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GOVERNMENT OF INDIA  
BHABHA ATOMIC RESEARCH CENTRE  
REACTOR, DESIGN & DEVELOPMENT GROUP (RD&DG)  
DIVISION OF REMOTE HANDLING & ROBOTICS (DRHR)

Ref: DRHR /HKS/INQ/2019/233

Date: 16/04/2019

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**Sub: Minor Fabrication - Invitation of Quotation.**

**High precision manufacturing, assembly, testing and CMM measurements of 5-DOF Serial Robot (Qty: Two Sets)**

Dear Sir,

1. Quotations are invited for **High precision manufacturing, assembly, testing and CMM measurements of 5-DOF Serial Robot** (Qty: Two Sets)
2. Bidder shall quote for fabrication and assembly of these components with material.
3. Taxes, Excise Duties, other charges, if any, shall be quoted separately.
4. The quotation must reach **Head, DRHR, BARC** by 15/05/2019 and must be sent in a sealed envelope, super scribed with the **reference number & the due date given above through Registered / Speed post only.**
5. The address on the envelope should read:

**Head, DRHR, BARC  
BARC, Trombay,  
Mumbai - 400 085.**

6. The fabrication and assembly work shall be subjected to inspection by our engineer. The finished unit shall not be dispatched prior to approval by our engineer at bidder's premises. Necessary inspection facilities should be provided to our engineer during fabrication and assembly at bidder's premises.
7. The bidder shall deliver the finished unit, **within six months** from the date of firm work order issued to the bidder. The unit shall be delivered by the bidder at **DRHR, BARC, Trombay, Mumbai - 400 085.**
8. **Head, DRHR, BARC** reserves the rights to accept / reject any or all quotations without assigning any reason.
9. Incomplete offer / offer received after the due date shall not be considered.
10. Quotations should be preferably neatly typed and corrections are not acceptable.
11. Quotation must also indicate the validity of offer.
12. Quotation received in computer-generated form shall not be acceptable. Quotation must be submitted in printed letterhead, mentioning clearly **GST** registrations No., PAN No. & Service Tax Registration No. Submission of challan and Invoice shall also comply the same, in case, work order is placed.

Encl.: Tender specification , Assembly Drawing & Bill of Material.

**Head, DRHR, BARC**

## **Annexure-I** **Tender Specification**

The proposed minor fabrication work is for manufacturing, assembly and CMM measurement of **5-DOF Serial Robot (Qty: Two Sets)**.

These systems are indigenously designed by BARC for medical applications. Highest level of workmanship is desired in manufacturing and calibration. Hence, the supplier should possess technically qualified staffs and machine shop as mentioned in Sec.-3.7 supported by high precision metrology unit in one place. **Based on vendor evaluation, Work Order would be issued to the technically suitable vendor.**

### **1.0 Applicable Engineering Standards:**

ASTM A-240:	Heat Resisting SS304/304L Plates/Sheets/Strips
ASTM A-370:	Methods and definition for Mechanical Testing of Steel Products.
ASTM A-484:	General requirements for Stainless and Heat-Resisting Bars, Billets and Forgings
IS 919:	Recommendations for Limits and Fits
IS 2048:	Parallel Keys and Key-ways
IS 2269:	Hex. Socket Head Cap Screws
IS 2473:	Dimensions for Centre Holes
IS 3075:	Dimensions for Circlips
IS 3428:	Dimensions for Relief Grooves
IS 4218:	ISO Metric Screw Threads

Note: Material shall be tested and qualified as per standard procedure.

### **2.0 SCOPE OF THE WORK**

- 2.1 Preparation of manufacturing drawings of components from the CAD models supplied, Manufacture of components and assembly as per the approved drawings. Design and 3D CAD model will be provided along with Purchase Order.
- 2.2 Procurement of all standard hardware such as fasteners, bearings, etc., as per the tender specification and mentioned in the drawings. Motors and encoders will be provided for assembly and testing.
- 2.3 Cable procurement, connection and routing, powder coated terminal box and interfacing with the standard electronic board (procurement of the electronic board is not in the scope of work).
- 2.4 Manufacturing of necessary fixtures for CMM measurement of the system.
- 2.5 Submission of test certificates for the materials procured as and when required by the purchaser.
- 2.6 Preparation of inspection reports of all components and sub-assemblies at the appropriate stage during fabrication and submission of these reports to the

purchaser as and when required by the purchaser to do so during the execution of the contract.

- 2.7 Approval for any deviation in design with necessary reasons for the same through QC agency.
- 2.8 Offering the components, sub-assemblies, or the full equipment for inspection by the purchaser as and when required by him to do so during the execution of the contract.
- 2.9 The finished components, sub-assemblies & assembly must be as per the technical instructions provided with the manufacturing drawings and work order specifications. The vendor must modify/replace components deviating from the specification at own cost.
- 2.10 A customized good quality flight suitcase to carry the system along with the interface has to be provided as a part of packaging and safe crating of the equipment so as to avoid any damage during handling.
- 2.11 Delivery of the equipment at the specified destination.
- 2.12 A guarantee of the equipment for a period of one year from the date of acceptance. This guarantee shall cover free repairs or replacement of parts, which have failed during normal operation within the guarantee period of one year due to defective workmanship.
- 2.13 In the event that certain requirements of drawings conflict with the requirements of the specifications, the governing requirements shall be at the discretion of the purchaser. The purchaser reserves the right to revise the drawings without materially altering the scope of work. Minor changes or modification in design that may be incorporated at any stage for ease of fabrication or to improve the performance of the product should be considered within the scope of the specified work.

### **3.0 Materials and Workmanship**

- 3.1 All the raw materials required for manufacturing of components are to be arranged by the supplier as per given specification. Materials, processes and parts shall be of good commercial quality and in accordance with good practice pertinent to manufacture of high quality equipment. Supplier is required to submit material test certificate and get it approved by the purchaser before starting the manufacturing.
- 3.2 Electrical cables & connectors shall be procured through genuine/ authorized dealers only.
- 3.3 Fasteners, External/ Internal Circlips, Plain/ spring washers, etc as required for assembly and sub-assemblies should be procured by the supplier. It is preferred for supplier to procure stainless steel fasteners.
- 3.4 Obtaining prior approval of the purchaser for the material to be used or intended to be used as an alternative to the specified material.
- 3.5 The workmanship shall be in accordance with high-grade industrial practice. The machines and processes used for manufacturing shall ensure consistent surface finish and dimensional tolerances specified in component drawings. All parts shall be free of sharp edges, cuts scratches and other visible defects.

- 3.6 The mechanism consists of number of precision mechanical components with close tolerances. Strict cleanliness should be maintained at all stages of storing, handling, machining, inspection, assembly, functional checking and packing. Assembly of all the components should be done in dust free clean room.
- 3.7 Bidder is required to have following items with them:
- (i) High quality machining facilities like CNC turning center, VMC, CNC, EDM, Wire-cut etc.
  - (ii) Component inspection facilities like CMM, high quality inspection tools, go-no-go gauges, etc.
  - (iii) Technically qualified staff to take up assembly as well as testing.
  - (iv) Clean room facility for component storing, handling and assembly.
  - (v) Assembly facilities like small size press, assembly kits, external/internal circlip pliers, bearing fitting kit, etc.

#### **4.0 CMM Measurement**

Repeatability and accuracy at various configurations are prerequisite for the successful use of the system. Hence, CMM measurements would be taken to ensure that.

- CMM of assembly and sub-assemblies for establishing various parameters.
- Calibration of the system based on CMM and theoretical data.
- The calibration, accuracy, repeatability of the systems should be carried out in presence of officiating BARC personnel according to the procedures set by the BARC engineers. The step by step procedure will be made available at the time of placing the order.
- Approximately 40 hours of CMM facility would be required for the calibration job.

#### **5.0 Quality surveillance, inspection and inspection report**

- 5.1. The supplier shall depute one Quality Control Engineer dedicated to this work. He should inspect every component and assembly and prepare inspection reports.
- 5.2. As already detailed, all the raw materials to be used for the manufacturing have to be of tested quality. It will be the responsibility of the supplier to provide such test certificates and obtain approval from the Purchaser before the commencement of manufacturing.
- 5.3. The standard parts (screws, bolts, nuts, ball bearings, circlips, and other items like this) have to be of good standard quality and conforming to BS or IS or other equivalent standard. The certification to this effect has to be provided by the supplier.
- 5.4. The item covered under this tender specification demands highest degree of quality and reliability standards. In line with the requirement, the supplier should have documented quality assurance system to ensure the quality at all the stages of job execution.

- 5.5. During manufacturing, inter-stage inspection shall be carried out by the purchaser's representative. Supplier has to submit inspection reports along with the delivery of components. For inspection, the fabricator would provide the following:
- The drawings and / or tooling involved.
  - Gauge, instruments etc required for inspecting the work.
- 5.6. Inspection including dimensional inspection during all phases of manufacture shall be the responsibility of the supplier. All the components shall be subjected to 100%-dimensional inspection to ensure that they confirm to the respective drawings. All dimensions shall be recorded and made available for inspection. Deviations, if any, may be clearly brought out and component acceptance shall be reviewed/ approved by BARC. In case, deviation is found to be not acceptable, this will form ground for component rejection.
- 5.7. Components found unsatisfactory due to workmanship or material shall be removed by the fabricator and replaced by components, which are satisfactory.
- 5.8. The fabricator shall use materials as specified by the purchaser.
- 5.9. The finished components shall not be dispatched prior to approval by our engineer at bidder's works.
- 5.10. The supplier should manufacture, assemble and test the unit as per the specifications and should obtain clearance from the purchaser before making the delivery.
- 5.11. The various component storing, handling and assembly is required to be done in a dust free clean room. Suitable jigs/ fixtures may be used, if required. Supplier shall arrange complete assembly of the mechanism and shall demonstrate free running of various components.
- 5.12. The purchaser will have free access to the manufacturer's premises or the premises of his sub-contractors for the purpose of inspection of raw materials, semi or fully finished components or sub-assemblies of the equipment during any stage of manufacture.
- 5.13. The supplier shall prepare internal inspection sheet for each component. Internal inspection sheet for dimensional inspection shall have sketch of the part to be inspected. Internal inspection sheets should be provided to the purchaser at the time of component inspection.
- 5.14. Pre-dispatch inspection and testing of the full assembly will be carried out by the purchaser. The assembly will be tested for manufacturing errors and its influence on the end effector position and orientation. The supplier will provide the suitable mounting arrangement and testing equipment.

## **6.0 Packaging and Delivery**

After assembly, inspection and clearance by BARC, the items shall be suitably packed in a weather-proof, roadworthy strong transportation box and delivered to BARC, Trombay, Mumbai. Spare components manufactured shall also be separately packed and delivered to BARC.

## **7.0 Sub-contract**

At any stage of manufacturing, the supplier shall not sub-contract any work without written consent from the purchaser. The supplier shall be responsible to the purchaser for the work sub-contracted by him. The scope of the subcontract shall be clearly indicated in the offer. The sub-contractor shall be approved by the purchaser.

## **8.0 Terms and conditions, in general**

- 8.1. All the drawings, technical specification issued with the tender are the property of BARC. After job execution, supplier is required to return all the drawings/ technical documents, if any to the purchaser.
- 8.2. Delivery schedule: The work covered under the work-order shall be completed on/before **Six months** of release of purchase order.
- 8.3. Payment shall be made only after satisfactory completion of work and on production of bill and advanced stamped receipt.
- 8.4. Any delay which is attributable to the supplier is liable for a penalty @0.5% per weeks (maximum 5%) to be impaired on the supplier.
- 8.5. In case of any extension in delivery date is to be granted, a request from the supplier for extension may be given before expiry of the work order.

## **9.0 Income Tax**

Income Tax @ 2% will be deducted from supplier's bill.

## **10.0 GST**

As per the latest Govt. of India guidelines.

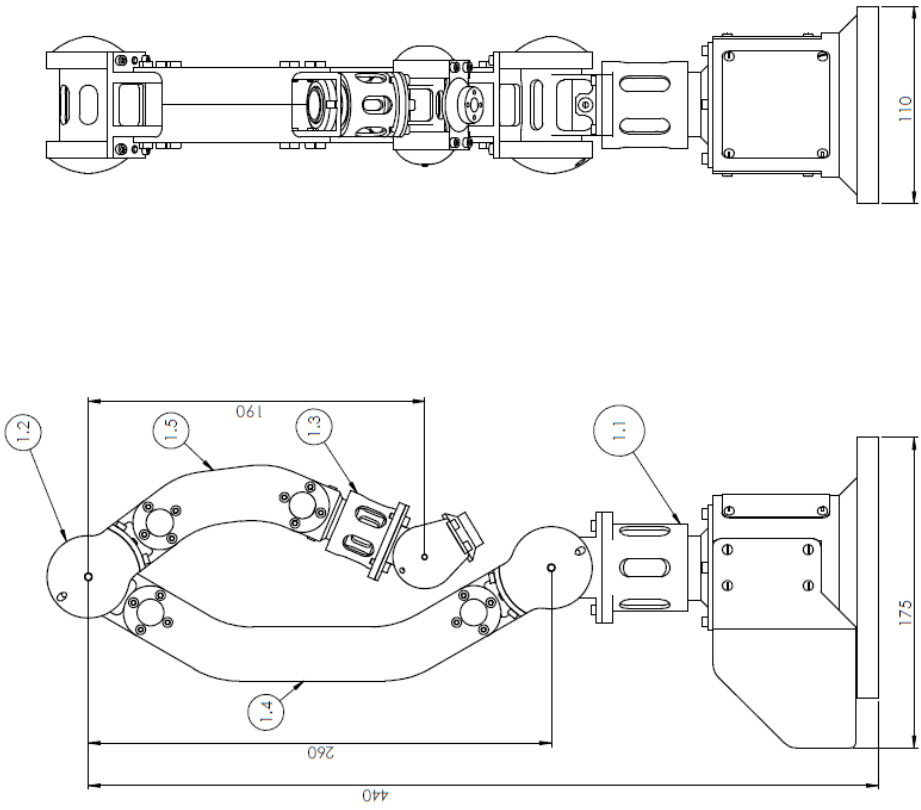
## **11.0 Guarantee/Warranty**

Supplier must issue the warranty certificate for minimum of **12 months** from the date of dispatch, against workmanship/design defects etc and a certificate of compliance.

## **12.0 Confidentiality clause**

- 12.1. No party shall disclose any information to any third party concerning the matters under this contract generally. In particular, any information identified as 'Proprietary' in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party. This clause shall apply to the sub-contractors, consultants, advisers or the employees engaged by the party with equal force.
- 12.2. The contractor or sub-contractor, consultant, adviser or the employees engaged by the contractor shall not use BARC's name for any publicity purpose through any public media like Press, Radio, TV or Internet without the prior written approval of BARC.
- 12.3. Any contravention of the above-mentioned provisions by any contractor, sub-contractor, consultant, adviser or the employees of a contractor will invite penal consequences under sec. 18 of Atomic Energy Act and 'Official Secrets' under sec. 5 of Official Secrets Act.

1	2	3	4	5	6	7	8
<b>BILL OF MATERIAL</b>							
ASSEMBLY							A
ASSTY NO. ITEM NO.	DESCRIPTION	MATERIAL	QTY.	DRAWING NO.	REMARKS		
#1	MAIN ASSEMBLY	-	1	A2-DRFR/NEUROBO1.0			
1.1	BASE ASSEMBLY	-	1				
1.2	MID JOINT ASSEMBLY	-	1				
1.3	WRIST ASSEMBLY	-	1				
1.4	ARM-1	-	1				
1.5	ARM-2	-	1				
B							
C							
D							
E							
F							



**Annexure-III**  
**Bill of Material for one set of Assembly**

SR. NO.	COMPONENT NAME	MATERIAL	NOS.	SIZE (mm)
	<b>ARM1_ASSY</b>			
1	MDARM 1	Titanium	2	215X60X30
	<b>ARM2_ASSY</b>			
1	ARM2	Titanium	2	120X50X30
	<b>MID_JOINT_ASSY</b>			
1	MID_JOINT_MOTOR_HSG	AISI 304	1	80X60X40
2	JOINT2_FRONT_BEARING_CAP	AISI 304	1	65x55x25
3	JOINT2_BACK_BEARING_CAP	AISI 304	1	65X55X25
4	JOINT2_BRACKET	AISI 304	1	65X50X35
	<b>WRIST_ASSY</b>			
1	WRIST_BRACKET	AISI 304	1	45X45X45
2	WRIST_PAN_MOTORHSG	AISI 304	1	Ø30x50
3	WRIST_PAN_BEARINGHSG	AISI 304	1	Ø50X40
4	WRIST_TILT_MOTOR_HSG	7075-T6	1	50X50X40
5	ENDEF_BEARING CAP1	AISI 304	1	45X25X25
6	ENDEF_FLANGE	AISI 304	1	55X35X20
7	ENDEF_BEARING CAP2	AISI 304	1	45X40X25
	<b>BASE_JOINT_ASSY</b>			
1	BASE FIXTURE	AISI 304	1	Ø150X100
2	CONNECTOR BOX	6061 ALLOY	1	125X85X85
3	BASE_COVER	6061- ALLOY	1	65X65X20
4	BASE_JOINT_BEARING_HSG	AISI 304	1	Ø70X60
5	BASE_JOINT_MOTOR_HSG	AISI 304	1	Ø40X80
6	JOINT2_MOTOR_HSG	AISI 304	1	70X60X55
7	BASE_JOINT_LOWER_BEARING_CAP	AISI 304	1	Ø75X25
9	JOINT2_FRONT_BEARING_CAP	AISI 304	1	65x55x25
10	JOINT2_BACK_BEARING_CAP	AISI 304	1	65X55X25
11	JOINT2_BRACKET	AISI 304	1	65X50X35
	<b>STANDARDS</b>			<b>Specification</b>
1	NSK Slim Ball Bearing	30x42x7	6	6806 DD
2	NSK Slim Ball Bearing	20x32x7	4	6804 DD
3	SOCKET HEAD CAP SCREW IS	STD	57	M3X8
4	SLOTTED PAN HEAD SCREW IS	STD	12	M3X8
5	LOCK NUT IS	STD	1	ID19 OD32