



Liquid Cooling Hurdles: Kickoff, Call To Action

- Holistic Integration of Work Projects = Hurdle Plan
- What can Cooling Environments do better?
 - Collaboration communities
 - Key Hurdles to Address
- Call to action – Get Involved

Connect. Collaborate. Accelerate.



Overcoming Hurdles to Liquid Cooled ITE

Facility Hurdles

Connect. Collaborate. Accelerate.

<u>Liquid Cooled ITE Issues</u>	<u>ACF WorkProduct</u>	<u>DoorHX WorkProduct</u>	<u>Coldplate WorkProduct</u>	<u>Immersion WorkProduct</u>
Facility Challenges:	ACF1			
● Planning FWS Pipe Connections	ACF1			
● Pipe Route Planning	ACF1			
● CDU Planning	ACF1			
● Thermal Ride Through	ACF1			
● Service Level Agreement Impact	ACF1			
● Risk & Reliability Considerations	ACF1			
· FMEA	ACF1,			
· Inspection/Commissioning	ACF1, ACF2			
· Leak detection, protection	ACF1			
● Condensation Considerations	ACF1			
● Concurrent Maintainability	ACF1			
● Procedures - SOPs/MOPs & EOPs	ACF1			
● DfMA Delivery	ACF1			
* BIM Requirements	ACF1			
* Pipe Movement Accommodation	ACF1			
● Reference Design Requirements	ACF1	1 MW layout	1 MW layout	1 MW layout
* Form factor alignment	In progress			Input needed
* Floor loading	In progress			Input needed
* Delta T, Delta P compatibility	In progress	In progress	In progress	Input needed
● FWS Connection Standardization	ACF2			
· Leak detection, protection	ACF2, CP3			
TCS Challenges:				
* CDU Guidance	ACF1			
* TCS Leak Detection			CP3	
* TCS Connection			CP4	



Overcoming Hurdles to Liquid Cooled ITE

ACS Hurdles

<u>Liquid Cooled ITE Issues</u>	<u>ACF WorkProduct</u>	<u>DoorHX WorkProduct</u>	<u>Coldplate WorkProduct</u>	<u>Immersion WorkProduct</u>
<u>Door HX technology Issues</u>				
· OCP Compatibility				DHX1
· Tech Refresh, Expansion Method				TBD
· MOP/SOP				TBD
Connection to TCS			CP2	
<u>Cold Plate technology Issues</u>				
· OCP Compatibility			CP1	
· Tech Refresh, Expansion Method			TBD	
· MOP/SOP			TBD	
Connection to TCS			CP2	
<u>Immersion Cooled Technology Issues</u>				
· OCP Compatibility				IM1
· Fluid Material Compatibility				
· MOP/SOP/EOP				TBD
· ITE Tech Refresh, Expansion Method				TBD
· Fiber Connect Fluid Compatibility				IM2



Overcoming Hurdles to Liquid Cooled ITE Sustainability Focus

<u>Liquid Cooled ITE Issues</u>	<u>ACF WorkProduct</u>	<u>DoorHX WorkProduct</u>	<u>Coldplate WorkProduct</u>	<u>Immersion WorkProduct</u>
<u>Door HX technology Issues</u>				
· OCP Compatibility				DHX1
· Tech Refresh, Expansion Method				TBD
· MOP/SOP				TBD
Connection to TCS			CP2	
<u>Cold Plate technology Issues</u>				
· OCP Compatibility			CP1	
· Tech Refresh, Expansion Method			TBD	
· MOP/SOP			TBD	
Connection to TCS			CP2	
<u>Immersion Cooled Technology Issues</u>				
· OCP Compatibility				IM1
· Fluid Material Compatibility				
· MOP/SOP/EOP				TBD
· ITE Tech Refresh, Expansion Method				TBD
· Fiber Connect Fluid Compatibility				IM2

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Cooling Environment Work Product Index



Work Product #	Title	Link
<u>ACF1</u>	Guidelines for Connection of Liquid Cooled ITE to Data Center Facility Systems	https://docs.google.com/document/d/1h7dv_bP3Yc7ASUARkNXxz6P557mS3s6Ame8GH3vhfFw/edit
<u>ACF2</u>	ACS to FWS Connection Guidance	https://docs.google.com/document/d/1oo5rQCrzQ4KpPwr-nh7hsG_4NWUX-vCPsStZ9DQt5Y/edit
<u>DHX1</u>	ACS Door Heat Exchanger Requirements Document	https://docs.google.com/document/d/1NW-67-tXHGIt45aEbZn2ABGFXhM93IWPIgJaVsxLLxg/edit#heading=h.haapch
<u>CP1</u>	Cold Plate Reqs Rev 1	https://www.opencompute.org/documents/ocp-acs-liquid-cooling-cold-plate-requirements-pdf
<u>CP2</u>	Universal Quick Disconnect	https://www.opencompute.org/documents/ocp-universal-quick-disconnect-uqd-specification-rev-1-0-2-pdf
<u>CP3</u>	Leak Detection and Intervention	https://www.opencompute.org/contributions?query=leak%20detection&configure%5BfacetFilters%5D%5B0%5D=archived%3Afalse
<u>CP4</u>	Hose Manual Couplings	https://www.opencompute.org/contributions?query=Couplings%20and%20hose&configure%5BfacetFilters%5D%5B0%5D=archived%3Afalse&page=1
<u>IM1</u>	Immersion Requirements Rev2	https://www.opencompute.org/documents/ocp-acs-immersion-requirements-rev-2-v1-00-pdf
<u>IM2</u>	Material Compatibility	https://docs.google.com/document/d/1WbdRHFDugsbHnu-ISH887UX3cBdZAsRKZuVERfekr58/edit
<u>IM3</u>	Design Guidelines for Immersion-Cooled IT Equipment	https://www.opencompute.org/documents/design-guidelines-for-immersion-cooled-it-equipment-revision-1-01-pdf
<u>IM4</u>	Immersion qualification checklist (XLSX)	https://drive.google.com/u/0/uc?id=1-XnBAa8uDcivrPQkoEaxnBGHFysUln52z&export=download

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OpenCompute Cooling Environments Project

<https://www.opencompute.org/projects/cooling-environments>

- Advanced Cooling Facilities
<https://www.opencompute.org/projects/advanced-cooling-facilities>
- HeatReuse –
<https://www.opencompute.org/projects/heat-reuse-incubation>
- OCP-Immersion
<https://www.opencompute.org/projects/acs-immersion>
- OCP-Coldplate
<https://www.opencompute.org/projects/acs-cold-plate>
- OCP-DoorHX
<https://www.opencompute.org/projects/acs-door-heat-exchanger>

• Call to Action:

• Get in Involved!