

Annexure - I

TECHNICAL SPECIFICATIONS FOR WIRE ARC ADDITIVE MANUFACTURING AND WELDING SYSTEM

End Use: The following equipment and accessories consist primarily of welding power sources, robotic manipulators, welding positioner, welding table, cooling units, wire feeders, etc., which will be used systematically for wire arc additive manufacturing research. The same system can be also used for the robotic welding and refurbishing work if necessary.

S. No.	Parameter	Required Specification
1.0	Manufacturers Credentials	Manufacturer must be ISO 9001 certified. Please enclose Certificate.
		The Bidder must be a manufacturer/authorized representative of a manufacturer who must have designed, manufactured, tested and supplied the equipment(s) and the bidder is authorized sales & service provider.
		For every numerical point, bidder must have to write the exact value of their system; “complied”, “agreed”, “accepted” such words will not be allowed.
Major Components of the system		Two Welding power sources, two robotic manipulators, one positioner/turn table (double axis) and one nitrided welding table of following specifications must be provided.
2.0	Power source	Two MIG/MAG power sources with following specifications must be provided
2.1	Mains voltage	400-415 V AC 3-phase or as per IEC 60974-1&2
2.2	Mains voltage tolerance	+/- 5% or better or as per IEC 60974-1&2
2.3	Mains frequency	50 Hz or as per IEC 60974-1&2
2.4	Power factor	0.95 or better
2.5	Welding current in MIG/MAG	40 A - 400 A or better
2.6	Welding current at 10 min / 40°C (104°F)	400A @ 60% D.C. or better 350A @ 100% D.C. or better
2.7	Output voltage in MIG/MAG	10 V - 34.0 V or better
2.8	Open circuit voltage	80V or lower
2.9	Type of Cooling	Water Cooled torch
2.10	Wire feeding speed	30 M/min or better
2.11	Degree of protection	IP 23 or better
2.12	Overvoltage protection	Machine should incorporate overvoltage surge protection device to protect the machine. Bidder to clarify
2.15	Safety symbols	S, CE
2.16	The Insulated Gate Bipolar Transistor	Completely Digital Microprocessor controlled software base inverter power source built with latest IGBT inverter technics.
2.17	Welding characteristics	<div><div>i.</div><div>Machine must have single knob Synergic welding process.</div><div>ii.</div><div>The m/c should have very specific software programme to weld very thin sheet with controlled heat input without any spatter.</div><div>iii.</div><div>Power source must be capable of delivering short-circuit, spray, pulse spray and double pulse spray metal transfer.</div><div>iv.</div><div>The machine must produce Minimal spatter even in CO₂ welding.</div><div>v.</div><div>Upgradable to Advanced welding Processes/custom make programs at extra cost</div><div>vi.</div><div>The power source should be optimized to weld all grades of MS, SS, Al, Copper, Inconel alloy, Monel Alloy, Duplex & Super Duplex, Ti, etc.</div></div>
2.18	General System Specifications	<div><div>i.</div><div>The overall system must ensure stable operation.</div><div>ii.</div><div>The system must be integrated with the following hardware options.<div><div>a.</div><div>Gas Flow sensor</div><div>b.</div><div>Thermo-flow sensor for coolant</div></div></div></div>



		<ul style="list-style-type: none"> c. Gas test & wire inch function should be available on wire feeder, on Robot Teach Pendant & on power source d. Gas & Wire empty sensor. The complete system should stop with an error message automatically if wire or gas is empty. <ul style="list-style-type: none"> iii. The system must be capable to add welding processes and other functionality as and when required. iv. The system must have Ethernet port to connect with LAN/PC. v. Every system must have its own IP address. vi. The system must be accessed in PC through LAN, wherein one can access <ul style="list-style-type: none"> a. the entire configuration of the system, b. real time parameters, c. Saved parameters for a particular Job and an option to edit the saved parameter. d. Historical data of parameter during welding, downloading the historical parameter in PDF or other format and an option to download in .csv format. vii. The rollers must be colour coded as per wire size for trouble free identification and it must be of universal type i.e., same set of rollers must be used for hard wire and soft wire for one wire size. viii. The system must ensure precise wire feeding with the use of encoder. ix. The system must have tabular log format for all the events which must record all the welding operation. x. The power source must have an option to highlight, alert in-case of violation of set parameter beyond the permissible limit. xi. The power source & robot controller must have a functionality/communication process, wherein it allows the system to switch between two or more different set of weld parameters during continuous arc on mode & automatic operation mode. xii. The system must have functionality to save up to 500 different job parameters in the system. xiii. Power source must be compatible for the industry 4.0 needs. xiv. Robotic communication must be compactible to Industry 4.0 technology software xv. The robot controller should be capable to identify/integrated and control all welding parameters (Wire speed, voltage, pulse current, oscillation frequency, amplitude, pulse frequency, start crater, end crater, height set value, base current etc) via robot teach pendant during arc on condition. xvi. Minimum 30 days data documentation must be available in welding system and can capable of transfer the data thru Ethernet cable, via Internet and Via USB slot xvii. System must have facility to give an alarm in case of desired motor force is not being performed, this can intimate the feeding issue. xviii. Earth cable of 4m long 70 mm² Copper cable fitted with earth clamp.
2.19	Wire Feeder	<ul style="list-style-type: none"> i. 4-roll driven Wire Feeder. Easier pressure dipper with single arm attachment. ii. Wire diameter – 1.0 mm, 1.2 mm, 1.6 mm & 2 mm must be supported. iii. Wire Speed: Up to 30 m/min or higher iv. Torch End Connector: OEM to specify v. Operating Voltage: Up to 60 V DC or higher vi. Degree of protection: IP21 or better vii. Inbuilt with wire feeder control card. viii. Feed rolls with colour marking for wire diameter.
2.20	Cooling Unit	<ul style="list-style-type: none"> i. Closed circuit circulating unit. ii. Tank capacity: up to 3.0 liters or higher. iii. Flow rate: minimum flow rate should 1.2 lpm at the torch. iv. Max. Pump Pressure: Up to 4 bar or higher.

		<div><div>v.</div><div>vi.</div><div>vii.</div><div>viii.</div></div> <div>Rise: Up to 35 m or higher. Cooling capacity at 40°C: 1000 W and above is preferable. Coolant pump: centrifugal type. Hoses and fittings with bypass valve. Pressure switch for feedback. Thermal sensor in the return flow to measure the return temperature of the coolant.</div>		
2.21	Welding Torch	<div><div>i.</div><div>ii.</div><div>iii.</div></div> <div>Torch Bend neck angle – Up to 45 degrees after mounting with robot axis Cooling Type – Water Cooled Collision Sensor must be present to protect the Torch head & the sensor should be capable to stop the complete system automatically in case of any collision.</div>		
2.22	Welding Helmet – 01	Auto darkening helmet must 1/1/1/2 EN379 classification and shade level must 9-13 DIN.		
3.0	Welding Table – 01 no.	<div><div>i.</div><div>ii.</div></div> <div>3000 mm x 2000 mm nitrided welding table. All type of clamps and holding devices must be provided.</div>		
4.0	Robotic manipulator	Two 6-axis robotic manipulator with following specifications must be provided		
4.1	Robot specification	<div><div>i.</div><div>ii.</div><div>iii.</div><div>iv.</div><div>v.</div><div>vi.</div><div>vii.</div><div>viii.</div><div>ix.</div><div>x.</div><div>xi.</div><div>xii.</div><div>xiii.</div><div>xiv.</div><div>xv.</div><div>xvi.</div><div>xvii.</div></div> <div>Type Number of controlled Axis Rated Payload Protection Working Area Operating range axis 5+90degree Operating range height Collision radius Positional repeatability Wrist Design for cables Input Power Supply Power Consumption Controller Robot controlling Software Safety PC interface protocol Pedestal for robot</div> <div>Pedestal Mounted Welding Robot 6 4 Kg and above IP40/IP54 or better Dia. 3800 mm or better Dia. 2800 mm or better 2200 mm or better 500 mm or better +/- 0.15 mm or better Preferably solid to ensure better feeding & prevent damage of internal torch conduit cable 400 V 3 Ph AC +/- 5% or better Up to 15 KVA or lower Both the controller must be configured in such that robot & manipulators are synchronised with each other PC interface software package (perpetual type) with all the necessary features required in additive manufacturing operation. Offline programming software must be able to directly communicate with the controller. Double circuit with supervision, emergency stops and safety functions. 3 positions enable device. TCP/IP based PC interface protocol for PC based communication with robot controllers must be available. Suitable pedestals not less than 800 mm in height must be provided for the installation of the robots.</div>		
		5.0	Backup and Data Communication (PC configuration)	<div><div>i.</div><div>ii.</div></div> <div>UPS Communication system</div> <div>Suitable UPS only for the controller with at least 60 minutes back up for the communication system. <div><div>•</div></div>Processing Unit: 2.8GHz. Or better, Intel Core i7 (seventh generation or newer) or equivalent;</div>

			<ul style="list-style-type: none"> • Memory: 1TB or higher, • RAM: 16 GB or higher • Graphics card, • USB front port: minimum 2 • Display: 23" or higher Color LED Monitor; • Operating system: Windows 10
		iii. Communication software	<ul style="list-style-type: none"> • Any other items or software's necessary, other than the mentioned above, for the proper installation and commissioning of the WAAM system as well as its hassle- free functioning must be specified in the pre-bidding meeting by the vendor. • If found to be suitable, those additional items or software's must also be quoted and supplied by the vendor.
6.0	Turn Table/positioner Specification – 01 no.	i. Type	2 Axes Floor Mounted
		ii. Handling capacity	400 Kg or above
		iii. Max continuous torque	600 Nm or above
		iv. Repetitive accuracy	0.5 or better
		v. Max rotation speed (°/s) Axis 1	85 or above
		vi. Max rotation speed (°/s) Axis 2	100 or above
		vii. Degree of tilting	45° or above
		viii. Structure height from floor to table	700 mm or above
		ix. Synchronization	This Two Axes Turn Table must synchronise with one of the above 6 Axis robots.
7.0	Warranty	2 Year's warranty for robot and all the above-mentioned items for the smooth and trouble-free working after installation and commissioning.	
8.0	Training	On-site hands-on training for at least 7 working days covering all aspects of equipment, operation and maintenance within two weeks of installation.	
9.0	Support	After warranty the bidder must provide the necessary after sales support for smooth operation of the system for 5 years or more.	
10.0	Acceptance criteria	The system must able to perform a proper butt joint of thick plate as per AWS B3.0-77 specification after installation.	


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