



Specifications for the procurement of the Vacuum Vessel

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Prepared By	Name	J Strachan	Signature	
	Organisation	UK ATC, STFC	Date	14 th August 2017
Reviewed By	Name	P Rees	Signature	
	Organisation	UK ATC, STFC	Date	14 th August 2017
	Name		Signature	
	Organisation		Date	
Approved By	Name	A Fairley	Signature	
	Organisation	UK ATC, STFC	Date	14 th August 2017
Issued By	Name	A Fairley	Signature	
	Organisation	UK ATC, STFC	Date	14 th August 2017



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LIST OF FIGURES

NO TABLE OF FIGURES ENTRIES FOUND.

LIST OF ACRONYMS AND ABBREVIATIONS

CAD	Computer Aided Design
ESO	European Southern Observatory
MOONS	Multi Object Optical and Near-infrared Spectrograph
QA	Quality Assurance
TBC	To Be Confirmed
TBD	To Be Decided
VLT	Very Large Telescope

1 INTRODUCTION

1.1 Purpose and Scope of Document

MOONS (acronym for Multi-Objects Optical and Near-infrared Spectrograph) is a new concept for an astronomical Spectrograph for the European Southern Observatory's Very Large Telescope (VLT). It has been selected by the European Southern Observatory (ESO) in response to a call for proposals for the study of new instruments. The project is officially approved by ESO; the preliminary and final design phases of the spectrometer have been successfully completed. This document describes and specifies the customer's requirement for a Vacuum Vessel for this project.

1.2 Intended Audience

This specification document defines the parameters and the acceptance tests necessary for the procurement of the Vacuum Vessel. It is the reference document for the commercial contract that will be signed with the manufacturing company. The main audience consists of the manufacturing company and the persons of the MOONS consortium in charge of the specific task.

1.3 Terminology

The following interpretation shall be associated with the phrasing of requirements in this document:

May: Suggested or optional requirement
Shall or Must: **Mandatory requirement**

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable Documents

The following documents at their indicated revision form part of this document to the extent specified herein.

Table 1 Applicable Documents

Ref No	Document/Drawing Number	Document Title	Issue Number
AD1	VLT-DWG-MON-14620-00-311-010	Vacuum Vessel Assembly	B

2.2 Reference Documents

The following documents provide useful reference information associated with this document. These documents are to be used for information only. Changes to the date and/or revision number do not make this document out of date.

Table 2 Reference Documents

Ref No	Document/Drawing Number	Document Title	Issue Number and date

3 MANUFACTURE AND SUPPLY

This section summarizes all the requirements for the Vacuum Vessel. The MOONS project foresees the construction of two identical spectrographs fed by optical fibres. The spectrographs will be mounted either side of an optical bench inside a Vacuum Vessel. The optical bench will be cooled to cryogenic temperatures (about 120K).

The completed vacuum chamber is large, approximately 2.5m x 2.5m x 4m. It must be constructed in aluminium and will have an estimated mass of 2635 kg.

The completed vacuum vessel shall meet the following performance and functional requirements:-

- Base Pressure $<10^{-6}$ mbar.
- Maximum leak rate $10E^{-9}$ torr litres per second.

3.1 Technical Specification

The Vacuum Vessel shall be manufactured to drawing VLT-DWG-MON-14620-00-311-010 and all lower level drawings - refer to AD1, 'Vacuum Vessel Assembly'.

3.1.1 List of Drawings

The table below shows the drawings included in this requirement:-

Drawing Number	Drawing Name	Issue	Quantity	Remarks
VLT-DWG-MON-14620-00-311-010	Vacuum Vessel Assembly	B	1	Top level drawing
VLT-DWG-MON-14620-00-311-011	Vessel Centre Section	B	1	
VLT-DWG-MON-14620-00-311-012	Vessel Door Side 1	A	1	
VLT-DWG-MON-14620-00-311-013	Vessel Door Side 2	A	1	
VLT-DWG-MON-14620-00-311-014	Vessel Support Structure	A	2	
VLT-DWG-MON-14620-00-311-018	Vessel Guide Pin	A	8	
VLT-DWG-MON-14620-00-311-022	Special Washer	A	96	

The following sub-sections describe the main steps of design, fabrication and the procedures for acceptance.

3.2 Materials

Where a specific grade of material is specified on the drawing it is not acceptable to exchange this for any other material grade without agreement from the UK ATC. Where no grade is specified in the drawing the grade used should be stated in the tender response.

3.3 Design

3.3.1 The design of vacuum vessels is a specialist skill and requires attention to detail with respect to weld design, helium leak checking and trapped volumes. It is expected that the supplier will expand on the provided drawings using a 2D or 3D Computer Aided Design (CAD) package to produce fabrication drawings that include weld, weld preparation details, and other details dependent upon the bidders preferred method of construction. The supplier shall be expected to demonstrate relevant experience in producing fabrication drawings for vacuum vessels using a 2D or 3D Computer Aided Design (CAD) package.

3.3.2. The supplier shall provide a description of their CAD facilities and give relevant examples of vacuum vessels they have provided fabrication drawings for.

3.3.3. The expected mass of the completed vacuum vessel is 2635 KG.

3.4 Fabrication

The fabrication of aluminium vacuum vessels is a specialist skill. STFC will require evidence of the supplier's understanding of and previous experience in welding aluminium vacuum vessels and in the construction of vacuum vessels of a similar scale to that required in VLT-DWG-MON-14620-00-311-010.

Fabrication of the vessel shall not begin until the final fabrication drawings have been approved by STFC.

The vessel shall be cleaned after fabrication, prior to evacuation.

3.4.1. The supplier shall provide a description of their proposed manufacturing techniques they will employ to fabricate the vacuum vessel.

3.4.2. The supplier shall provide a description of their welding processes and capabilities they will employ in the manufacture of the vacuum vessel.

3.4.3. The supplier shall provide a description of how they propose to clean the vacuum vessels.

3.5 Inspection

Basic dimensions shown on sheets 14 and 17 of drawing VLT-DWG-MON-14620-00-311-011 shall be inspected by STFC after the required welding has been conducted but before vacuum testing in order that STFC can be satisfied that the dimensions comply with the drawings.

3.6 Vacuum and Load Testing

The supplier will be responsible for undertaking the testing specified below:-

3.6.1 The integrity of the chamber shall be checked using helium leak detection equipment whilst the chamber is under vacuum. Load testing shall be performed by the supplier on certain pads as identified in the drawings.

3.6.2 The base pressure requirement for the vessel during testing is high vacuum (less than 10^{-6} mbar). The vacuum leak rate of the full assembly must be better than $10E^{-9}$ mbar.l/s using a mass spectrometer with Helium gas detection.

3.6.3. The supplier shall provide a description of their vacuum leak checking methods and capabilities.

3.6.4. The supplier shall provide a description of how they will perform the load testing. (The use of eye pad pullers or similar is assumed).

3.6.5. Appendix A shows the minimum product verification that STFC expect the successful bidder to report on. However, STFC anticipates that the supplier will wish to undertake significant additional QA activities. These shall be detailed in the Verification Plan (refer to Section 4).

3.6.6 The supplier shall be responsible for supplying any equipment required for testing.

4 QUALITY ASSURANCE, CONTROL & TESTING

4.1. The supplier shall provide details of their proposed Quality Assurance programme and specific processes including the tests and inspections they intend to carry out to ensure that the finished product meets this specification. Activities will include retention of material certificates, proposed inspection of the Vacuum Vessel, and all documentation produced.

4.2. A Draft Verification Plan shall be provided by the supplier, together with details of the proposed processes and procedures they intend to follow, and all testing and confirmatory quality checks that they shall perform on the product to assure conformity to this specification.

This shall, as a minimum, cover the following areas:-

- Manufacturing processes (QC on machining, finishes, cleanliness etc.) and record keeping
- Testing must occur in a clean, dry and dust free environment with due regard for cleanliness.
- Assembly and testing of finished product including verification QA and functional testing.
- Pre-delivery inspection process and sign-off by an appropriately qualified person (e.g. the contractors Quality Manager).

5 PROJECT TIMESCALES

5.1. MOONS is a large international project and hence the delivery date of the vessel affects other consortium members. As such it is important that the delivery date is well understood and if delays or problems are encountered any change to the delivery date must be relayed to the UK ATC in a prompt manner. Delivery of the completed vessel to UK ATC Edinburgh is required 10 months from receipt of order.

5.2. A logically linked Delivery Plan shall be included in the tender response. All tasks and activities relevant to the design, manufacture and testing of the vacuum vessel must be the subject of project planning. The plan will show what needs to be done, the timescales for each task, any interdependencies, and the major and mini milestones to be used for progress monitoring. The critical path shall be highlighted in the plan.

5.3 The supplier shall commit to updating the plan every 2 months to ensure progress is in line with expectations.

6 BID PRICE

Bidder price to include separate itemised prices for the following:-

- 6.1. Design, Manufacture and vacuum test of the complete assembly.
- 6.2. Manufacture and supply of any hardware, including blanking plates and o-rings, necessary to perform vacuum testing.
- 6.3. Packaging for shipment.
- 6.4. Shipping and delivery to the customer at the UK ATC, Blackford Hill, Edinburgh, Midlothian, Scotland EH9 3HJ.
- 6.5. Painting as specified on drawing (as a separate option).
- 6.6. Load testing as specified on drawing.

7 DELIVERABLES

- 7.1. Final Project Delivery Plan agreed with the UK ATC (to include design approval, manufacture testing, acceptance and delivery) following kick-off meeting.
- 7.2. Final Fabrication drawings for design approval by the UK ATC.
- 7.3. Final Verification Plan agreed by the UK ATC.
- 7.4. Delivery of completed Vacuum Vessel (fully assembled) to the UK ATC.

8 APPENDIX A – INSPECTION AND TEST

Quality Control Requirements: A – Approval, I – Inspection, S-Submission, V – Verification, H-Hold Point, W - Witness.

No	Activity	Ref Document	Acceptance Criteria	Freq.	Responsible for Approval	QC Req.	Resulting Documents	Remarks
1	Material	Design drawings and Manufacturing Specification	Mechanical properties achieved.		STFC	S, V	(ref 3.2) Certificate or independent material test certification	
2	Machining, Finishing and Cleaning	Design drawings and Manufacturing Specification	Visual inspection, measurement of some critical dimensions.		STFC	I	Sign off sheet, photographs	
3	Assembly	Design drawings and Manufacturing Specification	Measurement of critical assembly dimensions, trial fit	Once	STFC	I	Sign off sheet, photographs	
4	Load Test	Design drawings	Successful load test	Once	STFC	I, W	Sign off sheet, photographs	
5	Vacuum Integrity and Cleanliness	Design drawings and Manufacturing Specification	Leak rate and base pressure achieved.	Once	STFC	W, H	Sign off sheet, photographs	