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/

Document Title: **VISTA Technical Verification Plan**

Document Number: **VIS-PLA-ATC-95000-0006**

Issue: **0.8**

Date: **21-Mar-2006**

Sign-off Table on Following Page.

Sign-Off Table

Document Prepared By:	**Brian Stobie Control Engineer**	**Signature and Date:**	
Document Approved By:	**Andy Born Systems Engineer**	**Signature and Date:**	
Document Released By:	**Alistair McPherson Project Manager**	**Signature and Date:**	
Document Reviewed by :	**Will Sutherland VISTA Project Scientist**	**Signature and Date:**	
Accepted on behalf of the VISTA Consortium:	**Jim Emerson Principal Investigator**	**Signature and Date:**	
Accepted on behalf of PPARC :	**Richard Wade Director, Programmes (PPARC)**	**Signature and Date:**	
Accepted on behalf of ESO :	**Martin Cullum**	**Signature and Date:**	

Change Record

Issue	Date	Section(s) Affected	Description of Change/Change Request Reference/Remarks
0.1	8/8/03	All	New document
0.2	20/8/03	All	Combine Compliance an Verification into single document
0.3	25/8/03	All	Table brought up to date with V2.5 of Tech Spec
0.4	28/8/03	All	Verification and Compliance Table Completed
0.5	28/07/04	All	
0.6	16/03/06	All	Re-name, re-order and expand content.
0.7	17/03/06	All	Incremental draft edited by AJB – short summary comments relating to verification methods
0.8	21/03/06	All	Final pre-publication version

Table of Contents

1 Introduction

This document defines the verification methodology to demonstrate compliance to the VISTA Verification Technical Specification.

2 Acronyms and Abbreviations

3 Applicable and Referenced Documents

	Title	Number & Issue
AD01	VISTA Technical Verification Specification	VIS-SPE-ATC-00000-0008 Issue 1.0
AD02	VISTA Verification Procedures	VIS-PLA-ATC-90000-0007
AD03	VISTA Integration Plan	VIS-PLA-ATC-14000-0010
RD01	Technical Specification for the Telescope Structure Work-Package	VIS-SPE-ATC-01000-0006
RD02	Telescope Structure Finite Element Analysis	VIS-ANA-VER-01001-0252
RD03	Pointing and Tracking Analysis Report	VIS-TRE-VER-01001-9001
RD04	Wind Effect on Altitude Axis	VIS-TRE-ATC-00002-0012
RD05	Telescope Earthquake Analysis Report	VIS-TRE-VER-01001-0700
RD06	M2 Unit Earthquake Analysis Report	VIS-ANA-CSE-05041-0009
RD07	Technical Specification for the Telescope Enclosure	VIS-SPE-ATC-10000-0009
RD08	VISTA Network Layout	VIS-SPE-ATC-13040-0001
RD09	Technical Specification for the M2 Unit	VIS-SPE-ATC-05040-0001
RD10	VISTA MCS, Integrated Test Procedure	VIS-PRO-VER-01001-9008
RD11	Primary Mirror Figuring and Polishing	VIS-DWG-ATC-02020-0001
RD12	VISTA IR Camera Technical Specification	VIS-SPE-ATC-06000-0004
RD13	M2 Assembly Strength and Stiffness Analysis Report	VIS-TRE-LZO-05011-5100
RD14	Controls System Design Report	VIS-ANA-VER-01001-9002
RD15	Pointing and Tracking Analysis Report	VIS-TRE-VER-01001-9001

RD16	Motor and Brake Sizing Analysis Report	VIS-ANA-VER-01001-9003
RD17	Design Report: Axial Support	VIS-TRE-VER-03001-0701
RD18	Axial Support Test Report and Conclusions	VIS-TRE-VER-03001-0708
RD19	Design Report: Lateral Support	VIS-TRE-VER-03001-0704
RD20	Test Report and Conclusions for : Axial and Lateral Support and Control	VIS-TRE-VER-03001-9704
RD21	Controls System Verification Test Plan	VIS-PLA-VER-01001-9006
RD22	EMC Test Report – Az/Alt/Cass PDU and DAQ Unit	VIS-PRO-VER-01001-9012
RD23	EMC Test Report – FCC (M1)	VIS-PRO-VER-03001-9816
RD24	EMC Declaration of Conformity and CE marking	
RD25	Electrical Safety – Az/Alt PDU	VIS-PRO-VER-01001-9011
RD26	Electrical Safety – Cass PDU	VIS-PRO-VER-01001-9021
RD27	Electrical Safety - FCC	VIS-PRO-VER-03001-9815
RD28	Controls Preliminary Design Report	VIS-ANA-VER-01001-9002
RD29	VISTA IR Detector Characterisation Procedure	VIS-PRO-ATC-06032-0003
RD30	(Enclosure Building) Electromagnetic Compatibility Verification Procedure	VIS-PRO-EIE-10100-0303

4 Verification Plan

4.1 VISTA Test Philosophy

1. Several forms of verification activities will take place during the design, manufacture, assembly and commissioning of VISTA.
2. In order of precedence the verification shall be achieved through testing, inspection, analysis or design.
3. In cases where more than one method of verification has been used, only the highest precedent method is defined in this document, unless a subset of that requirement is verified through different methods. In the later case, the requirement will be sub-divided in future issues to uniquely identify the verification method.
4. These activities will take place in several locations ranging from sub-system manufacturers premises to the commissioning site in Chile.

4.2 Verification

1. In addition to the inspections performed as part of quality assurance requirements by each supplier, the methods of verification described in Sections 4.2.1 to 4.2.3 shall be carried out to show that the technical requirements of VISTA defined in AD01 have been achieved.
2. The table in Section 6 has an identifier "x" in the verification method to be used to verify each requirement from AD01, and is also used to indicate the Technical Acceptance tests.
3. Each entry in the test column of the table has a corresponding test procedure in AD02 detailing the tasks necessary to ensure verification, or in the case of vendor activities, references to the applicable vendor documentation.

4.2.1 Verification by Design

1. Verification of the design by reference to sub-system and part specifications and drawings. This will include the use of Formal Design Reviews.

4.2.2 Verification by Analysis

1. The performance of the specific item will be demonstrated by carrying out appropriate analysis.

4.2.3 Verification by Inspection

1. The compliance will be verified by inspection by qualified personnel, optionally witnessed by the VPO or ESO.

4.2.4 Verification by Test

1. The performance of the specific item will be verified by specific tests, optionally witnessed by the VPO or ESO.
2.

4.3 Verification Location

1. Verification that shall be performed at various locations identified in Section 6 as follows:

- S: Verification at site of use
- F: Verification at sub-contractors Factory or VPO facility
- R: Verification through design reviews

2. The VPO shall inform ESO of such activities in sufficient time that, if required ESO representation can be organised.

4.4 Acceptance Data Package

1. The VPO shall deliver to ESO an Acceptance Data Package containing as a minimum the following:

- As built drawings and documentation
- User manuals
- Maintenance manuals

- Sub-system acceptance data packages
- Verification data package

5 Compliance Matrix

The table in Section 6 of this document shows the compliance of the VISTA project against the requirements of the VISTA Technical Verification Specification, AD01.

5.1 Compliance

The column titled "Compliance" is mapped against every performance requirement in AD01.

This has three levels of compliance:

C	Compliant (i.e. design is compliant, but may not be verified yet)
P	Partially compliant
N	Non-Compliant

In the case of partial or non-compliance, additional information shall be presented in the notes column, if necessary referencing additional documentation.

5.2 Status of Compliance

5.2.1 Compliance Verified

An identifier "V" in the verification columns of the table shows that this requirement has been fully met and no further demonstration of compliance is required.

5.2.2 Interim status

An identifier "c" in the verification section of the table shows that a requirement is complied with, possibly in addition to any 'Verified' entries.

5.3 Technical Acceptance

Those tests identified as part of the Technical Acceptance process are identified in that column. These tests are a sub-set of AD01 agreed between VPO and ESO.

6 Compliance and Verification Table

The following table shows the compliance to the requirements listed in the VISTA Technical Verification Specification and how these requirements will be verified:

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
4.3.1	General Environmental Conditions	C		c				S	Flowed down to all Sub-system specifications, e.g. RD01 S/6.1
4.3.2	Transportation Environment	C		c				F	Flowed down to all Sub-system specifications, e.g. RD01 S/6.2
4.3.3	Installation Operation Maintenance Environment	C		c				F	Flowed down to all Sub-system specifications, e.g. RD01 S/6.3
4.3.3.1	Natural Temperature	C		c			x	S	. All sub-systems are designed to limits, c.f. RD01 S/6.3.1, RD09 S/5.4.1.3 and partially tested during integration/commissioning.
4.3.3.2	Natural Wind	C		c	c		x	F/S	. Telescope is designed and analysed to limits, c.f. RD02 S/4.4.4 and 5, RD03, RD04, RD09 S/5.4.1.4 and partially tested during integration/commissioning.
4.3.3.3	Earthquakes	C		c	c			S	. Flowed down to all Sub-system specifications, c.f. RD01 S/6.3.7. Analysed in RD05, RD02 S/4.4.7, RD06, etc

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
4.4.1	Power Distribution	C		c			x	F	c.f. RD07 S/12.1, 12.2. Implicitly tested during telescope integration/commissioning.
4.4.2	Local Area Network	C		c			V	F	Flowed down to Sub-system specification RD08. Fully tested during Sub-system testing.
4.5	Reference Frame Definition	C		V					Flowed down to all Sub-system specifications, e.g. RD01 S/4.5 and RD09 S/4.3
4.6	Telescope aperture								
	(1) Mirror aperture	C	x	c			x	F	c.f. RD11
	(2) Clear aperture	C		V				S	Design Refs
4.7	Wavelength coverage	C		V				S	Design Refs
4.8.1	Zenith Distance	C	x	c			x	S	c.f. RD10 S/4.4.4 SIQ Tests (S/4.9.1.2) shall include Altitude angle limits.
4.8.3	IR Camera Field								
	(1) Field diameter	C	x				x	S	astrometric parameters determined from tiling known starfields.
	(2) Plate Scale	C	x				x	S	as above
	(3) Pixel size	C	x				x	S	as above
	(4) Observed area	C	x				x	S	as above
4.9.1.2	SIQ IR Channel Requirements								
	SIQ as in Table	C	x	c			x	S	Procedure owner allocated WJS. (see S/4.8.1, 5.1.18.2.2, 5.1.18.2.3)
4.10.1.1	Co-planarity								

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	Planar spacing	C		c			x	F	c.f. RD12 S/4.2.3 Procedure owner allocated WJS.
	Tilt	C		c			x	F	c.f. RD12 S/4.2.3 Procedure owner allocated WJS.
4.10.1.2	Thermal Expansion	C		c				F	c.f. RD12 S/4.2.3
4.10.1.3	Flexure	C		c				F	c.f. RD12 S/4.2.5
4.10.1.4	(Pincushion) Distortion	C		c			x	S	Procedure owner allocated WJS.
4.11	Photometry	C		V			x		See refs to other sections in Table 2 of AD01.
4.12.2	Throughput								
	J Band	C	x				x	S	Throughput determined from known stellar sources at varying zenith angles.
	H Band	C	x				x	S	as above
	Ks Band	C	x				x	S	as above
4.12.3	Scattered Light								
	(1) 1st magnitude object	C					x	S	from on-sky tests
	(2) >= 25deg from Full Moon	C					x	S	as above
	(3) 15-25deg from Full Moon	C					x	S	as above
4.12.4	Emissivity								
	(1) Telescope + sky	C			V				by analysis, in comparison with other Paranal instruments for consistency of background
	(2) Telescope + IR Camera	C					x	S	Procedure owner allocated WJS.
4.12.5	Ghosting								
	(1) >= 2 Reflections	C	x				x	S	observing 6th mag star, looking for ghosts

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(2) 6th magnitude star	C	x				x	S	as above
4.12.6	Light Leakage	C		c			x		Procedure owner allocated WJS.
4.12.7	System Noise Characteristics	C	x				x	S	observe for 16h, stack to examine noise properties
4.13.1.2	Absolute Pointing	C	x				x	S	Procedure owner allocated AJB
4.13.1.3	Offset Pointing								
	(1) Offsets < 2 deg	C	x				x	S	Procedure owner allocated AJB
	(2) Guide start remains on autoguider	C	x				x	S	Procedure owner allocated AJB
4.13.1.4	Re-Acquisition	C	x				x	S	measure star's position on science array.
4.13.2	Acquisition Time	C							
	(1) <= 0 deg	C	x				x	S	Procedure AD02 R/4.13.2
	(2) <= 15 deg	C	x				x	S	Procedure AD02 R/4.13.2
	(3) <= 2 deg	C	x				x	S	Procedure AD02 R/4.13.2
	(4) <= 10'	C	x				x	S	Procedure AD02 R/4.13.2
	(5) <= 2'	C	x				x	S	Procedure AD02 R/4.13.2
	(6) <= 20"	C	x				x	S	Procedure AD02 R/4.13.2
4.14.1	Open Loop Tracking								
	(1) 15s	C	x				x	S	log guide star posn whilst tracking
	(2 5min	C	x				x	S	as above.
	(3 Non-sidereal at 1"/s	C	x				x	S	Procedure owner allocated WJS
4.14.2	Closed Loop Tracking								
	(2) Autoguider ready time	C	x				x	S	Procedure owner allocated AJB
4.14.3	Non-Siderial Tracking at up to 2"/min	C		V				S	No limitation in standard ESO s/w.
4.15.1	Exposure Length	C	x				x	S	take exposures

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
4.15.2	Exposure Accuracy								
	(1) Duration	C		c			x	S	Procedure owner allocated WJS
	(2) Recording tolerance	C		c			x	S	Procedure owner allocated WJS
4.15.3	Time Stamping	C		c			x	S	
4.15.4.2	Exposure rate and Readout, IR Camera	C	x				x	S	Multiple exposures using maintenance template VIRCAM_gen_tec_exp.
4.15.4.3	Multiple Readouts per IR Exposure	C	x				x	S	Multiple exposures using maintenance template VIRCAM_gen_tec_exp.
4.15.4.4	Rapid Sequence of IR Exposures								
	(1) Exposure sequence delay	C	x				x	S	Multiple exposures using maintenance template VIRCAM_gen_tec_exp.
	(2) Exposure rate	C					x	S	Multiple exposures using maintenance template VIRCAM_gen_tec_exp.
4.16.1.2	IR Stored Data forms	C	x				x	F	check FITS headers.
4.16.2	Writing to Disk								
	(1) Disk space	C		c				F	Design Refs
	(2) Concurrent operation	C	x				x	S	check order of operations during OB
4.16.3	Archiving	C	x				x	S	check FITS headers.
4.16.4	Media	C		c					Data is shipped to Paranal.
4.16.5	Data Storage								
	(1) 2 night maximum	C		c			x	S	Check RAID capacity
	(2) 10 night typical	C		c			x	S	As above.
4.16.8	Local Data Reduction								

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(1) Processing lag	C	x				x	S	make exposures at the design rate
	(2) Impact on other processes	C		c			x	S	examine timestamps, confirm data acquisition not affected.
	(3) Software updates	C		c					install a software module
	(4) FTP Export	C		c			x	S	export some data…
4.17	Thermal Control								M2 unit thermal analysis ongoing
	(1) Above primary mirror	C					x	S	Procedure owner allocated AJB
	(2) Below primary mirror	C					x	S	Procedure owner allocated AJB
	(3) Concentrated sources	C		V				S	c.f. VIS-ANA-VER-01001-0253, Thermal Analysis, Liquid Cooled Components.
	(4) Dispersed sources	C		V				S	Design Refs
4.17.1.1	Thermal Sensors	C					x	S	Data Acquisition System not tested yet - 130306
5.1.3	Telescope Mass								
	(1) Cass rotator <= 2.9 tonne	C		V				F	Design Refs
	(2) Largest liftable sub-assembly < 10tonne	C		V				F	Design Refs
	(3) Balancing masses	C					V	F	Implicitly tested as part of Telescope Sub-system sell-off demonstrations 14/17-10-05, c.f. RD10
5.1.5	Telescope Optics Requirements	C		V			x	S	c.f. SIQ Tests
5.1.6	M1 Blank Characteristics	C		c		V		F	drawing refs + Schott Acceptance Report
5.1.7.1	M1 Mirror Optical Prescription	C		c			x	F	Factory Acceptance
5.1.7.3.1	M1 Test Set-up								
	(1) Support geometry	C					V	F	VPO dwgs + MIP Report
	(2) Print-through removal	C					V	F	Factory Acceptance

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
5.1.7.3.2	M1 High Spatial Frequency Errors								
	(2) Magnitude	C					x	F	Factory Acceptance
	(3) Included in budgets	C			c				Analysis Ref.
5.1.7.4	M1 Microroughness	C				V		F	c.f. RD11. Roughness derives from powder used during polishing
5.1.7.5	Interface to the M1 Cell								
	(1) Bonded pads	C		c		V		F	VPO dwgs + MIP Report
	(2) Push only	C		c				F	
5.1.7.6	Polishing Requirements								
	(1) Support system	C		c		V		F	VPO dwgs + MIP Report
	(3) M1 Orientation	C				V		F	Factory Acceptance
5.1.8.1	M2 Optical Design Characteristics								
	(1) Conform to AD33	C		c		x		F	Factory Acceptance
	(2) Chamfer	C		c		V		F	VPO dwgs + MIP Report
5.1.8.2	M2 Optical Quality	C					x	F	Factory Acceptance
5.1.8.2.1	M2 Test Set-up								
	(1) Support system	C					V	F	Factory Acceptance
	(2) Print-through removal	C					V	F	Drawings + Factory Acceptance
5.1.8.2.2	M2 High Special Frequency Errors								
	(2) Errors < 0.15" rms	C					x	F	Factory Acceptance
5.1.8.3	M2 Micro Roughness	C				V		F	Roughness derives from powder used during polishing
5.1.8.4	M2 Assembly Mechanical Characteristics								
	(1) Material	C				V		F	LZOS QA Test Certificate
	(2) Mass	C					V	F	MIP Rpt
	(4) 1st Eigenfrequency > 40Hz	C					V	F	46Hz, M2 Mirror Vibration

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									Testing Report VIS-TRE-LZO-05011-5420
	(6) Thermal effects considered	C		c				F	Design Rpt
	(7) Safety of connection	C		c				F	Design Rpt
	(8) Safety backup support	C		c				F	Design Rpt
	(9) M2 cell usage	C		c		x		S	F during factory acceptance - repeat under site conditions
	(10) Handling features	C		c				F	Design Rpt
	(11) Flat centre area	C				x		F	Design Rpt + MIP
	(12) Vacuum compatibility	C		c				F	Design Rpt
5.1.9.1	Azimuth bearing and Pier Interface								
	(1) Support function	C		c	V			F	c.f. RD02
	(2) Compliant with AD37	C		c		x		F	Design Refs - PFJ Inspection Report
	(3) Bearing function	C		c	V			F	c.f. RD02 VIS-SPE-VER-01001-0400, Azimuth Gearbox Design Specification VIS-TRE-VER-01001-0760, Azimuth Bearing Analysis Report VIS-TRE-VER-01001-0761 Azimuth Bearing Factory Acceptance Test Report
	(4) Bearing supports tracking requirement	C		V				F	c.f. RD15
	(5) Has earthquake restraints	C		c	c			F	Design data – PFJ
	(6) Has bearing seals	C		c				F	Design data – PFJ
	(7) Oil supply failure damage	C		V				F	c.f. RD14 S/4.2.4.3, Oil pressure fault disables axis.

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(8) Avoids oil contamination	C		V				F	c.f. RD14 S/4.2.4.3, Oil overflow sensor disables axis..
5.1.9.2	Azimuth Cable Wrap								
	(1) Cable wrap position	C				x		S	Inspection Report - PFJ
	(2) Allows tracking requirement	C		V				F	c.f. RD15, VIS-TRE-VER-04001-0750, Cable Wrap Design Report Appendix A
	(3) No cable damage throughout operating range	C		c			x	S	c.f. RD15, VIS-TRE-VER-04001-0750, Cable Wrap Design Report Implicitly tested during Telescope sell –off tests, 14/17-10-05
	(4) Capacity	C		c		x		S	c.f. RD15, VIS-TRE-VER-04001-0750, Cable Wrap Design Report
	(5) Delivered cabling and services	C				x		S	Inspection Report
5.1.9.3	Telescope Fork and Base								
	(5) Access to bearings, etc	C				V		F	Verified during Telescope sell – off tests, 14/17-10-05
	(6) Has suitable Azimuth floor	C				x		S	Inspection Report
	(7) Az floor handling equipment provision	C				x		S	Inspection Report
	(8) Safe working surface	C				x		S	Inspection Report
5.1.9.4	Altitude Bearings and Drive System								
	(1) Uses two bearing sets	C		V				F	Design Refs
	(2) Suitable for loads	C			c			F	Analysis Ref.
	(3) Drive permits tracking requirement	C			c			F	Analysis Ref.
	(4) Bearing has earthquake restraint	C		c	c			F	Design Refs
5.1.9.5	Telescope Tube								
	(1) Conforms to AD38	C		V		x		F	Design Refs
	(3) Design interfaces to M1 cell and M2	C					x	S	Verify by mounting M2 and

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									building telescope on site.
	(5) Vane obstruction area < 1.5%	C		V				S	Design Refs (FDR)
	(6) Cables, etc do not obstruct optical path	C				x		S	Inspection Report
5.1.9.6	Telescope Tube Structural Performance	C					x	F	c.f. SIQ Tests
5.1.9.7	Altitude Axis Cable Wrap								
	(2) Is un-powered	C				V		F	Verified at telescope sell-off testing 14/17-11-05
	(3) Capacity	C		c		x		S	Design Refs Inspection Report
	(4) Delivered cables and services	C				x		S	Inspection Report
5.1.9.8.1	Adjustment and Balancing – Upper Structure	C					x	F	c.f. SIQ Tests
5.1.9.8.2	Balancing								
	(1) Balancing mass provision on structure	C				V		F	Telescope sell-off tests
	(2) Residual balancing torque	C					x	S	Procedure owner allocated PFJ
	(3) Fine-tuning provision	C				x		S	Inspection Report
5.1.10.2	TCS Interface	C				V		F	Standard ESO S/W
5.1.10.3	Software/Hardware Interface	C		V				F	c.f. VIS-ICD-ATC-01000-0007, ICD between the Electro-Mechanical Hardware and the Control System of the VISTA Telescope.
5.1.10.4	Control Algorithms	C		V				F	Standard ESO source code used, as described in VLT-SPE-ESO-17130-1210, 'LCU Axis Control Module – Design Description' S/4.1
5.1.10.5	Position Measurement	C		c	c		x	S	c.f. RD03, RD15, RD14 S/4.3 c.f. RD10 S/5.14.2,5.14.8

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									c.f. SIQ Tests
5.1.10.7	Motors								
	(1) Margins	C		c				F	c.f. RD16
	(2) Effects included in budgets	C		c				F	c.f. RD15
5.1.10.8.1	Kinematic Ranges								
	Azimuth zero and polarity	C	x				x	S	Procedure AD02 R/5.1.10.8.1
	Azimuth angular range +130 to -310 deg	C	x				x	S	Procedure AD02 R/5.1.10.8.1
	Altitude zero and polarity	C	x				x	S	Procedure AD02 R/5.1.10.8.1
	Altitude angular range 0 to +90 deg	C	x				x	S	Procedure AD02 R/5.1.10.8.1
5.1.10.8.2	Operational Conditions								
	Zenith blind spot <=4.0 deg dia.	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Azimuth range +130 to -310 deg	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Az tracking velocity 480"/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Az tracking acceleration 10"/s/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Az slew velocity 2.0deg/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Az slew acceleration 0.5 deg/s/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Altitude range +20 to +88 deg	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Alt tracking velocity 17"/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Alt tracking acceleration 0.5"/s/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Alt slew velocity 2.0deg/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
	Max Alt slew acceleration 0.5 deg/s/s	C	x				x	S	Procedure AD02 R/5.1.10.8.2
5.1.10.8.4	Telescope Limits								
	(1) General functions	C		c			V	F	c.f. RD01, RD10
	(2) Operational limits	C	x				x	S	Procedure AD02 R/5.1.10.8.4
	(3) Software limits	C	x				x	S	Procedure AD02 R/5.1.10.8.4
	(4) Vicinity limits	C	x				x	S	Procedure AD02 R/5.1.10.8.4
	(5) Interlock limits	C	x				x	S	Procedure AD02 R/5.1.10.8.4

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(6) End Stops	C	x				x	S	Procedure owner allocated PFJ
5.1.10.9	Telescope lockout								
	(1) Pin loading	C		c		c		F	Design Refs
	(2) Pin disables drive	C					x	S	Insert locking pin and confirm drive is disabled.
	(3) Tagging out	C				c		S	Inspection Report
	(4) Positions in Table 4	F		x				S	Park Locations too Wide – PFJ
	(5) Position accuracy 0.05 deg	F		x				S	Park Locations too Wide - PFJ
5.1.10.10	Brakes	C	x				x	S	RD10 S/5.9 (Performed during VRSI On-site Acceptance testing, optionally witnessed by ESO)
5.1.10.11	Altitude Auxiliary Drive								
	(1) Auxiliary drive provided	C					V	F	Auxiliary drive used during telescope sell-off testing 14/17-11-05
	(2) Useable with 1000 Nm OOB	C					x	F	Procedure owner allocated PFJ
	(3) Interlocked	C	x	c			x	S	Verify that extracting auxiliary drive handle from cradle disables Altitude drive.
5.1.11.1	M1 Cell – General Requirements	C		c				F	Design Refs
5.1.11.2	M1 Mirror Support								
	(1) Conforms to AD35	C		c		V		F	Design Refs Inspection Report
	(2) Allows force control	C					V	F	Verified at telescope sell-off testing 14/17-11-05
	(3) Has three axial definers	C		c				F	Design Refs
	(4) Mirror figure can be modified	C	x	c			x	S	Procedure R/5.11.2(4)

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(5) Has three lateral definers	C		c				F	Design Refs
	(6) Protected against earthquakes	C		c				F	Design Refs
	(7) Has mirror restraint for low angles	C	x	c			V	S	(see 5.1.11.6)
	(8) Cell has provision for telescope balancing	C		c				F	Design Refs
	(9) Definer range and adjustment as in Table 5	C		V				F	c.f. RD01, Design Report: Axial Definer VIS-TRE-VER-03001-0703, Design Report: Lateral Definer, VIS-TRE-VER-03001-0705
5.1.11.3	M1 Cell Stability Requirements w.r.t M1	C					x	F	c.f. SIQ Tests
5.1.11.4	M1 Axial Support Requirements								
	(1) Force range 5 to 900N	C		V			x	F	c.f. RD17, RD18, RD20
	(2) Absolute accuracy +/- 2.0N	C		c				F	c.f. RD17, RD18, RD20
	(3) Load cell resolution 0.5N	C		c				F	c.f. RD17, RD18, RD20
	(4) Definer limiting force 1700N	C		c				F	c.f. RD17, RD18, RD20
	(5) Definer minimum Stiffness 30.0e6 N/m	C		c				F	c.f. RD17, RD18, RD20
5.1.11.5	M1 lateral Supports Requirements								
	(1) Force range 10 to 2700N	C		c				F	c.f. RD19, RD20
	(2) Absolute accuracy +/-10N	C		c				F	c.f. RD19, RD20
	(3) Resolution 1.5N	C		c				F	c.f. RD19, RD20
	(4) Definer Total stiffness >= 1.2e8 N/m	C		c				F	c.f. RD19, RD20
	(5) Definer force limiting 5000N	C		c				F	c.f. RD19, RD20
	(6) Max linkage frictional torque 150 Nmm	C		c				F	c.f. RD19 S/4.4.3.4
5.1.11.6	M1 Restraint	C		c			x	S	Move Altitude axis below 20 deg until restraint system is activated.
5.1.11.7	Requirements for Cassegrain Interface Flange	C		c		V		F	Inspection Report
5.1.12.2	Thermal Conditioning of Primary Mirror	C		c		V		F	Inspection Report
5.1.13.1	M1 Control TCS Interface	C		c		x		S	Design Ref

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									Verified during telescope Integration activities
5.1.13.2	M1 Control Hardware Interface	C		c			V	F	Design Ref Verified used during telescope sell-off testing 14/17-11-05
5.1.14.1	M2 Unit Functional Requirements								
	(1) M2 unit has 5 degrees of freedom	C					V	F	Test Refs
	(2) Produces effective motion in focus, centring and tilt as in Fig. 2	C		c			V	F	Test Refs
	(6) Motions controllable via TCS	C					V	F	Test Refs
	(7) No fast tip-tilt	C		c				F	c.f. M2 Unit
	(8) Resolution, accuracy and stability included in system budgets	C			V			F	Analysis Ref.
5.1.14.8	M2 Baffle Requirements								
	(1) Reflective annular baffle used	C		c				F	Design Refs
	(2) Baffle presents a spherical surface	C		c		V		F	Inspection Report
5.1.15.1	M2 Control TCS Interface	C					V	F	Test Refs
5.1.15.2	M2 Control Hardware Interface	C		c			V	F	Delta Tau PMAC used
5.1.16.1	Cassegrain Rotator Bearing								
	(1) Designed in conjunction with mirror cell	C		c				F	c.f. VIS-SPE-VER-04001-0402, Cassegrain Rotator Bearing Design and Fabrication Specification.
	(3) Rolling element bearings are sealed	C		c				F	Design Refs
5.1.16.2	Cassegrain Rotator Tracking Requirements	C		c			x	S	c.f. RD03 Verified as part of tracking tests.
5.1.16.3	Cassegrain Rotator Interface	C		c		x		F	Design Refs Inspection Report

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
5.1.16.4	Cassegrain Cable Wrap								
	(1) Dedicated drive system, synchronised	C					V	F	c.f. RD14, Verified during telescope sell-of testing, 14/17-11-05
	(2) Travel range = Rotator endstops + 5deg	C		c			P	F	c.f. RD14 S/4.2.5.2 Partially verified during RD10 - Travel Range > Rotator endstops
	(3) Interlocked to rotator drive	C		c			x	S	c.f. RD14, S/4.2.5.3
	(4) Sufficient capacity	C		c				F	c.f. Telescope Systems Requirements Document, VIS-SPE-VER-01001-0410 S/6.3.4
	(5) Delivered cables and services	C		c		x		S	Inspection Report
5.1.17.1	Re-use of ESO software								Standard ESO source code used, as described in VLT-SPE-ESO-17130-1210, 'LCU Axis Control Module – Design Description' S/4.1
	(1) Rotator controlled from LCU running ESO software	C		c			V	F	c.f. Response to 5.117.1 Verified during telescope sell-of testing, 14/17-11-05
	(2) Software (parameters) configured to VISTA requirements	C					V	F	Verified during telescope sell-of testing, 14/17-11-05
5.1.17.2	Cass TCS Interface	C					x	S	Standard ESO source code used. Verified Implicitly during Commissioning.
5.1.17.3	Cass Software/Hardware Interface	C					V	F	c.f. VIS-ICD-ATC-01000-0007, ICD between the Electro-Mechanical Hardware and the

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									Control System of the VISTA Telescope.
5.1.17.4	Cass Control Algorithms	C		V				F	Standard ESO source code used. Verified during telescope sell-of testing, 14/17-11-05
5.1.17.5	Slew When Tracking Open-Loop	C					x	S	Procedure owner allocated JMS
5.1.17.6	Cass Performance								
	Range +180 to -360 deg	C	x				x	S	Procedure AD02 R/5.1.17.6
	Max tracking velocity 480"/s	C	x				x	S	Procedure AD02 R/5.1.17.6
	Max tracking acceleration 10"/s/s	C	x				x	S	Procedure AD02 R/5.1.17.6
	Max slew velocity 3.6 deg/s	C	x				x	S	Procedure AD02 R/5.1.17.6
	Max slew acceleration 1.0 deg/s	C	x				x	S	Procedure AD02 R/5.1.17.6
5.1.17.10	Cass Brakes	C	x				x	S	RD10 S/5.9 (Performed during VRSI On-site Acceptance testing, optionally witnessed by ESO)
5.1.17.12	Safety Locking	C	x				x	S	Insert Cassegrain locking pin and verify that Interlocks are activated.
5.1.18.1	G-WFS, Telescope Feedback Requirements								
	(1) Has guide sensing	C		V					c.f. RD12
	(2) Has LOWFS	C		V					c.f. RD12
	(3) Has HOWFS	C		V					c.f. RD12
5.1.18.2.1	Guiding								
	(1) User-select frame rate up to 10Hz	C		c			x	S	Procedure owner allocated JMS
	(2) Centroiding accuracy enough for SIQ	C					x	S	c.f. SIQ tests
	(3) Guide Star acquisition probability >=99%	C					x	S	Procedure owner allocated WJS
5.1.18.2.2	LOWFS								

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(1) LOWFS concurrent with observations	C		c			x	S	c.f. SIQ Tests
	(2) 99% probability of finding useable star	C					x	S	Procedure owner allocated WJS
	(3) Sample rate <=1/min	C		c			x	S	Procedure owner allocated WJS
	(4) Integration time >=30s	C					x	F	Procedure owner allocated WJS
	(6) LOWFS outputs	C		c		V		F	Inspection Report
	(7) Accuracy commensurate with SIQ	C					x	S	c.f. SIQ Tests
	(8) LOWFS low image quality warning	C					x	F	Procedure owner allocated WJS
5.1.18.2.3	HOWFS								
	(1) Determines M1 force corrections	C		c				F	Design Refs
	(2) Provides first 15 M1 modes	C		c				F	Design Refs
	(3) Accuracy commensurate with SIQ	C					x	S	c.f. SIQ Tests
5.1.18.3	Sensor Location	C		c		V		F	Design Refs Inspection Report
5.3	IR Camera								
	(1) Complies with AD33, AD34, AD 39 and AD40.	C		c		c		F	Design Refs Inspection Report
5.3.1.1	Infrared Camera Optical Design Characteristics								
	(1) FOV 1.65 deg diagonal	C	x	c			x	S	Tested during S/4.8.3
	(3) Plate scale 58.2 µm/arcsec	C	x	c			x	S	Procedure owner allocated GBD
5.3.1.2	Infrared Camera Optical Interface	C		V				F	Design Refs
5.3.2	IR Filters								
	(1) Three science filters provided	C		c		x		F	Design Refs Inspection Report
	(2) Covering J,H and Ks	C		c			V	F	Filter manufacturer data
5.3.3.1	Filter Mechanism Assembly – Filter Sets	C		V				F	Design Refs
5.3.3.2	Access for manual Filter Replacement	C		x				F	Design Refs

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
5.3.3.3	Filter Deployment								
	(1) Move to adjacent filter in < 25s	C					x	S	Using optical source, time with stopwatch
	(2) Move to any filter in < 60s	C					x	S	as above.
	(3) Positioning < 100µm V. and 500 µm H.	C		c				S	Design Refs
5.3.6	Focal Plane Unit Assembly								
	(1) General functionality	C		V				F	Design Refs
	(2) 16 Detectors 4x4	C		V				F	Design Refs
	(3) Voltage protected	C		V				F	Design Refs
	(4) Linearity <3% pre-cal	C					x	S	RD29 S/4.4
	(5) Gain variation <2% pk to pk								owner allocated WJS
	(6) Crosstalk < 5e-5 for pixels >= 10px apart	C					x	F	RD29 S/4.7.2
5.3.6.1	IR Detector								
	(1) Wavelength 1.0 to 2.5 µm	C		c				F	Raytheon data
	(2) QE for best 90% of pixels in J,H and Ks = 38, 47 and 47% respectively	C					V	F	RD29 S/4.8
	(3) Format 2048 x 2048	C		V				F	Raytheon data
	(4) Pixel size 15.5 to 20.5 µm	C		V				F	Raytheon data
	(5) Read noise <32 electrons	C					x	F	RD29 S/4.3 or use VIRCAM_img_cal_noisegain
	(6) Max read time 1s	C					x	F	Procedure owner allocated GBD
	(7) No. of bad pixels < 4% in central 1952^2	C					x	F	RD29 S/4.10
	(8) Dark current < 8e/s	C					x	S	RD29 S/4.5 or use VIRCAM_img_cal_darkcurrent
	(9) Remnant decay time constant < 60s	C					x	F	RD29 S/4.7.1
	(10) Maximum dT/dt <= 8 deg/hr	C						F	Procedure owner allocated WJS
	(11) Image smearing < 10%	C						F	Procedure owner allocated WJS

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(12) On-chip glow < 8e/s	C					V	F	RD29 S/4.6
	(13) Flatness consistent with SIQ	C					x	F	c.f. SIQ Tests
	(14) Well depth >= 100k electrons	C					V		RD29 S/4.2
5.3.6.2	Detector Controller uses IRACE	C		V				F	Design Refs
5.4.3.1	Control – LCU Hardware	C		V				F	Design Refs
5.4.3.2	Unix Hardware	C		V				F	Design Refs
5.4.3.4	Location of Computing Equipment								
	(1) LCU's located in enclosure	C				x		S	Inspection Report
	(2) Workstations in Cerro Paranal bldg	C				x		S	Inspection Report
	(4) LCU located in basement	C				x		S	Inspection Report
5.4.3.5	Local Area Networking								
	(1) AD28-compliant connections used	C		c				S	c.f. VIS-SPE-ATC-13040-0001, VISTA Network Layout
	(2) Uses 10Mbps or Gigabit Ethernet	C		c				S	c.f. VIS-SPE-ATC-13040-0001, VISTA Network Layout
5.4.3.6	Software Infrastructure	C		c				S	c.f. VIS-PLA-ATC-00150-006, VISTA Software Management Plan
5.4.3.7	Telescope Control System								
	(2) TCS provides sub-set of AD25 functions	C		c				F	c.f. VIS-PLA-ATC-00150-006, VISTA Software Management Plan
	(3) VISTA TCS is modified form of AD25	C		c				F	c.f. VIS-PLA-ATC-00150-006, VISTA Software Management Plan
5.4.3.8	Observation Control								
	(1) High level control uses ESO software	C		c				F	c.f. VIS-DES-ATC-06084-0001, IR Camera Observation Software

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									Design Description
	(2) Obs control software runs on agreed hardware	C		c				F	c.f. VIS-DES-ATC-06084-0001, IR Camera Observation Software Design Description
5.4.3.9	Instrument Control								
	(1) Includes listed items	C		c				F	c.f. VIS-DES-ATC-06083-0001, Instrument Control Software Design Description
	(2) I/F's Comply with AD32, AD24, AD25	C		c				F	c.f. VIS-DES-ATC-06083-0001, Instrument Control Software Design Description
	(3) Obs. Software commands comply with AD26	C		c				F	c.f. VIS-DES-ATC-06083-0001, Instrument Control Software Design Description
	(4) Instrument H/W as listed	C		c				F	c.f. VIS-DES-ATC-06083-0001, Instrument Control Software Design Description
5.5.4.7	On Line Archive System	C		c				S	c.f. VIS-PLA-ATC-00150-006, VISTA Software Management Plan
5.5.4.8	Hardware and Data Rates								test on WS in Garching configured as per ESO.
	(1) Hardware includes items in Table 7	C		c			x	S	Procedure owner allocated JMS
	(2) Data rates comply with Table 7	C	x	c			x	S	Procedure owner allocated JMS
5.6.1	Purpose of the Enclosure								
	(1) Provides safe environment	C		V				S	Design Refs
	(2) Provides stable environment	C		V				S	Design Refs
	(3) Provides all infrastructure	C		V				S	Design Refs

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
5.6.4.1	Environmental Conditions	C		c				S	Design Refs
5.6.4.2	(nominal) Floor Loading								
	(1) Rail load <= 120kN/wheel	C		c				S	Design Refs
	(2) General loading <=10kN/m^2	C		c				S	Design Refs
	(3) Localised loading 100kN/m^2	C		c				S	Design Refs
5.6.4.3	Emergency Lighting	C	x	c			x	S	Procedure owner allocated BL
5.6.4.4	Protection Against Fire	C	x	c			x	S	Procedure owner allocated BL
5.6.4.5	Enclosure Video and Audio Monitoring	C		c			x	S	Procedure owner allocated JMS
5.6.5.1	Dome – General Requirements								
	(1) Has suitable observing slit	C		c				S	Design Refs
	(2) Slit has doors	C		c				S	Design Refs
	(3) Same rotation axis as telescope Az	C		c				S	Design Refs
	(4) Independent rotation	C		c				S	Design Refs
	(5) Has floor at AZ floor level	C		c				S	Design Refs
	(6) Slit has moveable windscreen	C		c				S	Design Refs
	(7) Has ventilation apertures	C		c				S	Design Refs
	(8) Has a roof gantry crane	C		c				S	Design Refs
	(9) All ladders and access platforms supplied	C		c				S	Design Refs
	(10) RF remote control shall not interfere with camera	C					x	S	
5.6.5.2	Dome Cladding								
	(1) Dome has cladding on roof, walls and exterior doors	C		c				S	Design Refs
	(2) Cladding is water- and air-tight	C		c			x	S	Tested – Report
	(3) Bonding of metal sheets in accordance with AD12	C		c			x	S	Tested – Report
5.6.5.3	Observing Slit Door								

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(1) Slit doors do not vignette	C		c				S	Design Refs
	(2) Open/close time < 60s	P					P	S	Approx 65s tested
	(3) Open/closed indicators provided	C		c			x	S	Design Refs
	(4) Doors operate at winds up to 36 m/s	C			c			S	Analysis Ref.
5.6.5.4	Dome Rotation System								
	(1) Performance exceeds telescope	P					P	S	Tested – Report
	(2) System withstands Dome loads	C		c				S	Design Refs
	(3) Allows unlimited rotation in each direction	C					x	S	Procedure owner allocated AJB
	(4) Stops within 5s in emergency	C	x				x	S	Procedure owner allocated AJB
	(5) Allows adjustment/assembly during build	C		c				S	Design Refs
	(6) Parts protected against corrosion	C		c				S	Design Refs
	(7) Preferential wheel wear	C		c				S	Design Refs
5.6.5.5	Seals	C		c		x		S	Design Refs Inspection Report
5.6.5.6	Windscreen	C					x	S	Procedure owner allocated AJB
5.6.5.7	Moon Screen								
	(1) Adjustable screen can track upper extent of slit	C					x	S	Procedure owner allocated AJB
	(2) Range of travel +/- 2.5m from dome centre	C					x	S	Procedure owner allocated AJB
5.6.5.8	Flat Field								
	(1) Illumination controllable from Paranal control room	C	x				x	S	Procedure owner allocated AJB
	(2) Illumination even to 10%	C					x	S	compare dome flats to sky flats
	(3) Illumination repeatable to <=0.5% and continuous spectrum	C					x	S	as above.
	(4) Minimum effective area 4.5m dia	C		c				S	Design Refs
	(5) Perpendicular to telescope tube axis	C		c				S	Design Refs

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(6) Installed in Enclosure	C		c				S	Design Refs
	(7) Minimum of 2 light clusters of 3 lights	C		c				S	Design Refs
5.6.5.9	Dome Crane								
	(1) Capable of radial access to Az floor	C		c				S	Design Refs
	(2) Can reach m1 handling locations	C					x	S	Procedure owner allocated AJB
	(3) Is interlocked to telescope	C	x				x	S	Procedure owner allocated AJB
	(4) Dome rotation has manual override	C		c			x	S	Design Refs
	(5) SWL >= 10 tonne	C		c			V	S	Proof Test
	(6) Min clearance is 1m from telescope	C					x	S	Procedure owner allocated AJB
	(7) Hoist (vertical) speed Variable between 100 and 2000 mm/min	C					x	S	Procedure owner allocated BS
	(8) Hoist horizontal speed Variable between 100 and 2000 mm/min	C					x	S	Procedure owner allocated BS
	(9) (Any) RF control robust to interference and comply with standards	C		c				S	Design Refs
	(10) Manual control has joysticks with separate high-speed select button	C		c				S	Design Refs
	(11) Has Crane 'out of park' switch	C	x				x	S	Procedure owner allocated BS
	(12) Crane can be inhibited by external hardware input signal	C	x				x	S	Procedure owner allocated BS
5.6.5.10	Maintenance Platform								
	(1) Has mobile access platform on AZ floor	C		c				S	Design Refs
	(2) Alternative access installed where platform cannot be used	C		c				S	Design Refs
5.6.6.1	Basement – General Requirements								
	(1) External wall concentric with telescope pier	C		c				S	Design Refs
	(2) Has service rooms	C				x		S	Inspection Report

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(3) Has mirror and instrument handling area below hatch	C				x		S	Inspection Report
	(4) Structure of pier and enclosure isolated	C		c		x		S	Design Refs Inspection Report
	(5) Base has access doors	C				x		S	Inspection Report
	(6) Allows access to Auxiliary Building coating plant room	C				x		S	Inspection Report
	(7) Allows installation of rotation rails	C		c				S	Design Refs
5.6.6.2	Access								
	(1) Mezzanine floor provided to allow access to Az bearing and motors	C	x			x		S	Inspection Report
	(2) Incorporates two stairs to mezzanine and AZ floors suitable for emergency exit	C	x			x		S	Inspection Report
5.6.6.6	Primary Mirror Washing Requirements								
	(1) Suitable area with drainage provided	C				x		S	Inspection Report
	(2) Mezzanine and Az floors allow transfer of m1 from telescope to basement	C					x	S	Procedure owner allocated AJB
	(3) Suitable Az floor covers supplied	C				x		S	Inspection Report
	(4) Rails between coating area and stripping area installed	C				x		S	Inspection Report
	(5) Safety cabinets for stripping and washing materiel provided	C	x			x		S	Inspection Report
5.6.6.7	Camera Storage and Support								
	(1) Facilities to store and operate a camera provided in the basement	C				x		S	Inspection Report
5.6.7.1	Enclosure Temperature Stabilisation								
	(1) Adequate insulation and seals used in	C		c				S	Design Refs

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	design								
	(2) Air conditioning capability provided	C				x		S	Inspection Report
	(3) Surface temperatures above Az floor are < 2 degC above To when dome is opened	C					x	S	Procedure owner allocated AJB
5.6.7.2	Auxiliary Building								
	(1) Heat is removed from Auxiliary building	C		c				S	Design Refs
	(2) Outlet point is located at prevailing downwind	C				x		S	Inspection Report
5.6.7.3	Cooling								
	(1) Liquid cooling system used	C		c				S	Design Refs
	(2) primary circuit used to cool all VISTA facilities	C		c				S	Design Refs
5.6.7.4	Ventilation Doors								
	(1) At least 3 ventilation openings provided	C				x		S	Inspection Report
	(2) Openings are equally sized and spaced	C		c				S	Design Refs
	(3) Total aperture area >= 100 m^2	C		c				S	Design Refs
	(4) Door mechanisms operate with wind speed <= 36 m/s	C		c				S	Design Refs
	(5) Use fixed louvre stray light control	C				x		S	Inspection Report
	(6) Each door motor-driven with position/status feedback.	C		c				S	Design Refs
5.6.8.1	Command Interface	C		c				S	Design Refs
5.6.8.2	Hardware Interface	C		c				S	Design Refs
5.6.8.3	Manual Control	C					x	S	Procedure owner allocated BS
5.6.9.1	(Telescope Pier) Definition								
	(2) Volume has access areas for equipment	C					x	S	Procedure owner allocated AJB
	(3) Top face incorporates Telescope anchoring	C		c				S	Design Refs

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	system								
5.6.9.2	Stiffness	C			c			S	Analysis Ref.
5.6.9.3	Vibration								
	(1) Pier is vibration decoupled from enclosure	C		c				S	Design Refs
	(2) Foundations are cast separately	C		c				S	Design Refs
	(3) No equipment connects pier and enclosure base to transmit vibration	C				x		S	Inspection Report
5.6.9.4	Access	C				x		S	Inspection Report
5.7.3.1	Washing Facility	C		c				S	Design Refs
5.7.3.2	Water Supply for Mirror Washing								
	(2) 500ltr storage tank for de-ionised water storage supplied	C				x		S	Inspection Report
	(4) Water purification facilities not provided	C		c				S	Design Refs
5.7.3.4	Lighting	C							Repeated in S/5.8.10
5.7.3.5	Hazardous Materials								
	(1) Hazardous materials used in accordance with AD62	C	x	c				S	(Procedure) Inspection Report
	(2) Suitable storage cabinets supplied	C	x			x		S	Inspection Report
	(3) Material data sheets kept on-site	C	x			x		S	Inspection Report
5.7.3.6	Emergency Shower	C	x			x		S	Inspection Report
5.7.4	Transformer Room *(Power Substation)*								
	(1) Suitably rated dry resin transformer supplied	C	x	c				S	Transformer data sheet
	(2) Installed in dedicated room in Aux. bldg.	C				x		S	Inspection Report
	(4) Normal peak load <= 250 kVA	C		c				S	Design Refs
	(5) When mirror coating, load <= 300 kVA	C		c				S	Design Refs
5.7.5	Electrical Power Distribution Room								

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(1) Low Voltage switchgear, etc provided	C				x		S	Inspection Report
	(2) Installed in dedicated room in Aux. bldg.	C				x		S	Inspection Report
	(3) Room is directly accessible from enclosure	C				x		S	Inspection Report
	(4) UPS power provided, rated at >= 20 kWh	C		c				S	Design Refs
5.7.6	Plant Room								
	(1) In Aux. Bldg., contains compressor, air dryer and air receiver	C				x		S	Inspection Report
	(2) Has room for additional eqpmt	C				x		S	Inspection Report
5.7.7	Office/rest area								
	(1) Office/document store room provided	C				x		S	Inspection Report
	(2) Equipped with network, communications, heating and ventilation facilities	C				x		S	Inspection Report
5.7.8	Sanitary Provision					x		S	Inspection Report
5.7.9	Heat Exchange								
	(1) Cooling circuit provided	C		c				S	Design Refs
	(2) Chiller is mounted remotely from enclosure	C				x		S	Inspection Report
5.8.1	Coating Plant - General Description	C				x		S	Inspection Report
5.8.3	Lower Vessel							S	
	(1) Has whiffle-tree and earthquake restraints	C		c				S	Design Refs
	(2) Whiffle-tree rotates at controlled rate	C		c				S	Design Refs
	(3) Vessel is mounted on rails	C		c				S	Design Refs
5.8.4	Upper Vessel	C		c				S	Design Refs
5.8.5	Magnetrons								
	(1) Has Al target for testing	C	x			x		S	Inspection Report
	(2) Has Ag reflective target	C	x			x		S	Inspection Report
	(3) Has NoCr adhesor layer target	C	x			x		S	Inspection Report

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(4) Has Ag protective layer target (silicon)	C	x			x		S	Inspection Report
	(5) Has Al reflective coating target	C	x			x		S	Inspection Report
5.8.6	Vacuum Pumping Equipment								
	(1) Vacuum is achieved by cryo-pumping	C		c				S	Design Refs
	(2) Two cryo pumps with 3-way gate valves and Rootes-style roughing pump-set installed	C		c				S	Design Refs
	(3) Fully automated pumping process	C		c			x	S	Procedure owner allocated BS
5.8.7	Power Requirements	C		c				S	Design Refs
5.8.8	Cooling								
	(1) Magnetrons are water cooled	C		c			x	S	
	(3) Closed-circuit cooling with stand-alone heat-exchanger used	C		c				S	Design Refs
5.8.9	Process Gas								
	(1) Provision for gas injection	C		c				S	Design Refs
	(2) Automatic flow rate control	C		c				S	Design Refs
5.8.10	Lighting (levels)								
	General level = 100 lux	C	x				x	S	Procedure owner allocated BS
	Mirror coating level = 500 lux	C	x				x	S	Procedure owner allocated BS
5.8.11	Coating Plant Control								
	(1) Fully automatic system used	C		c				S	Design Refs
	(2) Requires operator supervision	C		c				S	Design Refs
5.9.1	Service/Handling Equipment - General								
	(1) Dome crane is primary lifting facility	C	x	c				S	Design Refs
	(2) Safe service and handling equipment provided	C	x			x		S	Inspection Report
	(3) All special maintenance tools provided	C	x			x		S	Inspection Report
	(4) Sufficient basic tools provided	C	x			x		S	Inspection Report

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
5.9.2	Lifting Equipment		x						
	(1) 1 Tonne wall mounted jib crane fitted in camera service area	C	x			x		S	Inspection Report
	(2) 1 Tonne wall mounted jib crane fitted in mirror stripping area	C	x			x		S	Inspection Report
	(3) 1.6 Tonne overhead rail-crane installed in Aux. Bldg.	C	x			x		S	Inspection Report
5.9.3	Basic Handling Equipment								
	(1) 5 Tonne manual trolley provided	C				x		S	Inspection Report
	(2) Necessary slings, shackles provided	C				x		S	Inspection Report
5.9.4	Special Handling Equipment								
	(1) Top-end handling tool provided	C	x			x		S	Inspection Report
	(2) Primary mirror handling tool provided	C	x			x		S	Inspection Report
	(3) M2 handling equipment provided	C	x			x		S	during factory acceptance - repeat under site conditions
	(4) Camera removal and handling equipment provided	C	x			x		S	Inspection Report
5.10.2	Test Equipment – reflectometer provided	C				x		S	Inspection Report
	Monochromator or similar filter test device provided	C				x		S	
6.1.1	Control of Equipment	C					x	S	Procedure owner allocated WJS
6.1.2	Independent Operation of Cameras								
	(1) Independent operation	C		c			x	S	By implication from other tests
	(2) Operates stand-alone off telescope	C		V				F	Design Refs
6.1.3	Calibration Procedures								
	(1) Calibration records all changes	C					x	S	Implicitly from other tests
	(2) Calibration records all raw data	C					x	S	Implicitly from other tests

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(3) Capable of running automatically	C					x	S	Implicitly from other tests
6.1.4	Observing Modes								
	(1) Normal method is queue scheduling	C					x	S	Implicitly from other tests
	(2) Operator can override mode and continue manually	C					x	S	Implicitly from other tests
6.1.5	Observing and Engineering Logs								
	(1) All observations logged	C	x			x		S	Inspection Report
	(2) Significant listed events logged	C	x			x		S	Inspection Report
	(3) Logs (can be) transmitted the day after observations	C	x			x		S	Inspection Report
	(4) Logs shall properly take into account non-operating detectors	C	x			x		S	Inspection Report
6.1.6	Handling Faults								
	(1) System can operate normally with certain faults	C		x				S	Design Refs
	(2) Data headers indicate missing or poor data	C		x				S	Design Refs
	(3) All faults are logged with diagnostic data	C		x				S	Design Refs
6.1.7	Weather Monitoring								
	(1) Paranal weather data included in science headers	C				x		S	Inspection Report
	(2) Data will include seeing, temperature and wind speed	C				x		S	Inspection Report
6.1.8	Readout Noise Pickup						x	S	Telescope enclosure mechanisms only
7.1	Telescope Lifetime >= 15 yrs	C		c				F/S	Flowed down to Sub-systems
7.2.1	Overall Availability								
	(1) Designed and manufactured so non-scheduled downtime < 5% observing time	C		c				S	Design Refs

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(2) Non-scheduled down-time < 15% in first year	C		c				S	Design Refs
7.2.2	Specific Reliability requirements								
	(1) MTBF of major sub-systems > 3 yrs	P			x			S	M2 Unit is ~11,000 hrs Telescope
	(2) High reliability enforced in design and manufacturing	C		c				S	Design Refs
7.3.1	Maintainability Guidelines (software)								
	(1) Checks performance and reports failure	C		c				S	Design Refs
	(2) Runs automatically	C		c				S	Design Refs
	(3) Logs all procedures	C		c				S	Design Refs
	(4) Logs data	C		c				S	Design Refs
7.3.2	Maintenance Approach								
	(1) Design minimises maintenance work-load	C		c				S	Design Refs
	(2) (Some) maintenance is by replacement of LRU's	C		c				S	Design Refs
	(4) Spare LRU' are available	C	x			x		S	Qty TBD Inspection Report
	(5) VISTA complies with AD06 and AD12	C		c				S	Design Refs
	(6) The listed categories of maintenance have been considered.	C		c				S	Design Refs
7.3.2.1	Predictive Maintenance	C	x	c				S	Design Refs
7.3.2.2	Preventative Maintenance								
	(1) Is planned in the listed manner	C	x	c				S	Design Refs
	(2) Capable of being performed by two trained technicians	C		c				S	Design Refs
7.3.2.3	Overhaul	C		c				S	Design Refs
7.3.3	Monitoring and Test Routines								

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(1) Does monitoring similar to listed tasks	C		c				S	Design Refs
	(2) Self-tests similar to listed tasks	C		c				S	Design Refs
	(3) Has operator-initiated diagnostics	C		c				S	Design Refs
7.3.4	Spares	C				x		S	Inspection Report
7.3.5.1	In Situ Cleaning	C		c				S	Design Refs
7.3.5.2	Primary Mirror coating	C		c				S	Design Refs
7.3.5.3	Camera Installation/Removal								
	(1) Removal and re-installation time < 8hrs with up to 3 technicians	C	x				x	S	need to determine optimum mounting procedure.
	(2) All camera maintenance can be performed with the camera off-telescope	C	x	c				S	as above
	(3) After re-installation, the time to reach standard operating performance is < (2 hours of clear observing plus 4 hrs of daylight)	C					x	S	Image known star field immediately after installation – check for position shifts, distortion etc.
	(4) After cool-down, the IR camera shall meet astrometry stability requirements in < 48hrs.	C					x	S	as above
7.3.5.4	Camera Intervention								
	(1) Possible to cycle the IR camera from operating via room temp. to operating again in less than 10 days	C					x	S	Follows from timing of handling/stabilisation.
	(2) Possible to change all IR filters within 11 days	C					x	S	Procedure owner allocated GBD
7.4	Safety	C			x			F/S	Analysis Ref.
7.4.2	General Safety Requirements	C		c				F/S	Design Refs
7.4.3	Mechanical Safety								
	(1) Safety margin of >= 1.5 with respect to sigma 0.2% for Unacceptable or Undesirable	C			x			F	Analysis Ref.

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	risks has been used in design of relevant components								
	(2) Transport, lifting, hoisting and similar equipment has been approved by suitable verification agency	C	x			x		F	Manufacturer's data sheets Inspection Report
7.4.4.2	Safety Compliance – VISTA designed and erected complying with AD54, AD55 and AD56	C		c				F/S	Design Refs
7.4.4.3	Electrical and Electronic Equipment								
	(1) Complies with AD55	P		c			V	F	Tested to IEC 60950-1:2001 (1st Edition) c.f. RD25, RD26, RD27
	(2) IT equipment complies with AD57	C		c				F	Standard ESO parts Used.
7.4.4.4	Bond Corrosion requirements as specified	C		c				S	Design Refs
7.4.5	Primary Mirror Safety – principle tensile strength								
	(1) <= 6MPa for < 24hrs	C			c			F	Analysis Ref.
	(2) <= 3.5 MPa for > 24 hrs	C			c			F	Analysis Ref.
7.4.6	Hydraulic Safety	C	x	c				S	Design Refs
7.4.7	Pneumatic Safety	C	x	c				S	Design Refs
7.4.8	Cooling System Safety	C	x	c				S	Design Refs
7.4.9	Software Safety	C		c					Software has no effect on safety
7.4.10	Handling, Transport and Storage Safety	C		c				S	Design Refs
7.4.11	Operational Safety	C		c				S	(Software has no effect on safety)
7.4.12	Safety Interlock System	C	x	c			x	S	Procedure owner allocated AJB
8.1.1	Finite Element Structural Analyses								
	(1) FEA uses recognised standard code	P		c				F	Telescope : Ansys – c.f. RD02

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									M1/M2 : COSMOS/M, Nastran c.f. VIS-TRE-ATC-02020-0005, RD13 M2 : Basic beam model in Matlab c.f. VIS-ANA-CSE-05041-0010 S/3.1.1
	(2) Analysis error due to mesh density is <10%	C			c			F	Negligible non-compliance (10 points from 101,196) in RD02 in low-stress areas.
	(3) A sufficient number of points have been used for optical surfaces	C			c			F	c.f. RD13
8.1.1.1	Modal Analysis								
	(1) Modal analysis performed to estimate eigenfrequencies	C			c			F	Analysis Ref.
	(2) Suitable number of DOF and boundary conditions used	C			c			F	Analysis Ref.
8.1.1.2	Gravity Load Analysis	C			c			F	Analysis Ref.
8.1.1.3	Wind Stress Analysis								
	(1) Wind effects estimated by FE analysis	C			c			F	Analysis Ref.
	(2) Wind load appplication method to follow AD52	C			c			F	Analysis Ref.
8.1.1.4	Seismic Analysis								
	(1) AD04 used for critical damping figures	C			c			F	Analysis Ref.
	(2) Occasional use figures as in AD04 where appropriate	C			c			F	Analysis Ref.
	(3) Model detailed enough to predict up to 35 Hz, and include foundations	C			c			F	Analysis Ref.
	(4) Combining of modes done as specified	C			c			F	Analysis Ref.

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	(5) Earthquake analysis of camera performed in described manner	C			c			F	Analysis Ref.
8.1.1.5	Load Combination Operational Conditions								
	(1) Operational loads combined as specified	C			c			F	Analysis Ref.
	(2) Relevant load cases identified for sub-systems	C			c			F	Analysis Ref.
8.1.1.6	Load Combination Survival Conditions	C			c			F	Analysis Ref.
8.1.2	Requirement for Safety Analysis	C			c			F	Analysis Ref.
8.1.3	Control Loop Design and Analysis								
	(1) Dynamic simulation performed for all control loops	C			c			F	Analysis Ref.
	(1) Simulation includes major non-linear effects. Stability margins computed.	C			c			F	Analysis Ref.
8.1.4	EMC analyses compatible with AD08, AD09 and AD10 as appropriate				c			F	Analysis Ref.
8.2	Material Parts and Processes							F	
	(1) Part selection in accordance with AD12 where applicable	C		c				F	Design Refs
	(2) Minimises use of non-standard components	C		c				F	Design Refs
	(3) Major welded parts are stress-relieved	C		c				F	Design Refs
8.3.1	Paints								
	(1) Tube is covered with low emissivity diffuse Al paint or foils	C				x		S	Inspection Report
	(2) Surfaces around optical beam are painted with defined paint	C				x		S	Inspection Report
	(3) Telescope spiders are painted as specified					x		S	Inspection Report
8.3.2	Surface treatments	C		c		x		S	Inspection Report

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
8.4	Electromagnetic compatibility								NOTE: All M2 Unit EMC Verification is by electronic and mechanical design. The only external electrical connections are power connections to CE-marked and ESO-standard Kniel power supplies.
8.4.1.1	Intra-system Electromagnetic Compatibility	C		c			V	F	Telescope by design, c.f. RD14, and implicitly verified as pert of Telescope sell-off testing, 14/17-11-05 M2 Unit – see S/8.4 Camera – single package, verified implicitly during factory acceptance testing. Enclosure – c.f. RD30
8.4.1.2	Inter-system Electromagnetic Compatibility	C		c			P	S	c.f. RD14, RD21, RD22, RD28 for Telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30 Full system will be implicitly verified as part of Integration activities.
8.4.2	Electromagnetic Environment	P		c				F	Flowed down to all Sub-systems, c.f. RD01 S/14.4.2
8.4.3	Emissions	P		c			V	F	c.f. RD21, RD22, RD28 (Table

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									4.2.1) for telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30
8.4.3.1	Radiated Emissions	P		c				S	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30
8.4.3.2	Conducted Emissions (harmonic currents)	P		c				F	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30
8.4.3.3	Conducted Emissions (voltages)	P		c				F	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30
8.4.3.4	Conducted Emissions (disturbance currents)	P		c				F	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30
8.4.3.5	(Conducted) Immunity	P		c				F	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – see S/8.4 Camera

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
									Enclosure – c.f. RD30
8.4.3.7	AC Power Ports	P		c				F	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30
8.4.3.8	Control and Signal Ports	P		c				F	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – n/a, optical fibre used Camera Enclosure – c.f. RD30
8.4.3.9	Enclosure Port	P		c				F	c.f. RD21, RD22, RD28 (Table 4.2.1) for telescope. M2 Unit – see S/8.4 Camera Enclosure – c.f. RD30
8.4.3.10	DC Power Ports	N/A							No DC power ports.
8.5	Nameplates and product marking								
	(1) LRU's have nameplates	C				x		F	Inspection report
	(2) Nameplate includes listed items	C				x		F	Inspection report
8.6	Workmanship								
	(2) Development and manufacturing use as minimum, best practice	C		c				F	
	(3) Quality assurance to a recognised standard	C		c				F	Design Refs
9	Technical Documentation								
	(1) Language is English	C				x		F	
	(2) SI units used with listed exceptions	C				x		F	
	(3) Drawings delivered in paper and electronic	C				x		F	

AD01 Section	Heading	Compliance	Technical Acceptance.	Design	Analysis	Inspect	Test	Location	Reference/notes ("S/n.n" = Section n.n "R/n.n = Reference n.n)
	format								
	(4) FE models and similar analyses also to be delivered in electronic form	C				x		F	
	(5) Electronic circuit layouts also to be delivered in electronic form	C				x		F	

__oOo__