

Terms & Conditions

1. Scope of Work

The scope of work involves development of LME sub scale thrust chamber through LPBF process with Cu Cr Zr material of the following

Sl. No	Description	Quantity	Drawing/Model
1	Subscale TC	2 Nos	As per model attached
2	Specimens (12 in H & V directions)	16 Nos	LPSC/MME/AML/TTS/Flat/RT – Sl.No. 1

2. Responsibility of the vendor

2.1. **Preprocessing:** Decision on orientation & supports, generation of slices conversion to machine format for 3D printing and generation of inspection parameters.

2.2. **Allowances:** In order to achieve better dimensional tolerances and surface finish of hardware, extra shock of material shall be printed on all locations and subsequently, the hardware shall be machined to meet the requirements.

2.3. Material:

2.3.1. Cu Cr Zr metal powder shall be used for realisation of hardware and specimens.

2.3.2. Powder should be inert gas atomized / any other suitable technique that result in output suitable for LPBF. The vendor shall share the material data sheet from the powder supplier.

2.3.3. The vendor shall report the Particle size distribution and mean particle size, flow ability, apparent & tap density and chemistry of the powder.

2.3.4. Blending of used powder is allowed provided that it meets the properties range of optimized powder. Used / Blended powder shall be characterized for each run. It is preferable to use virgin powder for realisation of parts and specimen.

2.4. Additive Manufacturing:

2.4.1. Additive manufacturing of plates & specimens as per approved models to near net shape. Same process parameters or manufacturing strategy and machine shall be used for realisation parts.

2.4.2. The identification of specimen should be printed on the parts & specimen.

2.5. **Heat Treatment:** The parts shall be supplied in heat treated conditions as mentioned below. Heat treatment shall be carried out with the baseplate in a qualified furnace as per AMS 2750 Class IV.

Sl. No	Heat Treatment	Temperature	Soaking	Cooling	Remark
1	Solution Treatment	980 °C	30 min	Water cool	All items

3. Inspection & Acceptance

- 3.1. 100% dimensional & visual inspection of parts shall be carried out as per drawings/models.
- 3.2. LPSC will carry out the mechanical properties' evaluation at Ambient temperature, NDT (DP & RT) and chemical analysis on specimens & parts.
- 3.3. The metal powder and test coupons shall have the following chemical composition of Cu Cr Zr.

Cr	Zr	Si	Fe	Cu
0.5 - 1.2	0.03 - 0.3	0.1 max	0.08 max	Balance

- 3.4. The mechanical properties at ambient temperature (Heat Treated conditions - STA) of test coupons shall be comparable with the mechanical properties as tabulated below

UTS (MPa)	0.2% YS (MPa)	% EL
300	200	30

- 3.5. DP testing will be performed after post processing and 100% in accordance with the standard ASTM E1417. No surface defects are permitted.
- 3.6. X-ray radiography inspection will be carried out in accordance with ASTM 1742. Acceptance criteria shall be as per the requirements given in the below table.

Sl.No	Defects	Acceptance limits
1	Porosity	0.33t or 1.52 mm, whichever is less
2	Inclusions	Up to the extent of pores
3	LOF defects, Cracks & other linear indications	Not permitted
4	Shrinkage defects	Not permitted
5	Un consolidated powder & Trapped powder	Not permitted
6	Layer & Cross layer	Not permitted
7	Porosity & Inclusions accumulated	1.33 t or 6.1mm, whichever is less in 76.2 mm ²
8	Spacing between pores & inclusions	3 times of larger discontinuity

't' denotes thickness under inspection

- 3.7. The hardware supply shall be accompanied with relevant inspection reports. The finished product shall be dispatched only after clearance by LPSC.

4. Responsibility of LPSC

- 4.1. LPSC will provide the 3D model for Additive manufacturing
- 4.2. LPSC will provide clearance for realisation after reviewing the model for Additive manufacturing and manufacturing process plan supplied by the vendor.
- 4.3. LPSC will perform pre delivery inspection. Vendor has to inform the readiness to focal point of LPSC in advance

5. Focal Point

The focal point from both the vendor and LPSC for this work shall be identified in the purchase order. Any technical clarification needed shall be referred to the Focal point of LPSC, identified for this purchase order.

6. Delivery Period

The realisation and delivery shall be completed within 3 months from clearance for fabrication.

7. Free Issue Materials

There is no Free Issue Material for this purchase order.

8. Rework:

Any rework that may be required to maintain the specified quality level (clause-3) shall be carried out by the contractor free of cost with due intimation & approval from LPSC. Details of reworks shall be furnished in the QC documents. After rework, the relevant dimensions shall be re-inspected and hardware with non-acceptable deviations shall get rejected, if it is not complying the quality requirements as per clause 3.

9. Rejections

In case of any rejections due to non-compliance to clause 3, vendor shall replace the item free of cost.
