ANNEXURE TO TENDER NO.MRPU/IGCAR/CAP/6673

I. Description of the ITEM: Sample Handling Robot

II. Detailed SPECIFICATIONS and Quantity:

Technical specification for Sample Handling Robot (SHR)

Sample Handling Robot constitutes a major role in the Remote Sampling System. Comprehensive remote sampling system is a robotic sampling system for the remote sampling of process liquid in the DFRP analytical cell. It is an application specific programmable robotic sampling system to carry out various operations of remote sampling and analysis of process samples. The function of SHR is to collect sample bottles from various predefined locations and move through different stations to collect sample in the sampling cell, Capping / de-capping of filled sample bottle, Pipetting & dispensing of sample and disposal of tip and used sample bottle in the analytical cell. Though these operations are executed remotely through a robotic sampling system containing a Sample Handling Robot (SHR), Capping / Decapping Robot (CDR) and Pipette Robot (PPR), only SHR is in the scope of supply and other robots like CDR & PPR are not covered in the scope of delivery. These robotic systems form a complete remote sampling system for DFRP sampling and analytical cell. The environment of the remote analytical cell is highly radioactive along with nitric acid fumes. The main constraints are remote assembly and disassembly of robot using 250 kg capacity in-cell crane along with articulated Master slave manipulator of capacity 4.5 Kg and nitric acid fume compatible construction elements.

1.00 Scope of Supply:

Scope of supply includes the supply of sample handling robot as per the specifications detailed in this technical specification. The supplier has to prepare manufacturing drawing with tolerance and allowances for approval, manufacturing the same as per the approved drawings, assembling &testing at supplier's shop floor, delivery, and installation & commissioning at IGCAR.

2.00 Sample Handling Robot (SHR)

SHR contributes major share in the remote sampling process. It has five degrees of freedom viz., X-axis, Y-axis, Z-axis, Theta-axis, YM_1-axis, YM_2-axis plus two grippers. It is a cantilever configured custom built robot. The entire design concept is based on the remote assembling and dismantling of SHR using the 250 kg capacity in-cell crane along with articulated master slave manipulator of capacity 4.5 Kg. Major design criteria is that all the components used in the SHR should be compatible with radiation as well as compatible for nitric acid fumes environment. The major task of this robot is to pick the sample bottles from the sample bottle storage rack, transport it to various stations (20 stations placed in the operator side and 40 stations placed on far side of operator platform) within the sampling cell for different operations like capping, de-capping, sample collection through the available sampling points and storing the filled sample bottle in storage rack, which will be transported to analytical cell (located at the lower elevation) or transported to lab. Z, YM_1, & YM_2-axes ball screw shall be THK make made of stainless steel. X, Y, Z - Axes actuators shall have remote replacement provision using articulated master slave manipulator and manual canting provision to move the respective axis to the convenient position for maintenance. The following are the major operations to be carried out by the SHR in a normal cycle of operation. The sequences below given are to understand the operation only. The final sequence of operation shall be obtained from the department during manufacturing. The execution command can either be issued through **pendant or PC** from a taught command stored in a controller memory. The sequence of operation shall be modified by the operator during the course of operation subjected to the operational requirement.

a) Homing of all the axes of SHR

b) Picking the sample bottle from sample bottle rack (bottle racks are positioned in a predetermined location with empty bottles in a matrix) - SHR

c) Transporting the empty sample bottle to the user selected station from the available sixty sampling point to collect sample - SHR

d) Transporting the filled sample bottle to the transport rack placed in the predetermined location for the transportation of the same to the analytical cell. - SHR

e) Back to home position if there is no further samples to be collected immediately otherwise the robot has to continue the above cycle of operation (i.e. b to d) as many times it is required to be performed.

Configuration of SHR: Cartesian coordinate

DOF: 5 (with 2 Redundant DOF) plus two grippers

Payload: 5 kgf

Structural materials: SS 304L unless specified

High stressed components: Transmission gears/screws/shafts, guide bars and Load bearing strips in fixed rail structure 17-4 PH steel / SS 410 or SS 420 with required heat treatment with anti corrosive hard chrome plating finish

Bearings: Material- AISI 440C, Tolerance & finish - Class 6(IS 5692, IS5933), Double side sealed & lubricated with radiation resistant lubricant, Make – SKF or equivalent

Radiation dose level: Cumulative dose of 10^8 Rads (approx)

2.01 Travel & Speed Range for Various Modules:

S. No.	Module	Travel range	Speed range	Remark
1	X-axis	5900mm	05 – 30 mm/s	
2	Y-axis	400mm	05 – 30 mm/s	
3	Z-axis	500mm	10 – 30mm/s	
4	Theta	±180 deg.	10 – 30deg/s	
5	YM1	150mm	05 – 20mm/s	
6	YM_2	150mm	05 – 20mm/s	
7	Gripper	5 – 30mm	05 – 20mm/s	2 Nos.

Quantity: one unit

2.02 X – Axis:

This is a longitudinal axis parallel to the cell wall running along the cell wall at an elevation of 1000 mm from an operator platform to a length of 6200mm (Approx. structure length) and a travel of 5900mm. This is the basic module on which the remaining axes viz. Y-axis, Z-axis, Theta-axis, YM_1-axis, YM_2-axis and grippers are added as a module. The structure of the X-axis is a 6200mm long fabricated box structure split into four pieces of each 1550 mm long on which rails are placed and X-axis carriage moves on these rails to achieve the X motion along the X-axis. This special configuration of the rail system allows the total SHR system to be assembled and disassembled remotely using the in-cell crane and articulated master slave manipulator provided inside the cell. The rail cross sectional configuration and other details are shown in the drawing **No. IGC/GRIP/RHS/RCN/001 and 003.** The load bearing surface in the fixed rail shall be made of SS 410, hardened with hard chrome plated finish. X-axis carriage is designed such that it ensures self alignment with the fixed rail while assembling it remotely. Side Roller assemblies provided one side shall be provided with eccentric shaft with proper shaft locking arrangement so that the clearance between roller and load bearing strips can adjusted using the eccentric shaft and locked in position after the adjustment is completed. This axis should be provided a radiation resistant cable tray and the fixing of the cable tray with X-carriage should be remotely removable using MSM from the carriage when it is required to be removed for maintenance. All the power cables for the modules shall also be remotely removable along with the respective modules & motors. Power connectors shall be made of SS 304L and push pull type with radiation resistant elastomer sealed connector. Locating pins should be used to align the connectors. Each module in the SHR shall be provided with lifting hook considering the CG of the subassembly. Motors used inside the cell shall be sealed against acid fumes.

2.03 Y – Axis

The Y – axis is modular in construction and shall be engineered and assembled in such a way that it shall be dismantled without disturbing the X-axis modules using crane and articulated master slave manipulator available inside the cell. It is a cantilevered type configuration. This axis assists in coarse positioning of SHR end effectors. It has a maximum travel of 400mm. The interface of Y axis with X-carriage shall be provided with roller guide dovetail slot with two dowel pin stoppers at the bottom and a cam lock. Uniform chamfer in the sliding plate should be provided in the thickness and width dimensions.

The rail cross sectional configuration and other details are shown in the drawing No. IGC/RHS/DFRP/002 attached to this technical specification**.** This axis shall be stiff enough to

minimize the deflection and sturdy enough to absorb vibrations to facilitate the precise positioning of the end effectors during the operation. It is the base for mounting Z – axis, YM_1-axis, YM_2-axis and gripper modules. Lifting hook / bails shall be provided at the CG position to handle the Y- axis module by in-cell crane. Moving carriage of Y axis should be provided with lock which will be used during the removal / assembly of Z, Y axis in order to keep its position locked at one position since the y axis is driven by rack & pinion and its position may get disturbed during the assembly / removal. The lock should be placed in articulated master slave manipulator reach and should be smoothly operable by MSM. All the power cable shall be routed to a junction point and it shall be possible to disconnect the cable connections remotely along with their respective modules using the in-cell crane and articulated master slave manipulator provided inside the cell. Necessary cable tray shall be provided for this axis. Stainless steel THK linear motion guides, rails and sealed precision bearings shall be used for this axis. The supplier should ensure that there is no polymers are used in the THK linear motion guides, rails and sealed precision bearings in the form of retainer etc.

2.04 Z – Axis

This Z – axis is provided to move the end effectors vertically up and down. It also provides base for mounting theta axis on top of the Z-axis structure. The structure of the Z-axis with theta axis will form a "T" structure. It has a travel range about 600mm (approx). A stainless steel rectangular hollow box section shall be used to mount the THK stainless steel LM rails and other guides which are required for the Z-axis travel. To avoid tilting of the Z-axis structure two THK make WIDE LM rails and moving block shall be used. The rail cross sectional configuration and other details are given in the drawing No. **IGC/RHS/DFRP/002.**

2.05 θ - Axis

This axis provided to rotate the **YM_1-axis and YM_2** axis by ±180 deg. It shall be driven through a worm and worm wheel (finish grade of AGMA 10) to prevent back drivability due to impulsive force experienced by SHR during the motion of the system. This module shall be mounted on the top of the Z-axis. Also this module provides base for mounting YM_1-axis and YM_2 axes. The general arrangements are shown in drawing No**. IGC/GRIP/RHS/RCN/002.**

2.06 YM_1-axis and YM_2-axis

Both axes YM_1 and YM_2 are identical in all aspect. This is complementary to the Y-axis. This axis is used for precise positioning of the SHR end effectors, also to have additional reach by 150mm. It shall be precisely guided by the standard guide bar and SS linear bearing inside the

circular shell housing. All stainless steel construction LM guide bar and linear bearing of reputed make like THK should be used to reduce the deflection and weight. Motors, lead screw and nut etc. are housed inside the housing pipe.

2.07 Gripper

The gripper is the non-reversible electrically operated end effectors. It will be fixed at the end of YM_1-axis and YM_2-axis as a separate module. Payload at the gripper shall be **5 kgf**. Its function is to grip the bottle and transport to various stations, sample collection point, storage rack etc. Gripping range shall be 05 to 30 mm.

3.00 Structural supports to be done at site during installation

All SS 304L structural supports shall be provided by the supplier along with this order. The fixed rail and its accessories shall be welded with the 6mm vertical containment enclosure sheet provided in the DFRP sampling cell. Since the containment sheet is a thin member, necessary gusset support and frames are to be welded with the existing containment sheet, where the system has to be installed. The supplier shall contact the indentor for any clarification.

4.00 Controller

Though the drives and controller and power supply are not covered in the scope of supply, it shall be compatible to be operated with PLC controller. All the axes shall be fitted with stepper motor with required torque to run the system smoothly. All axes shall be fixed with Honeywell make hermetically sealed limit switches which are to be in module to facilitate remote replacement in case it is required to be replaced. The components which are needed to be replaced during the service shall be engineered for manipulator removal and assembly. The frequently replaced components shall include stepper motor, couplings, limit switches etc. Internal wiring should be radiation resistant and it shall be terminated at the stainless junction box which will be kept inside the sampling cell. Connectors in the junction box shall be placed with sufficient space to facilitate the remote removal cable connectors.

5.00 Spares

Stepper motors:	one number each for X, Y, Z, Theta, and YM1, GP1 each two, total - 8Nos
Drive cards:	one number each for X, Y, Z, Theta, and YM1, GP1 each two, total - 8Nos
Limit Switches	X- axis limit switches two nos.

Micro limit switches 10. Nos.

SS push pull connectors: 2-pin- 10 Nos., 4-PIN – 24 Nos., 6 PIN – 12 Nos., 10 PIN – 12 Nos., and 25 PIN – 10 Nos.

6.00 Delivery schedule:

S. No.	Work	COMPLEION TIME
1	Submission of detailed schedule of execution of the order	One Week From the date acceptance of order
2	Submission of manufacturing drawing for approval	Two weeks From the date acceptance of order
3	Manufacturing, Inspection, testing and supply	Twelve weeks From the date of approval of design report
4	Site erection, commissioning and testing	Two weeks
	Total time for execution of the order -	**Sixteen weeks**

7.0 Inspection and Testing

7.01 Inspection will be done at various stages i.e. starting from Bought out items, raw material procured, machining, heat treatment, finishing process of components, sub-assembly, and assembling & testing at suppliers' site and final site erection, commissioning and testing at supplier's site.

7.02 Supplier has to produce test certificates for material various materials used for the development of the system, this includes indigenous and imported materials raw materials, castings, bearings, etc..

7.03 The supplier has to submit the process sheet as per the standards mentioned in this technical specification for approval before carrying out the following operations, fabrication of different components, pickling & passivation, hard chrome plating etc..

7.04 Certified welder only will be allowed to carry-out welding in this equipment and critical welds are to be X-ray radio-graphed and the certificate should be produced for approval.

7.05 Based on the applications difference in hardness has to be maintained in the mating contact pairs and the same has to be mentioned in the drawings.

7.06 All items will be inspected for overall dimensional requirements as per the specification, travels (angular & linear), Speed of various motions, payload capacities, electrical current and voltage for each motion, Operation of limit switches and interlocks, manual canting and deflection where ever applicable.

7.07 A mock up remote assembly and dismantling of all modules shall be demonstrated at suppliers work before delivery. Size and weight of the individual components will also be checked for remote assembly and disassembly.

7.08 All the components supplied against this order should be provided with inspection report in the format provided in the end of this technical specification. All the components will be inspected individually by the department apart from the other routine inspections and testing done by the supplier**.**

7.09 Standard test procedures shall be followed for testing of deflection, backlash etc. of the systems. Accuracy and repeatability will be checked for acceptance as detailed in the "Accuracy and repeatability of the system"

8.00 Accuracy and repeatability of the system

1.0 Sample Handling Robot

1.1.0 Deflection at the far end of "YM_1" and "YM_2"axis end effectors under 5.0 kgf. Payload should be less than 1.00 mm.

1.1.1 X axis positional accuracy shall be better than 0.5 mm and repeatability should be ≤ **0.30** mm.

1.1.2 The positional accuracy of linear movement of all other axes shall be demonstrated accuracy of better than 100 µm and the repeatability shall be≤50 µm.

1.1.3 The accuracy of angular rotation shall be better than 20 arc-minute and the repeatability shall be ≤10 arc-minute.

8.01 Performance of the system

The supplier has to assemble completely at their facility and demonstrate the cycle of operation given in this specification in a mockup setup in the supplier's works using the robots. Each cycle of operation should be demonstrated minimum of fifteen times to prove its accuracy, repeatability & ruggedness. Remote

removability should also be demonstrated as per the requirement specified in this specification.

9.00 Validity

Quotation shall be valid for a period of three months from the date of opening of the tender.

10.00 Monthly Review Meeting

Monthly review meeting will be held alternatively at venders and purchasers premises to discuss the problems and solutions. This is to ensure the timely completion of the project.

11.0 Vendor Qualification

In case, the supplier engages a sub-contractor to manufacture the components, the supplier has to make arrangements to visit their facility to assess their manufacturing facility & capability to execute the work, by the department. After assessing the sub-contractor facility, the department will qualify them if they are found to be capable to manufacture the items. The supplier should initiate manufacturing with their sub-contractor only after obtaining approval from the department. During manufacturing, if it is found that the sub-contractor is not adhering to the quality as specified in this technical specification, the sub-vendor will be disqualified and will not be allowed to continue further to complete the rest of the work. In such cases it is the supplier's responsibility to identify a new sub-vendor, offer their facility for the inspection by the department officer's to assess their capability of executing the manufacturing of the system and get approval before engaging them for manufacturing.

12.0 Conditions relevant to design and manufacturing

12.01 The supplier has to supply three sets of as built manufacturing drawings with signature of the relevant design engineer & approving authority, with manufacturing tolerances in hard copy format and the same in soft copy in a DVD along with 3D models and product specification numbers and relevant catalogues with technical details in case of the usage of externally manufactured standard components in this order.

12.02 The supplier should supply three sets of operational manual and maintenance manual along with preventive maintenance schedule & procedures, probable causes and remedies, technical details relevant to the controller hardware, manufacturer's catalogue

in hard copy. Circuit diagram with test signals at various points in the circuits for finding faults. Soft copy of the same shall be supplied in the DVD format.

12.03 All the gears supplied along with this order should be as per Class 10 of AGMA standard.

12.04 The complete gear dimensions like, Concentricity of blank diameter, surface finish, perpendicularity between faces, module, face width, tooth profile, tooth thickness at PCD and other geometric features shall be given in the gear inspection report.

12.05 All the limit switches used in this system shall be a standalone module and should be possible to assemble / dis-assemble remotely using MSM inside the cell, it shall be demonstrated before it is adopted for various axes.

12.06 All the cable connectors used in this sampling system inside the cell be of push-pull connector made of stainless steel 304L grade and filled with radiation resistant elastomer.

12.07 Drawings, software codes etc., which are developed by a supplier against this order, shall be the intellectual property of IGCAR and the supplier shall not part any of the information either in part or as whole with anyone.

12.08 Weight of all the individual modules (Axis) shall be kept less than 50 kgf.

12.09 All the individual modules shall be provided with lifting hook / bails at the nearest possible location of CG of that particular module. It shall be considered as a basic design requirement.

12.10 Size of individual module shall be kept in such a way that it shall be easily introduced into the cell using the cell opening of 450mm X 450mm.

12.11 All the systems constitutes the part of the sample handling robot shall be engineered in such a way that it should be possible to remotely dismantle / assemble using in-cell crane and manipulators. The lifting capacity of the articulated master slave manipulator available inside the cell is 4.5 Kgf only. It shall be used to assist in hooking / aligning etc., it cannot be used to exert force more than the rated capacity. The design shall be modular with all sub-assemblies divided into number of sub-modules for the convenience of remote assembly & maintenance.

12.12 Reliability, remote operation and maintenance shall be the prime consideration in the design and manufacturing of the sample handling robot.

12.13 Manual cranking wheel shall be provided in X. Y, Z, Theta motions, which will be used to move axis of SHR to the desirable position for maintenance.

12.14 The contour and surfaces of modules shall be smooth and free from unwanted recesses, pockets, crevice, threaded interfaces etc. to avoid entrapment of radioactive contaminants.

12.15 All cables used inside the cell shall be of radiation resistant cables from reputed make like LAPPKABEL, Plflex-Classic-FD-810 and 900 P, HeluKabel Topserv 110 and 120 EMC.

12.16 All the materials shall be AISI 304L stainless steel unless otherwise specified for the particular component.

12.17 The lubricants used in the in-cell crane shall be of radiation resistant.

12.18 Preparation of the 2D-manufacturing drawings shall be in accordance to the BIS standard shop practice. The supplier should get the manufacturing drawings approved from the department before carrying out the machining and fabrication of the item.

12.19 The approval of drawings is to ensure the overall dimensional & travel requirement is met, adequate design concepts are followed to suit remote assembly & maintenance and the materials suitability to working environment like radiation, nitric acid fume etc of the entire system. It is the supplier's responsibility that the systems developed against this order should satisfy the performance criteria given in this technical specification. The approval of design drawings by the department does not relieve the supplier's responsibility of demonstrating the system as per the acceptance criteria given in this specification.

12.20 If any modifications are required to meet the performance criteria during testing, the supplier should perform the necessary modification on the system to improve the system performance.

12.21 All the guide rails and moving guides shall be of THK to achieve the desired performance.

12.22 The supplier shall submit schedule of execution of the project like submission of drawing for approval, purchasing of standard items, manufacturing, assembly, testing and delivery, to the purchaser and get approval on receipt of purchase order.

12.23 The entire SHR included in the scope of this order shall be assembled and tested at supplier's site. The item shall be allowed to ship only after the satisfactory

demonstration. All the items shall be erected and commissioned satisfactorily as per the technical specification at site by the supplier.

13.00 Reference drawings

The drawings attached with the tender specifications fro references are:

1. Global view of the analytical cell:	**DRG No.: IGC/GRIP/RHS/RCN/ 001**
2. Full view of SHR:	**DRG No.: IGC/GRIP/RHS/RCN/ 002**
3. Rail detail	**DRG No.: IGC/GRIP/RHS/RCN/ 003**
4. Details of sample bottle	**DRG No.: IGC/GRIP/RHS/RCN/ 004**

14.00 Standards to be followed

The supplier has to follow the below given standards in the execution of this project in addition to the standard followed in general for the design and development of equipments.

ASTM-C 1217-00 Standard guide for processing nuclear and radioactive materials

ASTM-C 1533 – 08 Standard guide for general design considerations for hot cell equipments

ASTM-C 1554-11 Standard guide for material handling equipment for hot cells

ASTM-C 1725-10 Standard guide for hot cell specialized support equipment and tools

ASTM-C 5144-08 Standard guide for use of protective coating standards in nuclear power plants.

Pickling and Passivation of SS 300 and SS 400 series shall be carried out as per the ASTM standard A 380 - 06.

Note: Individual components shall be disassembled for carrying out this process. Standard acid bath procedure is the only option.

All SS 410 components which are heat treated shall be hard chrome plated to a thickness of 75 - 100 micrometers. If any finishing process like grinding (in case of gear train) has to be done after hard chrome plating, it has to be ensured that minimum of 50 micrometer coating thickness remains everywhere in the component, coating thickness has to be decided accordingly.

All the gears and gear trains which are not provided with enclosure shall also be Hard Chrome Plated without affecting the functional requirements of the gear trains.

Pipette head shall have the specified range and the accuracy should be within 1% error, and repeatability when the quantity of sample is more than 100µl should be ≤1%, which has to be demonstrated using micro-weighing balance.

15.0 General Conditions

15.01 Procurement of the materials shall be in accordance with the materials specification given in the technical specification. This will include all materials of construction both indigenous and imported, raw materials, castings, forgings, commercial items like pipes, plate and standard hardware such as fasteners etc.

15.02 In case the contractor is to supply alternative material

The supplier shall give the specification of the materials, identified for use in the fabrication of the equipment. The main composition and physical properties etc. shall be submitted to the purchaser. The acceptances of suggestions are subjected to purchaser's review and approval.

There should be no defects like seam, lamination, inclusion, cracks etc. in the materials. Such items shall be used, if found suitable after it is inspected and approved by the purchaser.

15.03 Supplier should submit **monthly reports** showing the current status, schedule of completion of remaining activities including the material procurement, fabrication, assembly and delivery.

15.04 Approval of the purchaser should be obtained in case of any deviation in the design with necessary reason for the change.

15.05 Offering of components, sub-assemblies, assemblies or full equipment for inspection to the purchaser as and when required by him to do so during the execution of the contract.

15.06 The purchaser or his authorized representatives shall have free access to supplier's works or the works of his subcontractor for the inspection of raw materials, stage inspection and final inspection during the entire period of contract.

15.07 The supplier shall provide all the facilities for inspection.

15.08 Carrying out necessary modification or improvements until the satisfactory performance is achieved. Such modifications shall be carried out by the supplier free of cost if they are required for reasons arising from bad workmanship or non conformity to the specifications.

15.09 Submission of the finished items for final inspection / testing and during inspection, the supplier shall provide all the instruments, equipments and personnel needed for the inspection to the purchaser.

15.10 Delivery and installation is at IGCAR, Kalpakkam.

15.11 Welders qualification and welding procedure should be got approved from the purchaser prior to commencement of the work.

15.12 The sketches submitted here are for tender purpose only. There are likely to be minor modifications. Fabricator has to incorporate all such minor modifications / changes, if any.

15.13 There is **NO FREE ISSUE OF MATERIALS ENVISAGED** under this tender.

15.14 All the hardware items/components required for complete and proper functioning of the control system either mentioned or otherwise required are deemed to be provided by the supplier.

15.15 A guarantee of the equipment for a period of **one year** from the date of acceptance of the item. The guarantee shall cover free repair or replacement of parts which might fail during the normal operation, within the period of one year due to defective material and / or workmanship.

16.00 Inspection report format

Inspection Report

Part Name:_____ Report No.:_____

Part No.:_____ DATE:_____

Drawing No.:_____ Qty.:_____

Material:_____ Additional test ref._____

S. No.	Dimension Specified along with tolerance	Actual dimension	Remark

Special Notes:

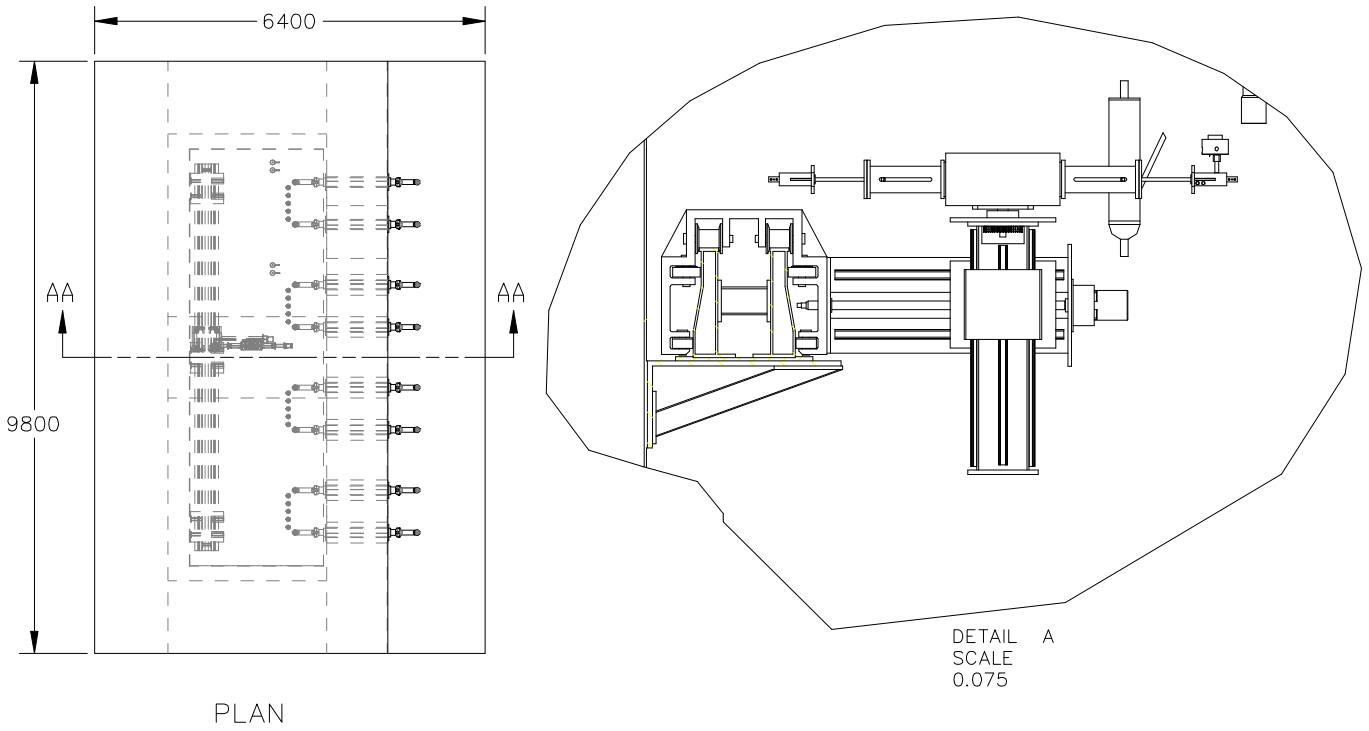
Signature of Inspector (Supplier) **IGCAR, Representative**

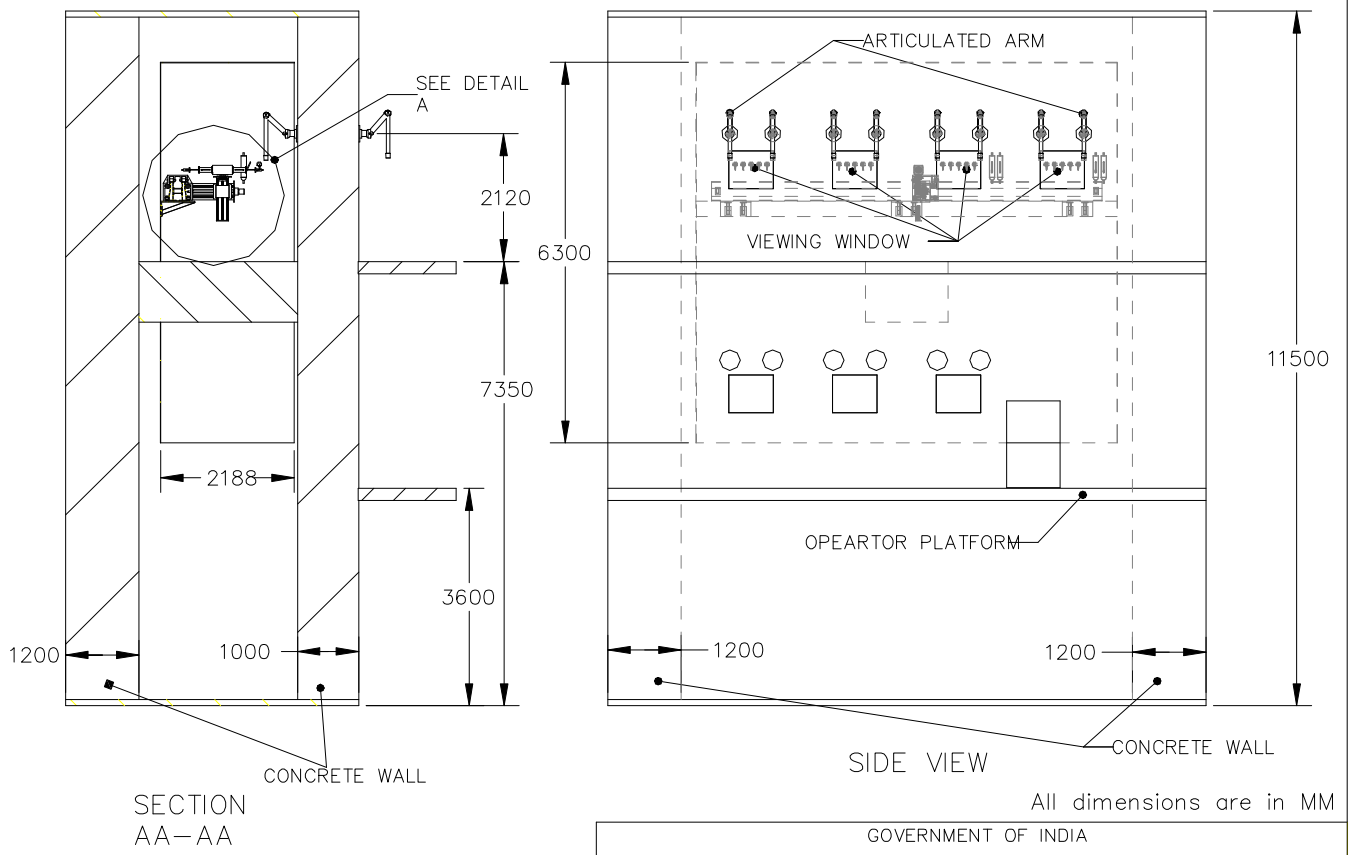
Note: Part number has to be engraved in the component without affecting the functional requirement.
If same part number has more than one number, sub-category number has to be Engraved in the components.

After publishing the tender, if there is any change in specification, it will be published as corrigendum in the MRPU portal.

Accessories, Spares, Breakup costs etc. if any, may be quoted online in the 'Price Bid Alternate Offer' form.

Make offered may be clearly indicated in the remarks column.





All dimensions are in MM

GOVERNMENT OF INDIA

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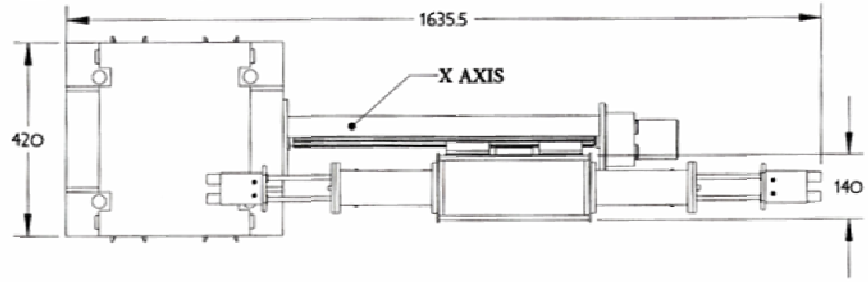
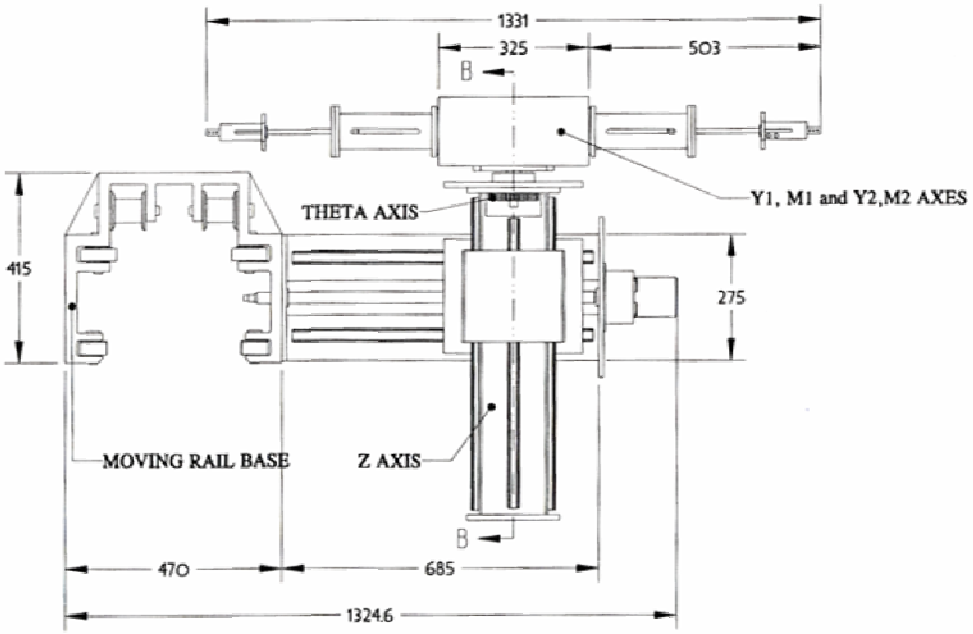
METALLURGY AND MATERIALS GROUP

CELL GLOBAL VIEW

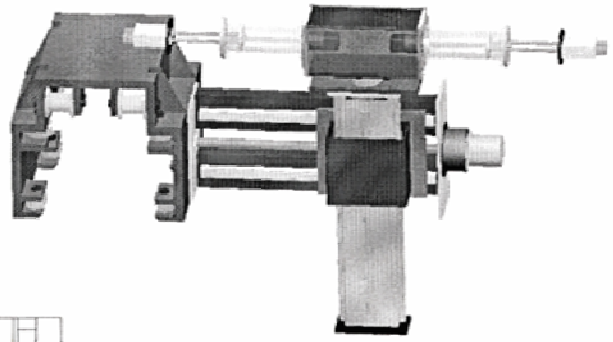
INDEX	DRN. DATE:	DESGN. CHD.: DATE:	
DESD.: DATE:	DRN.: DATE:	APPD.:	
ORIGINATING AGENCY	REMOTE HANDLING SECTION	PROJECTION:	
DRG. NO. IGC/GRIP/RHS/RCN/ 001		SHEET 01OF01	REV. 00.0



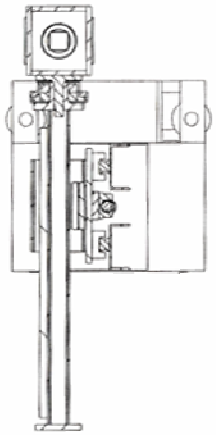
PLAN



ELEVATION



3D VIEW



SECTION B-B

NOTE: SCALE 0.080
ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED

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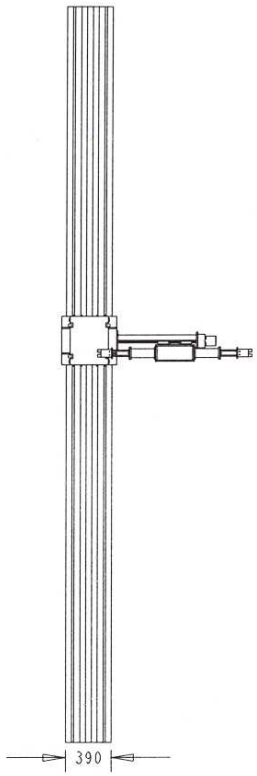
TITLE: Y AXIS MODULE

INDEX	DRN. DATE	DES. CHD DATE:	
DESD. DATE	DRG. CHD. DATE:	APPD.:	
REMOTE HANDLING SECTION		SCALE: NTS	
		PROJECTION	
DRG. No. : IGC/GRIP/RHS/RCN/ 002		SHEET 01 OF 01	REV. No. 00.0



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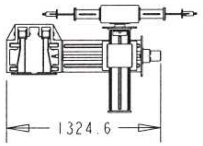
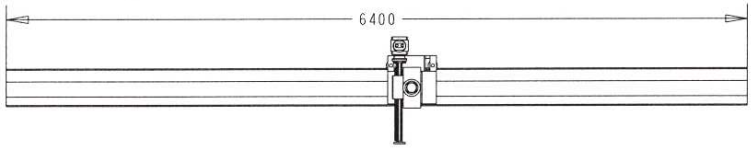
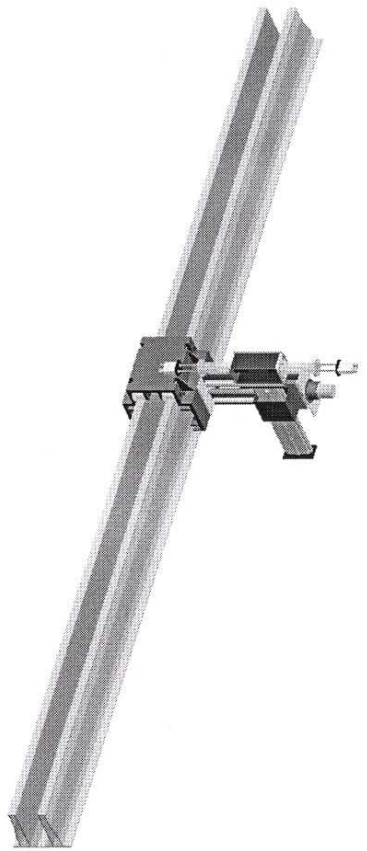


ELEVATION



SIDE VIEW



SCALE 0.035

NOTE:
ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED

GOVERNMENT OF INDIA
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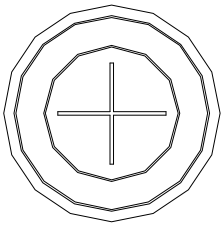
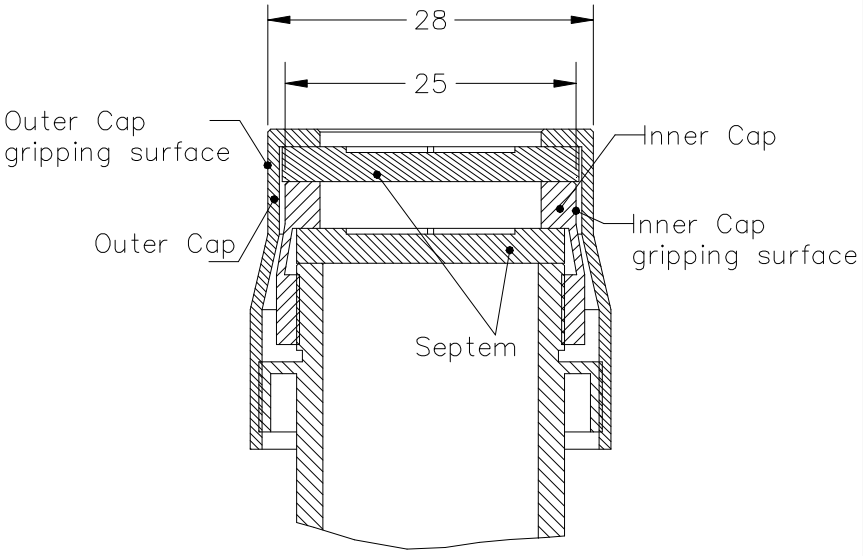
METALLURGY AND MATERIALS GROUP

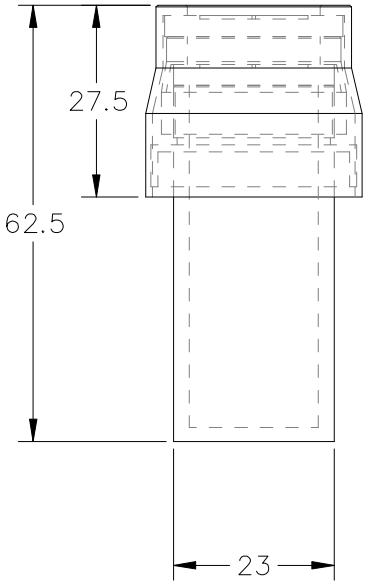
TITLE: SHR VIEW

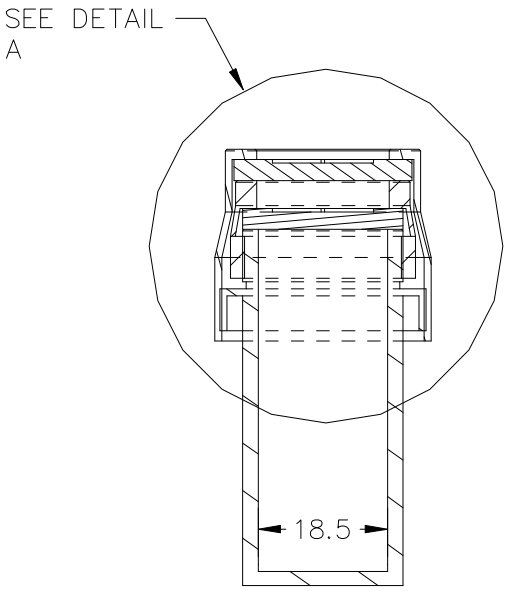
INDEX	DRN. DATE	DES. CHD DATE:	
DESD. DATE	DRG. CHD. DATE:	APPD.:	
	REMOTE HANDLING SECTION	SCALE: NTS	
		PROJECTION	
DRG. No. : IGC/GRIP/RHS/RCN/ 003		SHEET 01 OF 01	REV. No. 00.0





DETAIL A
SCALE 2.500





SECTION
A–A

GOVERNMENT OF INDIA INDIRA GANDHI CENTRE FOR ATOMIC RESEARCH METALLURGY AND MATERIALS GROUP		
TITLE: SAMPLE BOTTLE		
INDEX		DES CHD: DATE:
DESD: DATE	DRN : DATE:	APPD:
	REMOTE HANDLING SECTION	SCALE: NTS PROJECTION:
DRG. NO.: IGC/GRIP/RHS/RCN/004	SHEET: 01 OF 01	REV. NO.: 0.00