

DEPARTMENT OF MATERIALS ENGINEERING
INDIAN INSTITUTE OF SCIENCE (IISc), BENGALURU, INDIA

Global Tender Notification for 6-axis articulated robot.

(Last Date for Submission: January 10, 2024)

GTE Approval No.: IISc-GTE-2023-315

Tender Notification Ref No.: MT/ENQ-GL-TNDR/SSU-CoE/23-24/06

Date: 20th December 2023

This is a **Request for Quote (RFQ)** for supply of “**6-axis articulated robot for robotic arc welding application. The robot must be interfaced with a gas metal arc welding (GMAW)**” for Department of Materials Engineering Indian Institute of Science, Bangalore. The tender should be submitted in two separate sealed envelopes: one containing the **technical bid** and the other containing the **commercial bid**, both of which should reach us, duly signed on or before **10th January 2024 on or before 1700 hrs.** The bids should be addressed to:

The Chair
Department of Materials Engineering
Indian Institute of Science
Bangalore – 560 012
Kind Attn.: Prof. Satyam Suwas
Email: satyamsuwas@iisc.ac.in/chair.mte@iisc.ac.in

The scope of the supply includes Installation, Commissioning and Training at site for the “6-axis articulated robot for robotic arc welding application. The robot must be interfaced with a gas metal arc welding (GMAW)”.

Tender Summary

1	Tender number	<i>MT/ENQ-GL-TNDR/SSU-CoE/23-24/06</i>
2	Tender Date	<i>20.12.2023</i>
3	Item Description	6-axis articulated robot
4	Tender Type	Two Bid System: (a) Technical Bid (Part A) (b) Commercial Bid (Part B)
5	Place of Tender submission	Prof. Satyam Suwas Chair, Department of Materials Engineering, Indian Institute of Science, Bangalore - 560012
6	Last date & Time for submission of tender	10th January 2024 at 5.00 P.M

General Terms and Conditions:

1. The bid should be submitted in two-cover system, i.e., technical bid and commercial bid separately in sealed covers. The technical bid should contain all commercial terms and conditions, except the price.
2. In the commercial bid, the price should be inclusive of all discounts.
3. The lead time for the delivery of the items should not be more than 16 weeks from the date of receipt of our purchase order. It should be clearly mentioned in the technical and commercial bids.
4. All the quotations must be valid for at least 90 days at the time of submission.
5. List of customers and references: It is preferable for the Bidder should have supplied similar equipment in centrally Funded Technical Institutes (IITs, IISC, IISER, NIT). Please provide the details and contact information.
6. The Bidder must not be blacklisted/banned/suspended or have a record of any service- related dispute with any organization in India or elsewhere. A declaration to this effect should be provided.
7. Items in addition to those listed in the technical table that you would like to bring to the attention of the committee, such as data sheets, technical plots etc. can be listed at the end of the compliance table.
8. Vendors are encouraged to highlight the advantage of their product over comparable products from the competitors.
9. If needed, a meeting for any technical clarifications can be scheduled with the undersigned by sending an email.
10. The Institute reserves the right to accept or reject any bid, or to annul the bidding process and reject all bids, at any time prior to the award of contract without thereby incurring any liability of the affected bidder or bidders.
11. After the award of purchase order, the vendor must provide an Order Acknowledgement within 30 days from the receipt of the Purchase Order.

The tender documents can be sent at the following address:

The Chairman
Department of Materials Engineering
Indian Institute of Science, Bangalore 560012
Karnataka (INDIA)

Technical requirements

Please note that the requirements listed below are only guidelines. It does not disbar bids that do not meet the criteria listed. Vendors are requested to quote for equipment that meet the criteria to the best extent possible and list deviations. Deviations are NOT an automatic reason for disqualification. They will be discussed by the technical committee prior to making an informed decision.

01. 6-axis articulated robot

Scope: 6-axis articulated robot for robotic arc welding application. The robot must be interfaced with a gas metal arc welding (GMAW) power supply, torch and support all the accessories of the welding equipment.	
Sr. No.	
1.0	Specifications of the robot
1.1	Arm type: Articulated.
1.2	Number of axes: six.
1.3	Robot wrist (4, 5, and 6 axes): Thermally coated with suitable material to withstand the welding preheat and inter-pass temperatures of 350 ⁰ C or more.
1.4	Payload: 16 kg or more (20 kg preferred).
1.5	Supplementary load on robot arm: 20 kg or more (at base unit/Joint 1) and 15 kg or more (at arm/ Joint 3).
1.6	Pose repeatability = ± 0.05 mm or better.
1.7	Minimum axes range (minimum speed) required Joint 1: +185 deg / -185 deg (190 deg/s) or better Joint 2: -185 deg / +65 deg (170 deg/s) or better Joint 3: -138 deg/ +175 deg (170 deg/s) or better Joint 4: +350 deg/ -350 deg (350 deg/s) or better Joint 5: -120/ +120 deg (350 deg/s) or better Joint 6: +350/ -350 deg (540 deg/s) or better.
1.8	Maximum reach: 1600 mm or more.
1.9	Mounting position: Floor.
1.10	Noise level: 80 db or less.
1.11	Motor: AC Servo Motor for all 6 axes.
1.12	External drive: Provision for external drive addition in controller.
1.13	Ambient temperature: 10 ⁰ C to 45 ⁰ C
1.14	Brakes: Electrical/ Mechanical brakes in all axes.
1.15	Main application: Automated thin sheet welding and direct energy deposition - wire fed additive manufacturing using a GMAW welding setup.
1.16	Protection rating of robotics arm: IP 54 or better.

1.17	Safety regulations: Should fulfil one or more of the following standard industry applicable safety regulations like EN60204-1:2006, ISO 10218-1:2006, ANSI/RIA R15.06, UL 17410 or equivalent.
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2.0	Controller
2.1	Drive system: AC servo drive.
2.2	Number of controlled axes: 6 Axes.
2.3	Provision for additional axes: Minimum 2 numbers via a synchronized positioner.
2.4	Processor: Multi processor system preferably with PCI bus.
2.5	Operating system: Well proven real time operating system.
2.6	Programming language: User friendly programming through teach pendant and robot programming language specially for additive manufacturing applications.
2.7	Program memory capacity: Flash disk for mass memory at least 1 MB, expansion and additional back-up facility will be preferred.
2.8	External storage: SD/PCMCIA card slot or RW CD/ DVD drive.
2.9	Other requirements: USB memory interface. Energy back-up power failure handling. Provision for connecting to external keyboard and external monitor display.
2.10	External Interfaces: Device net/ Profibus/ Interbus/ Ethernet.
2.11	Number of I/O points as provision: Provision for minimum 256 digital inputs and 256 digital outputs (should be expandable). Appropriate number of points for interfacing with a GMAW system should be provided initially.
2.12	Communication Ports: RS 232 / RS 485 / Ethernet port.
2.13	Protection: IP 54 or better.
2.14	Input voltage: 415V +/- 10%, AC 3 phase
3.0	Operator's panel (Teach pendent)
3.1	Cable length (from teach pendent to controller): 8m and above.
3.2	Basic switches: Lockable emergency, reset, power on/Off, mode selector, and other functional keys as required, Joystick/6D Mouse for robot axes moment.
3.3	Visual Display: At least 8 " or larger color LCD screen on teach pendent.
3.4	Hot pluggable provision for teach pendent.
4.0	Software
4.1	Welding technology software: Robot OEM's arc welding technology package for multi-pass, continuous welding to generate arc welding programs by defining process parameters such as torch angle, work angle, push/ drag and spin angles, seam and weave data, wire feed, velocity, speed, current, voltage, etc.

4.2	<p>Two IISc students/technical staff/project staff should be trained on all the above-mentioned softwares and related programming, and the welding cell operation for a minimum of four days, till the engineers gain the confidence.</p> <p>The training program should also include fabrication of components using wire arc additive manufacturing (WAAM).</p> <p>Training on the tasks mentioned below must be covered:</p> <p>Generating the robot program.</p> <p>Uploading the developed robot program into robot control so that the robot can fabricate the component automatically without supervision.</p>
4.3	<p>It is mandatory for the vendor to arrange their trainers visit to IISc Bangalore in person, two months and four months after the commissioning of the robot integrated with the welding equipment. The trainer needs to interact with the designated operators (trained during the initial installation and commissioning period) at IISc Bangalore and clarify their doubts and any problems in using the hardware, software, and related programming.</p>
5.0	<p>Mastering of all axes of robot: Electronic Mastering provision for all the axis of robot.</p>
6.0	<p>Preferred make: KUKA, ABB, FANUC.</p>
7.0	<p>Consumables: Need to supply the consumables necessary for the trouble-free operation of the robot.</p>
8.0	<p>Warranty: Three years warranty for all the above-mentioned items for the smooth and trouble-free working after installation and commissioning.</p>
9.0	<p><i>Any other accessories or softwares necessary (other than mentioned above) for the proper installation and commissioning of the welding robot as well as for its hassle-free functioning, also need be supplied by the vendor.</i></p>
10.0	<p><i>It is the duty of the vendor to perform the integration operation between the welding equipment and the robot, and finally providing the system in working condition. The intended application is wire arc additive manufacturing (WAAM).</i></p>
11.0	<p><i>There must be an option to add additional axes via synchronized positioners at a later date.</i></p>

- ✚ Should have proven record of successful installations within Indian education/research institutes. Proof of such installation must be enclosed.
- ✚ The OEM/Supplier should have trained service engineers stationed in India for any on-site service requirement, details to be provided in the offer.
- ✚ OEM/supplier should have requisite stock of necessary spare parts in India.
- ✚ Company should have a minimum annual turnover of INR 5 crores.

TERMS AND CONDITIONS

1. Warranty period: 3 years.

2. Supplier Credibility:

- a. The Bidder/Vendor Must have supplied minimum 3 robots for WAAM application to reputed Government Organizations in INDIA in the past 3 years. Copies of Purchase Orders to be enclosed along with the Technical Bid as proof.
- b. Supplier should compulsorily indicate details of facilities / expertise/ qualification of support staff in India. Factory trained engineer/s should be available in India for complete product support.
- c. Please enclose User list in INDIA.
- d. Minimum 3 Reference letters of similar system supplied in INDIA need to be submitted for further consideration.

3. Publications:

- a. As our Research Work is of critical nature, Vendors need to enclose reference publications/application note on the usage of “6-axis robot integrated with GMAW system for wire-arc additive manufacturing (WAAM)” to show expertise of the product being offered.

4. Institute reserves the right for final selection of items.

5. Vendors may quote for any other items/accessories separately as “Optional Items”.

For queries or clarifications, please contact:

Prof. Satyam Suwas at satyamsuwas@iisc.ac.in

Annexure-I

Note: Compliance Certificate must be enclosed with the Technical bid. Non submission of Compliance Certificate will lead to disqualification of the bidder.

Sr. No.	Description	C	NC	D	Remarks
1.0	Item description				
1.0	Specifications of the robot				
1.1	Arm type: Articulated.				
1.2	Number of axes: six.				
1.3	Robot wrist (4, 5, and 6 axes): Thermally coated with suitable material to withstand the welding preheat and inter-pass temperatures of 350 ⁰ C or more.				
1.4	Payload: 16 kg or more (20 kg preferred).				
1.5	Supplementary load on robot arm: 20 kg or more (at base unit/Joint 1) and 15 kg or more (at arm/ Joint 3).				
1.6	Pose repeatability = ± 0.05 mm or better.				
1.7	Minimum axes range (minimum speed) required Joint 1: +185 deg / -185 deg (190 deg/s) or better Joint 2: -185 deg / +65 deg (170 deg/s) or better Joint 3: -135 deg/ +175 deg (170 deg/s) or better Joint 4: +350 deg/ -350 deg (350 deg/s) or better Joint 5: -120/ +120 deg (350 deg/s) or better Joint 6: +350/ -350 deg (540 deg/s) or better.				
1.8	Maximum reach: 1600 mm or more.				
1.9	Mounting position: Floor.				
1.10	Noise level: 80 db or less.				
1.11	Motor: AC Servo Motor for all 6 axes.				
1.12	External drive: Provision for external drive addition in controller.				
1.13	Ambient temperature: 10 ⁰ C to 45 ⁰ C				
1.14	Brakes: Electrical/ Mechanical brakes in all axes.				
1.15	Main application: Automated thin sheet welding and direct energy deposition - wire fed additive manufacturing using a GMAW welding setup.				
1.16	Protection rating of robotics arm: IP 54 or better.				
1.17	Safety regulations: Should fulfil one or more of the following standard industry applicable safety regulations like EN60204-1:2006, ISO 10218-1:2006, ANSI/RIA R15.06, UL 17410 or equivalent.				
2.0	Controller				
2.1	Drive system: AC servo drive.				
2.2	Number of controlled axes: 6 Axes.				
2.3	Provision for additional axes: Minimum 2 numbers.				
2.4	Processor: Multi processor system preferably with PCI bus.				
2.5	Operating system: Well proven real time operating system.				
2.6	Programming language: User friendly programming through teach pendant and robot programming language.				

2.7	Program memory capacity: Flash disk for mass memory at least 1 MB, expansion and additional back-up facility will be preferred.				
2.8	External storage: SD/PCMCIA card slot or RW CD/DVD drive.				
2.9	Other requirements: <ul style="list-style-type: none"> • USB memory interface. • Energy back-up power failure handling. Provision for connecting to external keyboard and external monitor display.				
2.10	External Interfaces: Device net/ Profibus/ Interbus/ Ethernet.				
2.11	Number of I/O points as provision: Provision for minimum 256 digital inputs and 256 digital outputs (should be expandable). Appropriate number of points for interfacing with a GMAW system should be provided initially.				
2.12	Communication Ports: RS 232 / RS 485 / Ethernet port.				
2.13	Protection: IP 54 or better.				
2.14	Input voltage: 415V +/- 10%, AC 3 phase				
3.0	Operator's panel (Teach pendent)				
3.1	Cable length (from teach pendent to controller): 8m and above.				
3.2	Basic switches: Lockable emergency, reset, power On/Off, mode selector, and other functional keys as required, Joystick/6D Mouse for robot axes moment.				
3.3	Visual Display: At least 8 " or larger color LCD screen on teach pendent.				
3.4	Hot pluggable provision for teach pendant.				
4.0	Software				
4.1	Welding technology software: Robot OEM's arc welding technology package for multi-pass, continuous welding to generate arc welding programs by defining process parameters such as torch angle, work angle, push/ drag and spin angles, seam and weave data, wire feed, velocity, speed, current, voltage, etc.				
4.2	Two IISc students/technical staff/project staff should be trained on all the above-mentioned softwares and related programing, and the welding cell operation for a minimum of four days, till the engineers gain the confidence. The training program should also include fabrication of components using wire arc additive manufacturing (WAAM). Training on the tasks mentioned below must be covered: <ul style="list-style-type: none"> • Generating the robot program. 				

	Uploading the developed robot program into robot control so that the robot can fabricate the component automatically without supervision.				
4.3	It is mandatory for the vendor to arrange their trainers visit to IISc Bangalore in person, two months and four months after the commissioning of the robot integrated with the welding equipment. The trainer needs to interact with the designated operators (trained during the initial installation and commissioning period) at IISc Bangalore and clarify their doubts and any problems in using the hardware, software, and related programming.				
5.0	Mastering of all axes of robot: Electronic Mastering provision for all the axis of robot.				
6.0	Preferred make: KUKA, ABB, FANUC.				
7.0	Consumables: Need to supply the consumables necessary for the trouble-free operation of the robot.				
8.0	Warranty: Three years warranty for all the above-mentioned items for the smooth and trouble-free working after installation and commissioning.				
9.0	<i>Any other accessories or software's necessary (other than mentioned above) for the proper installation and commissioning of the welding robot as well as for its hassle-free functioning, also need be supplied by the vendor.</i>				
10.0	<i>It is the duty of the vendor to perform the integrating operation between the robot and the welding system, finally providing the system in working condition.</i>				
11.0	<i>There must be an option to add additional axes via synchronized positioners at a later date.</i>				

C-Compliant, NC- Non Compliant, D- Deviation