

CHAPTER – 4

Prequalification document for Servicing of 6 HP PMDC motors including loading and unloading.

1 BRIEF NOTE ON THE GMRT PROJECT

The National Centre for Radio Astrophysics (NCRA) of the Tata Institute of Fundamental Research (TIFR) has an active research program in many areas of astronomy and astrophysics. NCRA has setup a unique facility for radio astronomical research using the metre-wavelengths of the radio spectrum, known as the Giant Metre Wave Radio Telescope (GMRT), it is located at a site about 80km north of Pune. GMRT consists of 30 fully steerable parabolic dishes of 45m diameter each, spread over distances of upto 25km. Fourteen of the thirty dishes are located more or less randomly in a compact central array in a region of about 1 sq.km (Refer figure 1). The remaining sixteen dishes are spread out along the 3 arms of an approximately 'Y'-shaped configuration (Refer figure 2) over a much larger region, with the longest interferometry baseline of about 25km.

2 BRIEF DESCRIPTION OF GMRT SERVO SYSTEM

The GMRT Servo Control System is located at the base of each antenna and facilitates the accurate tracking of targets by positioning the Azimuth (AZ) and Elevation (EL) axes of the antenna. The servo electronics housed in three cabinets, namely AZ and EL drive-Power cabinets and control cabinets. The 45m diameter parabolic dish of the antenna is mounted on EL axis, which in turn rests on AZ axis. Counter-weights are used to balance the load in the EL drive system. AZ axis is steerable in the range of -270 to +270 degree and EL axis can be steered from 15 to 110 degree. Each axis is driven by two numbers of 6HP Permanent Magnet Direct Current (PMDC) motors which have in-built fail-safe brake, tachometer and thermostat. Each motor is driven by a four quadrant thyristor based DC Servo Amplifiers. AZ/EL axes are coupled to respective motor pair through reduction gears. Motors are coupled in counter torque arrangement so as to reduce back-lash errors. Refer annexure – II for GMRT Servo System specifications.

3. PREQUALIFICATION CRITERIA :

1. Applicant must have been in the business of servicing, repairing and rewinding of brushed DC motors for the past three years. Document evidencing the same like purchase orders / work orders executed and on hand needs to be submitted.
Applicant to please enclose copy of certificate of their authorized service partners along with the quotation.
2. Intending firms / contractors must have been registered with shops and Establishments, company incorporated, registered partnership firm etc.
3. Must have valid Service Tax and VAT Registration.
4. Must have valid insurance policy for their Work/Service Centre including cover for third party materials.

4 **LANGUAGE :**

The prequalification bid prepared by the bidder, as well as all correspondences and documents relating to the bid and exchanged by the bidder and NCRA, shall be written in English language.

5. **SUBMISSION OF PREQUALIFICATION DOCUMENT :**

Documents complete in all respect must be submitted in a sealed envelope duly superscribed to be sent to:

**Purchase Officer,
National Centre for Radio Astrophysics (NCRA),
Tata Institute of Fundamental Research (TIFR),
NCRA, Pune University Campus, Post Bag 3, Ganeshkhind,
Pune 411 007, India.**

6. **OPENING OF BIDS :**

If sufficient responses are received by the due date, it will be opened after the due date, if not, reminders will be sent extending the due date for submission.

7. **CLARIFICATION OF BIDS :**

During evaluation of the prequalification document the Centre may, at its discretion, ask the parties for clarifications. The request for clarification and the response shall be in writing.

8. **RIGHT TO ACCEPT OR REJECT PREQUALIFICATION DOCUMENT :**

Centre reserves the right to accept or reject any or all responses without assigning any reasons.

9. **EVALUATION OF THE RESPONSES :**

Response received against this advertisement will be scrutinized and list of parties who meet our pre-qualification criteria will be prepared. Centre will use this list subsequently for floating limited tenders. Centre may restrict the number of prequalified parties to any number deemed suitable to whom limited tender will be sent by it if too many applications are received satisfying the prequalification criteria.

Decision of the Centre in this regard is final. No interim correspondence shall be entertained.

10 SCOPE OF WORK

1. Servicing of 6HPPMDC Motors as per detailed scope of work,
2. Loading and unloading of 4 no.s of 6HP PMDC motors in GMRT Antennas each time as per detailed scope of work,

11.0 PLACE OF WORK

1. Motor Servicing – GMRT, Khodad only,
2. Motor Loading & Unloading – Any of the 30 GMRT Antennas,

12.0 DURATION OF CONTRACT

1. April – 2015 to March – 2016
2. April – 2016 to March – 2017

13.0 ORDER QUANTITY FOR SERVICING, LOADING, UNLOADING

S.No	Description	Period	Quantity
1.	Servicing of Imported Kollmorgen 6HP Permanent Magnet DC Motors	April 2015 to March 2016	140 Motors
		April 2016 to March 2017	96 Motors
2.	Loading and unloading of 6HP imported Kollmorgen Permanent Magnet DC Motors in GMRT antennas	April 2015 to March 2016	28 Antennas
		April 2016 to March 2017	15 Antennas
3.	Loading and unloading of 6HP imported Kollmorgen Brush Less DC Motors in GMRT antennas	April 2015 to March 2016	7 Antennas
		April 2016 to March 2017	15 Antennas

14.0 TECHNICAL SPECIFICATIONS OF PMDC MOTOR

14.1 Motor

Make	:	Kollmorgen
Type	:	TTB2-53810-3036-T, Permanent Magnet, Low inertia
Power	:	6 HP
Maximum Speed	:	2250 RPM
Continuous Current	:	85 A
Peak Current	:	200 A
Maximum Terminal Voltage	:	150 V
Dimensions	:	549 x 238 x 227 (L x H x W)
Weight	:	~80 Kgs

14.2 Tacho Generator

Voltage Sensitivity	:	17 V/ KRPM
Output	:	DC

14.3 Brake

Input : 90 V, 0.39 A

Brake Torque : 22 ft-lb

14.4 Cost of Motor

Approximate cost of Each Motor : Rs.4 Lakhs

15 DETAILED SCOPE OF WORK FOR MOTOR SERVICING

15.1 ISSUE OF MOTORS

5 motors will be issued in a lot to contractor / vendor for servicing at GMRT Site, Khodad. Out of which contractor / vendor can service 4 motors as per the scope of work.

15.2 DETAILS OF WORK TO BE CARRIED OUT

The following work to be carried out during servicing of 6HP PMDC servo motor.

1. Visual Inspection for anomalies for physical damage, burnt smells etc. If any abnormalities found it has to be reported to GMRT Servo Engineer.
2. After motor disassembled the following test to be conducted,
 - a. Inspection on motor armature windings,
 - b. Inspection on stator assembly.

Any abnormalities found it has to be reported to Servo Engineer. Megger values to be taken after visual inspection as per our test report.

3. Wipe off carbon dust, dirt, oil etc by using the suitable technique (Hot air blowing, cleaning with solvent and baking motor winding in oven or suitable techniques) given in the test sheet and measurement of megger values.
4. Visual inspection and checking of brush spring assembly for alignment with commutator, spring tension and brush connection. Check the amount of carbon brush wear, if excessive replace them.
5. Visual inspection of commutator segment for threading, grooving and streaking. If need be it has to be corrected.
6. Check for bearing noise and sound. If found any abnormalities it has to be replaced.
7. The thermostat status to be checked and if found faulty it has to be replaced.
8. The Motor brake must be adjusted and brake torque to be maintained in accordance with the instruction given in the test report.
9. Visual inspection of tacho-generator and tacho constant to be maintained with in the tolerance. If excessive difference in tacho constant it may be replaced after consultation with servo engineer/inspector.
10. After assembly of motor the polarity tests to be conducted as per our test report and megger values to be taken as per our test procedure.

15.3 TESTING AND VALIDATION

1. Megger test will be done by servo engineer after servicing and final assembly of motors.
2. Armature, tacho and brake resistance values to be validated by servo engineer.
3. Rotation test will be conducted in-front of servo engineer to validate the performance of serviced motors in-terms of electrical and mechanical means. Test report to be filled accordingly.
4. After satisfactory performance of serviced motors, final clearance will be given to install serviced motors at antenna.
5. Refer the attached Service test report.

15.4 DURATION OF SERVICE

Two consecutive working days other than National and Institutional holidays

15.5 WARRANTY

The contractor / Vendor shall give the performance guarantee for the serviced motors for the period of **2000 hours** of service after installation at antenna or three months from the date of servicing. During the warranty/guarantee period any abnormalities found in the performance of motor or any problem noticed in the serviced parts it has to jointly investigate by the contractor / vendor with GMRT servo engineering team. If problem found in the serviced motor it has to be freely repaired by the contractor/ vendor.

16.0 DETAILED SCOPE OF WORK FOR LOADING AND UNLOADING

16.1 DETAILS OF WORK TO BE CARRIED OUT

1. Transporting serviced PMDC motors into antennas from service shed with valid gate pass as per GMRT administration procedure.
2. The detailed pre-installation test will be conducted on the antenna which undergoes motor replacement by GMRT servo engineer in front of Contractor / Vendor to ensure the healthy status of antenna before installation of serviced motors. The installation report will be filled accordingly.
3. After mutual conformance of servo performance by both contractor and servo engineer, contractor may unload the 6HP PMDC Servo motors from Azimuth and Elevation axes. During and after unloading of motors contractor should take care of the safety of antenna. (Since brakes are not available after removal motor till the fitment of serviced motors.)
4. Load the serviced PMDC motors in Azimuth and Elevation axes.
5. Co-ordinate with mechanical team for break torque measurement and oil seal fitment.
6. The detailed post installation test will be conducted by servo engineer after loading of serviced motors in antenna by contractor.
7. The pre and post installation performance of antenna should be identical in all aspects once validated jointly by servo engineer and contractor; contractor may re-transport removed PMDC motors to GMRT site Khodad.

16.2 DURATION

Depends on the availability of antenna, only ONE Working day will be provided for loading and unloading (i.e 10:00 to 17:00 hrs).

17.0 INFRASTRUCTURE AND FACILITIES

1. The GMRT shall provide limited open space (15 M x 10 M) at site for building the Contractors / Vendors site office and stores. If needed, the Contractor / Vendor may arrange to build a shed for storing materials at antenna site at his own cost at a spot around the antenna so approved by GMRT.
2. All arrangements for the safe and secure storage of the materials/ equipment and of the Contractors / Vendors tools, tackles, instruments etc. shall be made by the Contractors / Vendors at his own cost. The Contractors / Vendors shall provide the watch and ward arrangements.
3. All arrangements for the subsequent removal of the above materials / equipment, tools, instruments etc. on completion of the work and handing over of the open space in clean condition to the GMRT shall also be made by the Contractors / Vendors at his own cost.

18.0 TERMS OF PAYMENT

The payment towards the servicing, loading and unloading of 6HP PMDC motors in each antenna will be made as follows,

1. No advance payment will be made.
2. After completing servicing, loading and unloading of 4 no.s of PMDC motors in antenna, payment will be made within 7 working days on pro-data basis against a bill duly certified by servo engineer. Bill must accompany delivery challan, test certificate, returned defective parts etc. Bills may be forwarded to Servo In-charge or Group Coordinator or indenter at GMRT, Khodad.

19.0 MATERIALS WHICH WILL BE ISSUED BY THE CENTRE :

If need be following motor parts / items will be provided for replacement

1. Carbon brushes,
2. Brush spring assemblies,
3. Brush holder and brush cap
4. Bearings,
5. Tacho generators,
6. Tacho rotor assemblies,
7. Brake assemblies,
8. Armature connectors,
9. Tacho Generator connectors.

20.0 TOOLS AND EQUIPMENTS

Contractor / Vendor shall have to arrange the following tools for their works,

- Bearing Puller
- Insulation testers/Meggers
- General workshop tools for assembly and disassembly of 6HP PMDC motors
- Multi-meters, clamp meters etc
- Suitable lifting tools (eye bolts/lifting lugs)
- Chain pulley and ropes etc.
- Solvent/Compressor/oven for cleaning of armature, stator assemblies and commutator segments.

21.0 GENERAL TERMS AND CONTITIONS

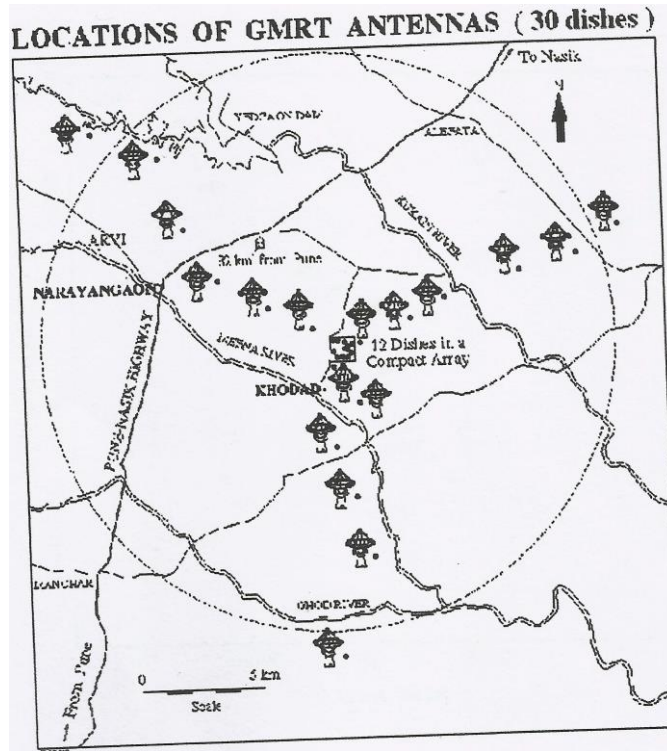
1. This specification is intended as a general description of quality envisaged for materials, workmanship and the finished work. It is not intended to cover minute details. The work shall be executed in accordance with the best modern practices and to the complete satisfaction of the GMRT.
2. You shall not employ any person who has not attained the age of 18 years. You shall deploy sufficient equipment's and labour as may be necessary to maintain the progress of schedule.
3. All the quality standards to be followed for repair, service and rewinding of large permanent magnet DC motors.
4. Contractor / Vendor should arrange only the **diesel driven four wheeler** light goods carrier vehicle
(capable of having enough space for carrying 4 PMDC motors, tools and persons for servicing and two motors for repairing) at its own cost.
5. Other than the scheduled or planned servicing, loading and unloading works, Contractor / Vendor may need to provide their service during the emergency situations.
6. No work on legal holidays will be carried without the written consent of the Engineer and if permitted such work to be done in the presence of the Engineer or his representative.
7. It is the responsibility of the **contractor to obtain, workmen compensation insurance policy at their own cost** for all the workers valid till completion of work and also for works to be undertaken during defect liability period. Copy of the workmen compensation insurance policy to be submitted to our Engineer before commencement of such work.
 - a) Nos. of labourers and Supervisor deployed for this work for working at height of 20M from the ground.
 - b) Place of work: Giant Metrewave Radio Telescope, Office.

Tata Institute of Fundamental Research,
Post Box No: 6, Narayanagaon, Khodad, Pune – 410504.

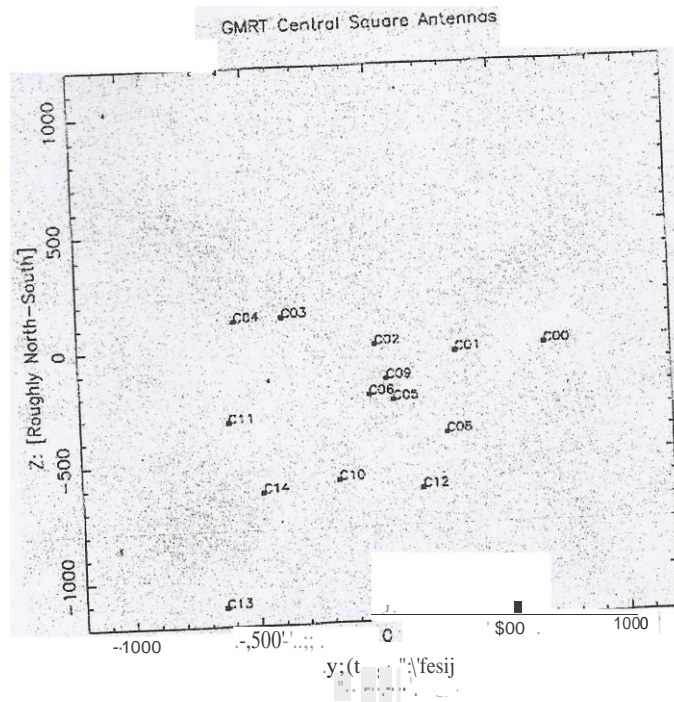
9. No work to be started at site without submitting valid Workmen Compensation Insurance Policy for all workers including supervisor to be deployed at the site.
10. Contractor will have to make necessary arrangement for deploying his own person for safe unloading and receiving and storing of the same at purchasers identified place till they are taken out for consumption.
11. The transportation of labour and materials are the responsibility of the contractor.
12. The Contractor / Vendor is advised to visit the site, after taking prior permission from the Center servo representative to inspect the antenna structure and the adjoining areas to familiarize himself with site conditions and the requirements in prior to submission of the quotation.
13. Contact person for the above visits etc. –
Shri B. Thiyagarajan /
Shri Suresh Sabhapathy
Servo Group,
Giant Metrewave Radio Telescope,
Tata Institute of Fundamental Research,
Post Box No 6,
Khodad,Pune — 410504.
Phone: 02132-258300/320/420,

Annexure - I

GMRT Antenna Location

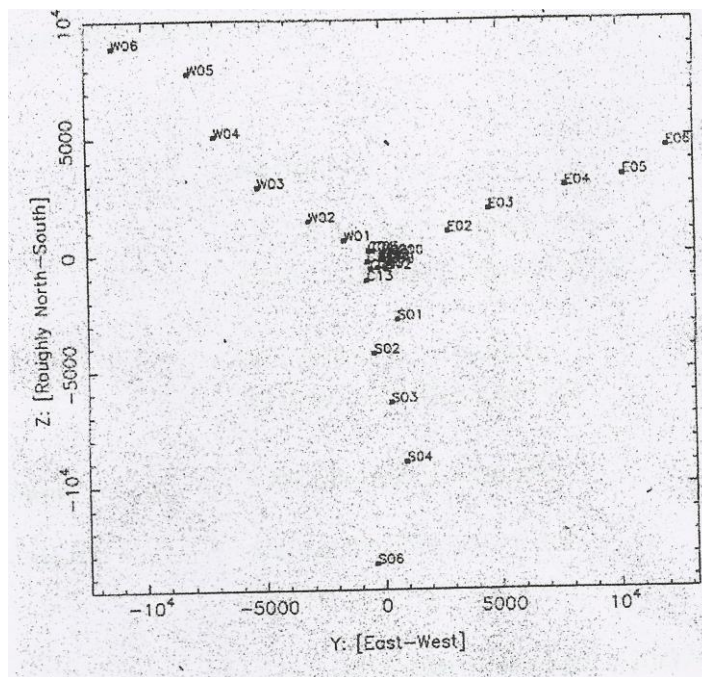


Central Square Antenna Configuration



Y-Array Antenna Configuration

GMRT Y-Array Antennas



Annexure - II

GMRT SERVO SYSTEM SPECIFICATIONS

Dish Mount	Alt-Azimuth
Dish Movement	+/- 270 degree in Azimuth Axis 15 to 110 degree in Elevation Axis
Dish Speed	30 Deg/Min in Azimuth Axis 20 Deg/Min in Elevation Axis
Tracking Speed Minimum	5 Arc min/min in both axis
Tracking Speed Maximum	150 Arc min/Min in Azimuth 15 arc min/Min in Elevation
Pointing Accuracy	1Arc min rms for wind speed < 20KMPH Few Arc min rms for wind speed > 20KMPH
Gear Reduction Ratio	18963 in Azimuth 25162 in Elevation
Operating Voltage	415V AC, 3Phase, 50Hz.

Identification of faults on motors removed from antenna for repairs

Form K5

This sheet is to be filled by inspector and contractor for identifying the faults and for giving clearance for rectification of the same.

Ref: GMRT/KH/MOT check:repairs/callsheet no:

Dated:

1.0 Continuity Test (Before Opening Motor)

S.No	Description	Armature		Tacho		Brake		Remarks
1	AZ Motor 1							
2	AZ Motor 2							
3	EL Motor 1							
4	EL Motor 2							

2.0 Megger Test

S.No	Description	2.1	2.2	2.3	2.4	2.5	2.6	Motor Frame No
1	AZ M1 Armature							
2	AZ M2 Armature							
3	EL M1 Armature							
4	EL M2 Armature							
5	AZ M1 Tacho							
6	AZ M2 Tacho							
7	EL M1 Tacho							
8	EL M2 Tacho							
9	AZ M1 Brake							
10	AZ M2 Brake							
11	EL M1 Brake							
12	EL M2 Brake							

2.1	Megger value taken at antenna site	2.2	Megger value taken at repair shop
2.3	Megger value taken after opening the motor	2.4	Megger value taken after blowing carbon brush
2.5	Megger value taken after cleaning with CTC	2.6	Megger value taken after heating

3.0 Rewinding / Service Status

S.No	Motor Frame No.	Action to be Taken	Rewinding of			
			Brake	Tacho	Armature	Commutator
1		Assmble/Rewind				
2		Assmble/Rewind				
3		Assmble/Rewind				
4		Assmble/Rewind				

Checked By _____

Contractor _____

Approved By _____

(Approved for carrying out repairs as detailed in para no.3 above)

Signature:

Signature:

Signature:

Date:

Date:

Date:

Performance test report on serviced/repaired 6HP servo motors

Form K6

A.1 Megger Test for serviced / repaired motor as detailed below

S.No	Motor Frame No		Armature/Body		Tacho/Body		Brake/Body
1							
2							
3							
4							

B.1 Continuity Test for serviced / repaired motor as detailed below

S.No	Motor Frame No		Armature/Body		Tacho/Body		Brake/Body
1							
2							
3							
4							



IMPORTANT: PI should note the following polarity convention for avoiding over speed while checking motor in the amplifier test mode.

1. Connect Motor armature & tacho connectors to amplifier.
2. Rotate motor shaft CW by hand and measure tacho HI voltage (C4) MCC w.r.t GND.
3. Rotate motor shaft CW by hand and measure armature voltage (pin. 3) of TB using DMM w.r.t GND.
4. Measured polarity convention at Sr.No 2 & 3 should be opposite.

S.No	Description	Terminal	Direction of Rotation	
			CW	CCW
1	Armature Voltage between terminals			
2	Terminal voltage between terminals			

E.1 Motor Thermo Stat Status

S.No	Motor Frame No	Status (D & E)	S.No	Motor Frame No	Status
1			3		
2			4		

Requisition of 6HP Motor installation on GMRT Antenna

Form K8

Reg: GMRT/KH MOT INSTALL/K8

DATE:

Cross Ref: Callsheet No:

Dated:

S.No	Activity A	Activity B
1	Activity A means motors are released by GMRT for installation to contractor serviced or new one from outside agencies other than installation contractor.	Activity B means motors are serviced or repaired by the installation contractor at the motor repair shop in GMRT campus.

Dear Sir,

The following 6HP servo motors are to be installed in GMRT antenna as follows,

Antenna No		Axis	Azimuth	Elevation
-------------------	--	-------------	----------------	------------------

S.No	Motor Position in Antenna	Motor Serial No
1	Azimuth Left Motor	
2	Azimuth Right Motor	
3	Elevation Up Motor	
4	Elevation Down Motor	

Requisition Filled By		Fitment of Motors authorized by	
------------------------------	--	--	--

Signature

Signature

Date:

Date:

Work Done Report

Antenna No:

Date:

Start Date		Vehicle No for transporting motors to antenna	
End Date		Number of persons deployed by contractor	
Fitment of motors on antenna checked by			

Signature

Contractor Signature

Date:

Date:

Note: This form is to be enclosed to the bill raised by the contractor for onward transaction of accounts

**Performance report of 6HP motors fitted on antenna by the installation contractor
(Either activity A or Activity B)**

Form K9

Ref: GMRT/KH/MOTINSTALL/K9

I. Motors fitted as per form K8	On:	Antenna	
--	------------	----------------	--

II. Mechanical Performance

Axis	Motor No	Description	Status			
			OK		Not OK	
AZ	A.1	Locating of key and inserting the motor shaft into the hollow block coupling and fitting of flange bolts.	OK		Not OK	
	A.2	If A.1 OK then see blow, else repeat alignment, rotation of antenna axis in manual mode and check for any abnormal sound and current variation from min to max value.	Normal Sound	OK		Not OK
			Range of current value			
EL	E.1	Locating of key and inserting the motor shaft into the hollow block coupling and fitting of flange bolts.	OK		Not OK	
	E.2	If E.1 OK then see blow, else repeat alignment, rotation of antenna axis in manual mode and check for any abnormal sound and current variation from min to max value.	Normal Sound	OK		Not OK
			Range of current value			

Axes cleared for checking by servo person

Checked By Mechanical Person			Signature Date:
---	--	--	----------------------------

III. S.1 Testing in MANUAL – Single Motor operation and recording currents for AZ Motor A (LH)

Direction	Input POT	Tacho A	Tacho B	Amm A	Crnt A	HHT			
						Tacho A	Tacho B	Crnt A	
CW	1 V								
	5 V								
CCW	1 V								
	5 V								

S.1 Testing in MANUAL – Single Motor operation and recording currents for AZ Motor B (RH)

Direction	Input POT	Tacho A	Tacho B	Amm B	Crnt B	HHT			
						Tacho A	Tacho B		Crnt B
CW	1 V								
	5 V								
CCW	1 V								
	5 V								

S.1 Testing in MANUAL operation and recording currents for both AZ Motors

Direction	Input POT	Tacho A	Tacho B	Amm A	Amm B	Crnt A	Crnt B	HHT			
								Tacho A	Tacho B	Crnt A	Crnt B
CW	1 V										
	5 V										
CCW	1 V										
	5 V										

IV. S.1 Testing in MANUAL – Single Motor operation and recording currents for EL Motor A (DN)

Direction	Input POT	Tacho A	Tacho B	Amm A	Crnt A	HHT			
						Tacho A	Tacho B	Crnt A	
UP	1 V								
	5 V								
DN	1 V								
	5 V								

S.1 Testing in MANUAL – Single Motor operation and recording currents for EL Motor B (UP)

Direction	Input POT	Tacho A	Tacho B	Amm B	Crnt B	HHT			
						Tacho A	Tacho B		Crnt B
UP	1 V								
	5 V								
DN	1 V								
	5 V								

S.1 Testing in MANUAL operation and recording currents for both EL Motors

Direction	Input POT	Tacho A	Tacho B	Amm A	Amm B	Crnt A	Crnt B	HHT			
								Tacho A	Tacho B	Crnt A	Crnt B
UP	1 V										
	5 V										
DN	1 V										
	5 V										

S.2 Testing in LOCAL mode operation and recording currents:

Azimuth

Directi on	Input POT	Tacho A	Tacho B	Amm A	Am m B	Crnt A	Crnt B	HHT			
								Tacho A	Tacho B	Crnt A	Crnt B
CW											
CCW											

Elevation

Directi on	Input POT	Tacho A	Tacho B	Amm A	Am m B	Crnt A	Crnt B	HHT			
								Tacho A	Tacho B	Crnt A	Crnt B
UP											
DN											

S.3 Testing in REMOTE mode operation and recording currents:

Azimuth

Directi on	Input POT	Tacho A	Tacho B	Amm A	Am m B	Crnt A	Crnt B	HHT			
								Tacho A	Tacho B	Crnt A	Crnt B
CW											
CCW											

Elevation

Directi on	Input POT	Tacho A	Tacho B	Amm A	Am m B	Crnt A	Crnt B	HHT			
								Tacho A	Tacho B	Crnt A	Crnt B
UP											
DN											

Remarks

Checked By Servo Person			Signature Date:
----------------------------	--	--	--------------------