Phone: 25530672-76 Fax: 25534043 Email: astron@iiap.res.in Web: www.iiap.res.in

INDIAN INSTITUTE OF ASTROPHYSICS

IIND BLOCK, SARJAPUR ROAD, KORAMANGALA, BANGALORE-560 034

PUBLIC TENDER NOTICE NO: PR/PUK/1.3 METER DOME/VBO/CAP/54 DATED 18 MAY 2011

The Director, Indian Institute of Astrophysics invites sealed Quotations/Bids both Technical bid and Commercial bid separately in a sealed cover from reputed firms for following / specification. The firm (s) interested in offering bids should have executed similar items/works.

Sl.No.	Description	Quantity	E.M.D	Tender Fee	
			(Refundable)	(Non-refundable)	
			Rs.	Rs.	
1. Fabrication and Installation of 1.3 Meter Dome					
an	d Enclosure Structure				
(As per detailed specification in the Request for Proposal					
ar	nd drawings enclosed).		3,40,000/-	300/-	

Note: The Tender documents with Specification details are available on IIA website www.iiap.res.in/tenders.htm. Hence the interested tenderers may at their option down load the same from our website (as no hard copies of Tender documents is/are provided from this office) and submit their offer along with EMD (refundable) & Tender fee (non-refundable) prescribed therein, only in the form of Demand Draft drawn in favour of Director, IIA. However, your offer (both Technical & Commercial bids) with bids should be superscribed in a envelope mentioning the tender notice no., Date of opening, and submit the Bids in a sealed envelope addressed in favour of Director, Indian Institute of Astrophysics, 2nd Block, Koramangala, Bangalore – 560 034.

- 2. The firms who fulfill the following requirements shall be eligible to submit their bids. Joint ventures are not acceptable.
- (a) Tendering Company shall be professionally managed and equipped with facility for the supply and maintenance of tendered items.
- (b) The tenderers should have completed, in the last 3 financial years (i.e., current year and two previous financial years) at least one similar single work for a minimum value of Rs.200 Lakhs.
- (c) The total contract amount received during the last 3 financial years, and the current financial year should be minimum of Rs.200 Lakhs. The tenderer should submit Audited Balance

Sheet duly certified by the chartered accountant to this effect. They should also submit Bankers Solvency Certificate to a minimum of Rs.200 Lakhs.

- (d) The Private Body Contractor shall be required to produce the TDS Certificate indicating the Income Tax deducted by the client for the execution of similar items, completed individually of value not less than Rs.200 Lakhs.
 - 3. Both Technical / Commercial/Price Bids supported by the above information should be submitted in Sealed envelope duly superscribed with the name of work/item. The completed Bids will be received by this office upto 15.00 Hrs. latest by 20.6.2011.
 - 4. If any information furnished by the tenderers is found incorrect at a later stage, the firm shall be liable to be debarred from tendering and taking up of work in IIA. The Institute reserves the right to verify the particulars furnished by the tenderers.
 - 5. The interested tenderers may contact Mr. P.M.M Kemkar (Ph.No.25530672, Ext: 381) or Mr P.U. Kamat (ext.244) to discuss Technical Clarification and Shri.Y.K.Raja Iyengar (Ph.No.25530672, Exten: 244) for Commercial Clarification, if any, with prior permission on or before 10.6.2011, before submitting bids. The pre-bid meeting will be held at IIA, Bangalore on 10.6.2011 at 15.00 hours.
 - 6. The firms should submit the bids superscribed along with Tender fee of prescribed amount **upto 15.00 Hrs. Latest by 20.6.2011.** The Technical Bids will be opened in presence of the bidders or their authorized representatives **at 16.00 Hrs on 20.6.2011.**
 - 7. The commercial bids of those who are successful in the Technical bid will be opened later.

 The date will be intimated to successful vendors.
 - 8. Incomplete bids are liable for rejection.
 - 9. Late / delayed offer will not be considered.
 - 10. IIA is not responsible for any delay / loss of documents in transit.
 - 11. No bids will be considered if prescribed Tender Fee and EMD is not found with the Technical bid.
 - 12. The offer should be valid for a minimum period of 120 days from the date of opening of bid.
 - 13. Both EMD and Tender fee DD should be sent along with Technical Bid only.
 - 14. IIA reserves the right to reject any or all tenders without assigning any reasons.

Administrative Officer IIA, Bangalore-34

Phone: 25530672-76 Fax: 25534043 Email: astron@iiap.res.in Website:www.iiap.res.in

INDIAN INSTITUTE OF ASTROPHYSICS

IInd Block, Koramangala, Bangalore-560 034

ma block, Rotumar	iguia, Bangarore 300 05 i
No. PR/PUK/1.3 METER DOME/VBO/CAP/	DATED:18 May, 2011
M/s.	
Dear Sirs,	
of Stores detailed in the Tender Form hereto an	sics, Bangalore invites Sealed Tenders for the supply nexed. The Tender Terms enclosed are also may a to quote for the supply in accordance with the e attached Tender Form also.
Your Tender must reach this office on Schedule.	or before the date and time indicated in the Tender
Thanking you,	
	Yours faithfully,
Encl: as above.	P.Kumaresan Administrative Officer

Phone: 25530672-76 Fax: 25534043 Email: astron@iiap.res.in Website:www.iiap.res.in

INDIAN INSTITUTE OF ASTROPHYSICS

IInd Block, Koramangala, Bangalore-560 034

No. PR/PUK/1.3 METER DOME/VBO/CAP/5	4	D	ATED:1	8 May,	2011
FROM:					
TO THE DIRECTOR, Indian Institute of Astrophysics., Bangalore-560 034.					
Sir,					
I/We hereby offer to supply the stores indicated below at the price hereunder quoted and agree to					
hold this offer open till I/We shall	be bound to sup	oply the	store her	reby off	ered upon
the issue of the Purchase Order communicating to the acceptance thereof on or before the expiry of					
the last mentioned date. You are at liberty to accept any one or more of the items of such stores. I/We not withstanding that the offer in this tender has not been accepted in whole, shall be bound to					
					supply such items and such portion or portions of one or more of the items as may be specified in
the said Purchase Order communicating the accept	tance.				
Sl.No. Description of the item(s)	Quantity	Unit	Rate	Dely.	Period
1.0 Fabrication and Installation of 1.3 Meter	r Dome				
And Enclosure Structure as per detailed					
specification in the Request for Proposal					
and drawings enclosed					

Place at which the Delivery is required : Vainu Bappu Observatory, Kavalur Tamilnadu

Date by which the supplies are required : Six months from the date of purchase order.

2. I/We have understood the items of the tender annexed to the invitation to this Public Tender

and have thoroughly examined the specifications/drawing and /or pattern quoted or referred to herein and/are fully aware of the nature of the stores required and my/our offer is to supply the stores strictly in accordance with the requirements subject to the terms and conditions contained in the Purchase Order, if communicated on the acceptance of this tender either in whole or in part.

and seal of Tenderer

1.3metre Telescope Project

Indian Institute of Astrophysics, Bangalore

REQUEST FOR PROPOSAL

for

Manufacture and erection of 1.3m Telescope Enclosure and Dome structure at Vainu Bappu Observatory, Kavalur

Indian Institute of Astrophysics, Block –II, Koramangala, Bangalore –560034. Ph: 080-25530672 –76

Pn: 080-255306/2 -/(

Fax: 25534043

Date: 18th May 2011

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1.0 Background Information

The Indian Institute of Astrophysics (IIA) is setting up a 1.3m optical telescope at Vainu Bappu Observatory (VBO), Kavalur, which is located 30 kms from Vaniyambadi, Tamilnadu.

The manufacturing of 1.3m Telescope has already completed and the telescope is in the process of commissioning stages. The civil works on the project is under progress and an enclosure (building structure and dome)have to be fabricated and installed at VBO, Kavalur to house the telescope and auxiliary facilities.

The fabrication of dome and enclosure is planned to complete by July 2011.

This RFP is for manufacturing and project management services for realization of a suitable enclosure with dome and other auxiliary facilities.

2.0 **Project Site Information**

This project site is at Vainu Bappu Observatory, Kavalur, Tamilnadu.

Postal address : Vainu Bappu Observatory,

Kavalur, Alangayam –635704.

Tamilnadu

Phone: 04174 203014 -15, 16

Nearest railway station : Vaniyambadi (Bangalore- Chennai route) Road Distance : From Bangalore to Kavalur about 180 kms

Vaniyambadi to Kavalur 30 kms

Altitude : Around 800m MSL

Ambient Temperature : Maximum 40deg C /minimum 10 deg C

Relative Humidity : 100% Max (monsoon) 20% Min 50% Average

Climate condition : Mild tropical but generally dry

Latitude: 12 deg 35' N Longitude: 78 deg 37'E

Vendor may visit the observatory to evaluate site requirements after obtaining prior permission from the institute. The institute may be able to provide food and accommodation for the installation team limited to 8 to 10 persons. Vendor should ascertain availability of accommodation or arrange for erection of temporary sheds. Adequate power for welding and installation will be provided by the institute to the working team.

Contact:

For any technical clarifications pertaining to the scope of work,:

P.M.M. Kemkar email: pmmk@iiap.res.in
P.U.Kamath email: pmmk@iiap.res.in

For purchase terms & conditions and other commercial issues:

Mr. Y.K. Raja Iyengar email: ykri@iiap.res.in

3.0 Scope of works

The vendor shall be responsible for executing the following scope of works of 1.3m telescope enclosure and dome, conforming to the design and specifications detailed in **Annexure 'A'**"1.3m telescope Enclosure and Dome specifications".

The scope of work briefly outlined below shall include complete manufacturing, installation and commissioning of dome and enclosure along with accessory systems as specified in **Annexure A**

3.1 **Dome:**

This includes Dome structure, dome cladding, ring beams, circular rails, drive & wheel assemblies, guide roller & guide roller anti lift assemblies, dome drive automation, dome shutter drive & wheel assemblies, encoder assembly, lightning roller assembly, cable laying and routing arrangements, seven remote controlled windows/ventilators on dome, power supply method for automated windows, encoder mounting arrangements, limit switches, methodology of installation for dome drive and shutter drive assembly, material handling facility including dome hoist, painting/ surface treatment etc.

3.2 **Enclosure**:

This includes structure elements such as columns & beams, floors, staircases, lift shaft, outer panels, maintenance structure inside telescope pier etc as per specifications in **Annexure A**. Mechanical fixtures related to electrical power distribution system, cable routing for telescope, lift etc may be added in course of the contract

4.0 Inspection, Assembly And Testing

Inspection, assembly and testing of dome structure, dome drive assembly, shutter drive assembly and Enclosure Building structure, etc. at manufacturer's factory premises is included in the Scope of vendor. Consultant will visit the manufacturer's works in consultation with IIA as and when required to ensure that manufacturing is being processed as per drawings and technical specifications, Quality of workmanship and dimensional accuracy etc. are maintained as per Quality Assurance Plan. If some unforeseen technical problems arise during fabrication process, consultant will have to study the same and sort out such problems and revise his drawings if required.

For standard equipment such as Fans, Electrical Panels, Cranes etc. inspection at final stage only is desired.

5.0 Safety Measures:

Dome shall include safety systems to prevent personnel injuries. All elements of safety such as over speed protection, over current protection, dome and shutter drive interlock with a safety switch, dome crane safety etc. shall be taken in to account during testing of the dome.

6.0 <u>Vendor's Scope of Supply</u>

The following items come under the scope of vendor.

Any jigs, fixtures, gauges and tooling necessary to complete the manufacture, assembly, inspection, testing and erection of dome and building will be under the scope of the vendor.

Grouting of the foundation bolts of the enclosure structure on the concrete columns at level of first floor

7.0 <u>Co-ordination with Subvendors / Subcontractors</u>

After placement of order to vendor for manufacturing, supply and erection of various structural assembly of dome and enclosure building. vendor will approach IIA for their queries on technical and commercial matters.

All technical queries are to be resolved by bidder with intimation to IIA. On the matters where concurrence of IIA is essential, the same should be communicated to Vendor through IIA only. Approval of vendors data sheets, specifications, catalogues / GA drawings / makes of components and fabrication drawing etc. shall be approved by IIA.

Visits to any vendor or sub vendors for technical discussions, inspect / testing or resolving any other technical matter, shall be done in co-ordination with IIA. Representatives of IIA also may visit the vendors works as and when required during manufacturing.

8.0 Supplier's Warranty

Vendor shall be fully responsible for the manufacturer's warranty of 1 years in respect of manufacturing, quality and functioning of all the complete scope of work covered by the offer. Vendor must warrant complete scope of work against any manufacturing defects during the warranty period and also he shall provide replacement of defective components at the installed site, at no additional charge to the IIA.

9.0 Dispatch Clearance

After completion of dome & enclosure structure fabrication, dome and building components/assemblies, dome and shutter drives, electrical panels, cables, instruments etc. will be offered for final inspection at manufacturers works. Representatives of IIA will also witness the final inspection / testing of material/subsystems. On satisfactory completion of inspection and testing IIA shall issue dispatch clearance to vendor.

10.0 Deliverables

- 10.1 Operation manuals and test certificates for all the bought out items such as gear boxes, motors, electrical schematics if any etc.
- 10.2 The safety Plan/ Procedure have to be provided by the vendor also including precautions, specific to the dome installation, maintenance, general safety

requirements and safety equipments required

- 10.3 Servicing procedures including trouble shooting techniques shall be provided. The procedures shall also include all technical information provided by sub component manufacturers, consumable servicing materials specifications(eg. Grease, oil etc.) as well as clearly written disassembly/assembly instructions for the major components of the dome.
- The procedures shall also include a list of all special tools and additional spares required.
- 10.5 A servicing schedule for assemblies requiring regular maintenance shall also to be provided.
- 10.6 Vendor shall also provide a detailed procedure for unpacking, transportation details, installation and testing of dome on VBO, Kavalur site.

11.0 <u>Eligibility Criteria:</u>

Vendor shall have adequate background and experience over at least the past five years in doing medium to heavy mechanical fabrication works and site erection, and have exposure to simulation of drive mechanism.

The vendor must have adequate infrastructure, skilled manpower, inspection & testing equipments along with the desired working machines & equipments. Vendor must enclose relevant information in the form of brochures, leaflets, manuals, work orders etc. to demonstrate the required technical competence for this job. The list of equipments to be placed at site during erection of the enclosure should also be submitted.

The vendor should be prepared to offer a plan for comprehensive on-site warranty for the manufactured / fabricated parts and assembled structure of the dome, dome & shutter drive assembly, and items of enclosure.

Vendor must comply with all the above mentioned criteria. Non-compliance of any of the criteria may lead to rejection of the offer. Photocopies of relevant documents / certificates should be submitted as proof in support of the claims made. IIA reserves the right to verify / evaluate the claims made by the vendor independently.

12.0 <u>Inspection of vendor's premises</u>

As a part of evaluation criteria, the IIA will inspect the works of the manufacturer before placing the purchase order through its staff / consultant for authentication of the various technical parameters being claimed by the vendor's factory/site. However, not allowing full cooperation in this regard will disqualify the vendor and his offer will be rejected summarily.

Manufacturer will furnish the inspection reports of all the materials, parts, subassemblies & assemblies to IIA during the course of manufacture.

Providing necessary facilities, instruments and tooling for the quality surveillance and inspection of components, assemblies and alignments during inspection.

13.0 Payment Terms:

Payments for the work will be made according to the following schedule, with each payment stage linked to a milestone in the contract. Vendor / Contractor's Bill upon completion of each milestone will be passed for payment only after the stores have been received, inspected and satisfactorily accepted by the Engineers at site.

20% advance payment on receipt and acceptance of Purchase Order (PO). The advance payment will be made against submission of the bank guarantee for the equivalent value with validity till the completion of the project and executing an agreement duly signed by both parties. The balance 80% in 5 stages of payments payable on pro-rate basis duly certified by the indenting officer. The details of stage payments are as follows:-

- 01. 15% of the value on readiness of material for fabrication /machining etc. by 6th week from PO
- 02. 15% of the value on completion of fabrication/machining of dome/enclosure parts by 12th week from PO
- 03. 15% of the value on completion of procurement of all the bought out items and shop Assembly by 16^{th} week from PO
- 04. 15% of the value on completion of erection of dome and enclosure at site.- by 22nd week from PO
- 05. 20% of the value on completion of testing and commissioning of the dome and satisfactory performance & acceptance by our engineers. by 26^{th} week from PO

14.0 <u>Liquidated Damages</u>

Notwithstanding the IIA's right to cancel the order, 0.5% of the order value per week would be payable to the IIA for every week's delay in the execution of this purchase order beyond the specified delivery/installation schedule subject to a maximum of 5% of the value of the work ordered. IIA reserves it's right to recover these amounts by any mode such as adjusting from any payments to be made by the IIA to the firm. Part of week will be treated as a week for this purpose. However liquidated damages may be exempted depending upon the reasons of delay on mutually agreed basis between Vendor & IIA. The reason for delays shall be recorded for justification by both the parties.

15.0 <u>Time of Completion</u>

The entire work shall be completed within 6 months after seven days from the date of awarding the contract. Time schedule shall be the essence of contract. The vendor shall prepare plan of work in consultation with IIA to complete the job as per the schedule. IIA reserves the right to impose a penalty clause for delay in completion of the work and such clauses shall be specified in consultation with the chosen vendor, in the contract to be signed after placement of order.

16.0 Material Approval

The material to be procured by the vendor, both at the vendor's premises as well as at the site, shall be approved by IIA before being put to use in the work. In case during execution of the work, any material being used in the work is found to be not as per the specifications, IIA may notify the vendor and such material is to be replaced by the approved material at the vendor's cost. All the necessary test certificates, test reports etc shall be produced from time to time. If any material is found to be not tested according to ISI standards or equivalent, the same shall be tested at approved/reputed laboratory by the vendor at his own cost.

17.0 Penalty and Termination of The Contract

In the event of supplier's failure to fulfill any of the terms and conditions of this contract including its failure to complete the contract within the stipulated period, the IIA shall without prejudice to other remedies available to it under the law enforced in the State be competent to impose all or any of the following penalties on the vendor, in addition to the forfeiture of the security deposit in full or in part as the IIA may deem fit: termination of the contract after 30 days clear notice to the vendor, if no proper response from the vendor.

Annexure A

SP 336-03 1.3m Telescope – Enclosure Technical Specifications

Prepared by M/s Tekcons, Secunderabad.

CONTENTS

- 1. Description
- 2. Drawings
- 3. Manufacture
- 4. Surface Treatment
- 5. Transport
- 6. Erection
- 7. Quality Surveillance

1. **Description**

Enclosure

1.3 m Telescope is housed in an octagonal enclosure which is covered on the top by an octagonal steel dome. The ground floor is of r.c.c and brick construction, 3 m in height and 3.5 m above the ground level. The telescope is mounted on an r.c.c pier rising from ground level to 13.7 m above. The pier is located at the centre of the enclosure. Apart from ground floor at 0.5 m and floor at 3.5 m level, floors are located at 6.5 and 9.5 m levels. These and the observation floor at 13.7 m are part of the steel structure made up of steel sections and plates.

Enclosure is as per Drg. No. 33602-000002.

Dome, Structure, Railing, Maintenance Structure and Hatch Cover are in the scope of this specification.

Dome

The dome has a slit which is closed by a pair of shutters. Both the shutters and dome are supported by wheels running on steel rails. The dome is supported by 16 wheels with spring suspension. 16 pairs of guide rollers located on either side of rail prevent radial movement of the dome. The wheels are conical with an angle converging on the axis of the dome to ensure smooth rolling on circular track. The rail is 52 Kg/m standard rail and it is held in position by clamps fixed to the ring beam on the top of the columns in the steel structure. The dome is driven by a pair of friction rollers. Each roller is driven by DC motor through a planetary gear reduction unit. The speed of rotation of the dome can be varied by varying the speed of the motor.

Each shutter is supported by a pair of wheels at the bottom and top ends which roll on rails fixed on the supports welded to the dome structure. The shutters are also fitted with guide and anti lifting rollers. A pair screw/nut mechanisms connected to the top and bottom ends of the shutters move the shutters apart or towards each other. A common screw having left hand and right hand trapezoidal threads pushes the nuts connected to each shutter in the opposite directions. The screw is driven by a DC motor through a planetary gear box.

Dome is fitted with seven windows on the seven vertical faces of the structure. The window shutters are operated by motors powered by a cable running around the dome structure.

A 2 ton hoist is provided in the dome. It runs on a radial beam on the centre line of dome opening and extending away from the edge of the opening. It is operated through a pendent hanging from the dome.

Two ventilation fans are fitted on the sloping faces of the dome located opposite to the opening and on either side of the central sloping face.

Power to operate the shutter motors, window shutters, crane and ventilation fans and lighting on the dome is to be supplied through cables taken from a power supply points

located on the moving structure of the dome. Power to the circuit will be available only when the dome is stationary. The power is supplied by plugging in the cable supplying the power to the receiving sockets fitted on the dome.

1.1. Dome (Drg. No. 33601-200003)

The Dome consists of the following assemblies.

1.	Dome-General Assembly	Drg. No. 33601-200003
2.	Shutter Assembly	Drg. No. 33601-210007
3.	Shutter Wheel Assembly	Drg. No. 33601-211008
4.	Shutter Drive Assembly	Drg. No. 33601-212009
<i>5.</i>	Dome Drive Assembly.	Drg. No. 33601-220010
6.	Encoder Assembly	Drg. No. 33612-290011
7.	Dome Wheel Assembly	Drg. No. 33601-230012
8.	Dome Guide Roller Assembly.	Drg. No. 33602-240013
9.	Dome Guide Roller Assy-Anti lift	Drg. No. 33602-250014
10.	Lightning Roller Assembly	Drg. No. 33602-260015
11.	Dome Cladding	Drg. No. 33601-270016
12.	. Dome Structure	Drg. No. 33601-280017

The Dome is octagonal in shape and made of tubular steel sections (mostly square tubes). A ring girder (box section made of plates) supports the eight vertical columns forming octagonal structure. The octagonal pyramid on top is truncated on the opening side. It consists of two main arches located at equal distance from the centre of dome and which rise from the top of the circular ring girder and extend up to the top rail support of the shutter at 22° . The opening formed by the main arches and top rail support provides the window for observations. The rest of the vertical and pyramid of the structure is made of eight vertical and inclined diagonal members connected by radial and circumferential members.

The dome is covered by aluminium sheet cladding which envelops the dome structure including ring beam, wheel assemblies etc. Aluminium cladding sheet is riveted to supporting structure made up of steel tubes. Structure for cladding is connected to steel structure of dome through cleats (square tubes).

7 windows with motorised aluminium shutters are fitted in the dome/cladding structure for ventilating the dome when necessary.

The ring beam of the dome structure is supported on sixteen wheels having spring suspension to ensure smooth and silent rotation of dome. The wheels run on rail fixed on

the top of the ring beam of the structure. The wheel is conical in shape. The angle of apex of the cone is the angle subtended by the diameter of the wheel at the centre of the dome. The axis of the wheel is tilted to make contact with the flat head of the rail.

The rail is clamped by steel plates at regular intervals. The clamps are fixed to the ring beam of the structure with screws.

Concentric rotation of dome on rails is ensured by sixteen pair of guide rollers which roll along the sides of the rail.

The dome is fitted with anti-lifting locks to prevent lifting of the dome off the rail track in extreme weather conditions.

The opening in the dome is closed by a pair of shutters. The shutter rail supports are welded to dome structure.

The following drawings present the structural details of the dome:

Dome Structure Drg. No. 33601-280017

Dome Cladding Drg. No. 33601-270016

Apart from the main structural members other structural supports, tubes and plates are to be welded while assembling or installing the dome and shutter wheels/rollers and drive assemblies. The details of such items are given in the assembly drawing for the Dome. These items shall be welded only after assembling/installing the sub-assemblies and verifying their correct location and alignment for smooth operation of dome and shutters. Full welding shall be done only after ensuring smooth operation through trial runs.

Sheet metal louvers are welded to shutter and dome structure to prevent entry of birds and leakage of rain water into the dome when the shutters are closed. The gap between moving and stationary louvers shall not exceed 20 mm. No gaps that allow seepage of water into the dome shall be left between the louvers and the supporting members of the dome or shutter. Suitable sealant shall be applied at the joint between the cladding sheet and members.

1.1.1.Dome Wheel Assembly (Drg. No. 33601-230012)

The conical wheels of the dome are keyed to shaft running in spherical roller bearings. The axis of the shaft is tilted to match the wheel with head of the rail. The bearing housings are bolted to a base frame which is fitted with a pair of springs and a vertical pin to carry the vertical load and horizontal loads respectively. The wheel assembly is inserted between the rail and ring beam of the dome. After adjusting to proper height and aligning the axis of the wheel the plate is welded to the ring beam in position.

1.1.2.Guide Roller Assembly (Drg. No. 33602-240013/250014)

Sixteen pairs of rollers butting on either side of the rail ensure that the dome remains on the track in spite of any wind or other disturbing horizontal loads on the dome.

Locks for preventing lifting of the dome off the rails are fitted to eight of the guide roller assemblies (drg. no. 33602-250014) alternatively.

1.1.3.Dome Drive Assembly (Drg. No. 33601-220010)

A pair of rubber lined rollers drive the dome by friction. Each roller is driven by a planetary gear reduction unit powered by an Ac servo motor. The entire assembly swivels on bearings. Two helical springs apply the force required to press the roller on to the dome for driving the same. The bracket holding the drive is welded to the ring girder on the top of structure. Two drives each capable of independently driving the dome and located at diametrically opposite ends move the dome.

Speed of rotation of dome 0.2 rpm

Ratio between dome and roller 9020/754

Speed of rotation of roller 2.4 rpm

Rated speed of DC motor 1750 rpm

Ratio of planetary gear unit 1:252.

Operating speed of motor 603 rpm

Torque on motor (start) 18.4 Nm

Running torque 8.8 Nm

Load Inertia on motor shaft 31 Nmsec²

The motor speed is varied. The dome shall have a soft start of minimum 3 seconds for accelerating to operating speed. Both motors shall operate in synchronous mode at same speed.

1.1.4 Encoder Assembly (Drg. No. 33612-290011)

Encoder is coupled to the shaft of a roller driven by the roller driving the dome.

Diameter of the roller 100 mm

Ratio between dome/encoder 90.2

Accuracy of positioning of dome 0.5°

Accuracy on encoder roller position 45.1°

Resolution of encoder 4.51° or better

Precision of encoder 10 bit/1000 ppr or better

Encoder is coupled to the roller shaft through flexible torsionally rigid coupling.

1.1.5 Shutter Wheel Assembly (Drg. No. 33601-211008)

Shutter is fabricated from square section steel tubes and plates covered by aluminium sheet metal. Drawing no. 33611-210068 presents the construction details of the shutter.

Each shutter is supported by two wheels at the top and lower ends. Shutter wheelsare flanged wheels running on rectangular bars. The bottom and top rails support and guide the shutter during it traverse. The supports are welded to the dome structure while installing the shutters. Each wheel assembly contains guide rollers and rollers preventing the lifting of the shutter off the rails. The gap between the anti lift roller and rail support can be adjusted by rotating the eccentric housing holding the roller shaft.

Top and bottom supports as well the rail and its supports need to be machined to ensure alignment of both shutter, smooth movement over the rails and avoid vibrations/oscillations in the shutter due to wind loads. The guide rollers and the roller shaft for preventing lift shall have no gaps or minimum gaps with rail/supports.

1.1.6 Shutter Drive Assembly (Drg. No. 33601-212009)

Both top and bottom end of each shutter is traversed by a screw and nut mechanism. Each shutter is connected to nuts by arms welded to top and bottom ends. While the nut at the drive at top end is rigidly connected to the shutter and nut at the bottom end is connected to the shutter through a stiff spring. This will eliminate jamming in case of any mismatch at the start of the movement of the shutter. Both the nuts of the drive at each end are moved by a common screw having left and right hand threads. The screw is driven by an 24V DC motor through a planetary gear unit.

Both the motors driving the top and bottom screws shall operate simultaneously with a common control system. Speeds of both motors shall be set to be identical

The shutter drives are mounted on the structure of dome.

Length of traverse for each shutter 1110 mm

Speed of traverse 3.9 m/min

Ratio of gear unit 3.75

Speed of rotation of DC motor 1800 rpm

Operating speed of motor 433rpm

Motor 0.75 HP, 1800 rpm, 24 V Baldor Make

Mounting Flange mounted

Both top and bottom drive motors shall operate in synchronous mode at same speed.

1.1.7 Louvers (Drg. No. 33601-200003 and 210007)

Louvers are welded to shutter and dome structures to prevent leakage of rain into the

dome and to block access to the birds when the shutters are closed.

The louvers fitted to parts which move relative to each other shall have overlapping edges forming labyrinth seals.

Even though design of the louvers is furnished the vendor shall modify the same if necessary to improve the sealing and present aesthetic look. All the louvers shall be adequately anchored by appropriate welding. Once the steel plates are welded in position and found satisfactory aluminium cladding sheets shall be riveted.

1.1.8 Rails (Drg. No. 33401-000001)

Rails shall be laid to form a circular track of specified mean diameter. The track shall be circular and the segments forming the track shall be concentric. The rail is supported by steel plates and held in position by clamps and retainers. The clamps/retainers are fastened to a plate supporting the rail through screws. The plates supporting the rail are located at regular intervals along the track and are welded to the ring beam on the top of the steel structure.

The joint between the segments of the rail shall be closed by weld.

The circularity and radius of different segments and the level of the rail top shall be ensured before welding the supporting plate to the structure.

1.1.9 Hoist

2 Ton motorized hoist is to be supplied and installed in the dome. ISMB 250 has been provided in the dome structure for installing the hoist.

Specifications for the hoist

Rated load 2 Ton

Lift 17 m

Travel 1.8 m

Hoisting speed 5 m/min

Travelling speed 5 m/min

Head room 750 mm

(bottom of hook to centre of travelling rollers)

Load chain Grade 80, tested and certified

Applicable code

Make Hercules

Machined hardened steel gears and load chain wheel.

Ergonomically designed hanging pendent. Contractor shall provide suitable socket on the ring girder of dome (above the dome drive roller) for keeping the pendent when not in use.

Brake, motors, gearbox and panel unit shall be easily accessible. FSB brakes shall be provided.

Hoist shall be tested and certified for lifting 2.5 tons load through complete lift.

Hoist shall be tested at rated load for full traverse.

Both lift and radial traverse are to be motorized.

The hoist shall be operated by a pendant hanging from the hoist. Power for the hoist will be supplied from a stationary power point on the steel structure through trailing cable of length sufficient to permit the radial movement of hoist and rotation of dome through 180° .

A cable dispensing drum for the hoist power cable shall provide required length of cable for the hoist while the dome is rotated.

1.1.10 Windows. (Drg No. 33601-200 003)

7 motorised window shutters fixed in the dome structure shall be procured as per the specification and installed.

Specifications for Windows in Dome.

Size 1200 wide x 1400 high

No. 7

Survival wind (closed) 44 m/sec
Operational Wind 30 m/sec

Material of Construction Aluminium with colour anodizing (25 microns class 1)

Colour - White

Operation Motor driven with E.M. Brake for stopping at any position

Speed 6 m/min

Control Remote control

Push button

Manual in case of motor or power failure

Limit switch/Sensor control at closed/fully open position

Power Supply 230 V or 430V AC

Spares 1 no. drive along with motor

Scope of work Supply, erection, testing and commissioning

Make M/s Gandhi Automation Pvt. Ltd., Mumbai

Ph. (022) 6672 0200/www.geapl.co.in or equivalent

1.2. Structure (Drg. No. 33601-100002)

Rotating dome is supported by a rail fixed on the top of the ring beam of the steel structure. The steel structure is the enclosure covering the levels 3.5 m to 13.7 m. The columns are bolted on the top of the r.c.c columns extending 500 mm above the 3.5 m level (r.c.c slab on ground floor). Steel structure provides for lift shaft to house lift going from 3.5 m level to 9.5 m. It also supports the steel staircases to the floors at 6.5, 9.5 and 13.7 m level. The structure is covered by aluminium sheet/stainless steel wire mesh bolted/riveted to steel frame extending from the main structure. Floors at 6.5 m and 9.5 m levels are made of steel grating. The wire mesh panelling and the grating on the floor permit adequate ventilation of the structure minimising accumulation of heat during the day time. The structure is fitted with doors for entry to 3.5 m level and to access the open terrace above the extended portion of the ground floor. Railing around the periphery of the terrace is also part of the steel structure.

Structure consists of the following sub-assemblies.

1. Structure – General Assembly Drg. No. 33601-100002

2. Columns and Beams Drg. No. 33601-111018

3. Staircase 3.5 m to 6.5 m Drg. No. 33601-112019

4. Staircase 6.5 m to 9.5 m Drg. No. 33601-113020

5. Staircase 9.5 m to 13.7 m Drg. No. 33601-114021

6. Floors Drg. No. 33601-110022

7. Panel Assembly Drg. No. 33601-120023

8. Lift shaft Drg. No. 33601-111024

1.2.1.Columns Beams (drg. no. 33601-111018)

8 columns defining the octagon of the structure are fixed on the top of concrete columns at 4 m level above the ground. The columns are fixed by grouting the anchor bolts in the pockets provided in the r.c.c. Columns.

1.2.2.Lift Shaft (drg. no. 33602-111024)

The columns of the lift shaft are welded to the steel plates inserted in the r.c.c columns at 3.5 m level. These columns are connected to the beams at levels 4.4, 6.485, 9.485 and 13.694 levels.

1.2.3.Stair Cases (Drg. nos. 33601-112019,113020 and 114021)

Stair cases are provided by taking support of the beams and columns to reach floors at 6.5, 9.5 and 13.7 m levels. One of the channels and columns for the staircase starting from 3.5 m level are welded to the plates inserted in the slab at 3.5 m level.

1.2.4.Floors (Drg. no. 33601-110022)

Floors at 6.5 m and 9.5 m level are made of 15 mm thick steel grating and the floor at 13.7 m level is made of 6 mm thick steel plate (plain).

1.2.5.Panel (Drg. no. 33601-120023)

A frame structure made of T, angle, tubular and channel sections surrounds the beams and columns of the structure and is covered by stainless steel wire mesh or aluminium sheet.

1.3. Railing (Drg. no. 33612-000025)

Railing around the terrace and hand rail for stairs from ground level to 3.5 m level is included in the scope of this tender. The vertical pipes of the railing shall be fixed to the slab/steps with anchor bolts.

1.4. *Maintenance Structure (Drg. No. 33612-500027)*

A monkey ladder and a maintenance platform inside the pier are used to erect and maintain the drain oil pipe line from the bearings of the telescope.

1.5. Hatch Cover (Drg. no. 33613-000026)

Aluminium hatch cover is provided to cover the hole in the top surface of the pier.

1.6. Drives, Motors and Control Systems

The following parts and systems, including electrical and electronic works, are part of the scope of the vendor (some of which are already covered in the lists of parts and assembly drawings for the dome).

- 1.6.1. Gear Box and coupling for the shutter drive as specified in the lists of parts. (Motor for shutter drive is excluded from the scope of supply)
- 1.6.2. Limit switches, actuators and suitable bracket for mounting and power and control cabling to the motor/control panel/limit switches for the shutter as per site requirement. The contractor shall mount the limit switches and the actuators such that the shutter traverses the specified distance and stops in open/closed position

One limit switch for the end of traverse both at open and closed positions as well as the top

and bottom ends for each shutter shall be provided. In all eight limit switches shall cover all limiting positions. Actuation of any limit switch shall cut off power supply to both top and bottom drives simultaneously.

- 1.6.3. Gear Box, coupling and motor (permanent magnet DC/AC servo motor), and speed control system/panel and cabling to from motor and control panel for dome drives.
- 1.6.4. Incremental encoder, coupling and display system for monitoring the speed of rotation of dome.
- 1.6.5. Motor powered windows with rolling shutters (made of aluminium) suitable for remote and push button operation. Make M/s Gandhi Automation Pvt Ltd, Mumbai or equivalent.
- 1.6.6. Cable and cable dispensing drum for the hoist so that hoist can be used for nearly 180° rotation of dome due east or west of North South axis.

2. Drawings

Appendix I contains lists the drawings covering the assemblies/subassemblies.

Appendix II contains details of parts specifying bought outs, proprietary and hardware parts.

Appendix III contains the Bill of Materials referred to in the drawings

The drawings as well as this specification form composite technical specifications for the Enclosure containing Structure, Dome and Railing of the 1.3 m Optical Telescope. In case of conflict between specifications the vendor shall obtain the clarification from the Purchaser.

Even though drawings give weights of the parts and the assemblies bidder/contractor can not question any deviations in weights from the manufactured/executed works due to omission or errors in the same and they can not claim any compensation for the same.

Part and assembly drawings contain notes giving instructions/guidelines for manufacture, assembly and erection. The contractor shall ensure that these are understood by the work force actually executing the work and in case of any doubt clarification shall be obtained from the purchaser. Any defect in the work due to non-compliance with the guidelines may lead to rejection of the work executed.

3. Manufacture and Assembly

3.1. Raw Materials

Raw materials used for manufacture shall conform to specification given in the drawings/lists of parts. Use of materials other than specified would be permitted only if prior approval for the same is obtained from the purchaser.

In case of plates/bars undergoing machining, the drawings specify only the thickness

required (even where plate or bar sizes are given) to be maintained after machining. Plates/bars having adequate size to accommodate required machining allowance, errors in weld fit up, and distortion during welding and heat treatment shall be used.

3.2. Manufacture

It is essential that the processes and machines used for manufacture would be of appropriate type and precision necessary to meet the dimensional and geometric tolerances specified in the drawing. Manufacturer shall permit access to the purchaser or his representative to assess the machines on which the components would be manufactured. Manufacturer shall adopt processes and methods appropriate for meeting specifications of the drawings/documents and ensuring quality of the components.

Noted below are some important aspects of manufacture.

- 1. All gas cut surfaces shall be ground or machined minimum 1 mm below the cut surface.
- 2. Necessary land/root gap shall be maintained between the mating edges/surfaces for the butt and fillet welds. 1 to 1.5 mm gap shall be maintained for all structural members joining to another member or plate.
- 3. Stress relief or heat treatment, if specified, shall be carried out leaving sufficient allowance for machining after the heat treatment to maintain the dimensional and geometric tolerances.
- 4. Machines and manufacturing processes used shall be such that specified accuracies shall be easily achievable.
- 5. Where drawings call for certain machining operations to be done at assembly they shall be carried out only at assembly following notes given in the component/assembly drawings. Purchaser shall be contacted for guidance if no specific instructions are provided in the drawings for such an operation.
- 6. Some of the work can only be completed while or after installing the sub-assemblies after the erection of the dome. Such work will be done only at site. However trial fit up/assembly at works (wherever possible) is necessary to finalise dimensions and minimise work at site.
- 7. Members of the steel structures shall be cut/shaped to meet the requirement of the already erected members so that the geometry, alignment, level and specifications of the assembly are maintained. The sizes of members given are as per design dimensions and the members may have to be cut longer or shorter than given in the drawing.

3.3. Assembly

While assembling the components guide lines/instructions given in the assembly drawings shall be implemented using appropriate assembly methods and techniques.

Dome structure shall be completely assembled (fit up) at works to ensure all the members are correctly formed and cut. The joints between the radial and circumferential or horizontal members and the arches shall be verified for proper fit up for welding at site.

Noted below are some important aspects for assembly.

- 1. All components shall be cleaned completely free of rust preventive, oil, grease etc. and wiped dry of any cleaning agent used before assembling the components.
- 2. Wherever holes are to be drilled or tapped to match with mating components at the time of assembly the requirement of alignment and fit of the mating components shall be ensured while marking/transferring holes for drilling.
- 3. Spacers and bearing covers locating bearings shall be ground after trial assembly to determine the exact extent of machining. When these components are reassembled the bearings/rotating parts shall rotate free and smooth with no axial play.
- 4. Only specified grease (will be specified) shall be used in the bearings wherever required.
- 5. Trial/proof assembly of the components in sub-assemblies shall be completed and offered for inspection before giving surface treatments viz. phosphate coating, painting etc. Components, which have undergone surface treatment, shall be thoroughly cleaned dry and reassembled.
- 6. Screws shall be tightened to the specified torque at the time of final assembly (for some of the assemblies at site only).
- 7. Movement of the shutter wheel assemblies (manual) on the top and bottom rails shall be verified at works.

4. Surface Treatment

Surface treatment to be given to each component is specified in the drawing. Noted below are the general guidelines to be followed.

4.1. General Instructions

- **1.** All machined surfaces of components shall be protected by applying rust preventive or grease to clean dry surface after completion of machining till they are taken up for assembly. All the traces of rust preventive or grease shall be completely removed before placing the component in assembly.
- 2. Chemicals, paints etc used for the surface treatment shall be from reputed manufacturers.
- 3. Surfaces shall be ground free of weld spatter, tack welds and burrs before giving any surface treatment.
- 4. Surface treated components shall be well protected from damage to the surface during storage, handling, transport and erection.

- 5. Instruments, electrical or electronic components, bearings etc shall be protected from paint or any damage during painting.
- 6. All hard ware items viz. bolts, screws, nuts and washers shall be zinc plated.
- 7. All the unmachined surfaces of the components and structurals shall be painted. Purchaser would specify the colours of paint to be used.

4.2. Manganese Phosphate Coating

All the completely machined components shall be given a coat of manganese phosphate. This is a chemical treatment process involving surface preparation like degreasing, phosphate coating, rinsing and finishing. All the machined components that can be immersed in the processing tanks (components which are not very big) shall be given this treatment.

Noted below are the guidelines, which shall be followed.

- 1. The manganese coating shall be of Class 1 of IS: 3618. Cleaning, degreasing, coating and sealing process shall be as per IS: 6005.
- 2. Petroleum solvent degreasing is not acceptable. Alkaline degreasing shall not be used on components having surface finish of 0.8 microns or better. Traces of chemicals used for degreasing shall be completely removed before phosphating.
- 3. After phosphating and rinsing in water rinsing in dichromate solution is recommended.
- 4. The manganese-coated components shall be immersed in black stain (spirit stain) and rust preventive oil to seal the coating.

4.3. **Painting**

All painting of steel members in dome shall be completed before taking up fixing cladding sheets by riveting or bolting. Fixing of stainless steel wire mesh and aluminium sheets in the panel for structure shall be taken up only after completing painting of all steel members including those in the panel.

The drawings specify the components and surfaces, which are to be painted. Noted below are the important guidelines for the components.

- 1. Projections on the surfaces to be painted viz. weld spatter, tack welds, burrs etc, shall be removed by grinding. The surfaces shall be cleaned completely free of oil, grease, scale.
- 2. When specified in the drawings components requiring blast cleaning shall be blast cleaned after cleaning as per 1. above. All machined surfaces shall be coated with grease or rust preventive and well protected from any possible damage during blast cleaning. The surface shall be blast cleaned to white metal. Shot or grit blasting method shall be used (no sand blasting).

Any area left due to covers protecting the machined surface shall be inspected and

- cleaned to white metal by hand grinding/buffing.
- 3. Surfaces cleaned as per 1. and 2. above shall be taken up immediately for painting. <u>No cleaned surface shall remain unpainted more than 4 hours after cleaning.</u>
- 4. The surface shall be given first coat of primer. The coat of primer shall be applied by brush followed by pressing with a roller. Spray painting of primer is not permitted.
- 5. The primer coat shall be followed by application of putty (if and wherever required), which shall be applied by a trowel or a putty applicator to fill the dents and crevices if any.
- 6. Large components, which are dismantled and transported to site for reassembly at site, shall be transported to site with one coat of primer and putty. No further painting shall be carried out at works.
- 7. Components, which are assembled at works and transported to site as parts of an assembly, shall be finish painted before transport to site.
- 8. Only Zinc chromate primer shall be used. Putty shall be of the same manufacturer as primer. Finish coat shall be of synthetic enamel of the same manufacturer as primer. Instructions of the manufacturer for painting shall be strictly followed.
 - Vendor shall obtain the approval of the purchaser for the make of the paint before procurement.
 - Two coats of synthetic enamel finish coat shall follow primer and putty coats. Finish coating shall be by spray. The second coat shall be applied after the first coat is hard dried and its gloss is knocked off by scuffing.
- 9. If there is any gap between the primer/putty application and finish coat any grease/oil/dust that might have gathered shall be completely wiped off (if necessary using soft soap solution) and dried before finish coating. Any damage to primer shall be rectified by applying primer to the damaged area and allowed to dry before spraying finish coat.
 - Accumulation of moisture, dust, oil etc. on surfaces, which received primer, or first coat of enamel, would lead to peeling of paint applied subsequently.
- 10. The components, which receive only primer coat at works before despatch to site, shall be inspected for any damage to primer coat after erection at site. All painting at site shall be done after completion of erection and assembly except of surfaces that become inaccessible after erection. The surfaces shall be cleaned to remove oil, grease, soil, rust, dust, moisture etc. Locally damaged primer coating and rusted areas shall be painted locally with primer by brush.
 - Then the whole surface shall be given a second coat of primer by spray. If necessary putty shall be applied on damaged surfaces before coating with primer.

Two coats of synthetic enamel as described earlier shall follow the primer coat.

All titanium dioxide painting shall be carried out at site following the instructions of the supplier of the paint.

11. Surfaces sliding and rolling against another, surfaces mating with others and threads shall not be painted.

5. Transportation

After weld fit up and inspection the dome structure shall be dismantled into transportable units, to ensure their safety during transportation. Each unit shall be put in wooden crates, if necessary, with appropriate packing material/restraints to prevent movement inside the crate. All items being transported shall be secured to the body of the truck. Contractor undertaking the transport shall be familiar with roads leading to Kavalur from Vaniyambadi in Tamilnadu.

Machined surfaces of components, which are dismantled from assembly, shall be given a protective coating before packing and despatch to prevent rusting during transport and storage.

6. Erection

The structure is to be erected on the RCC columns at 3.5 m from the ground.

Erection of Structure

1. Eight columns of the structure shall be erected and approval of the client obtained before grouting the foundation bolts. A gap of 50 mm below the base of the column shall be left for grouting later.

Octagon beams with plates/gussets in position as well 150 mm beams connecting the opposite columns shall be tack welded. Verticality and location of columns and beams in floor levels (whether horizontal or correctly located) shall be verified. If necessary, adjustments shall be made.

Quick cure grout mix made by M/s Fosroc Chemicals, shall be used for grouting.

- 2. The structure comprising of beams and columns (as per the drawing for the same), including the lift shaft, shall be erected and offered for acceptance in the tack welded condition. Full welding of structure shall be taken up only after obtaining the clearance to proceed.
 - Filling the 50 mm gap below the base with grout shall be taken up only after obtaining clearance/approval after tack welding.
- 3. After completing all welding of the beams and columns the same shall be offered for inspection and clearance obtained for taking up further work.

- 4. Weld fit-up for ring beam on the top of columns shall be offered for inspection before full welding. Top surface of the ring beam shall be horizontal within 3 mm over complete perimeter. The joints between the different segments of the ring beam shall be welded only after clearance by the purchaser.
- 5. Floor supporting members shall be tack welded and offered for inspection for each floor. The same shall be offered for inspection and clearance for further work after completion of full welding.
- 6. Staircases shall be erected and offered for inspection in tack welded stage and again offered for inspection after completion of all welding.
- 7. Gratings and plates forming the floors shall be welded in position.

Fitting and welding of railings and panels covering the structure shall be taken up only after completion of erection of dome and trial run.

Dome

- 8. Rail supporting the wheels of the dome shall be laid at specified diameter concentric to the ring beam. Diameter of rail shall be within ± 3 mm of the specified value. Top of rail surface shall be horizontal within 3 mm. After inspection and clearance the supporting plates below the rail shall be welded to the ring beam.
- 9. Ring beam for the dome shall be erected on supports placed on either side of the rail such that the specified gap between the structure ring beam and dome ring beam is maintained. The joints between the different segments of the ring beam shall be welded only after clearance by the purchaser.
- 10. Eight columns forming the octagon of the dome shall be erected and kept in position by tack welding the tie members forming the bottom octagon and tack welding columns to the dome ring beam along with gussets. The columns shall be offered for inspection before full welding.

<u>Structure for the cladding shall be taken up only after completing the structure of the dome and installation of the shutter.</u>

Window frames for fixing the shutters shall be erected to ensure that the shutters can be fitted properly and present an aesthetic view. Tack welding and fitting of shutter for one window frame shall be completed and approval obtained before taking up the erection of balance 6 window frames.

- 11. Aluminium Sheet metal covering of the dome shall be taken up only after obtaining approval for the structure of the dome.
- 12. The shutter supports (top and bottom) shall be kept in position and offered for inspection. Full welding of supports shall be carried out only after installation of

shutter and wheel assemblies and satisfactory movement by shutter drive.

- 13. The shutters can only be completed at site because of the size. Completed shutters shall be offered for inspection before installing on the dome.
- 14. The wheel assemblies for the shutter shall be installed and offered for inspection.

The rollers on the shutters shall be adjusted such that the movement of the shutter is free and smooth over the complete traverse with no excess gap between the rollers and the rail/support.

15. Screw and nut mechanisms for the movement of shutter shall be installed and assembled. The satisfactory movement of shutters with manual rotation of screw shall be ensured before installation of motors and operating with the same.

The motors with gear boxes shall be coupled to the screw and nut mechanisms at the top and bottom end of the shutters. Motors of both top and bottom drives shall be operate simultaneously with no time lag through a single control system.

16. Cladding structure shall be installed following the guidelines.

<u>Riveting of aluminium cladding shall be taken up only after installation of dome</u> wheels, guide rollers etc. and trial run of dome.

17. All the wheels and guide rollers for the dome shall be kept in the specified locations in between the temporary supports for the dome.

<u>Radial alignment of the wheels (converging of axes of all wheels at the centre of dome) shall be ensured and offered for inspection.</u>

Guide rollers and anti lifting locks shall be adjusted in stages slowly while rotating the dome and correcting any drift that may take place due to improper positioning of wheels/guide rollers. Position of guide rollers shall be fixed only after satisfactory rotation of dome number of times.

Installation of drive assembly of dome is necessary for carrying about the above adjustments.

Full welding of plates connecting the wheel assemblies to the ring beam of the dome shall be taken up only after satisfactory trial runs of the dome over complete revolutions.

18. The drive assembly for dome shall be held in position and alignment of driving roller with the dome shall be ensured. The drive assembly shall be temporarily held in position by tack welding/clamping and trial runs of dome (through small angles) shall be made. Only after satisfactory rotation of dome brackets in the drive assemblies shall be welded to the ring beam in the steel structure.

Assembly of drives for dome is required to be dome for the completion of the assembly of wheels, guide rollers and locks.

- 19. After satisfactory run of the dome, aluminium cladding of the dome and shutters shall be installed by riveting.
- 20. Fitments of louvres on the dome structure and shutters shall be completed and offered for inspection before taking up full welding or bolting or riveting.
- 21. The ISMB 250 beam (or its replacement if found necessary to suit the hoist) shall be kept in position and offered for acceptance by client.

The hoist shall have maximum possible radial travel.

- 22. Limit switches shall be kept at the end of traverse for both the open and closed positions of shutters which cut off the power to shutter drive before the dead end is reached.
- 23. Stoppers shall be welded at the end of the rails for each shutter at the top and bottom ends to stop the movement in case of failure of the limit switches.
- 24. The vendor shall study conditions at site and make necessary arrangements including handling systems and devices for proper handling and erection of components of the dome.

The vendor is responsible for proper storage at site for all the components and assemblies till the time of erection/assembly. Vendor shall discuss with the purchaser the available facilities and the need to augment any requirements.

7. Quality Surveillance

The structure for the enclosure should be fabricated and erected following good fabrication practices. Vertical columns shall be straight and erect and the beams forming the floor shall be horizontal. Gratings and plates in the floor shall be cut and laid neatly and straight. Wherever necessary they shall be cut to clear the gussets or railing to present neat and clean cut edges. Panels surrounding the structure shall be elegant and aesthetic in appearance and form a regular octagonal shape. Lift shaft inside the structure shall meet the requirement for satisfactory installation and operation of electric lift. Uniformity of rise of step in all staircases shall be maintained.

The dome shall rotate silent with uniform speed. No rain water shall enter the dome when the shutters are closed through the gaps between the dome and shutter or between the dome and the structure.

Water proof condition shall be demonstrated by conducting rain water test by spraying water at necessary pressure and flow rate on the cladding, louvre joints and shutters.

The shutters shall move uniformly at both the ends and automatically stop at the end of traverse.

On receipt of order vendor shall prepare a 'Quality Assurance Plan' covering raw material procurement to testing and commissioning of enclosure at site. The plan shall include check points where inspection and approval of clients needs to be obtained from purchaser before proceeding with further processing or work. The plan shall be submitted to purchaser for approval. After receipt of the comments if any from purchaser the vendor shall incorporate such comments and submit the final plan to purchaser. Vendor shall inform the purchaser well in advance of the check point to arrange for the inspection at works or site. Vendor in no case shall proceed with further processing/work without explicit clearance from purchaser.

The vendor shall carry out inspection of the components and assemblies at various stages of manufacture and assembly and maintain record of inspections. Test reports, inspection records etc. shall contain reference to the drawing, identification to each and every unit of the part (in case of parts, which are made in quantities) and the actually recorded results/dimensions etc. Any deviations from the specifications shall be noted.

Purchaser or his representatives shall be allowed to inspect the components or inspection records of the vendor at any stage of manufacture.

7.1. Raw Materials

All raw materials shall be free from any visible and metallurgical defects.

- 1. Plates, whether they undergo machining or not, shall be free from scale, pitting, dents etc.
- 2. Bars of alloy steel procured shall be in annealed condition. They shall be inspected for hardness. Any bars showing significant hardness shall be rejected.
 - Bars shall be inspected for chemical composition to meet relevant standard for the material.
- 3. Vendor shall maintain a record of all the raw materials inspected for chemical composition with references to the parts for which the same would be used.
- 4. All square tubes and any other sections procured shall be straight and regular in cross section with no objectionable defects. Vendor shall submit certificates from reputed testing labs for chemical composition of raw material as stipulated in the quality assurance plan.

7.2. Fabrication

- 1. The vendor shall inspect all welded components at the weld-fit up stage recording the locating dimensions of the machined surfaces and the available machining allowance on the plates forming the surface. Inspection record of the weld-fit ups shall be maintained. Gaps for the root of the welds and the lands maintained on the edges of the groove welds shall be inspected.
- 2. Welds shall be ground and blended smooth and subjected to check as specified in the drawing viz. dye-penetrant, etc.

3. The welded components shall be inspected again after clearance of welds to verify the available machining allowance on the plates. If necessary any corrections shall be made to ensure minimum plate thickness specified after machining while maintaining the locating dimensions. Then only the components shall be taken up for stress relieving wherever applicable.

7.3. Heat Treatment, Residual Stresses and Stress Relief

Components requiring hardening and tempering shall be heat treated in reputed heat treatment works. Chemical composition, time temperature chart for hardening and tempering and hardness test report shall be submitted. This procedure shall be followed without fail for all the springs used in the dome

Residual stress shall be kept to a minimum to ensure dimensional stability and minimum stress corrosion. Excessive force shall not be used to achieve a fit. Welding shall be performed in such a manner as to control and minimize distortion.

Stress relieving shall be carried out where ever required as per the ASME Code.

7.4. Machining

- 1. Components requiring heat treatment shall be rough machined leaving adequate allowance for finish machining before heat treatment.
- 2. All finish machined components shall be inspected immediately and as measured dimensions shall be recorded for each piece before storage for assembly.

Components shall be inspected for the removal of burrs and sharp corners.

7.5. Surface Treatment

Components, which have undergone manganese phosphate coating, shall be inspected for the following.

- i. All surfaces requiring coating have received coating over the complete area. Any surfaces exempted from coating are not coated. The coating is uniform. The coating is followed by oil and black stain rinsing.
- ii. Components undergoing painting shall be inspected at every stage viz. cleaning before primer coat, primer coat, application of putty, first finish coat and second finish coat. Any defects at every stage shall be rectified before proceeding further with painting.

Only approved paints and chemicals shall be used. Paints from the same manufacturer shall be used at all stages and for the complete project.

7.6. Proprietary Components and Hardware (ref. Appendix II of Annexure A)

Proprietary and hardware parts of the dome, which the vendor would procure, shall be from reputed manufacturers made to the specification given. The following guidelines shall be followed. All such items shall be offered to quality surveyor for approval well before they are required for use in assembly. Any rejections of the procured items shall not be a cause for the delay in assembling the components.

- 1. The bearing used in the telescope shall be of SKF or FAG make.
- 2. Lock nut and lock washers used for locating the bearings shall be inspected for complete checking of dimensions and quality of material used.
- 3. Where a specific manufacturer name is specified the vendor shall seek approval of the purchaser if the proprietary products of different make are to be procured. Purchaser reserve the right to reject products of alternate suppliers if prior approval is not obtained.

7.7. Assembly

Components and assemblies shall be inspected for the following.

- 1. All components entering the assembly shall be clean and dry. They shall be inspected for the presence of rust preventive, oil, or grease if required shall be sent for cleaning and drying. Superior kerosene shall be used for cleaning all machined surfaces.
- 2. All the components shall have inspection records showing clearance for assembly including acceptance of the surface treatment they have undergone. For the components, which require machining, to suit at assembly surface treatment would be done only after the trial assembly.
- 3. Components shall be free from burrs and sharp corners.
- 4. Where assembly involves use of bearings the bearings shall be thoroughly cleaned with superior kerosene if the bearings are not shielded bearings. Shielded bearings shall be cleaned with a clean, dry and lint free cloth.
- 5. Components rotating on bearings shall be inspected for free and smooth rotation with no axial or radial play. If the assembly is final and the component does not require dismantling for transport to site the locknuts locating the bearing shall be tightened fully and locked with lock washer in position.
- 6. If the assembly is final and the component do not require dismantling for transport to site screws/bolts shall be tightened with locking compound and tightened to specified torque after the approval of the assembly by quality surveyor. Approval of the assembly by the quality surveyor shall be in writing.
- 7. All sections and plates that are gas cut shall be ground minimum 1 mm beyond the cut surface before use in the weld fit up. The edges shall be ground smooth and straight.

- 8. All members in the dome and enclosure structure shall be inspected for location and orientation to match the geometry and shape at weld fit up stage.
- 9. After welding at site the welds shall be dye checked at all critical joints and any joints randomly identified by the client.
- 10. All welds of the dome and shutter which offer protection shall be leak proof against rain water.
- 11. All movements/rotations shall be checked for smooth and silent operation. No objectionable vibrations shall be present.

Appendix I (of Annexure A) List of Drawings

List of Drawings	Title	Filename(.dwg/.pdf)
33602-000001	Enclosure	336 000001 R1
33601-100002	Structure	336 100002 R1
33601-200003	Dome	336 200003 R1
33601-210007	Shutter Assembly	336 210007 R1
33601-211008	Shutter Wheel Assembly	336 211008
33601-212009	Shutter Drive Assembly	336 212009
33601-220010	Dome Drive Assembly	336 220010
33612-290011	Dome Encoder Assembly	336 290011
33601-230012	Dome Wheel Assembly	336 230012
33602-240013	Dome Guide Roller Assembly	336 240013
33602-250014	Dome Guide Roller Assly-AntiLift	336 250014
33602-260015	Lightning Roller Assembly	336 260015
33601-270016	Dome Cladding	336 270016
33601-280017	Dome Structure	336 280017
33601-111018	Columns and Beams	336 111018 R1
33601-112019	Staircase 3.5 m to 6.5 m	336 112019 R1
33601-113020	Staircase 6.5 m to 9.5 m	336 113020
33601-114021	Staircase 9.5 m to 13.7 m	336 114021
33601-110022	Floors	336 110022
33601-120023	Panel Assembly	336 120023 R1
33601-111024	Lift Shaft	336 111024 R1
33612-000025	Railing	336 000025
33613-000026	Hatch Cover	336 000026
33601-500027	Ladder/Platform	336 500027
	Component Drawings	
	Shutter Wheel Assembly	
33613-211041	Bottom Rail Support	336 211041
33612-211042	End Frame	336 211042
33613-211043	Housing	336 211043
33613-211044	Roller Axle	336 211044
33613-211045	Wheel	336 211045
33614-211046	Guide Roller	336 211046
33614-211047	Roller Shaft	336 211047
33613-211048	Eccentric Housing	336 211048
33613-211049	Wheel Axle	336 211049
33614-211050	Cover2	336 211050
33614-211051	Cover1	336 211051

33613-211052	Cover3	336 211052
33614-211053	Spacer	336 211053
33613-211054	Rail Support(Top)	336 211054
	Shutter Drive Assembly	
33613-212055	Screw	336 212055
33613-212056	Nut Housing(Top)	336 212056
33613-212057	Nut Housing(Bottom)	336 212057
33613-212058	Top Arm	336 212058
33614-212059	Flanged Nut	336 212059
33613-212060	Bearing Housing	336 212060
33613-212061	Bottom Arm	336 212061
33614-212062	Motor Plate – TBD-	336 212062
33614-212063	Cover	336 212063
33614-212064	Swivel Pin	336 212064
33614-212065	Spring Plate	336 212065
33614-212066	Spacer	336 212066
33614-212067	Coupling-TBD-	336 212067
	Shutter Assembly	
33611-210068	Shutter details	336 210068 R1
33614-210069	Rail Connecting Member	336 210069
33614-210070	Cover Plate 1	336 210070
33614-210071	Motor Support Plate-TBD-	336 210071
33614-210072	Bearing Housing Plate	336 210072
33614-210073	Gusset Plate1	336 210073
33614-210087	Cover Plate2	336 210087
33614-210088	Gusset Plate2	336 210088
33614-210136	End Cover (Bottom)	336 210136
33614-210137	End Cover (Top)	336 210137
33614-210138	End Cladding (Bottom)	336 210138
33614-210139	End Cladding (Top)	336 210139
	Dome Wheel Assembly	
33613-230074	Chassis	336 230074 R1
33613-230075	Bearing Housing	336 230075
33614-230076	Wheel	336 230076
33614-230077	Retainer Rod	336 230077
33614-230078	Top Plate	336 230078
33614-230079	Cover 1	336 230079
33614-230080	Vertical Pin	336 230080
33614-230081	Locator	336 230081
33613-230082	Shaft	336 230082
33614-230083	Guide	336 230083

33614-230084	Cover 2	336 230084	
33614-230085	Spring	336 230085	
33614-230086	Spacer	336 230086	
22/12/22/22	Dome Drive Assembly	22 (22) 0 0 0	
33612-220089	Bracket	336 220089	
33612-220090	Frame	336 220090	
33612-220091	Roller	336 220091	
33613-220092	Housing	336 220092	
33613-220093	Roller Shaft	336 220093	
33613-220094	Swivel Pin	336 220094	
33614-220095	Guide Rod	336 220095	
33614-220096	Housing 2	336 220096	
33614-220097	Sleeve2	336 220097	
33614-220098	Sleeve l	336 220098	
33614-220099	Cover	336 220099	
33614-220100	Spacer 1	336 220100	
33614-220101	Spacer 2	336 220101	
33614-220102	Spring	336 220102	
33614-220103	Gear Coupling-TBD-	336 220103	
	Dome Guide Roller Assembly		
33613-240105	Support	336 240105	
33613-240106	Bracket	336 240106	
33614-240107	Guide Roller	336 240107	
33614-240108	Axle	336 240108	
33614-240109	Cover	336 240109	
33614-240110	Belleville Spring	336 240110	
33614-240111	Spacer	336 240111	
33614-240112	Stud	336 240112	
33014-240112	Siuu	330 240112	
	Dome Guide Roller Assembly-Antilift		
33612-250113	Support	336 250113	
33614-250114	Lock	336 250114	
3301 / 23011 /	Lock	330 23011 7	
	Lightning Roller Assembly		
33613-260115	Support	336 260115	
33613-260116	Bracket	336 260116	
33613-260117	Slide	336 260117	
33614-260118	Roller	336 260118	
33614-260119	Guide	336 260119	
33614-260120	Guide Bush	336 260120	

33614-260121	Cover	336 260121
33614-260122	Axle	336 260122
33614-260123	Spacer	336 260123
33614-260124	Spring	336 260124
	Dome Encoder Assembly	
33613-290125	Housing	336 290125
33614-290126	Mounting Plate	336 290126
33614-290127	Roller 1	336 290127
33614-290128	Guide Rod	336 290128
33613-290129	Shaft	336 290129
33614-290130	Plate 1	336 290130
33614-290131	Cover	336 290131
33614-290132	Bush	336 290132
33613-290133	Clamp	336 290133
33614-290134	Spacer 1	336 290134
33614-290135	Spacer 2	336 290135
33614-290104	Spring	336 290104
	Dome Cladding	
33614-270141	Gusset 1	336 270141
33614-270142	Gusset 2	336 270142
33614-270143	Gusset 3	336 270143
33614-270144	Gusset 4	336 270144
33614-270145	Cladding 1&3	336 270145
33614-270146	Cladding 2	336 270146
33614-270147	Cladding 4	336 270147
33614-270148	Cladding 5	336 270148
33614-270149	Cladding 6	336 270149
33614-270150	Cladding 7	336 270150
33614-270151	Cladding 8	336 270151
33614-270152	Angle	336 270152 R1
	Dome Structure	
33614-280153	Inclined tube 2	336 280153
33614-280154	Inclined tube 1	336 280154
33614-280155	Vertical tube	336 280155
33614-280156	Radial Stiffener	336 280156
33614-280157	Radial Stiffener	336 280157
33614-280158	Radial Stiffener	336 280158
33614-280159	Stiffener 2	336 280159
33614-280160	Radial Stiffener	336 280160
33614-280161	Support tubes	336 280161
33613-280162	Bottom plate1	336 280162

33614-280163		
	Gusset	336 280163
33614-280164	Plate	336 280164
33614-280165	Plate	336 280165
33614-280166	Plate	336 280166
33614-280167	Gusset	336 280167
33614-280168	Gusset	336 280168
33614-280169	Plate	336 280169
33614-280170	Plate	336 280170
33614-280171	Plate	336 280171
33614-280172	Gusset	336 280172
33614-280173	Plate	336 280173
33614-280174	Gusset	336 280174
33614-280175	Gusset	336 280175
33614-280176	Plate	336 280176
33614-280177	Gusset	336 280177
33614-280178	Gusset	336 280178
33614-280179	Gusset	336 280179
33614-280180	Gusset	336 280180
33614-280181	Gusset	336 280181
33614-280140	<i>Inclined tube 3</i>	336 280140
	Dome General Assembly	
33614-200182	Plate	336 200182
33614-200183	Clamp	336 200183
33614-200184	Skirt cone	336 200184
33614-200185	Louver 4(Arch)	336 200185
33614-200186	Louver 5 (Shutter)	336 200186
33614-200187	Skirt Support	336 200187
33614-200188	Copper Conductor	336 200188
33614-200189	Retainer	336 200189
	Louver1	336 200190
33614-200190		330 200190
33614-200190 33614-200191	Gusset 1	336 200190
33614-200191	Gusset 1	336 200191
33614-200191 33614-200192	Gusset 1 Gusset 2	336 200191 336 200192
33614-200191 33614-200192 33614-200193	Gusset 1 Gusset 2 Gusset 3	336 200191 336 200192 336 200193
33614-200191 33614-200192 33614-200193 33614-200194	Gusset 1 Gusset 2 Gusset 3 Louver 3	336 200191 336 200192 336 200193 336 200194
33614-200191 33614-200192 33614-200193 33614-200194 33614-200195	Gusset 1 Gusset 2 Gusset 3 Louver 3 Louver 2	336 200191 336 200192 336 200193 336 200194 336 200195
33614-200191 33614-200192 33614-200193 33614-200194 33614-200195 33614-200196	Gusset 1 Gusset 2 Gusset 3 Louver 3 Louver 2 Shutter Plate Columns and Beams	336 200191 336 200192 336 200193 336 200194 336 200195 336 200196
33614-200191 33614-200192 33614-200193 33614-200194 33614-200195 33614-200196	Gusset 1 Gusset 2 Gusset 3 Louver 3 Louver 2 Shutter Plate Columns and Beams Gusset 1	336 200191 336 200192 336 200193 336 200194 336 200195 336 200196
33614-200191 33614-200192 33614-200193 33614-200194 33614-200195 33614-200196 33614-111197 33614-111198	Gusset 1 Gusset 2 Gusset 3 Louver 3 Louver 2 Shutter Plate Columns and Beams Gusset 1 Gusset 2	336 200191 336 200192 336 200193 336 200194 336 200196 336 111197 336 111198
33614-200191 33614-200192 33614-200193 33614-200194 33614-200195 33614-200196 33614-111197 33614-111198 33614-111199	Gusset 1 Gusset 2 Gusset 3 Louver 3 Louver 2 Shutter Plate Columns and Beams Gusset 1 Gusset 2 Gusset 3	336 200191 336 200192 336 200193 336 200194 336 200196 336 111197 336 111198 336 111199
33614-200191 33614-200192 33614-200193 33614-200194 33614-200195 33614-200196 33614-111197 33614-111198	Gusset 1 Gusset 2 Gusset 3 Louver 3 Louver 2 Shutter Plate Columns and Beams Gusset 1 Gusset 2	336 200191 336 200192 336 200193 336 200194 336 200196 336 111197 336 111198

33614-111202	Gusset 6	336 111202
33614-111238	Foundation Bolt	336 111238
	Staircase 3.5 m to 6.5 m	
33614-112203	Channel	336 112203
33614-112204	Channel	336 112204 R1
33614-112205	Channel	336 112205
33614-112206	Channel	336 112206
33614-112207	Landing tube 1	336 112207
33614-112208	Landing tube 2	336 112208
33614-112209	Step	336 112209 R1
33614-112210	Step supporting plate	336 112210 R1
33614-112211	Gusset 1	336 112211
33614-112212	Gusset 2	336 112212
33614-112213	Gusset 3	336 112213 R1
33614-112214	Landing	336 112214
33614-112215	Gusset 4	336 112215
33614-112216	Gusset 5	336 112216 R1
33614-112217	Cover	336 112217 R1
	Staircase 6.5 m to 9.5 m	
33614-113218	Channel	336 113218
33614-113219	Channel	336 113219
33614-113220	Channel	336 113220
33614-113221	Channel	336 113221
33614-113222	Gusset A	336 113222
33614-113223	Gusset B	336 113223
33614-113224	Landing tube A	336 113224
33614-113225	Landing tube B	336 113225
33614-113226	Landing	336 113226
	Staircase 9.5 m to 13.7 m	
33614-114227	Channel	336 114227
33614-114228	Channel	336 114228
33614-114229	Channel	336 114229
33614-114230	Channel	336 114230
33614-114231	Landing tube	336 114231
33614-114232	Landing tube	336 114232
33614-114233	Gusset 1	336 114233
33614-114234	Gusset 2	336 114234
33614-114235	Gusset 3	336 114235
33614-114236	Gusset 4	336 114236
33614-114237	Landing	336 114237
	J	

	Floors	
33614-110239	Plate 13.7-9	336 110239
33614-110240	Plate 13.7-2	336 110240
33614-110241	Plate 13.7-4	336 110241
33614-110242	Plate 13.7-1	336 110242
33614-110243	Plate 13.7-3	336 110243
33614-110244	Plate 13.7-5	336 110244
33614-110245	Plate 13.7-8	336 110245
33614-110246	Plate 13.7-7	336 110246
33614-110247	Plate 13.7-10	336 110247
33614-110248	Plate 13.7-6	336 110248
33614-110249	Grating 9.5/6.5-2	336 110249
33614-110250	Gusset 3	336 110250 R1
33614-110251	Grating 6.5-1	336 110251
33614-110252	Grating 9.5-3	336 110252
33614-110253	Grating 9.5-4	336 110253
33614-110254	Grating 9.5-5	336 110254
33614-110255	Gusset 1	336 110255
33614-110256	Gusset 2	336 110256
33614-110257	Plate 13.7-11	336 110257
33614-110258	Plate 13.7-12	336 110258
33614-110259	Plate 13.7-13	336 110259
33614-110260	Plate 13.7-14	336 110260
33614-110261	Plate 13.7-15	336 110261
	Panel Assembly	
33614-120262	Channel 125	336 120262
33614-120263	Vertical Tee 1	336 120263
33614-120264	Horizontal Tee 1	336 120264
33614-120265	Horizontal Tee 2	336 120265
33614-120266	Horizontal Angle 75	336 120266
33614-120267	Vertical Tee 2	336 120267
33614-120268	Cladding 1	336 120268
33614-120269	Flat 1	336 120269 R1
33614-120270	Flat 2	336 120270 R1
33614-120271	Flat 3	336 120271 R1
33614-120272	Gusset	336 120272
33614-120273	Angle 67.5°	336 120273
33614-120274	Cladding 2/3	336 120274
33614-120275	Cladding 4	336 120275
33614-120276	End Cover 1	336 120276
33614-270152	Angle	336 270152 R1
33614-120277	End Cover2	336 120277 R1

Appendix II (of Annexure A) – proprietory & bought out parts

Below are the specifications for proprietory or bought out items in the enclosure. The contractor shall obtain approval of the purchaser after submitting complete specifications of the items given by the respective supplier before procuring the same. Contractor shall procure only those makes specified in the enclosed specification if the same is insisted by the purchaser.

1.0 Specifications for Windows in Dome.(Drg No. 33601-200 003)

Size 1200 wide x 1400 high

No. 7

Survival wind (closed) 44 m/sec
Operational Wind 30 m/sec

Material of Construction Aluminium with colour anodizing (25 microns class 1)

Colour - White

Operation Motor driven with E.M. Brake for stopping at any position

Speed 6 m/min

Control Remote control

Push button

Manual in case of motor or power failure

Limit switch/Sensor control at closed/fully open position

Power Supply 230 V or 430V AC

Spares 1 no. drive along with motor

Scope of work Supply, erection, testing and commissioning

Make M/s Gandhi Automation Pvt. Ltd., Mumbai

Ph. (022) 6672 0200/www.geapl.co.in (or equivalent)

2.1 Gear Boxes for Shutter and Dome Drives

For Shutter (Drg No. 33601-212 009)

Type Planetary with minimum backlash

Ratio 3.75

Torque 8 Nm

Service factor 1.0

Input 0.75 HP 1800 RPM 24 V DC motor (free supply)

Baldor Flange mounted - 34PM NEMA 56C TEFC

Construction Foot mounted with solid output shaft and hollow input suitable

to fix the flange mounted motor

Orientation Axis of output shaft horizontal

Mounting Footmounted

Model 1065 L Magtorq Pvt. Ltd., Hosur, <u>www.magtorq.com</u>

2.2 For Dome (Drg No. 33601-220 010)

Type Planetary with minimum backlash

Ratio 252

Maximum load torque 3933 Nm

Operating speed 603 rpm (input)

Service factor 1

Orientation Axis of output shaft vertical

Input Suitable for flange mounting

5 HP 1760 RPM DC motor (to be supplied)

Baldor Flange mounted – CD 1805R or 1500 rpm 20 Nm torque (Siemens FT6102-8AB7)

Construction Foot mounted with solid output shaft and hollow input suitable

to fix the flange mounted motor

3 Floor Grating (Drg No. 33601-110 022)

Load capacity 200 Kg/m²

Height 15 mm (max)

Opening width 25 mm (max)

Material Steel

Grating shall be galvanized.

4 Wire Mesh in Panel (Drg No. 33601-120 023)

Material 304 SS

Wire gauge 18

Mesh 4/sq cm

5 Bearings

All ball and roller bearings to be used in the dome assemblies shall be of SKF or FAG make.

6 Hoist (Drg No. 33601-280 017)

Rated load 2 Ton

Lift 17 m

Travel 1.8 m

Hoisting speed 5 m/min

Travelling speed 5 m/min

Head room 750 mm

 $(bottom\ of\ hook\ to\ centre\ of\ travelling\ rollers)$

Load chain Grade 80, tested and certified

Applicable code

Make Hercules

Machined hardened steel gears and load chain wheel.

Ergonomically designed hanging pendent. Contractor shall provide suitable socket on thr ring girder of dome (above the dome drive roller) for keeping the pendent when not in use.

Brake, motors, gearbox and panel unit shall be easily accessible. FSB brakes shall be provided.

Hoist shall be tested and certified for lifting 2.5 tons load through complete lift.

Hoist shall be tested at rated load for full traverse.

Cable dispensing Drum Spring loaded cable dispensing drum for permitting 180° rotation of dome in clock wise or anti clock wise directions.

7 Rivets (Drg No. 33601-270 016)

Round head S S rivets shall be used for fixing the aluminium cladding sheets to the supporting structural members.

8 Sealant (Drg No. 33601-270 016)

Edges of the cladding sheets shall be sealed using all weather proof sealant.

9. Ventilation Fans

Size 200 mm

Power Supply 230 V AC

Mounting Wall/flange mount

Quantity 2 nos.

10. Shutter Drive (Drg No. 33601-212 009)

Speed of traverse 3.9 m/min

Ratio of gear unit 3.75

Speed of rotation of DC motor 1800 rpm

Operating speed of motor 433rpm

Motor 0.75 HP, 1800 rpm, 24 V

Baldor Make

Flange mounted

Both top and bottom drive motors shall operate in synchronous mode at same constant set speed with single push button operation. The motor speed shall be reversible with selection of open/close push buttons.

10.1 Control Panel

Single Push button operation to move the shutters at set(constant) speed. The operation shall either fully open or close the shutter to reach the end position controlled by limit switches. Shutter can be stopped at any position by the release of push button.

Accuracy ± 5 mm

Resolution 0.5 mm

Mode of operation Position mode

Power 1.5 KW max

Power input 230 V AC

Protection IP 55.

10.2 Limit Switches (Drg No. 33601-212 009)

Limit switches, their mounting brackets, actuators and necessary hardware are to be supplied and fitted appropriately to ensure the specified traverse of shutter and open and closing positions.

Type Normal roller lever

Construction Oil tight, metal clad

Contacts 1 NC + 1 NO

Code IS 6875

Quantity 8 nos.

11 Dome Drive (Drg No. 33601-220 010)

11.1 Dome Drive

Speed of rotation of dome 0.2 rpm

Speed of rotation of roller 2.4 rpm

Rated speed of DC motor (Baldor) 1750 rpm

or

AC synchronous motor 1500 rpm (Siemens FT6102-8AB7)

Ratio of planetary gear unit 1:252.

Operating speed of motor 603 rpm

Starting Torque on motor (start) 18.4 Nm

Running torque 8.8 Nm

Load Inertia on motor shaft 31 Nmsec²

The motor speed is varied. The dome shall have a soft start of minimum 3 seconds for accelerating to operating speed. Both motors shall operate in synchronous mode at same constant set speed with single push button operation. The motor speed shall be reversible with selection of clockwise/anticlockwise push buttons.

11.2 Controller (Drg No. 33601-220 010)

Type 1 Axis PLC

PLC 1/0-8/6

Make Mesung/Siemens/ABB/Sumitomo

Range Continuous

Accuracy $\pm 0.5^{\circ}$

Resolution 0.05°

Mode of operation Position mode

Power 7.5 KW max

Power input 420 V 3 Ph AC

Motor AC servo motor with built in encoder

Protection IP 55

Over load protection Overload current protection

Control panel shall be ergonomically designed with touch screen selection. It shall have Power

on, start/stop, position command and emergency power cut off. It shall display position, speed and direction of rotation (clockwise or anticlockwise). Panel shall display operation voltage and motor current.

12 Encoder (Drg No. 33602-290 011)

Position of dome shall be read by an incremental coupled to a roller driven by the drive roller of the dome.

Resolution of encoder 4.51° or better

Precision of encoder 10 bit/1000 ppr or better

Encoder is couple to the roller shaft through flexible torsionally rigid coupling (JACOB make or equivalent.

Appendix III (of Annexure A) - Bill of Materials

- 1. The Bill of Materials referred to in the drawings listed in Appendix 1 of annexure A can be made available as computer files to vendors in standard document format
- 2. The Bill of Materials are segregated as per subsystem eg. Dome drives, dome encoder, dome wheel assembly, shutter assembly, shutter drive assembly etc. and are in ten separate files.

DOMEDRIVE.doc

DOMEENCOSDER.doc

DOMEGENASSLYR1.doc

DOMEWHEELASSY.doc

GUIDEROLLER ANTILIFTASSY.doc

GUIDEROLLERASSY.doc

LIGHTNINGROLLER.doc

SHUTTER ASSY.doc

SHUTTERDRIVE ASSY.doc

SHUTTERWHEEL.doc

Annexure 'B' Assembly and part drawings

Note 1

Only Assembly drawings are attached in the tender document as Adobe Acrobat (pdf) format files. Bidders may download all the Assembly drawings, part Drawings and the Bill of materials from IIA Website "ftp://ftp.iiap.res.in/rfp". The pdf files can be enlarged to view all details except in the case of the top level assembly drawings of dome, shutter and enclosure. The bidder or his authorised representative can see or seek clarifications about the drawings, site of installation and any other details as required with Mechanical engineering Division at IIA during the working hours, with prior information (see contact information on Page 2 and Page 8 Section 2.0 "Project site information")

All the drawings and specifications are the property of and proprietory to IIA and shall not be copied/forwarded/remodeled in any manner without explicit permission from IIA.

Note 2

HARD COPIES AND AUTOCAD FILES OF DRAWINGS:

Bidders may refer to & examine the hard copies of main drawings available at IIA if they so require. Further, bidders may collect the set of enclosed drawings in printed form (A3 size for assembly drawings and A4 size for part drawings) or as AUTOCAD files on CD, from this office in person or through Post. These prints or AUTOCAD drawings will only be supplied on furnishing a letter expressing intent to bid referring to this Public Tender number and making a **statement of non-disclosure** as below:

"We, M/s _____ Co. Ltd, hereby express our intent to bid for the Tender No. Xxxxx floated by M/s Indian Institute of Astrophysics (IIA) for 'Manufacture and erection of 1.3m Telescope Enclosure and Dome structure at Vainu Bappu Observatory, Kavalur'. We request a copy of prints / AUTOCAD files of the design drawings to enable us to submit a quotation. We agree that the design, drawings and computer files are proprietory to and the property of the IIA, and we declare and affirm that the design and drawings will only be used in pursuance of the bidding process and will not be used for manufacture of the parts, sub-assemblies or assemblies in the form contained in the drawings or any modifications thereof without the written consent of IIA. We further declare that the designs, ideas and drawings shall not be disclosed to or supplied to any other party for any purpose whatsoever, except in pursuance of the tender process or for fulfilling the Purchase Order placed by IIA, if our bid is successful. "

The request letter should be signed by senior authorised personnel of the company or firm making the request ie. Person authorised to submit the Technical and Commercial bid. The requesting company should keep the last date for bids in mind and allow for four days (after receipt of the request by IIA) to receive the prints/files in person and about a week to receive them by Speedpost.

Note 3.

Certain asssemblies/ sub-assemblies such as the dome drive assembly, the lift shaft structure, fixtures for cabling etc are in process of design optimization. IIA reserves the right to make changes in the design / drawings of such systems and these will be confirmed before actual manufacture of the sub-systems is taken up by the chosen vendor.

Annexure 'C' INSTRUCTIONS TO BIDDERS

- 1. Tenders / bids should be sent in sealed and superscribed envelopes with mention of Tender No. date and date of opening. Only one Tender should be sent in each envelope.
- 2. Late and Delayed Tender will not be considered.
- 3. Duties, Taxes where legally leviable and intended to be claimed should be distinctly shown separately in the Tender.
- 4. a) Quotation should be valid for 120 days from the date of opening of tender.
 - b) Prices are required to be quoted accordingly to the units indicated in the annexed tender form. When quotations are given in terms of units other than those specified in the tender form, relationship between the two sets of units must be furnished.
- 5. Preference will be given to those tenders offering supplies F.O.R Destination/Free door delivery at Site.
- 6. a) All available Technical Literature(s), Catalogue(s) and other data in support of the specifications and details of the item(s) should be furnished along with the offer.
 - b) Samples, if any, called for, should be submitted free of all charges by the bidder and the Purchaser shall not be responsible for any loss or damage thereof due to any reason whatsoever. In the event of non-acceptance of tender, the bidder shall have to remove the samples at his own expense.
 - c) Approximate net and gross weight of the items offered shall be indicated in your offer. If dimensional details are available the same should indicated in the offer.

d) SPECIFICATIONS:

Stores offered should strictly conform to our specifications. Deviation, if any should be clearly indicated by the bidder in their quotation. The bidder should also indicate the Make/type No. of the stores offered and provide catalogue(s), Technical literature(s) and sample(s), wherever necessary along with the quotations. Test certificates wherever necessary should be forwarded along with the supplies. Whenever options are called for in our specifications, the bidder should address all such options. Wherever specifically mentioned by us the bidder could suggest changes to specifications with appropriate response for the same.

- 7. The purchaser shall be under no obligation to accept the lowest or any tender and reserves the right of acceptance of the whole or any part of the tender or portion of the quantity offered and the bidders shall supply the same at the rates quoted.
- 8. The purchaser may shortlist qualified vendors / contractors on the basis of technical bids received and the purchaser reserves the right to supply detailed technical drawings and design data only to the shortlisted vendors and to solicit presentations from such shortlisted vendors.

- 9. Corrections, if any, must be attested. All amounts shall be indicated both in words as well as in figures. Where there is difference between amounts quoted in words and figures, amount quoted in words shall prevail.
- 10. The bidder should supply along with the tender /bid, the name of his bankers as well as the latest Income Tax Clearance Certificate duly countersigned by the Income Tax Officer of the circle concerned under the seal of his office, if required by the Purchaser.
- 11. The Purchaser reserves the right to place order on the successful bidders for additional quantity upto 25% of the quantity offered by them at the rates quoted.
- 12. The proof of authority of the person signing the tender / bid , if called for, should be produced.
- 13. Complete system configuration and system and sub-system design details and manufacturing drawings should have approval of the purchaser before actual fabrication or procurement process.
- 14. A complete set of instruction and operation manual should be supplied at the time of installation.
- 15. Final performance should be guaranteed at the site.

TERMS AND CONDITIONS OF CONTRACT

1. **DEFINITIONS**:

- a). The terms 'Purchaser' shall mean the Director, Indian Institute of Astrophysics, Bangalore-560 034.
- b). The term 'Contractor' or 'Vendor' shall mean the person, firm or company with whom or with which the order for the supply of stores is placed and shall be deemed to include the Contractor's successors, representative, heirs, executors and administrators unless excluded by the contract.
- c). The 'Stores' shall mean the items that contractor agrees to supply under the contract as specified in the Purchase Order including erection of Plants and machinery and subsequent testing, should such a condition be included in the Purchase Order.
- d). The terms 'Purchase Order' shall mean the communication signed on behalf of the Purchaser by an officer duly authorized intimating the acceptance on behalf of the Purchaser on the terms and conditions mentioned or referred to in the said communications accepting the tender, bid or offer of the contractor for supply of stores or plant, machinery or equipment or part thereof.

2. PRICES:

Tenders offering firm prices will be preferred, where a price variation clause is insisted upon by a contractor / vendor, quotations with a reasonable ceiling should be submitted. Such offers should invariably be supported by the base price taken into account at the time of tendering / bidding and also the formula for any such variations.

3. DUTY EXEMPTION

- (a) Any essential Equipment/part of the equipment can be imported for which "Customs Duty Exemption Certificate" will be provided by IIA under the Government of India notification No. 51/96 as an actual user basis.
- (b) Exise duty exemption certificate will be provided if considered against the categories of items tendered, under the Govt. of India notification No. 10/97 valid till 2011.

4. GUARANTEE AND REPLACEMENT:

- a) The contractor shall guarantee that the stores supplied shall comply fully with the specifications laid down, for material workmanship and performance.
- b) For a period of (12) twelve months after the acceptance of the stores, if any defects are discovered therein or any defects therein found to have developed under proper use arising from faulty stores, design or workmanship, contractor shall remedy such defects at his own cost provided he is called upon to do so within a period of 14 months from the date of acceptance thereof by the purchaser who shall state in writing in what respect the store or any part thereof are faulty.
- c) If in the opinion of the purchaser, it becomes necessary to replace or renew any defective stores such replacement or renewal shall be made by the Contractor free of all costs to the purchaser provided thenotice informing the contractor of the defect is given by the purchaser in this regard within the said 14 months from the date of acceptance thereof.
- d) Should the contractor fail to rectify the defects, the purchaser shall have the right to reject or repair or replace at the cost of the contract -or the whole or any portion of the defective stores.
- e). The decision of the purchaser, not withstanding any prior approval of acceptance or inspection thereof on behalf of the purchaser, as to whether or not the stores supplied by the contractor are defective or any defects has developed within the said period of 12 months or as to whether the nature of the defectives required renewal or replacement shall be final, conclusive and binding on the contractor.
- f) To fulfill guarantee conditions outlined in Clause 5(a) to (d) above, the contractor shall, at the option of the purchaser, furnish a Bank Guarantee (as prescribed by the purchaser) from a Bank approved by the purchaser for an amount equivalent to 10% of the value of the contract along with first shipment documents. On the performance and completion of the contract in all respects, the Bank Guarantee will be returned to the contractor without any interest.
- g) All the replacement stores shall also be guaranteed for a period of 12 months from the date of arrival of stores at Purchaser's site.
- h) Even while the 12 months guarantee applied to all stores in case where a greater period is called forth by our specifications then such a specification shall apply; in such cases the period of 14 months referred to in Para 4(b) and (c) shall be 'asked for' guarantee period plus two months.

5. PACKING, FORWARDING AND INSURANCE:

The Contractor will be held responsible for the stores being sufficiently and properly packed for transport by rail, road, sea or air, to withstand transit hazards and ensure safe arrival at the destination. The packing and marking of packing shall be done by and at the expenses of the contractor. The Purchaser will not pay separately for transit insurance, all risks in transit being exclusively of the contractor and the Purchaser shall pay only for such stores as are actually received in good condition, in accordance with contract.

6. TEST CERTIFICATE:

Wherever required Test Certificate should be sent along with the relevant dispatch documents.

7. ACCEPTANCE OF STORES:

- a) The Stores shall be tendered by the contractor for inspection at such places as may be specified by the purchaser at the Contractor's own risk, expenses and cost.
- b) It is expressly agreed that the acceptance of stores, contracted for is subject to final approval by the Purchaser, whose decision shall be final.
- c) If, in the opinion of the Purchaser all or any of the stores that do not meet the performance or quality requirements specified in the Purchase Order, they may be either rejected or accepted at the price to be fixed by the purchaser and his decision as to rejection and the prices to be fixed shall be final and binding on the contractor.
- d) If the whole or any part of the store supplied are rejected in accordance with Clause No.7 (c) above, the Purchaser shall be at the liberty, with or without notice to the Contractor, to purchase in the open market at the expenses of the Contractor, stores meeting the necessary performance and quality contracted for in place of these rejected, provided that either the purchase, or the agreement to purchase, from another supplier is made within six months from the date of rejection of the stores as aforesaid.

8. REJECTION OF STORES:

Rejected Stores will remain at the destination at the Contractor's risk and responsibility, if instructions for their disposal are not received from the Contractor within a period of 14 days from the date of receipt of the advice or rejection, the Purchaser or his representative has, at his discretion the right to scrap or seal or consign the rejected stores to the Contractor's address at the Contractor's entire risk and expense, freight being payable by the Contractor at actuals.

9. DELIVERY PERIOD:

- a) The time for and the date of delivery of the stores stipulated in the Purchase order shall be deemed to be the essence of the Contract, and delivery must be completed on or before the specified dates.
- b) Should the Contractor fail to deliver the stores or any consignment thereof within the period prescribed for such delivery, the Purchaser shall be entitled at his option either.
- i) to recover from the Contractor as agreed liquidated damages and not by way of penalty, a sum of 2% of the price of any stores which the contractor has failed to deliver as aforesaid for each month or

part of a month, during which the delivery of such stores may in arrears, or

- ii) to purchase elsewhere, without notice to the Contractor on the account and at the risk of the contractor, the stores not delivered or others of similar description (where other exactly complying with the particulars are not, in the opinion of the purchaser read -ily procurable, such opinion being final) without canceling the Contract in respect of the consignment(s) not yet due for delivery or,
- iii) to cancel the contract or a portion thereof, and, if so desired to purchase or authorize the purchase of stores not so delivered or others of similar description (where others exactly complying with the particulars are not, in the opinion of the purchaser readily procurable, such opinion final) at the risk and cost of the Contractor.

In the event of action being taken under sub-clause (ii) and (iii) of clause 9 above, the Contractor shall be liable for any loss which the Purchaser may sustain on that account, provided that the re-purchase, or, if there is an agreement to re-provided that the agreement, is made within (6) six months from the date of such failure. But the Contractor shall not be entitled to any gain on such re-purchase made against default. It shall not be necessary for the purchaser to serve a notice of such re-purchase on the defaulting Contractor. This right shall without prejudice to the right of the purchase to recover damages for breach of contract by the Contractor.

10. EXTENTION OF DELIVERY TIME:

As soon as it is apparent that schedule dates cannot be adhered to, an application shall be sent by the Vendor / Contractor to the Purchaser. If failure, on the part of the Contractor to deliver the stores in proper time shall have arisen from any cause which the Purchaser may admit as reasonable ground for an extension of the time (and his decision shall be final he may allow such additional time as he considers it to be justified by the circumstances of the case without prejudice to the Purchaser's rights to recover liquidated damages under clause 9 hereof.

11. RECOVERY OF SUMS DUE:

Whenever there is a breach of contract whether liquidated or not, money arising out of or under this contract, the Purchaser shall be entitled to recover such sum by appropriating, in part or full, the security deposited by the Contractor, if a Security is taken against the contract. In the event of the Security being insufficient or if no security has been taken from the Contractor, then the balance or the total sum recoverable as the case may be shall be deducted from any sum then due or which at any time thereafter may become due to the contractor under this or any other contract with the Purchaser. Should this sum be not sufficient to cover the full amount recoverable, the Contractor shall pay to the Purchaser on demand the remaining balance due. Similarly, if the purchaser has or makes any claims, whether liquidated or not, against the Contractor under any other contract with the purchaser, the payment of all moneys payable under the contract to the Contractor including the Security Deposit if any, shall be withheld till such claims of the Purchaser are finally adjudicated upon and paid by the Contractor.

12. INDEMNITY:

The vendor/ contractor shall warrant and be deemed to have warranted that all stores supplied against this contract are free and clean of infringement of any patent, copyright or trade mark, and shall at all times indemnity the purchaser against all claims which may be made in respect of the stores for infringement of any right protected by patent, registration of design or trade mark and shall take all risk of accidents of damage which may cause a failure of the supply from whatever cause arising and the entire responsibility for sufficiency of all the means used by him for the fulfillment of contract.

13. ARBITRATION:

In the event of any question, dispute or difference arising under these conditions contained in the purchase order in connection with this contract, (except as to any matters the decision of which is specially provided for by these conditions), the same shall be referred to the sole arbitration of the Head of the Purchaser Institution or of some other person appointed by him. It will be no objection that the arbitrator is a Government Servant, that he has to deal with matter to which the Contract relates or that in the course of his duties as Government Servant he has expressed views on all or any of the matters in dispute binding on the parties of this Contract.

TERMS OF THIS CONTRACT:

- (a) If the Arbitrator be the Head of the Purchaser Institution,
 - i) in the event of his being transferred or vacating his office by resignation or otherwise, it shall be lawful for his successor-in-office either to proceed with the reference himself, or to appoint another person as arbitrator, or,
 - ii) in the event of his being unwilling or unable to act for any reason, it shall be lawful for the Head of the Purchaser Institution to appoint another person as arbitrator or,
- (b) If the Arbitrator be a Person appointed by the Head of the Purchaser Institution:

In the event of his death, neglecting or refusing to act, or resigning or being unable to act for any reason, it shall be lawful for the Head of the Purchaser Institution either to proceed with reference himself or to appoint another person—as arbitrator in place of the outgoing arbitrator. Subject as aforesaid, the Arbitration Act, 1940 and the rules there under and any statutory modifications thereof for the time being in force shall be deemed to apply to the arbitration proceedings under this clause. The Arbitrator shall have the power to extend with the consent of the Purchaser and the Contractor the time for making a publishing the award. The venue of Arbitration shall be the place as the Purchaser. In his absolute discretion may determine. Work under the contract shall if reasonably possible, continue during Arbitration proceedings.

14 COUNTER TERMS AND CONDITIONS OF SUPPLIERS:

Where Counter Terms and Conditions whether printed or copied or cyclostyled, have been offered by the Supplier, the same shall not be deemed to have been accepted by the Purchaser, unless specific written acceptance thereof is obtained.





















































































