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OCP
SUMMIT

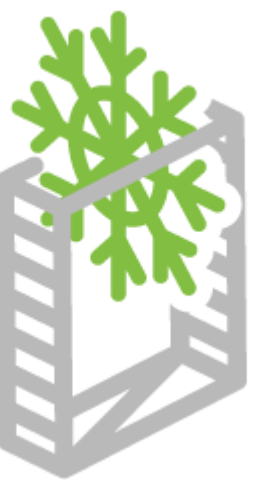


ACS Immersion Standards and best practices

Rolf Brink, Immersion stream leader, OCP



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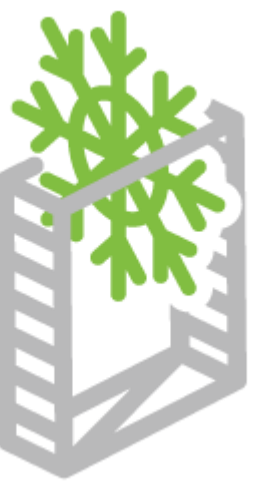
ACS Immersion goals

Define standards to allow immersion technologies in OCP

Most immersion technologies are unique in shape, size and solution approach

Standards must be inclusive to most solution types

Prevent limitations on new innovations



Technology differentiation

Single phase

- Hydrocarbons
- Fluorocarbons

Circulation method

- Pumps/natural flow

No/minimum evaporation

No/basic sealing

Dual phase

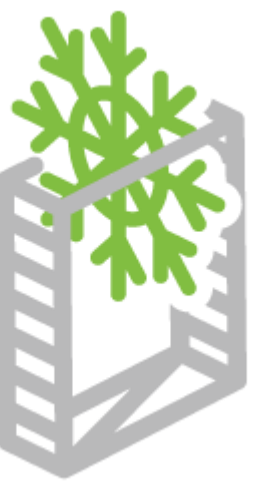
- Fluorocarbons only

Circulation method

- low-temperature evaporation/condensation

Evaporation by design

Sealing/pressure



Technology styles

Enclosed chassis

- Sealed per server
- Rack style

Cooling circuit

- Closed secondary
- Dripless connectors

Open bath

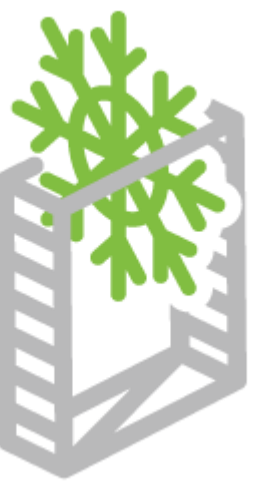
- Open liquid-air interface
- Tank style

Cooling circuit

- Direct or closed secondary
- Permanent fittings

Hybrid

- Varying designs




Certification compliancy examples

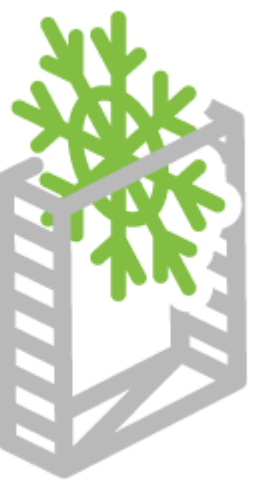
USA

-  • UL certification: Quality and safety standards
-  • FCC: electromagnetic interference below limits

EU

-  • CE marking: Conformity with health, safety and environment protection standards
- Machinery directive: If there are moving parts (lid!)

Safety

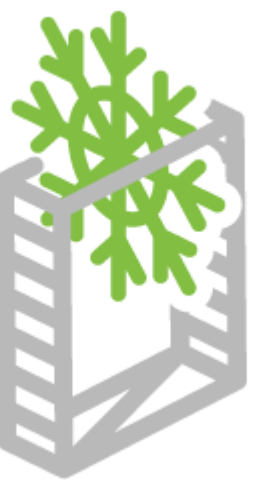


Safety for non-skilled operator

- Electrical systems shielded (High power systems!)
- Busbar protection
- No moving parts

Maintenance accessibility

- Electrical assembly
- Mechanical parts
- Instruments

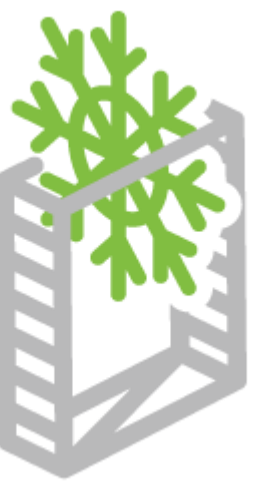


Liquid management

Risk assessments

Liquid containment standards (chemical industry standards)

- Ventilated rooms only
- Prevention of leakage into sewer or atmosphere
- Spill management/containment
- Thermal protection (over-pressure/evaporation)
- Documentation present (MSDS, TDS, containment etc)
- Trained personnel for chemical spill management



Feature classifications

Standard

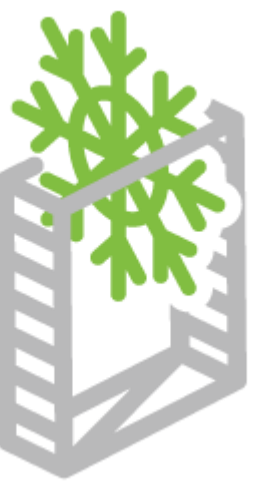
- Thermal sensors input & output
- Overheating alert
- Pump status

Thermal optimized

- Power input
- Water temp input/output
- Water flowrate monitoring
- Water flowrate ctrl

High safety

- Dielectric quality
- Volume detection
- Pressure sensing
- Full DCIM alerting and remote management
- False alarm prevention
- Pump/Power ctrl
- Auto shut-off



DCIM/Redfish integration

Statistics reporting (facilitate logging)

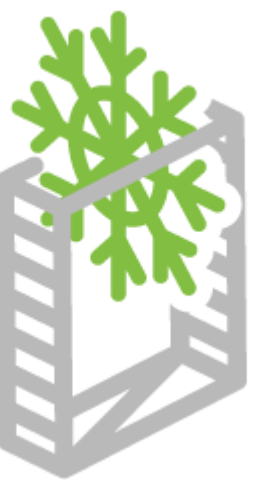
- I.e. On/off, flow, pressure, temperature, quality, volume, sensor status, etc.

Alarming

- I.e. Low, medium and high alerts

Control setpoints

- I.e. Temp, flow, power or water on/off, auto safety on/off, etc.



Comparable metrics based on SI

Distance: meters (m)

Surface area: square meters (m²)

Volume: Cubic meters (m³) or litres (l)

Power: Watt (W)

Temperatures: Degrees Celcius (°C)

Temperature Delta: Degrees Celcius or Kelvin (°C or K)

Pressure: Pascal (P) or KiloPascal (kPa)

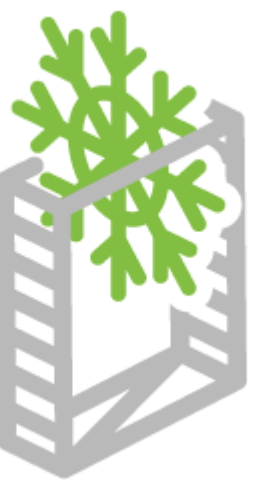
Flowrate: Volume per time index (m³/h, l/m, l/s)

Weight: Grams (g or kg)

Static load (construction): Newtons per square meter (kN/m²)

Thermal energy: Joules (J)

Comparisons – Solution descriptions



Rack type:

- Rack
- Tank

Solution type:

- Single-phase
- Two-phase

Liquid category

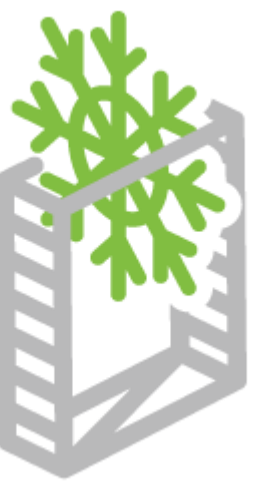
- Hydrocarbon
- Fluorocarbon

Liquid type

- Commodity
- Proprietary

Compliance (classifications)

- Standard
- Thermal optimized
- High safety
- (more classifications to be defined)



Density notes

Density claims should only refer to “verifiable” setups

Densities are influenced by:

- IT design
- Flow resistance
- Heat rejection surfaces
- Chip tolerances/thermal package designs
- Practical limitations

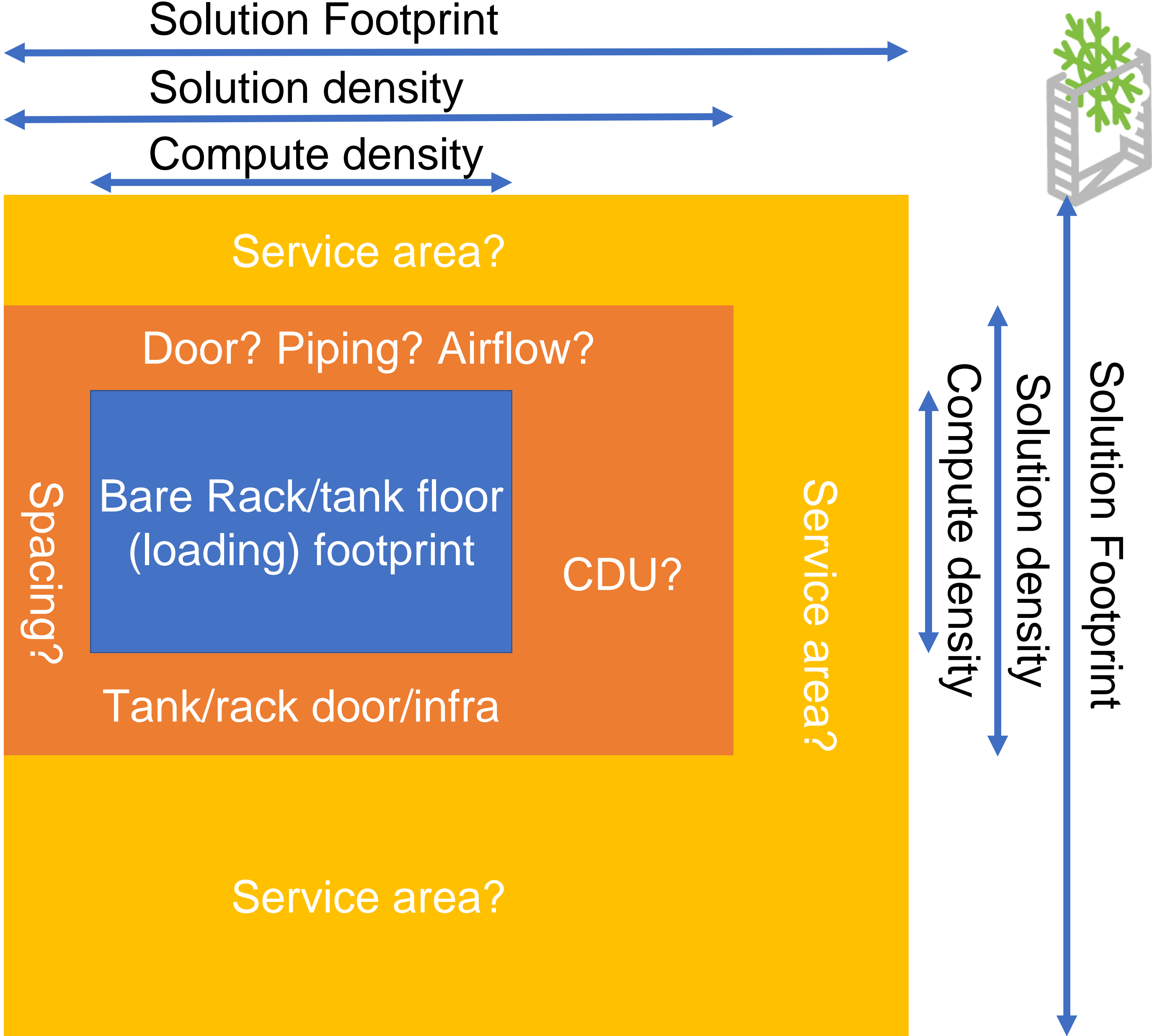
Density

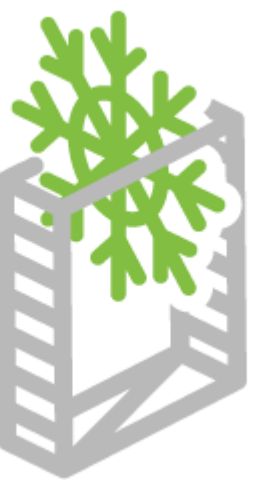
Highest practical density

- kW/m² @ #°C
- Compute density
- Solution density
- Solution footprint

***ASHRAE W3**
solution footprint

- kW/m² @ 32°C





Comparison metrics

Power/fluorocarbon volume

- kW/m³

Static load

- kN/m²
- Bare solution
- ***Full solution**
- IT solution

***Height clearance**

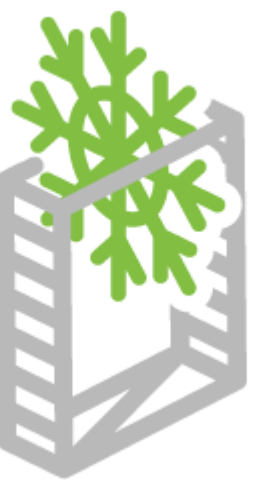
- mm (to ceiling)

Temperature delta min/max

- #/# °C (dT water)

Highest cooling supply tolerance

- # °C



Comparison metrics

Non-IT power/kW

- # W/kW_{IT}

Non-IT power overhead

- # W

Thermal loss to air

- # %

Chassis size

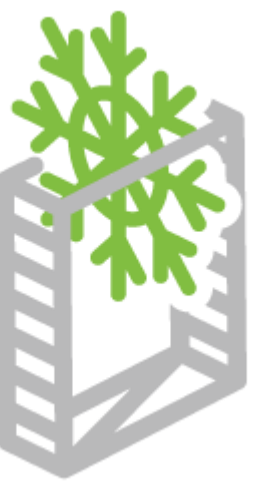
- #"

IT chassis type

- Enclosed
- Immersion-optimized
- Air

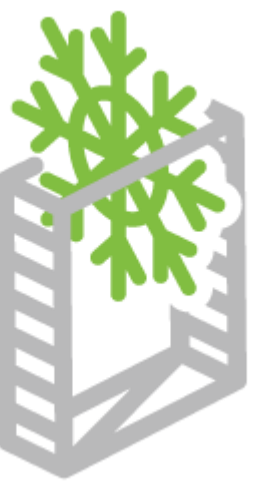
IT brand compatibility

- Agnostic
- Proprietary (list brand)
- Open design



Dielectric requirements

Property	Minimum req	Common
Dielectric strength over lifetime	>3 kV/mm (air)	>30 kV/mm
Flash point	>150°C	>200°C
Fire point	>200°C	>250°C
Auto ignition point	>250°C	>300°C
Odour (unsealed solutions only)	None	Slight
Sulphur content	<0,01 ppm	<0,001 ppm
Safe handling training level	Novice	Varying
Classification	Equal or less than H304 <i>(May be fatal if swallowed and enters airways)</i>	Equal or less than H304



Data center interface requirements

Input/output differentiation

- Blue/yellow-orange-red

Facility-side water quality management and filtration

- Higher requirements should be integrated

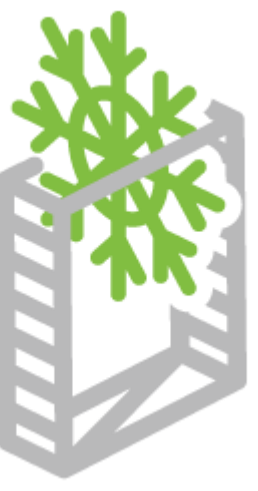
OCP facility infrastructure compatibility

- <800 kPa, 0-50% glycol and “basic” water quality mmt

Galvanic material properties (metallic only)

- +/- 0.15V to facility

Upcoming ACS Immersion activities



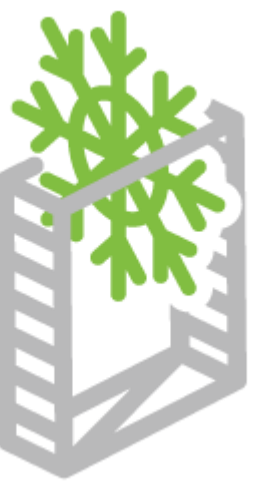
IT Gear

- Design guidelines for IT
- Liquid compatibility
- Thermodynamics
- Immersion components
- Future designs

Immersion systems

- New technology reviews
 - Solutions
 - Liquids

Industry standards optimization



Document links

Submitted spec

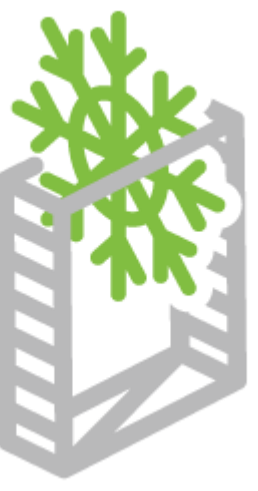
https://docs.google.com/document/d/1gsil4JE8BFKZEXUTiCmoJODc69q_UkqCVP1lq1CfO5k

Change/update suggestions

<https://docs.google.com/document/d/1vXaiFskJUy1zsOZZ8OsPFXnQw4xF08ZLYOlRiftcpc0>

Standards refresh schedule each 6 months

ACS – Immersion workstream



Join the immersion workstream and contribute!

Docs: [https://www.opencompute.org/wiki/Rack %26 Power/Advanced Cooling Solutions](https://www.opencompute.org/wiki/Rack_%26_Power/Advanced_Cooling_Solutions)

Mailing list: <http://lists.opencompute.org/mailman/listinfo/opencompute-acsimmersion>

Email: Rolf.Brink@OCProject.net

Bi-weekly, 10:30-11:30am ET, (next call March 19th)

Reschedule coming up

Next project: IT Gear specs, guidelines and best practices



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OCP Global Summit | March 14–15, 2019

