ENGINEERING DECISION ASSET

Copper LPBF RFQ and Qualification Checklist

A practical framework for pure copper and CuCrZr parts with internal channels, machined interfaces and evidence-based acceptance plans.

WHAT THIS NOTE DOES	WHAT IT DOES NOT DO
Converts a vague copper printing request into a review-ready engineering package: material identity, functional targets, geometry, powder removal, post-processing, inspection and commercial scope.	It is not a universal machine parameter set. Process windows remain dependent on alloy, powder, wavelength, machine, layer thickness, geometry, build plate, atmosphere and qualification evidence.

Prepared by	**Walter Chen | Copper3DP**
Scope	Pure copper, CuCrZr, metal powder, LPBF, machining and inspection
Project review	https://copper3dp.com/rfq/
Company	https://copper3dp.com/

1. Start with material identity, not the word 'copper'

Pure copper and precipitation-strengthened copper alloys solve different engineering problems. The quotation must preserve the requested grade, condition and property priorities.

Decision	Pure copper / Cu-OF family	CuCrZr family
Primary reason to select	Electrical or thermal conductivity, ductility and functional heat transfer.	A strength-conductivity balance, elevated-temperature stability and more robust structural duty.
Identity to record	Exact grade or purity basis, applicable designation and impurity/oxygen limits where relevant.	Exact alloy designation, composition basis and requested heat-treatment condition.
Acceptance targets	Conductivity or resistivity method, test temperature and direction; thermal property method when required.	Conductivity plus strength/hardness and condition-specific mechanical properties.
Common specification error	Writing only 'pure copper' without grade, state or property target.	Assuming the alloy name alone guarantees one fixed strength-conductivity combination.

Evidence boundary

- Published density, conductivity or strength values are valid only with their stated material, machine, wavelength, parameter set, orientation, heat treatment and test method.

- A single volumetric-energy-density value does not capture spot size, absorptivity, scan strategy, gas flow, heat accumulation or local geometry.

- Powder particle-size distribution must be tied to the process and recoating system. Do not transfer a DED or electron-beam feedstock range directly into an LPBF specification.

Source basis: Copper AM knowledge base (78 structured technical records; 196 independent URLs), verified 2026-07-16. The report intentionally uses decision rules instead of presenting a universal parameter window.

2. Qualify the machine-material-process system

The global equipment inventory is useful for finding candidates, but purchase or supplier approval must be based on current official evidence and a controlled acceptance build.

Qualification question	Evidence to request	Why it changes risk
Is this exact copper grade officially supported?	Current material data sheet, machine/material compatibility statement and the exact system configuration.	A generic 'copper' claim may mean an alloy, a research trial or a material outside the current commercial portfolio.
What is the energy-source configuration?	Wavelength, rated power, spot strategy, calibration state and qualified parameter revision.	Copper absorption and melt-pool behavior depend strongly on the complete energy-delivery system.
Can the envelope support the full process chain?	Usable build envelope, plate interface, support/access constraints and machining datum strategy.	Nominal XYZ size does not equal usable copper geometry after supports, gas flow and access are considered.
How is powder condition controlled?	Supplier and lot, chemistry/oxygen, PSD method, morphology, flow/density method, sieve history and reuse rules.	Powder condition affects spreading, stability, oxygen pickup, traceability and repeatability.
How is cross-contamination prevented?	Dedicated machine or documented changeover, cleaning verification and material-accountability records.	High-conductivity copper work can be sensitive to contamination and undocumented mixed-material handling.
What is the acceptance build?	A representative benchmark with channels, thin walls, machined faces and witness coupons; agreed test matrix before the run.	Capability evidence should reproduce the functional risks of the intended component, not just a density cube.

Inventory discipline

- The referenced equipment workbook is a public-information snapshot dated 2026-07-15. It retains active, transitional, pre-commercial, captive, uncertain and historical systems, but separates them by status.

- Current availability, ownership, software, service coverage, export controls, spare-parts support and local installation capability must be rechecked before procurement.

- Do not count a materials supplier, service bureau, reseller or captive process as a commercially available machine OEM without current official evidence.

3. Design internal channels as a manufacturing and inspection problem

A channel can be geometrically printable and still fail powder removal, machining access, leak testing, surface requirements or inspection coverage.

Design gate	What the RFQ should show	Review question
Function	Fluid, pressure, temperature, flow direction, allowable pressure drop, leak class and service environment.	What failure mode controls the design: heat transfer, flow, electrical duty, pressure or fatigue?
Geometry	Channel path, minimum section, transitions, manifolds, inlet/outlet interfaces, wall regions and revision-controlled CAD.	Are there abrupt changes, blind regions or orientations that trap powder or concentrate stress?
Powder removal	Drain/escape route, access ports, permitted cleaning method and acceptance evidence.	Can residual powder be removed and demonstrated without destructive access?
Machining	Datums, stock allowance, threads, sealing faces, connector fits and surfaces that may remain as-built.	Can the part be located, clamped and machined without distorting the functional geometry?
Inspection	CT or alternative NDT coverage, leak/pressure test, flow test, roughness requirement and dimensional plan.	Is every critical internal feature observable by an agreed method?

DfAM review prompts

- Mark all sealing surfaces, threads, datums and electrical contact faces separately from general as-built surfaces.
- State whether internal roughness is a functional limit or a reporting value; define the accessible measurement method.
- Identify any sacrificial access, plugs or welded closures and include them in the leak and cleanliness plan.
- Review supports, heat flow, gas-flow exposure and recoater risk together with the chosen build orientation.
- Link each proposed post-process to a measurable requirement; avoid automatic HIP, polishing or heat treatment without a functional reason.

4. Build four quality gates into the quotation

Monitoring data supports traceability, but it is not automatic proof that the finished component meets dimensional, material or functional requirements.

Gate	Minimum controlled records	Typical verification
1. Feedstock	Supplier, lot, chemistry, oxygen, PSD method, morphology, flow/density method, packaging, sieve and reuse history.	Certificate review plus project-specific incoming checks under an agreed powder framework.
2. Machine and build	System ID, calibration, optics/energy source, gas flow, plate, parameter revision, operator, maintenance, oxygen/dew-point trend and build log.	Witness coupons, layer records and deviation review connected to the qualified configuration.
3. Post-processing	Stress relief/solution/ageing or HIP cycle, furnace/batch, support removal, machining setup, cleaning and finishing records.	Condition confirmation, dimensional compensation, surface and cleanliness verification.
4. Finished component	Serial/lot traceability, dimensional result, internal-defect method, material properties and functional tests.	FAI, CT or agreed NDT, conductivity/resistivity, leak/pressure/flow test and applicable mechanical evidence.

Requirement	Define before quotation
Electrical conductivity	Target or reporting-only status, temperature, direction, specimen/part location and test method. ASTM B193 is a common reference for conductor resistivity.
Thermal performance	Whether thermal diffusivity, conductivity or a component-level thermal test is required; state test temperature and orientation. ASTM E1461 is a common flash-method reference.
Internal integrity	CT resolution/coverage or alternative NDT, acceptance logic, regions of interest and how indications are classified.
Leak and flow	Medium, pressure, hold time, sensitivity/allowable leakage, proof versus burst boundary and whether flow/pressure drop is acceptance-critical.

5. Minimum RFQ package

The quickest route to a defensible quotation is a controlled package that separates functional must-haves from negotiable design choices.

Module	Required information	Status
Geometry	STEP/Parasolid/STL, units, revision, design-change permission, critical dimensions, tolerances and assembly datums.	**Required**
Function	Thermal/electrical targets, service temperature, loads/cycles, fluid, pressure, flow, allowable drop and leak requirement.	**Required**
Material	Exact pure-copper grade or alloy designation, property priorities, composition/powder restrictions and equivalence rules.	**Required**
Channels	Minimum section, path, access, powder-removal plan, roughness requirement and CT/flow coverage.	**If applicable**
Post-process	Heat-treatment condition, HIP rationale, machining stock, sealing faces, threads, finishing, cleaning and packaging.	**Required**
Quality	FAI, material tests, conductivity/thermal tests, NDT, leak/pressure/flow test, certificates and traceability package.	**Required**
Commercial	Prototype and annual quantity, batch size, delivery destination, milestones, NDA/data rules and quotation breakdown expectations.	**Required**

Submit the controlled project package for a Copper LPBF feasibility review:
https://copper3dp.com/rfq/

Quotation note: prototype and small-batch pricing is normally driven by engineering setup, build allocation, powder/plate, post-processing, cleaning, machining, testing and documentation - not powder mass alone.

6. Evidence and maintenance notes

Selected primary sources used by the supplied knowledge base. Links below are clickable. Standards should be checked for the edition contractually required by the project.

1. ISO/ASTM 52900:2021 - Additive manufacturing fundamentals and vocabulary
https://www.iso.org/standard/74514.html

2. ISO/ASTM 52904:2024 - Metal powder bed fusion process for critical applications
https://www.iso.org/committee/629086/x/catalogue/p/0/u/1/w/0/d/0

3. ISO/ASTM 52907:2019 - Feedstock materials characterization for metal AM
https://www.iso.org/standard/73520.html

4. ISO/ASTM 52908:2023 - Post-processing, inspection and testing of metal PBF parts
https://www.iso.org/standard/81779.html

5. ASTM B193 - Resistivity of electrical conductor materials
https://store.astm.org/standards/b193

6. ASTM E1461 - Thermal diffusivity by the flash method
https://store.astm.org/e1461-13.html

7. NIST - Powder Bed Fusion research and metrology
https://www.nist.gov/additive-manufacturing/research-areas/technologies/powder-bed-fusion

8. ASTM - Design guidance for powder bed fusion metals
https://www.astm.org/news/design-guidance-powder-bed-fusion-metals-ja22

Maintenance mechanism

- Recheck all outbound links and standard editions at least quarterly, and before reusing this checklist in a regulated or contract-critical project.

- Update machine/material availability from official manufacturer pages rather than discovery directories.

- Record revisions to the RFQ, material state, parameter set, inspection plan and acceptance evidence as one controlled project package.

Prepared from the user-supplied Copper AM knowledge base (version 2026-07-16) and global metal AM equipment manufacturer inventory (snapshot 2026-07-15). Public company scope is limited to copper, titanium alloys and metal powders; this asset focuses on copper LPBF.