

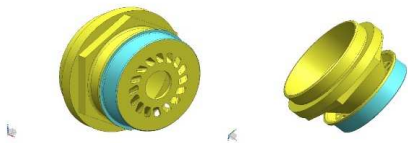


Specification for development and manufacturing of GT Fuel Nozzle tip through Direct Metal Laser Sintering Process

Specification Number: Q-E-20-16-041-RD-39/SP-001

BHEL R&D Drawing Number: 0-354-06-61012

Material specification : HY 12765-R00

S No	Specification	Bidder's Compliance
1	Objective: To develop and build a GT Fuel Nozzle tip (Part) having dimensions shown the drawing No: 0-354-06-61012 in single piece with Hastelloy X (HX) material using Additive Manufacturing (AM) technology through Direct Metal Laser Sintering (DMLS) process.  Part: GT Fuel Nozzle tip Material : Hastelloy X 2D drawing in pdf format and 3D Model in .stp/ .igs / .prt format are attached with the purchase enquiry. Files with .stp and .igs extension can be opened with any 3D CAD software whereas file with .prt extension can be opened with UG-NX software. Above Image files are for reference only.	
2	Pre-qualification criteria: 2.1- Bidder should have AM equipment suitable for printing the proposed component..i.e. 3D printer for DMLS technology 2.2- Bidder should have Required post processing equipment for machining and in-house inspection 2.3- Bidder shall prove minimum two years experience of building at least two parts (any model, any metal powder) with DMLS process by providing past purchase order copies or letters of references from customers mentioning contact details which BHEL R&D may verify independently. Bidders are required to give only references of customers who are willing to conform independent verification by BHEL R&D and not avoiding the same on the grounds of confidentiality.	



S No	Specification	Bidder's Compliance
3	Scope of work of bidder: The scope of work is in two stages as mentioned below. 3.1 STAGE-1: a) Development of the 3D printing process for HX material and manufacture of one number of the part and 10 Nos (5 Nos with Horizontal built + 5 Nos with vertical built) of sample test specimen for supply to BHEL R&D . b) Post processing and Testing to be carried out as per the following clauses (Of HY 12765-R00) and Testing to be carried out after heat treatment only (Clause 7.0-Heat treatment). BHEL will test 10 sample test specimens and one part as per the following clauses (Of HY 12765-R00). In addition, suitable number of test specimens to be manufactured and tested by the bidder at their works as per the following clauses (Of HY 12765-R00) and test report shall be submitted to BHEL R&D. Clause 7.0 -Heat treatment Clause 11.0 -Chemical composition Clause 12.0 - Mechanical properties (Tensile, Yield, Elongation and hardness) Clause 13.0- Stress rupture stress Clause 14.0 - Grain size c) Density of the part and test samples should be confined to 99.5% or above d) Surface finish to be confined to clause 9.0 of HY 12765 (i.e. 2D finish) e) CMM report for the part to be submitted by the bidder for ensuring dimensional accuracy. f) The bidder should submit a detailed test reports after post processing / testing as per the above clauses to BHEL R&D along with supply of the 3D printed part and sample test specimens. The delivery period for receipt of test reports, part and sample test specimen is 45 days from the date of PO. BHEL R&D will study the report and give clearance for proceeding to the next stage (Sr. No. 3.1 STAGE -2). BHEL R&D will test the specimens at their end and inform bidder for any changes to be made during stage-2 printing process and the bidder has to abide and proceed for stage-2 .	

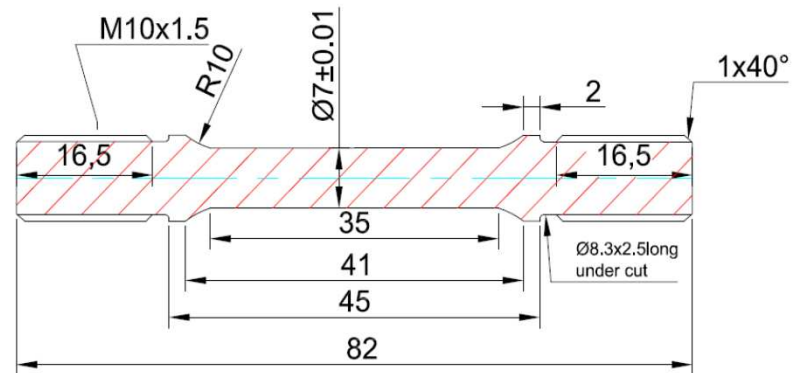


S No	Specification	Bidder's Compliance
3	3.1 STAGE-2: a) The bidder has to manufacture the 2 Nos parts and 6 Nos of (3 Nos of horizontal built + 3 Nos of vertical built) sample test specimens for supply to BHEL R&D. b) Post processing and testing to be carried out by the bidder for this stage also as per the above (3.1 STAGE – 1, S No. b, c, d and e) and after heat treatment only. c) The bidder has to built separate sample test specimens for testing at their works. The test report shall be submitted to BHEL. d) The delivery period for receipt of test reports, 2 Nos of parts built and 6 Nos of test specimens is 45 days from date of obtaining clearance from BHEL R&D. 3.2 The bidder has to submit a final report on methods of manufacturing and 3D printer parameters to BHEL R&D for reference.	
4	The part can be built by adding additional material/support in the model and shall be removed by the bidder after building the part and before handing over the final part to BHEL R&D.	
5	All post processing operations like support material removal, heat treatment, final machining and other surface improvement process and testing will be carried out by the bidder as per specifications and point mentioned in S No 3 scope of work (3.1 STAGE – 1, S No. b, c, d and e) .	
6	The bidder is required to carry out inspection of the 3D printed parts through CMM at their end and inspection report to be submitted to BHEL R&D.	



S No	Specification	Bidder's Compliance
7	The bidder is required to measure surface roughness of the 3D printed parts (Fuel Nozzle Tip) using any standard equipment and submit a report to BHEL R&D.	
8	Bidder shall ensure suitable packing of the parts & test specimens (with a clear marking of H for horizontal built and V for vertical built) and dispatch them to BHEL R&D. (Refer Purchase terms for insurance and delivery etc..)	
9	Dimensions of the test specimens for tensile test is provided below for reference.	

The specimens to be 3D printed as a circular bar initially and to be machined to cut the grooves as per the drawing for testing



M10 ROUND SPECIMEN FOR TENSILE TESTING



Acceptance criteria:

1	3.1. STAGE-1	Parameters	Reference for acceptance Criteria HY12765- Rev00	Deliverables	Vendor's compliance
	Test specimens (Testing)	Heat treatment Chemical composition Mechanical properties Stress rupture stress Grain size	Clause 7.0 Clause 11.0 Clause 12.0 Clause 13.0 Clause 14.0	1 No. of 3D printed part & 10 Nos. of test sample specimens as per 3.1 STAGE-1 (a) Test reports as per clauses under 3.1 STAGE-1 (b) and CMM report.	
2	3.1 STAGE-2	Parameters	Reference for acceptance Criteria HY12765- Rev00	Deliverables	Vendor's compliance
	Test specimens (Testing)	Heat treatment Chemical composition Mechanical properties Stress rupture stress Grain size	Clause 7.0 Clause 11.0 Clause 12.0 Clause 13.0 Clause 14.0	2 Nos. of 3D printed parts & 6 Nos. of test sample specimens as per 3.1 STAGE-2 (a) Test reports as per clauses under 3.1 STAGE-1 (b) and CMM report.	