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**21-10-2022**

**CORRIGENDUM-II**


**Sub.:** SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF FULLY INTEGRATED 4-AXIS CNC TABLE FOR HYBRID ADDITIVE AND SUBTRACTIVE PROCESS

**Ref.:** Tender No. TENDER/2022-23/115 Date of Publication: 30-09-2022

Existing Clause			Amended As		
S. No.	Items	Specification	S. No.	Items	Specification
<b>A</b>	<b>Technical specifications</b>		<b>A</b>	<b>Technical specifications</b>	
		3-axis CNC welding table with an integrated metal additive and subtractive heads along with other additional mandatory features that are listed in the sections and sub-sections of A to C			3-axis CNC welding table with an integrated metal additive and subtractive heads along with other additional mandatory features that are listed in the sections and sub-sections of A to C
<b>A.1</b>	<b>CNC Controller</b>		<b>A.1</b>	<b>CNC Controller</b>	
		CNC controller for programmable path motion with G codes and M Codes for metal printing, cladding and machining			CNC controller for programmable path motion with G codes and M Codes for metal printing, cladding and machining
<b>A.2</b>	<b>Software</b>		<b>A.2</b>	<b>Software</b>	
		The system should readily print the metal upon the input of '.stl' file. The necessary CAD/CAM and AM based pre and post processing softwares for both metal printing and machining should be pre-installed			The system should readily print the metal upon the input of '.stl' file. The necessary CAD/CAM and AM based pre and post processing softwares for both metal printing and machining should be pre-installed
<b>A.3</b>	<b>3 Axis mounting stage for metal printing and milling</b>		<b>A.3</b>	<b>3 Axis mounting stage for metal printing and milling</b>	
<b>A.3.1</b>	<b>XY stroke</b>	≥ 600 mm in both X and Y directions. The welding torch & machining head should move in the speed range between 60 mm/min to 600/min and the speed should be consistent from the absolute beginning to ending. Acceleration/declaration should be avoided.	<b>A.3.1</b>	<b>XY stroke</b>	≥ 600 mm in both X and Y directions. The welding torch & machining head should move in the speed range between 60 mm/min to 2000/min and the speed should be consistent from the absolute beginning to end. Acceleration/declaration should be avoided at both beginning and end
<b>A.3.2</b>	<b>XY drive</b>	Ball screw drive with stepper or step-servo motor.			

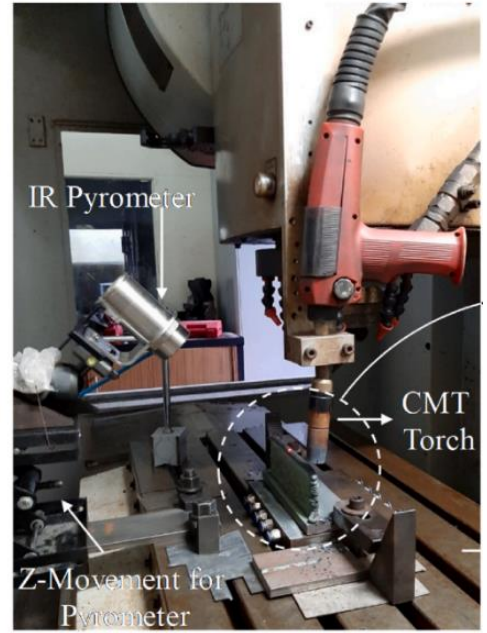
A.3.3	Resolution	$\leq 20 \mu\text{m}$	A.3.2	XY drive	Ball screw drive with stepper or step-servo motor.
A.3.4	Accuracy in XY Stroke	$\pm 0.1 \text{ mm} / \pm 300 \text{ mm}$ from the table center (Need to be demonstrated at time of installation)	A.3.3	Resolution	$\leq 20 \mu\text{m}$
A.3.5	Z-stroke	$\geq 200 \text{ mm}$	A.3.4	Accuracy in XY Stroke	$\pm 0.1 \text{ mm} / \pm 300 \text{ mm}$ from the table center (Need to be demonstrated at time of installation)
A.3.6	Z drive	Acme screw with stepper or step-servo drive.	A.3.5	Z-stroke	$\geq 200 \text{ mm}$
A.3.7	Resolution	$\leq 10 \text{ microns}$	A.3.6	Z drive	Acme screw with stepper or step-servo drive.
A.3.8	Accuracy in Z Stroke	$\pm 0.1 \text{ mm} / 200 \text{ mm}$ (Need to be demonstrated at time of installation)	A.3.7	Resolution	$\leq 10 \text{ microns}$
A.3.9	Welding torch and Machining head feed rate in all X, Y and Z directions	60 mm/min to 3000 mm/min	A.3.8	Accuracy in Z Stroke	$\pm 0.1 \text{ mm} / 200 \text{ mm}$ (Need to be demonstrated at time of installation)
<b>A.4</b>	<b>Rotating stage (Vertical)</b>		A.3.9	Welding torch and Machining head feed rate in all X, Y and Z directions	60 mm/min to 2000 mm/min
A.4.1	A separate round table of 300 mm diameter should be there, and it should rotate in the range of 0 to 500 rpm (user defined) under the load of 100 kg for printing of solid/hollow axisymmetric shapes. A $\geq 10 \text{ mm}$ thick nitride plate should be there for fixing the jobs on the round table.		A.3.10	CAD/CAM software	It should support STL file format. It should be capable of doing slicing or partitioning. It is also preferred, if the interface can allow user defined coding to control the CNC table
A.4.2	Welding head should be able to reach the center of the rotating table for material deposition.		<b>A.4</b>	<b>Rotating stage (Vertical)</b>	
<b>A.5</b>	<b>Motor connected three jaw chuck along with tail stock</b>		A.4.1	A separate round table of 300 mm diameter should be there, and it should rotate in the range of 0 to 200 rpm (user-defined) under the load of 100 kg for the printing of solid/hollow axisymmetric shapes. A $\geq 10 \text{ mm}$ thick nitride plate should be there for fixing the jobs on the round table. 40CrMoV13-9 Nitride steel plates or any cost efficient equivalent grade.	
	An additional three jaw check should be provided for fixing rods/hollow cylinders in horizontal position to perform the weld-cladding operation.		A.4.2	Welding head should be able to reach the center of the rotating table for material deposition.	
<b>A.6</b>	<b>Mounting clamp</b>		<b>A.5</b>	<b>Motor connected three jaw chuck along with tail stock (cladding setup)</b>	
	Mounting clamp for MIG/TIG/PAW welding torches with automatic on/off control (relay unit). The clamp should allow the user to vary the angle between ( $-40^\circ$ to $40^\circ$ ) with reference to the Z axis (vertical).			An additional three jaw chuck should be provided for fixing rods/hollow cylinders in	
A.7	<b>Automatic torch height controller</b>				
A.7.1	Arc voltage based auto height control using arc voltage				

	feedback.			the horizontal position to perform the weld-cladding operation and it should rotate in the range of 0 to 200 rpm (user-defined) under a load of 100 kg.	
A.7.2	Gap between sheet and nozzle should be user programmable.				
A.8	<b>Pen pointer attachment</b>		<b>A.6</b>	<b>Mounting clamp</b>	
	Required for part program verification			Mounting clamp for MIG/TIG/PAW welding torches with automatic on/off control (relay unit). The clamp should allow the user to vary the angle between (-40° to 40°) with reference to the Z axis (vertical).	
<b>A.9</b>	<b>Milling Head</b>		A.7	<b>Automatic torch height controller</b>	
A.9.1	Collets		A.7.1	Arc voltage based auto height control using arc voltage feedback.	
A.9.2	Cutting tools and accessories		A.7.2	Gap between sheet and nozzle should be user programmable.	
			A.8	<b>Pen pointer attachment</b>	
A.10.1	Operating airflow	≥ 3000 m <sup>3</sup> /h		Required for part program verification	
A.10.2	Operating negative pressure	1500 Pascal	<b>A.9</b>	<b>Milling Head</b> (should be mounted on a separate Z-axis head without interfering with the welding/printing head). The end user should be able to use both the heads simultaneously for both molten metal deposition and cutting. The table should not vibrate while machining the weld bead since the machine vibrations affect the metal deposition.	
A.10.3	Voltage	400 V	A.9.1	Spindle Speed	Min 18000 RPM
A.10.4	Unit should be supplied with 2 numbers of floor mounted extraction arm of diameter ≥125 mm and 2 m in length		A.9.2	Main Spindle Power	3.5 kW or more (Should be able to cut mild steel specimens).
<b>A.11</b>	<b>Cooling system with automatic on/off</b>		A.9.3	Spindle taper	ISO/BT/SK 40/50
A.11.1	The metal print should be submerged in a liquid coolant upto a certain preset height from the top surface for which the detachable cooling camber of size 400 mm * 400 mm * 200 mm made of SS304 should be there		A.9.4	Collets	
A.11.2	An additional coolant storage tank with electric motor should be there for pumping the liquid to cooling camber after the completion of every layer of printing.		A.9.5	Standard accessories	Standard accessories must include all items and accessories which are essential to the Four axis CNC milling machine, whether those are mentioned in this specification or not. A list of such items/ accessories is to be provided with the offer and price for the same should be shown
A.11.3	The inlet of the liquid cooling chamber should have a flow meter and valve to control the flow rate.		A.9.6	Cutting Tools	The bidder should supply essential mill cutting tools: 10 mm diameter end mill, roughing end mill, slab mill, and radius mill cutters. A list of cutting tools with
A.11.4	Floating ball arrangement for auto stop of liquid inlet as the printing progresses in Z direction.				
<b>A.12</b>	<b>Interface</b>				
A.12.1	USB				
A.12.2	An Android app, using which users can jog the machine, set program zero and start/pause/re-start the G-code to continue machining.				
<b>A.13</b>	<b>High temperature pyrometer</b>				
A.13.1	Operating wavelength	≤ 1.6 μm			
A.13.2	Focal length	≥ 200 mm			
A.13.3	Vision zone	≤ 0.7 mm diameter			
A.13.4	Accuracy	± 0.3% of reading + 2°C			
A.13.5	Temperature measuring range	385°C - 1680°C			
	Eg: Micro-Epsilon CTLM-2HCF3-C3H model with calibration certificate				
<b>A.14</b>	<b>Geometrical laser scanner</b>				

A.14.1	Measuring range Z-axis	$\geq 300$ mm			specifications and quantity is to be submitted with the offer
A.14.2	Measuring range X-axis	$\geq 300$ mm			
A.14.3	Resolution X-axis	$\geq 640$ points/profile			
<b>A.15</b>	<b>Fume extractor</b>				
	The generated fumes should be extracted out simultaneously through the enclosure. The enclosure can have one opening to facilitate the fume extractor inlet pipe.				
<b>A.16</b>	<b>Desktop</b>				
A.16.1	CPU	AMD Ryzen 7 3700X (with CPU cooler) or higher			
A.16.2	Motherboard	AMD B550 chipset, supports AM4 socket 3rd GEN AMD Ryzen™ processors and future AMD Ryzen™ with BIOS update.			
A.16.3	SSD Storage	3.5" 1 TB HDD, 64 MB Cache, 7200 RPM class, Interface: SATA 6 Gb/s			
A.16.4	Graphics card	8 GB or higher			
A.16.5	Case	Support E ATX motherboard, Support Graphics card, CPU cooler, 3.5" HDD/2.5" SDD: 3/1 Preferable: 2x200 mm ARGB Fans in front, 1x120 mm fan in the rear			
A.16.6	Power supply	750 Watts			
A.16.7	Monitor	27", IPS Panel, LED-Backlight, Full HD (Max resolution: 1920x1080), Aspect ratio: 19x9, Display colors: 16.7 million, HDMI and display ports Optional: Built – in speaker, Headphone jack, Audio line-in			
A.16.8	Keyboard	Mechanical Keyboard Preferable: RGB Mechanical Keyboard with Kalih LH Blue Switches			
A.9.7	Standard Tools				One (01) set of standard tools for maintenance of the machine is to be provided indicating the item-wise price. The nomenclature, quantity, and specification of the tools are to be mentioned in detail in the quotation (the price should be included in the total price)
	Operating airflow				$\geq 3000$ m <sup>3</sup> /h
A.10.1	Operating negative pressure				1500 Pascal
A.10.2	Voltage				400 V
A.10.3	One unit should be supplied with two fume extraction arms from two different locations of the welding/printing space. The reference setup is shown below				
A.10.4					
<b>A.11</b>	<b>Cooling system with automatic on/off</b>				
A.11.1	The metal print should be submerged in a liquid coolant upto a certain preset height from the top surface for which the detachable cooling camber of size 400 mm * 400 mm * 200 mm made of SS304 should be there				
A.11.2	An additional coolant storage tank with electric motor should be there for pumping the liquid to cooling camber after the completion of every layer of printing.				
A.11.3	The inlet of the liquid cooling chamber should have a flow meter and valve to control the flow rate.				



A.16.4	Graphics card	8 GB or higher
A.16.5	Case	Support E ATX motherboard, Support Graphics card, CPU cooler, 3.5" HDD/2.5" SDD: 3/1 Preferable: 2x200 mm ARGB Fans in front, 1x120 mm fan in the rear
A.16.6	Power supply	750 Watts
A.16.7	Monitor	27", IPS Panel, LED-Backlight, Full HD (Max resolution: 1920x1080), Aspect ratio: 19x9, Display colors: 16.7 million, HDMI and display ports Optional: Built – in speaker, Headphone jack, Audio line-in
A.16.8	Keyboard	Mechanical Keyboard Preferable: RGB Mechanical Keyboard with Kalih LH Blue Switches
A.16.9	Mouse	Wired, Optical, Maximum DPI: 4000
A.16.10	OS and supporting softwares	Windows 11 and pre-installed CAD, CAM and additive manufacturing (AM) softwares
	<b>B</b>	<b>Required features</b>
B.1		40CrMoV13-9 Nitride steel plates or any cost-efficient equivalent grade
B.2		The table should be able to move in all three X, Y, and Z directions.
B.3		As shown in the figure, the pyrometer should be fixed on a standalone manual Z-table mounted on the CNC bed.



B.4

The provision to set a pyrometer and laser pen pointer should be provided by default. Item-wise price of consumables cutting tools and tool holders, fume extractor, and sensors (laser pointer and pyrometer) should be shown separately as part of the total price of the setup. However, the indenter has a choice to proceed with purchase without any or few of the items mentioned in B.4.

C

**Required documents**

C.1

Manual/s for complete machine/s parts and specifications

C.2

Manual/s for machine operation

C.3

Manual/s for safety instructions and specifications

C.4

Accuracy report

F

**Warranty (1 years from the date of installation)**

Annually maintenance for three continuous years should be quoted separately on top of one year standard

warranty. The user have full rights to apt or not to apt for the AMC within the one year standard warranty period