

ENGINEERING AND TECHNICAL FAQ

This section of FAQs is geared to mechanical/design engineers, HPC architects, reliability managers, compliance/quality managers, contractors, and MEP firms.

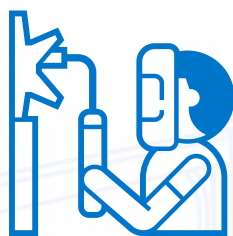
FABRICATION STANDARDS & MATERIALS

1. WHAT FABRICATION STANDARDS DO YOU FOLLOW FOR PIPING, FITTINGS, AND WELDS?

- ASME B31.3 for process piping design, fabrication, inspection, and testing.
- ASTM A270 for tubing quality.
- AWS-certified welders with orbital welding where geometry allows.
- Project-specific QC documentation and inspection records provided.
- Adaptable to additional hyperscale or OEM standards.

2. DO HYGIENIC WELDING PRACTICES MATTER IN DATA CENTERS?

- Yes — smoother welds reduce fouling, biofilm, and minimize crevices where corrosion can initiate.
- Practices drawn from food/pharma yield clean, leak-tight assemblies.
- Not full sanitary polish, but typical industrial piping data center fabrication quality.
- Supports longer service life and fewer leaks.



3. WHICH STAINLESS GRADES ARE RECOMMENDED FOR CDUS AND MANIFOLDS IN DATA CENTERS?

- 304 SS — standard for glycol/water loops (best balance of cost and resistance).

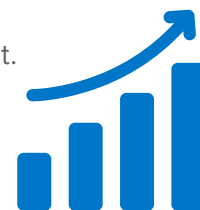
PRECISION TOLERANCE & QUALITY DATA

4. HOW DOES CSI ENSURE TOLERANCE REPEATABILITY AT SCALE?

- Tube-laser workflows and 3D-printed fixtures and jigs ensure consistency.
- Tolerance bands locked for OEM programs, set per-project for ETO builds.
- Gauge checks and dimensional inspections performed throughout fabrication.
- Inspection records provided at FAT turnover.

5. DO YOU TREND QUALITY AND TOLERANCE DATA OVER TIME?

- Inspection data logged per project.
- All products are built and inspected to the agreed-upon drawings and specifications.
- Statistical Process Control (SPC) available for OEM or volume programs.



CUSTOM DESIGN & INTEGRATION

6. CAN YOU DESIGN FULLY CUSTOM CDUS AND PIPING ASSEMBLIES?

- Yes — rack-level manifolds, CDU skids (2–10 MW/module), welded headers, and distribution.
- Custom layouts tailored to site density, footprint, and redundancy requirements.
- ETO and OEM programs supported.

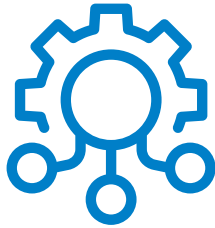
7. HOW DO YOU MINIMIZE SPACE CONSTRAINTS IN RETROFIT PROJECTS?

- Skids built up to 40 ft long with narrow clearances (~2 ft).
- BIM coordination ensures clash-free integration.
- AR/VR walkthroughs validate service access and maintenance.

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8. HOW DO YOU INTEGRATE WITH MEP ENGINEERS AND CONTRACTORS?

- Autodesk Construction Cloud used for clash detection and BIM integration.
- 30/60/90 reviews and detailed as-builts provided.
- Welded joints by default; flanges/tri-clamps where service is required.
- Prefab and FAT reduce on-site hours.



9. WHAT ADVANCED COOLING APPROACHES DO YOU SUPPORT?

- Direct-to-chip (D2C), direct liquid cooling (DLC), and immersion skids.
- Heat exchangers sized for low ΔP , improving pump efficiency and lowering total system energy use.
- Modular CDU architectures scale linearly with HPC rack density.
- Hybrid designs are possible for phased deployments.

10. CAN CSI ADAPT TO HYPERSCALE COMPLIANCE STANDARDS?

- Yes — QC, documentation, and component selection aligned per project.
- Experience adapting to internal standards across power, redundancy, vibration, and metallurgy.

LEAK PREVENTION & RELIABILITY

11. HOW DO YOU PREVENT LEAKS IN HIGH-DENSITY COOLING LOOPS?

- Orbital-quality welds with pulled-port manifolds (fewer joints vs. stacked tees).
- Hydrostatic and pneumatic pressure testing are performed before shipment.
- Annual gasket replacement intervals and clamp torque guidance provided.
- Custom leak-prevention strategies for high-pressure or vibration-prone sites.

12. DO YOU HAVE HISTORICAL LEAK RATE DATA?

- If the project requires leak testing, we will perform testing as part of the project and will provide documentation before shipping.
- Each CDU is hydro-tested and FAT-documented.
- Pressure test results and inspection records supplied with turnover.

13. HOW DO YOU VERIFY SYSTEM RELIABILITY BEFORE SHIPMENT?

- Hydrostatic testing to operating pressure.
- Optional pneumatic and helium leak testing when specified.
- FAT with simulated glycol/tower water.
- Customer-witnessed FATs available on any project.

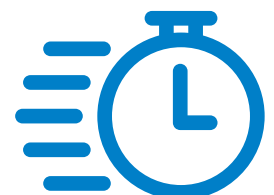
14. WHAT CONNECTION STRATEGIES REDUCE DOWNTIME?

- Default — welded connections (fewest leak points).
- Flanges used in high-vibration or service-critical areas.
- Tri-clamps where routine access is needed.

DELIVERY & CAPACITY SCALE

15. HOW FAST CAN CSI DELIVER ENGINEERED SYSTEMS?

- Same-day emergency builds executed in rare cases.
- Fast Fittings group delivers sketch-to-part in ~3 days.
- Lead time depends on scope and long-lead materials.
- Forecasting and multi-unit orders improve vendor priority. Get us the POs early, and we can help forecast and build the supply chain to manufacture and deliver your products.



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16. DO YOU STOCK PREFABRICATED ASSEMBLIES?

- No pre-welded assemblies.
- Large inventory of stainless steel and pump components for fast builds.
- Stocked compact CIP, pump carts, fittings, and installation material available.

17. WHAT SCALE CAN YOU SUPPORT FOR HYPERSCALE BUILDS?

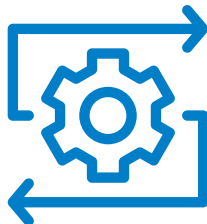
- 170,000 sq ft fabrication capacity.
- High-volume machining center for repetitive fittings.
- 100+ craftsmen and 40+ engineers for large-scale deployments.
- Proven track record of OEM and hyperscale programs.



AUTOMATION & REPEATABILITY

18. WHAT AUTOMATION ENSURES REPEATABILITY?

- Orbital welding wherever geometry allows.
- Tube-laser cutting and manifold pullers in use.
- Robotic welding under evaluation (adoption pending QC equivalence).
- Jigs and fixtures maintain consistency across batches.



QUALITY CONTROL AND COMPLIANCE

19. WHAT QC PROGRAMS ARE IN PLACE FOR MISSION-CRITICAL BUILDS?

- Baseline: AWS-certified welders, ASME B31.3 standards, staged inspections.
- Hydrostatic testing on all assemblies.
- Helium leak testing is optional when specified.
- Enhanced QC for skidded systems with full documentation packages.

20. CAN CUSTOMERS WITNESS INSPECTIONS OR FATs?

- Yes — audits, shop visits, and customer-witnessed FATs are encouraged.
- Turnover package includes dimensional records, hydro/pneumatic results, and O&M manuals.

21. DO YOU PROVIDE ONSITE STARTUP AND OPERATOR TRAINING?

- Yes. CSI supports startup, commissioning, and operator training for skids and assemblies.
- Documentation includes O&M manuals, test reports, and spares lists to support long-term reliability.
- A dedicated project manager and service team remain available after handover for ongoing support.



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22. HOW DO YOU HANDLE SCALING AND LARGE-CAPACITY DEPLOYMENTS?

- Modular CDU design: Our CDUs are engineered as modular building blocks, allowing linear scaling as rack density and site demand grow.
- Capacity range: Standard CDU modules cover ~2 MW up to 10 MW, but CSI can engineer larger single units when project requirements call for it.
- Multi-HX arrays: Instead of relying on a single oversized heat exchanger, CSI often designs arrays of multiple smaller HXs manifolded together. This approach improves:
 - Lead time (smaller HXs are faster to source)
 - Cost efficiency (avoids the premium of oversized units)
 - Serviceability (individual HXs can be maintained without taking the system offline)
 - Redundancy (if one HX is offline, the array continues to operate)
 - Resilience and lifecycle support: By combining modular CDUs and HX arrays, CSI balances scalability, redundancy, and ease of service —ensuring reliable growth paths for hyperscale and colocation facilities.



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