Visible & Infrared Survey Telescope for Astronomy

Project Office

Tel: +44 (0)131 668 8411
Fax: +44 (0)131 668 8412
Email: vista@roe.ac.uk,
http://www.roe.ac.uk/atc/projects/vista/

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Document Prepared By:	**Bobby McPeak**
Document Interpreted By:	**David Porter Program Manager**
Document Approved By:	**David Porter Program Manager**
Document Released By:	**John Kirkland Configuration Manager**

Change Record

Issue	Date	ECN	Section(s) Affected	Description of Change / Remarks
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Table of Contents

1 Introduction

The acceptance procedures for the Telescope Work Package are divided into two (2) documents: The Control System Verification and the Mechanical Verifications. This document addresses the mechanical verifications.

2 Scope

This document provides the methodology, procedures and a place for recording the results of testing for the verification of Telescope Work Package mechanical requirements of AD01. Use this document in conjunction with AD02.

3 Acronyms and Abbreviations

AD	Applicable Document
Alt	Altitude
Az	Azimuth
DRD	Document Requirements Definition
DVM	Digital Volt Meter
El	Elevation
MIP	Manufacturing Inspection Point
NA	Not Applicable
NCR	Non-Conformance Report
OSS	Optical Support Structure
PRO	Procedure
RD	Reference Document
SOW	Statement of Work
TBD	To be determined
VER	VertexRSI
VIS	VISTA
VOM	Volt-Ohm Meter
VPO	VISTA Project Office
w.r.t.	With Respect To

4 Applicable and Referenced Documents

The latest revision of the VER documents should be used.

	Title	Number & Issue
AD01	Technical Specification for Telescope Work Package	VIS-SPEC-ATC-0000-0006 Issue 3.0, 21 Feb 2003
AD02	Compliance Matrix Cross Reference List	VIS-LIS-VER-01001-0215 S780-0215
AD03	Telescope Installation Procedure	VIS-PRO-VER-01001-0695 S780-0695
AD04	Quality Assurance Procedure: In Process and Final Inspection	1000-1238-B
AD05	Quality Assurance Procedure: Corrective Action	1000-1234-B
AD06	MIP 3,4,5 Procedure	VIS-PRO-VER-10110-0661
AD07	Structural Verification Test Plan	VIS-PLA-VER-01001-0111 S780-0111
AD08	Thermal Analysis – Liquid Cooled Components	VIS-ANA-VER-01001-0253 S780-0253
AD09	Cooling System Assembly	VIS-DWG-VER-01001-6200 S780-6200
AD10	MIP 1 & 2 Procedure	VIS-PRO-VER-10110-0660
AD11	Operations and Maintenance Manual	VIS-MAN-VER-01001-0850 S780-0850
AD12	Altitude Axis Balancing Procedure	VIS-PRO-VER-01001-0691 S780-0691
AD13	Control System Verification Test Plan	VIS-PLA-VER-01001-9006 S780-9006
AD14	Axial Definer Test Report and Conclusions	VIS-TRE-VER-03001-0713 S780-0713
AD15	M1 Mirror Removal Procedure	VIS-PRO-VER-01001-0696 S780-0696
AD16	Drive Motor Insulation Installation	VIS-DWG-VER-01001-7010
AD17	Axial Actuator Test Report and Conclusions	VIS-TRE-VER-03001-0708 S780-0708
AD18	Lateral Definer Test Report and Conclusions	VIS-TRE-VER-03001-0714 S780-0714
AD19	Lateral Support Test Report and Conclusions	VIS-TRE-VER-03001-0712 S780-0712
AD20	M1 Mass Simulator Inspection	VIS-TRE-VER-01001-0770

	Report	S780-0770
AD21	M2 Mass Simulator	VIS-DWG-VER-01001-5300 S780-5300
AD22	Cooling System Installation	VIS-DWG-VER-01001-6270
AD23	Cassegrain rotator Bearing Design Specification	VIS-SPE-VER-01001-0402 S780-0402
AD24	Cassegrain Rotator Bearing SCD	VIS-DWG-VER-04001-1220 S780-1220
AD25	Cass Instrument Cable Wrap Installation	VIS-VER-DWG-04001-6050 S780-6050
AD26	Cable Wrap Design Report	VIS-TRE-VER-01001-0750 S780-0750

5 Test/Inspection Conditions

5.1 Instruments and Equipment Required

Additional equipment is specified in the procedural sections if required.

A. Machinist level
B. Talyvel Precision Level
C. Theodolite
D. Tape Measure
E. Thermocouples
F. VOM
G. DVM
H. Hamar Laser

NOTE: Calibration records in Appendix A.

6 Verification Testing

Insure that each item in Table 6.1-1 has been completed prior to conducting Verification testing.

Table 6.1 -1 Procedural Checklist

1	Inform the VPO at least three weeks in advance of the verification tests.
2	The verification will be witnessed by: The Test Manager or Engineer responsible for the part or assembly VRSI Quality Assurance representative, if deemed necessary. Specialists as required. VRSI subcontractor Quality Assurance representative. VPO representatives (Option of VPO).
3	Verify all test equipment is calibrated and within the calibration date.
4	The above witnesses will review the test data, decide to pass the system or sub-system or to repeat the inspection/test.
5	All results will be recorded in the space provided in the test procedure.
6	In the event of any non-conformity being discovered during inspection or testing, corrective action will be taken as specified in AD05
7	When required, multiple tests / inspections will be performed to confirm repeatability of the system under test.
8	If any variance from the Technical Specification is anticipated, an application for a waiver in accordance with AD01 (DRD15) and a non-conformance report (NCR) in accordance with AD01 (DRD16) will be submitted.

6.1 Control of Heat Sources

***NOTE**: The tests in the section are not required for VPO acceptance per AD01.*

6.1.1 Instruments and Equipment Required

Contact probe thermocouple (suggestion: Fluke DVM with thermocouple input)
Flow meter, range 0.75 to 10.0 L/min and 5 to 20 L/min, and pressure gauge, 0 to 800 kPa range, configured to measure the pressure at the input of the flow meter.

6.1.2 Verification Testing

Verify the requirements of section 9.1 of the Technical Specification by the following procedure.
AD01 paragraph 6.4.6

Surface Temperature Limits:
a) Above M1 mirror: +1.5°C to –3.0°C
b) Below M1 mirror: +1.5°C to –5.0°C
The above requirements will be verified by the test procedure below.

c) No individual heat source or sink shall transfer >100W to or from the ambient air
d) No dispersed system of heat sources or sinks shall transfer >200W to or from ambient air.
These requirements have been verified by the analysis shown in AD08

e) The cooling media shall be a mixture of water and 33% volume of ethylene glycol.
This requirement shall be verified by inspection.

6.1.2.1 Procedure

Each active component included on the VISTA telescope is liquid cooled and thermally insulated from the ambient environment. The telescope has no active components above the M1 mirror so the test criteria for surface temperatures is that stated in b) above.
This test procedure requires verification of the coolant flow rates through each active device prior to measuring the surface temperatures of these devices. Coolant supply shall be at a temperature of 8^{o}C below the ambient air temperature at a pressure of 6 bar minimum IAW AD01. This test is to be conducted with all drive insulation installed IAW AD16 and allowed to thermally stabilize.

6.1.2.2 Cooling System Flow Rates

Refer to AD09 and AD22 for locations of cooling system components. Starting with the azimuth manifold, sequentially install the pressure gauge and flow meter (heretofore referred to as “the meter”) in each branch of the cooling system at the output of the flow control valve (item 9) mounted to each supply manifold. The required flow rates for each branch are shown in the table below. Identification of the branches is as shown on AD09. Prior to installing or removing the flow meter in any branch, be certain that the branch isolation

valves (items 4, and 5) for that particular section of the fluid circuit has been closed on both the input and return side. Open both branch isolation valves before attempting to set the flow control value. Set the flow rate by adjusting the knob on the flow control valve. After the flow rate is set, lock-down the screw on the flow control valve and record the pressure gauge reading in the table below. The flow control valves are pressure compensated so they will remain at the set flow rate (within 5%) even in the presence of supply pressure fluctuations.

Branch	Flow rate (L/min)	Pressure Reading (kPa)
Azimuth Drive	12 –14	
Altitude Motor	10-12	
FCC	5-7	
CFE LCU (M1 LCU)	4-6	
Cass Drive	8-10	
Cass CW Drive	8-10	
Cass Instrument	20 – 22	
M2 Electronics	2-5	

PASS_____Initials_____Date_____

6.1.2.3 Surface Temperature of Active Devices

Measure ambient air temperature using the thermocouple.
Record this temperature reading in the table below for comparison to the active component measurements. Probe several points on the outside of each motor insulation case, the M1 LCU, and FCC. Report any temperature outside of the range of +1.5°C to –5.0°C from ambient.

Ambient Temperature °C		
Component	**Temperature °C**	**Difference from Ambient Temperature**

PASS_____Initials_____Date_____

6.2

6.3 Telescope Structure Interfaces

6.3.1 Verification by Inspection

The following telescope structure interfaces are verified by inspection at either the fabricator's facility or the VertexRSI facility.

Technical Specification Section	Interface	Method	Procedure	Verification Completed
7.1	Structure /Pier	Fabricator Inspection	Inspection Report	
7.2	M1 Mirror / Cell	Factory Integration with M1 Simulator	6.2.1.1	
7.3	M2 Structure (tube) / M2 Sys.	Fabricator Inspection Report and Factory Integration	Inspection Report	
7.4	M2 Structure (tube) / M2 Baffle	NA	NA	NA
7.5	Cassegrain Rotator / Instrument	Fabricator Inspection Report and Factory Integration	VIS-PRO-VER-01001-0661	
7.6	Telescope / CFE Control Hardware	Inspect at Factory Integration	6.2.1.2	
7.7	Structure / M1 Mirror Handling Equip.	M1 Simulator Removal at Factory Integration	AD15	
7.8	Structure / Camera Handling Equip.	Inspect at Factory Integration	6.2.1.3	
7.9	Structure / M2 Sys. Handling Equip.	Inspect at Factory Integration	6.2.1.4	
7.10	Structure / Enclosure Services	Inspect at Factory Integration	6.2.1.5	

6.3.1.1 Interface Between M1 Mirror and M1 Cell

Verify alignment and locations of actuators per Installation Procedure.

Measure and verify clearances between earthquake restraints and maintenance clamp.

PASS_____Initials_____Date_____

6.3.1.2 Interface Between Telescope and CFE Control Hardware

Verify size of the M1 LCU card cage meets board sizes.

Verify by inspection the location of M1, Altitude, and Azimuth LCUs.

Verify cooling hardware.

PASS_____Initials_____Date_____

6.3.1.3 Interface Between Telescope and CFE Camera Handling Equipment

Verify by inspection and measurement of the access opening to instrument.

Access dimension_____

PASS_____Initials_____Date_____

6.3.1.4 Interface Between Telescope and CFE M2 Handling Equipment

Rotate telescope OSS to horizon pointing.

Verify by inspection clear access to M2 Assembly can be removed through OSS tubes by measurement.

Access dimension_____

PASS_____Initials_____Date_____

6.3.1.5 Interface Between Telescope and VISTA Enclosure Services

Verify that telescope connections are compatible with the enclosure services.

Type of Service	Enclosure Connection	Telescope Connection	Compatible
Electrical Power			
3 Phase			
Single Phase			
UPS			
Fluid			
Coolant			
Helium			
Compressed Air			
Communication	Verified in Control System Procedure AD13		

6.4 Altitude and Azimuth Axis Alignment (Per Technical Spec para. 9.1)

Verify the requirements of section 9.1 of the Technical Specification by the following procedure.

Table 6.3-1 Altitude and Azimuth Axis Alignment

Verify	Procedure	Spec Value	Measured	Pass / Fail
Azimuth Axis Verticality	AD06	0.15 mrad (30.9 arcsec)		
Az Axis Concentricity to pier	Visual Verification	NA		
Azimuth Cable Wrap Concentricity to Pier	Visual Verification	NA		
Alt Axis Perpendicular to Azimuth	6.3.1	0.15 mrad (30.9 arcsec)		
Alt Axis Horizontal Offset to Az	6.3.2	0.5 mm		
Centre Section (El Ring)	6.3.2	0.5 mm		

Concentric to Az				

6.4.1 Altitude Axis Perpendicularity and Horizontal Offset to Azimuth Axis

The following equipment is required:

a) Theodolite
b) Altitude Axis Alignment stand
c) Precision Machinist Level
d) Talyvel electronic level
e) Alignment targets

Procedure:

1) Verify the serial numbers and calibration of equipment matches numbers in the calibration table in the appendix. If different record numbers below.

Serial Numbers / Calibration Match Yes / No Initial_____Date_____
If no, record below.

Equipment	Serial No.	Calibration Date

Initial_____Date_____

2) Install alignment targets on the outside ends of the el ring axle.

3) Set up Altitude Axis Test Stand on centre of torque box (between altitude housings) over the centre hole and level using the adjusting screws at the base and the machinist level.

4) Rough centre the stand over the alignment target mounted at the centre of the azimuth encoder tube in the yoke.

5) Mount theodolite on top of Altitude Axis Test Stand. Set height of theodolite at approximately the altitude axis centreline.

6) Centre the theodolite over the alignment target mounted at the centre of the azimuth encoder tube in the yoke.

7) Rotate the theodolite and sight on +X axis target. Record theodolite angles below.

8) Rotate the theodolite 180° and sight on -X axis target. Record theodolite angles below.

9) Repeat steps 7 and 8.

10) Average the readings for both targets: $\frac{EL1 + EL2}{2}$ and $\frac{AZ1 + AZ2}{2}$

11) Convert the average angle to radians (e.g.): EL1avg.*3600*π/180*10^{-3}

Measurement	**+X Axis Target Angles**		**-X Axis Target Angles**	
	El	Az	El	Az
1 (arcsec)				
2 (arcsec)				
Average (arcsec)				
Average (mrad)				
Offsets (m)				
Delta Offset (m)				
Perpendicularity				

Initial_____Date_____

12) Multiply by ½ distance between targets to determine El and Az offsets.

13) Subtract axis offsets and record in table above in Delta Offset.

14) Divide the El Delta Offset by the distance between targets to determine the altitude axis perpendicularity to azimuth.

15) The altitude axis offset is determined directly from the Az Delta Offset. Record in Table 6.3-1

6.5 Azimuth Bearing

Verify the requirements of section 9.2 of the Technical Specification by the following procedure.

Inspect bearing and record results in Table 6.4-1.

Table 6.4-1 Azimuth Bearing Inspection

Verify	Procedure	Spec Value	Measured	Pass / Fail
Friction Torque	AD10	NA	Verify AD10 completed	
Earthquake Restraint	NA	NA	By bolt earthquake loading analysis	NA
Bearing Seals	Visual Verification	Dust seals required	Inspection	

Initial_____Date_____

6.6 Azimuth Cable Wrap

Verify the requirements of section 9.3 of the Technical Specification by the following procedure.

Table 6.5-1 Azimuth Cable Wrap Inspection

Verify	Procedure	Spec Value	Measured	Pass / Fail
Verify Interlock Switches	Visual Verification	NA	NA	

Initial_____Date_____

Remaining requirements verified by design, analysis, and Control System Procedure AD13.

6.7 Altitude Bearing

Verify the requirements of section 9.5 of the Technical Specification by the following procedure.

Table 6.6-1 Altitude Bearing Inspection

Verify	Procedure	Spec Value	Measured	Pass / Fail
Verified Seals Installed at Assembly	AD10	NA		
Verify Lubrication System Installed	Visual Verification	NA		

Initial_____Date_____

6.8 Altitude Axis Cable Wrap

Verify the requirements of section 9.6 of the Technical Specification by the following procedure.

Table 6.7-1 Altitude Cable Wrap Inspection

Verify	Procedure	Spec Value	Measured	Pass / Fail
Verify Cable Wraps	Visual Verification	NA		

Initial_____Date_____

6.9 M2/M1 Differential Displacement

Verify the requirements of section 10.2.1 of the Technical Specification by the following procedure.

Measurement testing of the differential displacements is difficult to perform. VertexRSI believes the differential displacement can be measured optically but we have not defined the procedure. At this time we want to discuss testing methods with the VPO to help define a procedure that will satisfactorily validate the requirements.

6.10 M1 Mirror/Cassegrain Rotator Differential Displacement

Verify the requirements of section 10.2.2 of the Technical Specification by the following procedure.

Measurement testing of the differential displacements is difficult to perform. VertexRSI believes the differential displacement can be measured optically but we have not defined the procedure. At this time we want to discuss testing methods with the VPO to help define a procedure that will satisfactorily validate the requirements.

6.11 Cassegrain Rotator Alignment to M1 Cell

Verify the requirements of section 10.3.3 of the Technical Specification by the following procedure.

The Cassegrain Rotator is the alignment datum within the OSS (Tube) and w.r.t. the azimuth axis. The bearing is aligned to the cell through precision located pins and shims. All the actuators are aligned to the rotator bearing. Therefore the bearing is aligned by definition as a datum. The alignment of the bearing axis to the azimuth and altitude axes is described in the next sections.

6.12 M1 Cell Alignment to Telescope Centre Section (Elevation Ring)

Verify the requirements of section 10.3.5 of the Technical Specification by the following procedure.

The M1 cell alignment with the centre section is performed and verified at factory integration. The alignment is based on the Cassegrain Rotator interface in the M1 cell to the azimuth axis. The el ring is first aligned to the azimuth axis then the M1 Assembly is aligned to the azimuth axis. Therefore the optical axis of the instrument and the M1 Cell is held to the azimuth axis.

<u>Procedure –Axial:</u>

1) Using the fabrication inspection reports from the M1 Cell machining and Elevation Ring machining add the measured distance from the Instrument Rotator interface to the altitude axis and record in Table 6.1-1.

Procedure – Centring:

1) Align the theodolite on the azimuth axis. (See procedure in AD03)

2) Rotate the el ring (centre section) with the M1 assembly attached to zenith.

3) With the theodolite sighted up the +Z axis verify the Cassegrain Rotator is centred within the allowable radial requirement.

4) Record the measurement in Table 6.1-1

Procedure –Tilt:

1) Set up and level the Talyvel on the Cassegrain Rotator bearing.

2) Rotate the bearing and take measurements every 15°. Record readings in Table 6.1-2.

3) Repeat if necessary.

4) Use the routine described in the appendix to separate axis tilt from wobble.

5) Record axis tilt in Table 6.1-1.

Table 6.1-1 M1 Cell Alignment to Telescope Centre Section

M1 Cell to Centre Section	Requirement	Verify Alignment Measurements from AD03
Axial	± 0.5 (mm)	
Radial	± 0.5 (mm)	
Tilt	± 0.1 (mrad)	

Initial_____Date_____

Table 6.1-2 M1 Cell Tilt Readings

Angle °	Talyvel Reading (arcsec)
0	

15	
30	
45	
60	
75	
90	
105	
120	
135	
150	
165	
180	
195	
210	
225	
240	
255	
270	
285	
300	
315	
330	
345	
360 (0)	

6.13 Cassegrain Rotator Interface to Cameras

Verify the requirements of section 10.3.9 of the Technical Specification by the following procedure.

Verified by inspection and Cass Instrument mass simulator

Pass / Fail Initial_____Date_____

6.14 M1 Cell Requirements

Verify the requirements of section 10.4.2 through 10.4.7 of the Technical Specification by the following procedure. Some actuators will require removal of Cassegrain cable wrap or Cassegrain Instrument.

Table 6.14-1 M1 Cell Requirements

Verify	Procedure	Spec Value Sec. 10.4.2	Measured	Pass / Fail

Verify Access M1 Axial Actuators	Visual Verification	Verify Maintainable Equipment		
Verify Access M1 Lateral Actuators	Visual Verification	Verify Maintainable Equipment		
Verify Locations for Balance Weights on M1 Cell	Visual Verification	Required		

Initial_____Date_____

Table 6.14-2 Axial Definer Requirements

Verify	Procedure	Spec Value Sec. 10.4.3	Measured	Pass / Fail
Verify Access M1 Axial Definers for Adjustment	Visual Verification	Verify Maintainable Equipment		
Verify Location in Cell	AD03	ADO3		

Initial_____Date_____

The remaining requirements are verified in AD14

Table 6.14-3 Axial Support Requirements

Verify	Procedure	Spec Value Sec. 10.4.4	Measured	Pass / Fail
Verify Location in Cell	AD03	ADO3		

Initial_____Date_____

The remaining requirements are verified in AD17

Table 6.14-4 Lateral Definer Requirements

Verify	Procedure	Spec Value Sec. 10.4.5	Measured	Pass / Fail
Verify Access M1 Lateral Definers for Adjustment	Visual Verification	Verify Maintainable Equipment		

Verify Location in Cell	AD03	ADO3		

Initial_____Date_____

The remaining requirements are verified in AD18

Table 6.14-5 Lateral Support Requirements

Verify	Procedure	Spec Value Sec. 10.4.6	Measured	Pass / Fail
Verify Location in Cell	AD03	ADO3		

Initial_____Date_____

The remaining requirements are verified in AD19

Table 6.14-6 Earthquake and Maintenance Restraints Requirements

Verify	Procedure	Spec Value Sec. 10.4.7	Measured	Pass / Fail
Verify Construction of Restraints	Visual Verification	NA		
Verify Operation of Maintenance Restraint	Visual Verification and Operation	Activated Automatically @ 20°		

Initial_____Date_____

6.15 Cassegrain Rotator Bearing

Verify the requirements of section 10.5.1 of the Technical Specification by the following procedure.

Table 6.15-1 Cassegrain Rotator Bearing

Verify	Procedure	Spec Value	Measured	Pass / Fail

Cassegrain Rotator Bearing Requirements and Specification	Manufacturer's Test and Inspection	Axial run out: ≤ 0.02 mm		
		Radial run out : ≤ 0.02mm		
		Maximum friction torque: ≤ 250 N-m		

The Cassegrain rotator bearing shall be provided with a sealed rolling element bearing. Complete dimensional inspection and friction torque testing will be conducted and documented per AD23 and AD24 prior to acceptance from the supplier of the bearing. These inspection and test reports will become part of this document as verification of the above requirements.

Initial_____Date_____

6.16 Cassegrain Rotator Cable Wrap

Verify the requirements of section 10.5.3 of the Technical Specification by the following procedure.

Per paragraph 10.5.3 of AD01,

a) The Cassegrain cable wrap shall be mounted below the M1 cell and shall carry services to the camera.
b) The angular position of the cable wrap shall be slaved to the rotator to minimise loading on the Cassegrain rotator drive
c) The cable wrap shall be equipped with a dedicated drive system and shall be synchronized with the rotator axis.
d) The cable wrap shall exceed the rotator angular range of travel by a margin of 5º beyond the end stops (total travel range of +201º to –381º)
e) The wrap shall be interlocked to the main rotator drive to prevent damage to the cable wrap from differential motion or drive failure.
f) Cables and services shall be as specified
g) Services provision to IR camera will be from SCP mounted on Cassegrain cable wrap inner ring
h) The cable wrap shall de designed to allow access to the cell for maintenance; should removal of the cable wrap be necessary to access any LRU within the cell then the cable wrap shall be designed for rapid removal.

Requirements a), b), c), f), g), and h) will be verified by design (AD25, AD26) and inspection. Requirement d) and e) will be verified by the following test procedure.

6.16.1 Procedure

The Cassegrain cable wrap is equipped with two lanyard switches that will detect a divergence of approximately ±3º between the Cassegrain rotator and cable wrap. In the steps that follow, it is assumed that the software interlocks and hardware interlock limits have been disabled so that the axis can be driven beyond these limits. And, additionally, it is assumed that the lanyard switches can be manually overridden so that the axis can be driven out of the over travel condition. To verify e), perform the following:

Procedure:

1) Remove the power connector from the cable wrap motor

2) Drive the Cassegrain rotator, sequentially, in both directions until the lanyard switch has been actuated

3) Verify that power has been removed from the Cass rotator drive.

Repeated steps for both directions of travel.

Initial_____Date_____

Requirement d) can be verified during first article assembly, prior to installing the Cassegrain cable wrap drive system. The cable wrap can be rotated by hand when the drive system pinion gear is not engaged with the Cassegrain cable wrap bearing gear. The following should be performed with the LVDT/lanyard switch mount (S780-6517), item 6 on AD25, removed. With the cable wrap in the nominal position shown on AD25 (zenith pointing) perform the following:

Procedure:

1) Using installed fasteners as a guide, place reference marks (using masking tape under the mark so that it can be removed after the verification) on the outer and inner ring of the cable wrap assembly to represent nominal position, counter-clockwise rotation of 201º and a clockwise rotation of 381º.

2) Rotate the inner member of the cable wrap in both directions, sequentially, until the reference marks representing the extents of travel have been reached.

The requirement d) has been verified if the cable wrap successfully reaches the reference marks

Initial_____Date_____

6.17 M1 Mirror Removal

Verify the requirements of section 10.7 of the Technical Specification by the following procedure.

Table 6.17-1 M1 Mirror Removal

Verify	Procedure	Spec Value	Measured	Pass / Fail
Removal and Installation of M1 Mirror	Verify AD15 Performed	NA	NA	

Initial_____Date_____

6.18 Auxiliary Drives

Verify the requirements of section 11.1.12 of the Technical Specification by the following procedure.

Procedure:

1) Install weight on elevation ring to create a 100 Nm imbalance about the altitude axis.

2) Remove Altitude Auxiliary Drive hand crank from cradle. Verify telescope system interlocks.
    a. Command system to move. Verify axis does not move.

3) Insert hand crank through access hole in drive cover and engage drive gear.

WARNING

HOLD HAND CRANK SECURELY WITH BOTH HANDS.
RELEASE OF THE HAND CRANK CAN CAUSE PERSONNEL AND EQUIPMENT DAMAGE

4) Release altitude brakes with momentary switch.

5) Rotate altitude axis through full range of travel.

6) Apply altitude brakes.

7) Remove hand crank from altitude drive gear and replace in cradle.

8) Command system to move. Verify system will move.

Pass / Fail Initial_____Date_____

6.19 M1 Mirror Dummy

Verify the requirements of section 12.1of the Technical Specification by the following procedure.

Table 6.19-1 M1 Mirror Dummy

Verify	Procedure	Spec Value	Measured	Pass / Fail
Size, Mass Properties, Actuator Interfaces, Handling Equip. Interface	Manufacturer's Inspection Report for AD20			

Initial_____Date_____

6.20 M2 System and Electronic Cabinet Dummy

Verify the requirements of section 12.2 and 12.3 of the Technical Specification by the following procedure.

Table 6.20-1 M2 System and Electronic Cabinet Dummy

Verify	Procedure	Spec Value	Measured	Pass / Fail
Size, Mass Properties, Interfaces, Handling	Manufacturer's Inspection Report for AD21			

Initial_____Date_____

6.21 Instrument Mass Dummy

Verify the requirements of section 12.4 of the Technical Specification by the following procedure.

Table 6.21-1 Instrument Mass Dummy

Verify	Procedure	Spec Value	Measured	Pass / Fail

Size, Mass Properties, Interfaces	Manufacturer's Inspection Report			

Initial_____Date_____

__oOo__

APPENDIX A

EQUIPMENT CALIBRATION RECORD

Equipment	Last Calibration Date	Expires
Talyvel Precision Level		
Theodolite		
Machinist Level		
Hamar Laser		