Annexure-3

Specification Compliance Report (Format)

(To be duly filled by party and to be submitted along with quotation)

Sl.No.	VSSC / ISRO Specification	Supplier Specification	Comments
1	**I.** Development & Qualification of one set of LH2 Turbine Exhaust Casing Castings (One set = Dies & Toolings + 2 nos. of castings) **II.** Supply of LH2 Turbine Exhaust Casing Castings: **12 nos.**		
	III. Development & Qualification of one set of LOX Turbine Exhaust Casing Castings (One set = Dies & Toolings + 2 nos. of castings) **IV.** Supply of LOX Turbine Exhaust Casing Castings: **12 nos.**		
	Delivery Schedule: V. **Preparation & submission of Quality Assurance Plan (QAP) within one month from the receipt of PO.** VI. **Stage-1: Completion of development & qualification of one set of LH2 & LOX Turbine Exhaust Casing castings within 10 months from the approval of QAP.** VII. **Stage-2: Supply of Total PO quantity within 12 months from the date of clearance / approval of Production batch by VSSC.**		
2	**Raw Material:** **Master heat / Raw material shall be approved by VSSC**. Castings shall be made either from virgin alloys or melt of a master heat or by re-melting of the master heat. Vacuum Induction Melting (VIM) technique shall be used for re-melting and pouring of the casting. If master heat is made from scrap or mix of other grades, it shall be refined by secondary refining process such as VAR. Two master heats with composition within specified range can be blended for melting and pouring of casting. Each master heat		

	to be evaluated for chemical composition. Record of Master Heat(s) shall be maintained for traceability. Appropriate discard from top and bottom of the Master heat to be ensured. Visual Inspection of Ingot for surface oxides removal (through grinding/ skin machining) shall be carried out.		
3	**Facility requirements / Vendor Capability:**		
a)	**Design of Dies and toolings:** Party should design and fabricate the dies/toolings required for this tender. Once fabricated these dies/toolings shall be qualified by making sample castings as per specifications in annexures. Only qualified dies and tooling should be used for making the patterns for realization of these castings.		
b)	**Presses / suitable equipment for pattern making:** Vendor should have wax injection presses or suitable equipment for making patterns.		
c)	**Shell making facility:** All cutting, grinding tools should be available with at vendor's works for removal of gating and risering system, shell material etc.		
d)	**Melting and casting facility:** Vendor should have Vacuum induction melting facility of 40 kg or higher capacity at their works which should be suitable for melting and casting of these castings.		
e)	**Fettling, sand blasting and machining facility:** All cutting, grinding tools should be available with at vendor's works for removal of gating and risering system, shell materials etc.		
f)	**CNC facility:** Vendor should have suitable CNC machining facility for reference plane machining of castings.		

g)	**Visual and DP Examination:** Dye Penetrant testing facility should be available with the vendor. For DP assessment, at least ASNT / ISNT Level-2 qualified personnel required.		
h)	**X-ray/Gamma Ray radiography facility:** X-ray radiography facility for carrying out X-ray of castings upto thickness of 19mm. For higher thickness (> 19 mm) zones gamma ray can be used.		
i)	**Weld repair facility:** Vendor should have GTAW facility for weld repair of castings. Welders will be qualified by VSSC & those qualified welders should only carry out the weld repair of castings.		
j)	**HIPing facility:** HIPing operation shall be carried out for all the castings. VSSC HIP facility can be used for Hipping of these castings. Vendors shall clearly mention this requirement in their tender documents.		
k)	**Heat treatment facility:** Heat treatment of these castings calls for 4 stage heat treatment in vacuum including high temperature heat treatment at 1130°C and 1030°C and aging at 750°C & 650°C. Vacuum levels should be 10^{-2} m bar or better for vacuum heat treatment. All the furnaces used for heat treatment should be calibrated as per the AMS standards or as per ISRO standards. Vendor should have adequate facilities for heat treatment. Only approved facilities shall be used for heat treatment of castings. Calibration certificates to be provided to VSSC as and when required.		
l)	**Dimension inspection facility:** Vendor should have all the required dimension inspection facilities including CMM for inspection of casting dimensions. Only approved facilities shall be used for inspection.		

m)	**Mechanical Testing Facility:** Vendor should have testing facility for tensile (room temperature) and creep testing at High temperature (650°C). Calibrated extensometers and testing equipment should be used for the testing. Calibration certificates to be provided to VSSC as and when required.		
n)	**Pressure testing:** Castings shall be subjected to hydro & Pneumatic test as per the details given in annexure 5. Vendor should have facility for pressure test or should get it done with qualified source for all castings. VSSC clearance shall be taken prior to Pressure Test.		
o)	**Aerospace Quality Casting:** Vendor should have experience in realization & supply of aerospace quality castings through investment casting route in stainless steel / Superalloy in India / Abroad. Same shall be mentioned in the quote with documentary evidence. List of customers shall also be provided.		
4	**Dies & Tooling:** • **All dies and tooling developed shall be the exclusive property of the VSSC.** • The vendor will be the custodian of all the pattern dies and tooling required for the supply of castings. • The vendor shall ensure that the dies and the tooling are kept in proper storage condition while in their custody. No charges shall be levied on the VSSC towards the custody and up-keep of dies & tooling. • The vendor will not use these dies and tooling for the fabrication of any other identical jobs in the works of the vendor or elsewhere. These would be used only for the jobs offered by VSSC.		

5	**Inspection and Quality Assurance Plan (QAP):** a) QAP shall be prepared by party after release of P.O. and submitted to VSSC for approval. QAP shall be in line with processing requirements of casting, as given in specification. It shall highlight various inspection stages and provide the details of stages wherein stage clearance from VSSC before proceeding further. b) Inspection and quality assurance procedures and acceptance standards at various stages of fabrication will be as per details given in Annexure I, II, III, IV, and V. Vendor should confirm that it shall meet all the quality clauses as per these annexures. c) The vendor shall be responsible for total quality of the product by complying with the quality requirement and carrying out inspection at various stages of fabrication and processing. d) Quality Surveyor of the VSSC will cross check and oversee inspection procedure and ensure adherence to the quality control stipulations as per the QAP. Specifically identified inspection stages will be indicated in the process sheets for which inspection clearance shall be obtained by the vendor from the VSSC. e) The vendor shall make available to the VSSC all inspection records and documentation such as X-ray Radiographic films, reports, laboratory test reports, mechanical test reports, inspection reports and calibration reports and other QC related reports in not less than two copies of each. f) During all the reviews and surveillance Vendor's QC should participate and jointly release the reports which are to be prepared during surveillance. g) The vendor shall also maintain a shop inspection log book to record detailed in process inspection data and observations which shall be accessible to the VSSC at any time.		
6	**Deviation reporting and clearance:** a) A Snag report shall be generated by vendor for each inspection process separately, highlighting the deviations, if any. All these reports shall be signed by QC surveyor. b) These deviations reports duly signed by QC surveyor shall be referred to the		

	process team of VSSC by the vendor. On obtaining clearance from VSSC, item shall be taken up for further processing. c) Weld repair of RT, DP and visual unacceptable defects can be taken up after approval from VSSC. d) If deviations are not acceptable then vendor can propose a salvage plan for approval of VSSC. Otherwise hardware shall be rejected and process improvement shall bring in to address these unacceptable deviations.		
7	**Process and progress monitoring:** VSSC shall identify process engineers who shall be the focal point for review of the progress and provide all the technical feedback to party in real time. Vendor shall refer all the technical issues to these engineers for disposition.		
8	**Supply Condition:** The castings shall be supplied in HIP + fully Heat Treated condition. Surface of the casting shall be in sand / grit blasted condition.		
9	**Pre-dispatch Inspection:** All castings, relevant reports and Snag Sheets shall be offered to QC/ VSSC at its site before dispatch. Castings shall be delivered only after VSSC clearance, based on QC Assessment/Design Dispositions.		
10	**Non-conformance:** Any non-conformance to VSSC specification shall be communicated to the purchaser for disposition. Castings not conforming to these specifications, or to modifications authorized by the purchaser will be subject to rejection.		
11	Acceptable casting should be delivered along with all the test reports (Chemical, DP (Preliminary), RT, Weld repair, HT, Mechanical testing, Dimension inspection, Final DP) Pressure test and radiographic films.		
12	**Packing and Dispatch:** All the castings shall be suitably packed after removing dirt etc. present on their surfaces. In case more than one casting is packed in one box / container, adequate cushioning shall be provided to		

	avoid damage of the castings during transit. Each packaged unit shall have following minimum information marked on it. a. Product name and Serial / ID number b. Purchase order number c. Gross weight and net weight		

Details of availability of facilities with Vendor

S.No.	Facility	Available with Vendor	Vendor specification	Comments / Remarks (If any)
1	Dies and Toolings	YES / NO		
2	Wax Press for making patterns	YES / NO		
3	Shell making facility	YES / NO		
4	Melting and casting facility	YES / NO		
5	Fettling, sand blasting and machining facility	YES / NO		
6	CNC facility	YES / NO		
7	Visual and DP Examination	YES / NO		
8	X-ray / Gamma Ray radiography facility	YES / NO		
9	Weld repair facility	YES / NO		
10	HIPing facility	YES / NO		
11	Heat treatment facility	YES / NO		
12	Dimension inspection facility	YES / NO		
13	Mechanical Testing Facility	YES / NO		
14	Pressure testing facility	YES / NO		

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