CNR – ISTITUTO DI FISICA COSMICA G. OCCHIALINI

VIRMOS

MASK MANUFACTURING UNIT

Preliminary Acceptance Europe

Test Results

Authors :	L. Chiappetti, G. Conti, D. Maccagni, E. Mattaini	Approved by :	O. Le Fèvre

EVOLUTION PAGE

Issue	Rev.	Paragr.	Date	Observations
1	0		11/02/00	Draft
1	1		22/03/00	Avila's scheme adopted
1	2	1, Verification Table	27/04/00	Updating after PAE

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ACRONYMS

FDR : Final Design Report

IC : Instrument Cabinet

ICD : Interface Control Document

IFCTR : Istituto di Fisica Cosmica G. Occhialini

LAS : Laboratoire d'Astronomie Spatiale

MDJ : Mask Discard Job

MDR : Mask Discard Report

MHCU : Mask Handling Control Unit

MIJ : Mask Insertion Job

MIR : Mask Insertion Report

MMJ : Mask Manufacturing Job

MMR : Mask Manufacturing Report

MMU : Mask Manufacturing Machine

MSF : Machine Slit File

NIRMOS : Near InfraRed MultiObject Spectrograph

PAE : Preliminary Acceptance Europe

SC : Storage Cabinet

VIMOS : Visible MultiObject Spectrograph

VIRMOS : Visual InfraRed MultiObject Spectrographs

INTRODUCTION

This document outlines the tests performed at the PAE of the VIRMOS MMU, which took place on April 4, 2000 at IFCTR premises in Milano, and reports the results. The purpose of the tests is to show the compliance of the MMU with the specifications set forth in the Virmos Technical Specifications (VLT-SPE-ESO-14600-1335) and the VIMOS FDR Part E Chapter 5 (VLT-TRE-VIRG-14634-0001). As for Operation Procedures, these have been updated in the VIRMOS MMU Global Description (VLT-LIS-VIRG-14634-0001).

1. EDGE QUALITY

Specification : <5 μm peak to peak, regardless of the slit width
The interpretation of this specification in terms of measurable roughness parameters is given in VLT-TRE-VIRG-14634-0005.

Test : Cut 9 squares with sides 30 mm long and measure the edge roughness along 24 mm stretches of 9 sides for a total length of 216 mm. Check the following output parameters of the roughness meter :

- Profile shape on slit length scale (2.5 mm gaussian filter) : Wt
- Profile roughness on pixel size scale (0.12 mm gaussian filter) : Wq, Wz, Wt, WPC
- Profile microroughness (0.12 mm gaussian filter) : Rq, Rz, Rt, RPC

2. SLIT WIDTH

Specification : 300 to 1000 μm

Test : Cut a sample with slits of widths in the range 200 to 2000 μm. Verify slit width through a microscope.

3. SHAPE

Specification : It shall be feasible to cut slits of arbitrary shapes, with the above mentioned edge qualities and slit widths (degradation of 30% is acceptable).

Test : Inspection of masks containing curved slits. Comparison of the edge quality in these curved slits with the quality of the edges in the roughness samples, to be carried out by means of visual inspection under a microscope (enlargements up to 400x). Alternatively, measurement of the edge roughness by means of the roughness meter along sections (length depending on curvature) of a purposedly cut curved slit sample.

4. ABSOLUTE POSITIONAL ACCURACY OF THE SLITS WRT THE MASK SUPPORT BASE FRAME

Specification : <30 μm , including temperature variations between fabrication and operation in VIMOS or NIRMOS. The use of Invar, and the cutting of the mask interface with the focal plane at the same time as the slits has modified this into a positioning accuracy of <±10 μm.

Test : Cutting of 3 masks with equally spaced holes in the instrument field of view and measurement of the difference between measured and nominal position of the holes (done al LAS, see VLT-TRE-VIRA-1463A-2017).

5. SPEED

Specification : the cutting speed shall be >7 m/hr

Test : Verify the cutting speed of each of the tools used in mask manufacturing through inspection of the laser machine settings. Measure the time needed to manufacture typical masks.

6. SLITS OF VARIABLE WIDTH IN THE SAME MASK

Specification : It shall be possible to cut slits of variable widths without changing the cutting tool. In such a case, the above requirement on speed can be relaxed by a factor 2.

NOT APPLICABLE

7. MASK MANUFACTURING AND STORAGE

Specification : the MMU shall cut individual masks in a fully automatic and remotely controlled process. The masks shall have identifiers that can be automatically read when the masks are installed on the instrument.

Test : execution of a MMJ order with 1 mask set (4 masks).

Input : MMJ order according to ICD VLT-ICD-ESO-17240-19200 in the VIMOS staging area of the MHCU. MSFs shall also contain curved slits.

Output : (1) 4 masks stored in SC. (2) MMR in VIMOS staging area. (3) SC table updated.

8. INSTRUMENT CABINET LOADING

Specification : The MMU shall automatically move the masks, clean them, and position them in the cabinets, which are then left ready to be installed on the instruments.

Test : execution of a MIJ order for 2 mask sets.

Input : MIJ order according to ICD VLT- ICD-ESO-17240-19200 in the VIMOS staging area of the MHCU. ICs containing 2 sets of masks (2 masks in each IC).

Output : (1) ICs loaded with required masks. (2) MIR in VIMOS staging area. (3) SC table updated. (4) IC table updated.

9. MASK DISPOSAL
Specification : None

Test : execution of a MDJ order for 1 mask set.

Input : MDJ order according to ICD VLT- ICD-ESO-17240-19200 in the VIMOS staging area of the MHCU. SC containing several sets of masks.

Output : (1) 4 masks in the wastebasket. (2) MDR in VIMOS staging area. (3) SC table updated.

10. ERROR HANDLING AND RECOVERY PROCEDURES
Specification : None

Test : Presentation of the procedures that must be used to recover from communications, malfunctioning and human errors.

VERIFICATION OF MMU

NR.	SPECIFICATION	REQUIRED VALUE	MEASURED VALUE	COMPLIANCE	REF./REMARKS
1	Edge quality	<5 µm peak to peak	<Wt>=3.03 (0.12 mm filter)	Yes	See VLT-TRE-VIRG-14634-0005 Issue 1 Rev. 1
2	Slit widths	300 to 1000 µm	200 to 2000 µm	Yes	
3	Slit shape	Arbitrary		Yes	
4	Absolute positional accuracy of the slits wrt the mask support base frame	<30 µm, including temperature variations	X (spatial) axis : 4.4 µm r.m.s. Y (dispersion) axis : 2.4 µm r.m.s.	Yes	See VLT-TRE-VIRA-1463A-2017
5	Cutting speed	>7 m/hr	≥21.6 m/hr	Yes	See VLT-TRE-VIRG-14634-0005 Issue 1 Rev. 1
6	Variable slit width within mask	Yes		Yes	
7	Mask cutting and identification	Automatic and remotely controlled	Automatic and remotely controlled	Yes	
8	Mask positioning in cabinets	Automatic	Automatic positioning, manual insertion	Yes	The solution implemented is compliant with VLT-TRE-ESO-14610-1630 (VIMOS FDR Board Report), point 10 ; cleaning of the masks is no longer necessary

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