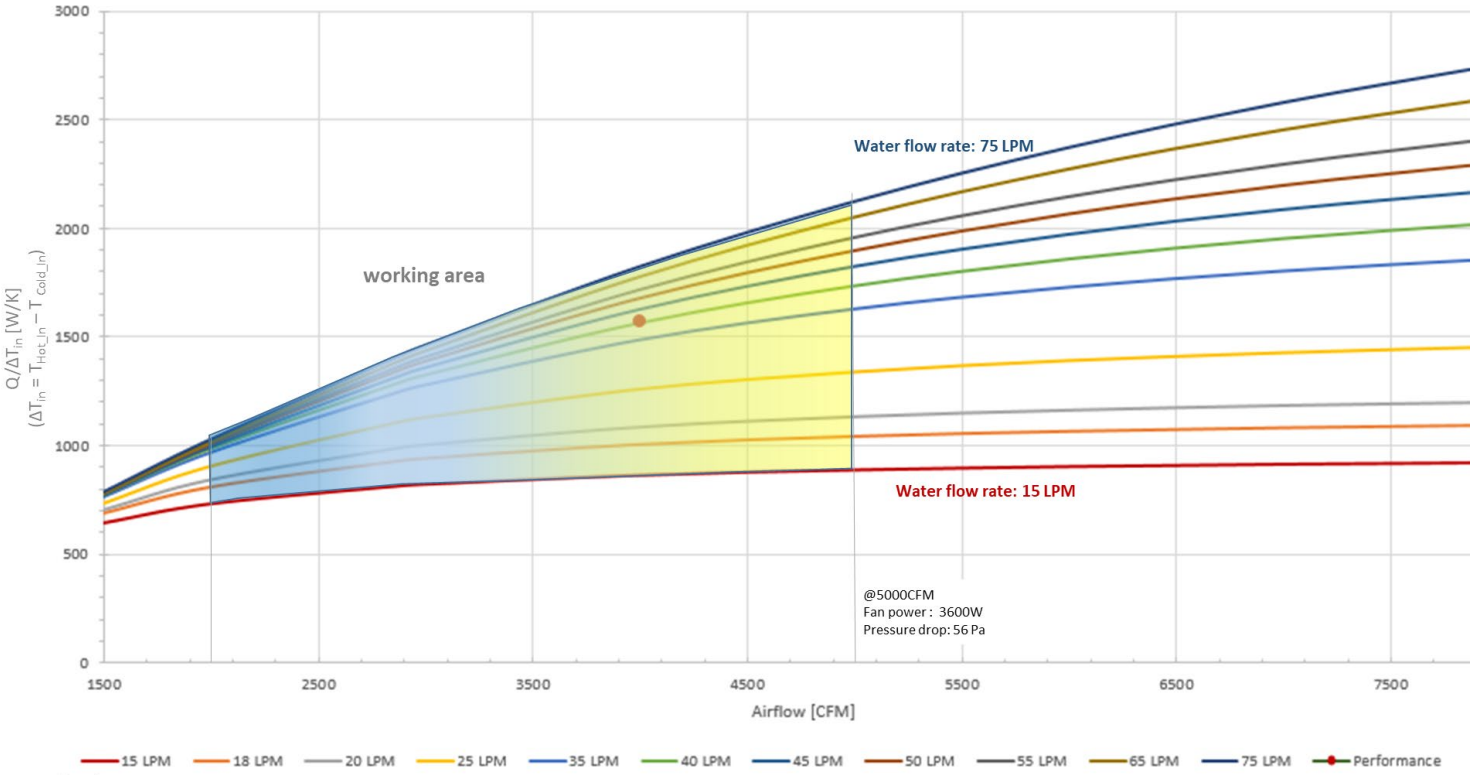

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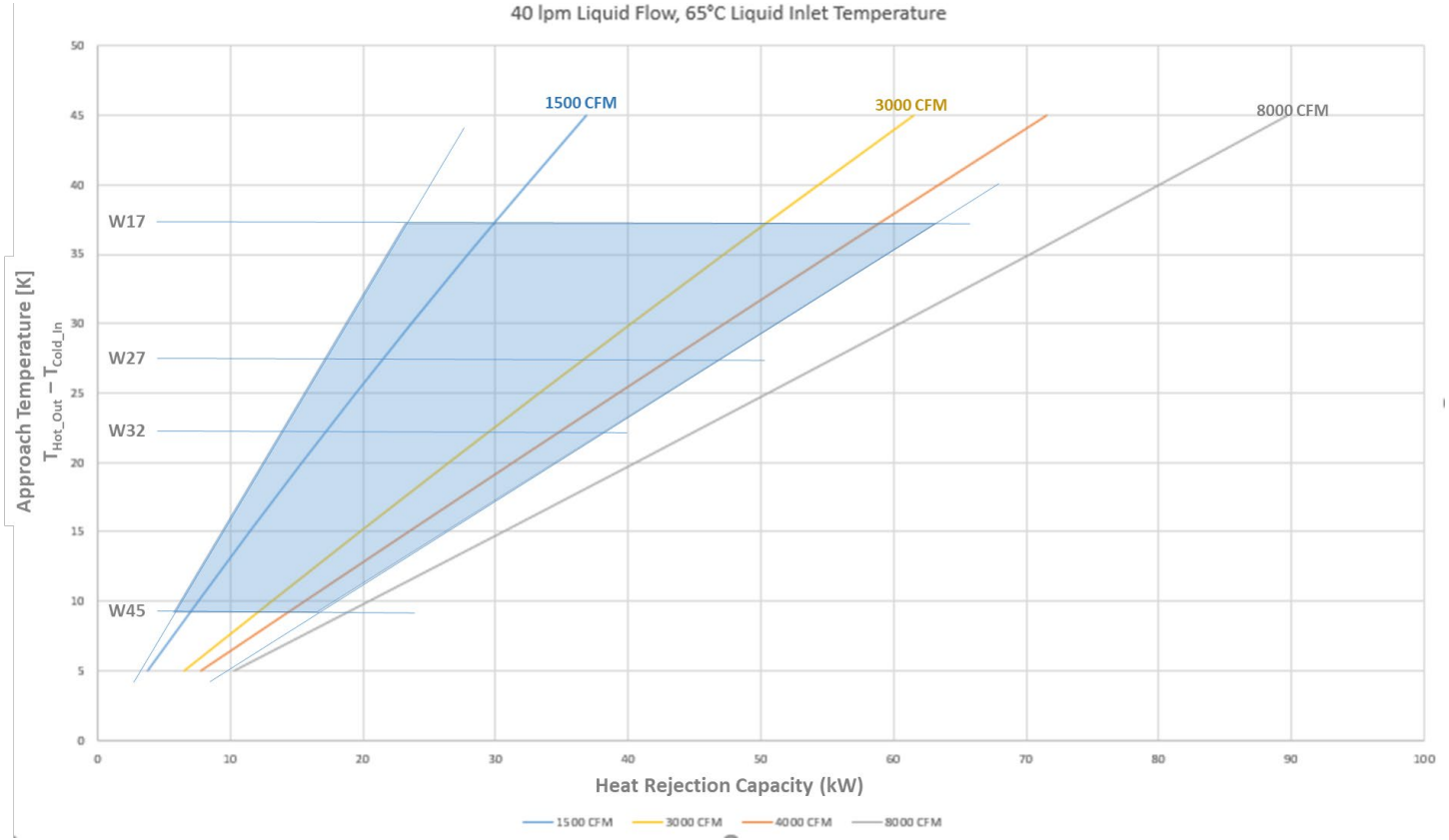

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Alternate representation of the previous chart/data

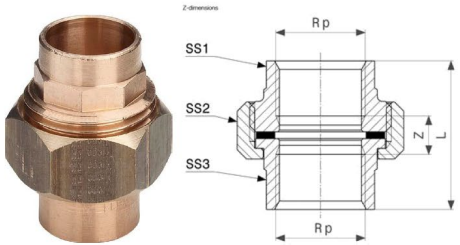
Call-to-action: Accurately capture impact of facility on cooling capacity

Harmonization Efforts

- [*ACF*] Standardizing FWS connections – deltaT, thread type

- Confirmation from sub-project
  - *deltaT*: Driven by multiple factors (desired capacity, coolant supply and air temps), but comfortable with a range of 7~13°C for water
  - *Thread type:* 'BSP – Parallel' is preferred to avoid leakage. Feedback on standardizing FWS connections shared (see below)

Screw nut connection



Sanitary tri-clamp

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Harmonization Efforts

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- [*ACF*] FWS compatibility – OCP Ready requirements for ACS
  - Pressure rating: 50kPa/7PSI (absolute) to 1000 kPa/150PSI (peak gage)
  - Water content: Plain water, treated water and glycol-water mixtures up to 50% should be supported
  - Water quality: Filtration and water quality management of FWS system follows guidelines of ASHRAE TC 9.9
  - FWS temperature: OCP Ready solutions' capacities shall be based on use of FWS temperatures *above dewpoint*

Supported by ACS Door HX requirements document; additional considerations for hybrid solutions

- [ACF] BIM content
  - Key Requirements to support construction and design evaluation (BIM LoD 350 or equivalent)
    - Revit RFA format
    - Specific geometry modeled (including clearances). 500KB-700KB target size
    - Connections for piping, power and drain (if applicable) modeled in dimensionally accurate locations and sizes
    - Electrical connections should have voltage, phase, kVA and load classification parameters as a minimum.

Interest in supporting; further engagement may be required

Call to Action

ADVANCED COOLING SOLUTIONS

- Open to input; get involved using the links below…
- Join the mailing lists
  - Advanced Cooling Solutions: https://ocp-all.groups.io/g/OCP-ACS
  - ACS Door HX Stream: https://ocp-all.groups.io/g/OCP-ACS-Door-Heat-Exchanger
- Project wiki
  - Main Rack & Power Wiki
  - ACS Door HX Wiki
- Biweekly calls on Thursdays at 9 AM PST

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Thank you!

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