

## Terms & condition

### (Fabrication of Ti6Al4V PS4 liners)

**1. Scope of work:** The work involves fabrication and supply of PS4 liner(2nos) using T6Al4V material supplied by VSSC.

**Work description:**

Major scope of work includes-

- a. Generation of manufacturing process plan.
- b. Fabrication of Tools & fixtures
- c. Machining of hemispheres of Ti forging to 5.45mm with intermediate vacuum stress relieving 550 deg C for 2 hr
- d. Machining of hemispheres to 1.45mm
- e. Machining of test ring
- f. Chemical etching Electron beam welding of test ring & NDT
- g. Electron beam welding of hemisphere
- h. Non-destructive testing of liner (Radiography test/Fluorescent penetrant test(FPI))
- i. Bead shaping
- j. Inspection including UT thickness gauge & profile template inspection
- k. Fluorescent penetrant test(FPT))
- l. Packing & forwarding

Work is to be done in accordance with following annexures:

- a. Design Drawings for PS4 liner - Annexure – I (B)
- b. Bill of free issue material (FIM) for PS4 liner - Annexure – II (B)
- c. Process and QC document for acid pickling of Titanium alloys (MME/ST/PQD/APTi/01/09) – Annexure – III
- d. Quality requirements for fabrication of Titanium liners (QDMF/146/QCR/02 Dt.08-09-2000) and MME/QCG/QIT/NDTF/QCP-01 dated 01-02-2015 Annexure IV.
- e. Chemical Cleaning Procedure for Gas bottles (Doc Ref.: CC/ST/LBF/IFAB/2001 ISSUE 15.12.06) - Annexure-V

Minor modification in the drawing during execution phase shall be accommodated by the fabricator without any additional financial implications on the part of the Department.

## **2. Free Issue Material (FIM)**

- 2.1 The Department shall supply as qualified free issue material (FIM )Ti6Al4V titanium alloy forging in annealed condition to the vendor for dome manufacturing as per Annexure-II(B).

- 2.2 All the materials and consumables required for the fabrication except free issue materials as shown in Annexure-II (B) shall be taken from the stock of the Contractor. No extra costs, whatsoever, shall be payable by the Department for such materials.
- 2.3 Contractor shall keep the free issue materials in safe custody & shall take all precaution during storage, handling as mentioned in Storage plan.
- 2.4 No charges shall be payable by the Department towards the storage and safe custody of materials.
- 2.5 All materials / components, test rings getting rejected during fabrication shall be segregated and stored for eventual return to the Department along with a statement showing the items rejected and reasons for such rejections.
- 2.6 Contractor shall prepare & submit to the Department, annual material consumption statement duly certified by the Engineer of the Department.

### 2.7 **BANK GUARANTEE**

The value of free issue material (FIM) to be supplied by the Department is **Rs. 12 Lakhs per assembly**. Contractor shall provide an unconditional bank guarantee from a Nationalized Bank towards the value of free issue material.

- 2.8 Contractor shall receive, unload, store and account for all free issue material of the Department, which will be delivered at Contractor works, freight paid. Any drawals of free issue materials from the said stock shall be duly documented. The usage of materials shall be as specified in the approved process sheet.

## 3. Facilities

- 3.1 All facilities required for realization of the hardware shall be either available or have to be established by the vendor before taking up this work

### 3.2 **Facilities required:**

- a) Facilities required are CNC turning centre Lathe, Heat Treatment facility, EBW facility, CMM inspection, UT thickness gauge, Mechanical testing facility, Grinding & polishing facility, X-Ray Radiography, FPT facility, Video-scopy inspection facility.
- b) Contractor shall up-keep the above facilities for meeting the job requirements and quality protocol.

In case vendor doesn't have facilities and outsourcing of any activity is planned, the same is permissible only if such source is a proven one and has adequate experience and expertise to carry out the work. The Department shall critically assess such facilities and may accept or reject the sources based on their credibility for carrying out the assigned task without affecting the delivery schedule.

- c) **Essential facility requirement-** Among above facility, followings shall be essentially available at vendor's end.

- i. CNC turning centre Lathe
- ii. CMM inspection
- iii. UT thickness gauge inspection
- iv. Electron beam welding (EBW) facility
- v. X-Ray Radiography, FPT facility

#### **4. Fabrication process in brief for PS4 Liner:**

- a) Realization of all tools and fixtures required for the execution of product.
- b) Machining of hemispheres of Ti forging to 5.45mm and vacuum stress relieving 550 deg C for 2 hr
- c) Final machining to the required specification as per design drawings (1.45mm thickness) & Dye penetrant test.
- d) Thickness profile inspection using CMM at four sectors at various angles from center axis of dome. 16 reading at each 4 generator thickness mapping is required. (Total 64 locations).
- e) Establishing the WPS (EBW) for 3mm thick hemispherical joint for liner.
- f) Chemical etching the weld zone prior to EBW (Ref. annexure III)
- g) Electron beam welding of test rings for process qualification of each batch of liner assembly. This test ring shall be qualified by 100% RT. In case of defect, another set of test ring is to be qualified prior to start of liner welding.
- h) Test rings are to be welded for evaluating the mechanical properties of all liners (Each hemisphere of the liner assembly is to be represented by respective rings).
- i) 100% RT & FPT of the test ring is to be carried out.
- j) PDPTRC review & clearance for welding
- k) EBW of hemispheres.
- l) 100% RT of liner & FPT of liner.
- m) Inspection of inside surface of liner assembly by videoscropy after EBW.
- n) Preparation of Tensile Test specimens (four specimens are to be tested from each test ring. Additional test specimens are to be tested from defect locations and also from specific area of interest)
- o) Mechanical testing of the specimens as per ASTM.
- p) Bead machining on lathe to maximum achievable limit.
- q) Manual grinding / polishing of bead profile to achieve the required profile dimensions. This process is to be well controlled to avoid low thickness, abrupt profile variation, excess thickness, etc.

- r) FPT of liners (Reference established during profile measurement is to be retained).
- s) Inspection of hemispheres and liners.
- t) Profile inspection using template
- u) PDPTRC review & clearance for welding
- v) Packing and forwarding in water proof wooden containers
- w) All the details of the processes, quality control procedures and inspection observations, right from raw-material to the finished product, shall be documented and recorded. Traceability of every hardware being manufactured shall be available at any time and easily verifiable.

## **5. FUNCTIONAL REQUISITES OF THE MANUFACTURER FOR EXECUTION OF CONTRACT**

### **5.1 MANUFACTURING DRAWINGS AND PROCESS SHEETS**

- 5.1.1 On receipt of the order, manufacturing drawings and process sheets shall be prepared / updated on account of a) revision, if any, in the design drawings b) work augmentation/improvement for all components and assemblies based on the requirement.
- 5.1.2 Five sets of all the manufacturing drawings and process sheets shall be submitted to the Department immediately on approval of these drawings by the Department.
- 5.1.3 Any further modification in the manufacturing drawings and process sheets shall be made only with the approval of the Department.

### **5.2 TOOLING**

- 5.2.1 Tools and fixtures required for the fabrication of the hardware shall be designed, fabricated and qualified. No tools shall be supplied as free issue by the Department.
- 5.2.2 Four sets of such tool drawings shall be submitted to the Department immediately on receipt of order.
- 5.2.3 All tooling(s) shall be inspected and qualified by Contractor before use. The Department shall identify specific tooling(s) like inspection templates, which shall be used by Contractor only after approval by the Department.

### **5.3 CUSTODY OF TOOLING AND DOCUMENTS**

- 5.3.1 All the tooling shall be the exclusive property of the Department. A consolidated list of tooling(s), fixtures, gauges and templates to be used against the order shall be prepared and submitted to the Department.

- 5.3.2 Contractor shall ensure that the tooling(s) is kept in working condition while in their custody and shall return the same, in good working condition, to the Department.
- 5.3.3 Contractor shall not use the tooling(s) as in clause 5.3 for the fabrication of any other identical jobs in the works of Contractor or elsewhere. These tooling(s) shall be used only for the jobs covered in this Order.
- 5.3.4 No charges shall be levied on the Department towards the custody and up-keep of tooling

#### **5.4 INSPECTION AND QUALITY ASSURANCE**

- 5.4.1 Inspection and quality assurance procedures and acceptance standards at various stages of fabrication shall be as per the Department guideline.
- 5.4.2 Contractor shall be responsible for all quality specifications of the product. Complying with quality requirements and carrying out inspection at various stages like material receipt, fabrication, assembly and testing shall be in the scope of Contractor.
- 5.4.3 Quality Surveyors of the Department shall cross-check and review inspection procedures and ensure adherence to the quality control stipulations. Clearance from the Quality Surveyor of the Department shall be obtained for all mandatory inspection stages.
- 5.4.4 Contractor shall make available to the Department all inspection records and documentation such as dimensional inspection reports and calibration records and other QC related reports in not less than four copies of each, hard bound.
- 5.4.5 Contractor shall maintain a shop inspection logbook to record detailed in-process inspection data and observations. The same shall be accessible to the Department at any time.
- 5.4.6 The Quality Surveyors of the Department shall have access to the jobs at any time, at any place, in Contractor's premises, where such work is carried out.

#### **5.5 ACCEPTANCE AND REJECTION**

- 5.5.1 Responsibility of acceptance and / or rejection of all the components at various stages rest with the Department.
- 5.5.2 The final acceptance of the hardware shall be based on the hardware meeting the
- (i) Drawing specifications
  - (ii) All quality specifications of the Department

## **5.6 REJECTION AND REPLACEMENT**

- 5.6.1 Materials required for replacement of any components getting rejected during fabrication, mutually established due to any inherent defect in the material, shall be replenished free of cost by the Department. The labor cost incurred by Contractor on such components shall be reimbursed by the Department after mutual negotiations.
- 5.6.2 Issue of materials by the Department for replacement of any component rejected during fabrication, when such rejection is mutually established as due to negligence, defective fabrication/defective workmanship and/or machinery/equipment of Contractor shall be made as under:
- (i) Free of cost up to the limit of 5% (five percent) of the total value of Free Issue Materials required for this Order.
  - (ii) On chargeable basis for material over and above the limit specified at clause 5.6.2 (i) above, provided that the cost of materials shall be estimated by the Department and their decision shall be final. Labour charges incurred on such rejected components shall not be payable by the Department.

## **5.7 DELIVERY**

The delivery schedule for completed hardware shall be as follows:

- 5.7.1 Delivery of the first PS4 liner shall not be later than six months from placement of order or from the date of supply of free issue material for the hardware whichever is later. Delivery of the subsequent hardware shall be at two months' interval after the scheduled delivery of the first hardware.
- 5.7.2 If the free issue material for any set of hardware is not supplied in full, the delivery of that set shall be within three months of supply of free issue materials for that set.

## **5.8 CHANGES AND MODIFICATIONS IN SPECIFICATIONS AND QUALITY REQUIREMENTS**

Minor changes in the quality requirements, specifications, drawing revision, etc. shall be made during the execution of the order. Such modifications shall be accommodated by Contractor at no extra cost to the Department. Any change in drawing revision during fabrication, shall be implemented by Contractor and latest drawing revision shall only be referred since such change. Cost implication of major changes in specifications/drawing, if any, can be mutually discussed and agreed upon.

## **5.9 PACKING, FORWARDING**

- 5.9.1 Contractor shall arrange for packing of all fabricated hardware in suitable packing cases.
- 5.9.2 Necessary wooden packing containers shall be manufactured by Contractor for this purpose.
- 5.9.3 Threads shall be necessarily protected with suitable caps during all stages of transportation including transfer for welding, NDT, etc.
- 5.9.4 Packing & dispatch as described in clause 5.9.1, 5.9.2 & 5.9.3 shall be done by Contractor without any extra cost to the Department.

## **5.10 TRANSPORTATION**

The Department shall collect the packed hardware from Contractor stores after issue of dispatch clearance by the Department.

## **6. WARRANTY**

Contractor shall remedy or rectify at his own expense any defects solely attributable to materials or faulty workmanship, that may appear in items fabricated under this Order, within twelve months from the date of acceptance of items.

## **7. INDEMNITY**

The Department shall have no claim against Contractor for damage suffered by it after acceptance and shall indemnify the Manufacturer in respect of any claim for damage to third parties. However, Contractor shall be required to indemnify the Department for any damage to the Department or to third parties whenever such damage arises from gross negligence on Contractor's part. Should a third party make a claim, the party claimed against shall, whenever the other party to the Order is required to bear the cost of the indemnity, be co-defendant in the proceedings.

## **8. PATENTS AND REGISTRATIONS**

It shall not be open to Contractor to attempt to acquire any ownership rights by patenting or by similar protection in respect of any information or process derived from the execution of this Order. Any publication with respect to work carried out under the scope of this order shall be with the prior permission of the Department.

## **9. FORCE MAJEURE**

Should a part or whole of items covered by this Order be delayed in delivery due to reasons of force majeure (if affecting this Order, in any other parts of India), which shall include lockouts, strikes, riots, civil commotions, fire, accidents, acts of god and war, stoppage of deliveries by governments, refusal for or non-receipt of import license for raw materials, the delivery period referred to in this Order shall be extended by a period(s) not in excess of

duration of such force majeure. Both Contractor and the Department undertake to advise each other as soon as one becomes aware of the circumstances of such force majeure, so that action under the provisions of this Order can be mutually reviewed and agreed upon between Contractor and the Department.

#### **10. LIQUIDATED DAMAGES**

The delivery period shall be deemed to be the essence of the Order. In the event of Contractor failing to deliver the fabricated component within the time specified (Delivery terms) in the Order or in extension agreed there to, the Department shall have the right to recover from Contractor as Liquidated Damages (LD) a sum at the rate of ½ % (half percent) per week not exceeding a total of 10% (Ten percent) of the cost of each hardware by way of liquidated damages against delayed delivery of that hardware.

#### **11. SECRECY**

All information related to this Order shall be treated as secret and the contents of designs, process sheets or any other documents shall not be divulged/disclosed or parted with to any third party whatsoever without the written authorization of the Department.

#### **12. DISPUTES**

Disputes arising during the currency of the Order shall, at the first instance, be settled by mutual discussions and negotiations. The result of such resolution of dispute shall be incorporated as an amendment to this Order, failing which; the parties can resort to arbitration.

#### **13. RESOLUTION OF DISPUTES**

In the event of any dispute or difference between the parties hereto, such disputes or differences shall be resolved amicably by mutual consultation. If such resolution is not possible, then the unresolved dispute or difference shall be referred to arbitration of the sole arbitrator to be appointed by the Secretary, Department of Space, on the recommendation of the Secretary, Department of Legal Affairs ("Law Secretary"), Government of India. The provisions of Arbitration and Conciliation Act 1996 (No. 26 of 1996) shall be applicable to the arbitration under this clause. The venue of such arbitration shall be at Delhi and the language of arbitration proceedings shall be English. The arbitrator shall make a reasoned award (the "Award"), which shall be final and binding on the parties. The parties shall continue to perform all their obligations during the pendency of the arbitration proceedings.

#### **14. SHORT CLOSING/TERMINATION OF ORDER**

Under normal circumstances, short closing/ termination of the Order is not foreseen. However, the need to have a formal clause provides for short closing or termination of this Order due to any of the following reasons:

- (i) Continued non-performance of Contractor, resulting in delay in the delivery dates, in spite of repeated written requests for meeting the delivery schedules as provided for in the Order.
- (ii) In such an event (as per 21.0 (i)), the Department reserves its rights to terminate wholly or partly the Order, by giving a notice of not less than one month.
- (iii) Major changes in the policies of the Government of India because of which the Department is compelled to curtail its requirements wholly/partly.
- (iv) In such an event, the Department and Contractor shall mutually agree to terminate this Order wholly or partly. The Department shall give a notice of not less than two weeks.
- (v) On receipt of such notice, Contractor shall take all necessary steps for winding up of the Order in line with the notice, with in a reasonable period, but in any case not exceeding three months from the date of posting of this notice.
- (vi) In the event of termination of the Order, the compensation to be paid to Contractor shall be agreed by mutual negotiations. The Department shall in no circumstances be liable to pay any sum, which added to the other sums paid, due or becoming due to Contractor under the Order, exceeds the amount specified as the Price of hardware agreed in the Order

#### **15. APPLICABLE LAW AND INFRINGEMENT THEREOF**

This Order shall be governed by and interpreted and construed in accordance with the laws of Indian Union. The Department shall not be responsible if Contractor infringed the laws or statutes in force, during the currency of the Order

#### **16. PAYMENT**

Payment shall be released against inspection, acceptance and clearance for dispatch of the hardware invoice certification by the head of indenting division and completion of mechanical testing of tensile specimens.

#### **17. SECURITY DEPOSIT**

The Contractor, immediately after entering contract, shall submit security deposit for 10% of the total order value in the form of a Bank Guarantee from a Nationalized/Scheduled bank valid till completion of the order.

#### **18. PERFORMANCE BANK GUARANTEE**

The Contractor shall submit Performance Bank Guarantee (PBG) from a Nationalized / Scheduled bank for 10% of the value hardware towards warranty support, along with the dispatch documents. PBG shall be released on pro-rata upon completion of the warranty period of that hardware.

**19. DETAILS TO BE CONTAINED IN THE OFFER**

Parties already engaged in qualification/supply of gas bottles / liners to the department will not be considered for this tender:-

The offer shall necessarily contain the following details:

- (i) Unit price for Ø400 PS4 liner
- (ii) Cost of tooling realization & qualification
- (iii) The price break-up separately indicating a) total package covering machining, welding and bead polishing b) all activities till welding and c) all activities after welding.
- (iv) Confirmation by the party regarding submission of performance bank guarantee and security deposit
- (v) Compliance to all the terms and conditions

ANNEXURE-I (B)

List of drawing-PS4 liner (Dia 400mm)

Sl. No.	Item	Drawing no.
1	Titanium liner for PS4 kevlar composite Gas bottle	256-101-17010001 R3
2	Titanium liner-Female half	256-101-17010002 R3
3	Titanium liner-Male half	256-101-17010003 R3
4	Titanium liner for PS4 kevlar composite Gas bottle(EB welding)	256-101-17010006 R0

Annexure – II (B)

Bill of free issue material(FIM) for PS4 liners (Dia 400mm)

Sl. No.	Item	Qty/Set	FIM Cost per set
1	Titanium hemispherical forging, Size ø430mm	2 Nos.	Rs. 12 Lakhs