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.Herschel/SPIRE

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SPIRE STRUCTURE– MAIV FLOW CHART

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Change Record

ISSUE	DATE	
0.1	September 2001	New document
1.0	November 2001	Issued
1.1	December 2001	Update the integration plan
1.2	February 2002	Update the integration plan
1.3	July 2002	Added detailed assembly sequences
2.0	December 2002	Added Mips and Kips
3.0	January 2003	Update to reflect the current changes on the design and make reference to the Structure Integration and Handling Procedure.

Table of Contents

1. Scope of Document

This document presents the Manufacturing, Assembly, Integration and Test (MAIV) flowchart for the Spire Structure CQM, PFM and FS units. The manufacture of the STM model should also be derived from this flow chart, although some tasks will not be performed (reduced functionality). These tasks will be described in detail in the Integration and Handling Procedure.

According to AD1 the following models have to be manufactured:

STM - Structural Thermal Model
CQM - Cryogenic Qualification Model
PFM - Proto Flight Model
FS - Flight Spare

AD30 gives the overall view of the use of the different models and lists the various tests and test requirement references for each model. It stipulates that the STM model and the STM testing encompasses the qualification of the structure. The various subsystems mounted within and on the structure will have their own separate qualification tests. The STM test focuses primarily on the structure, thermal hardware and the qualification test serves as a reference for the subsystem qualification tests.

The CQM model and test serves as a reference for the qualification of the various subsystems. The structure CQM model is the same as the STM structure model. The CQM model will be used in conjunction with the other two instruments (HIFI and PACS) at ESTEC for further verification.

2. Documents

All documents are listed in the Figure 3.2 of the CIDL. Documents of reference are

1. AD55 Structure Assembly, Integration and Handling
2. AD40 300mK Supports MAIV flowchart HSO-CDF-FC-039

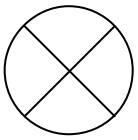
2.1 Glossary

All terms are listed in the CIDL.

3. MAIV Flow Chart

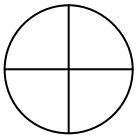
3.1 Explanation of Symbols

Test



Test Readiness Review
Post Test Review

Process/Action



Transport

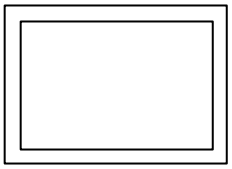
Document/
Report

MIP/KIP

Single Item

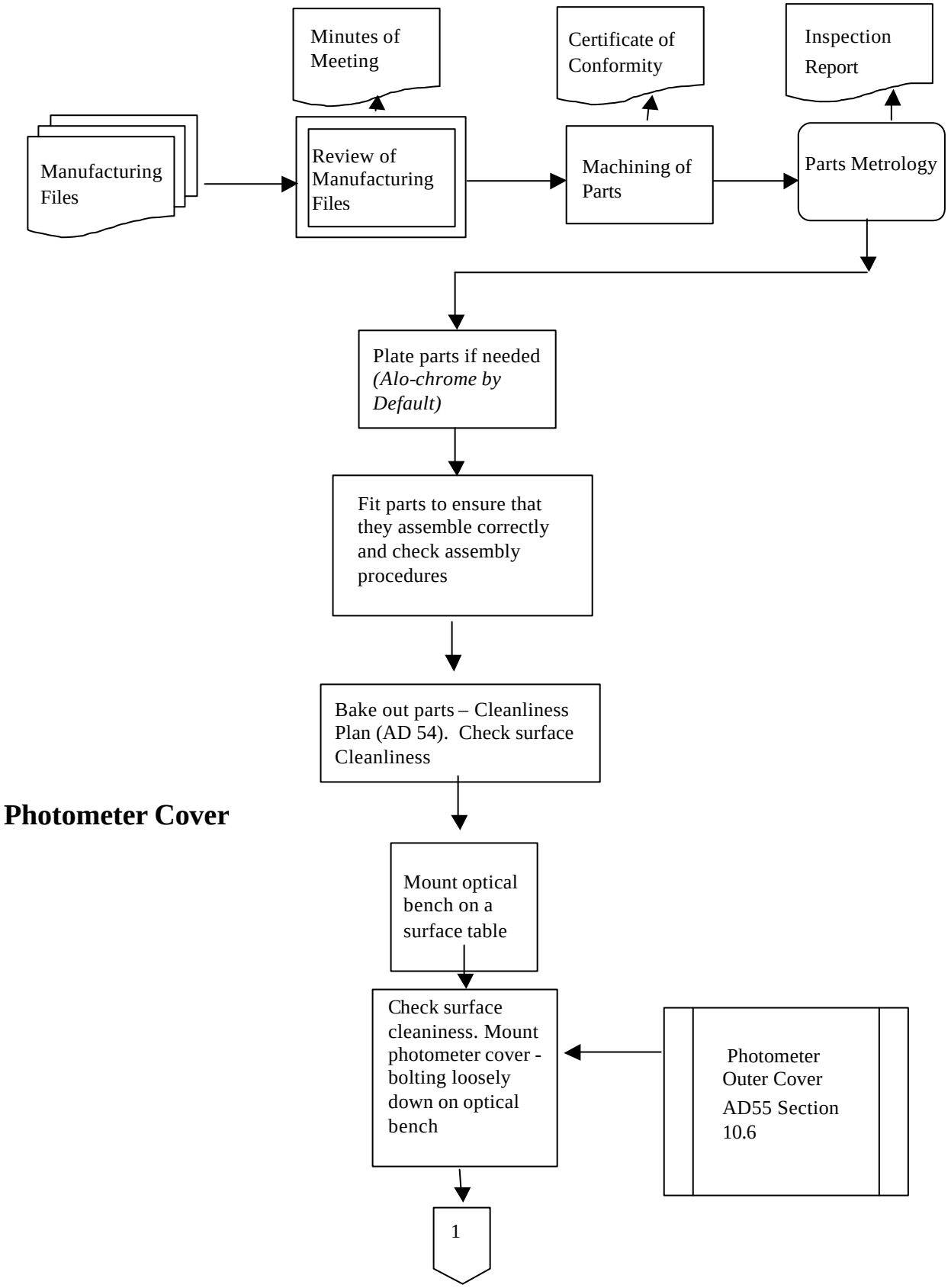
Next Step

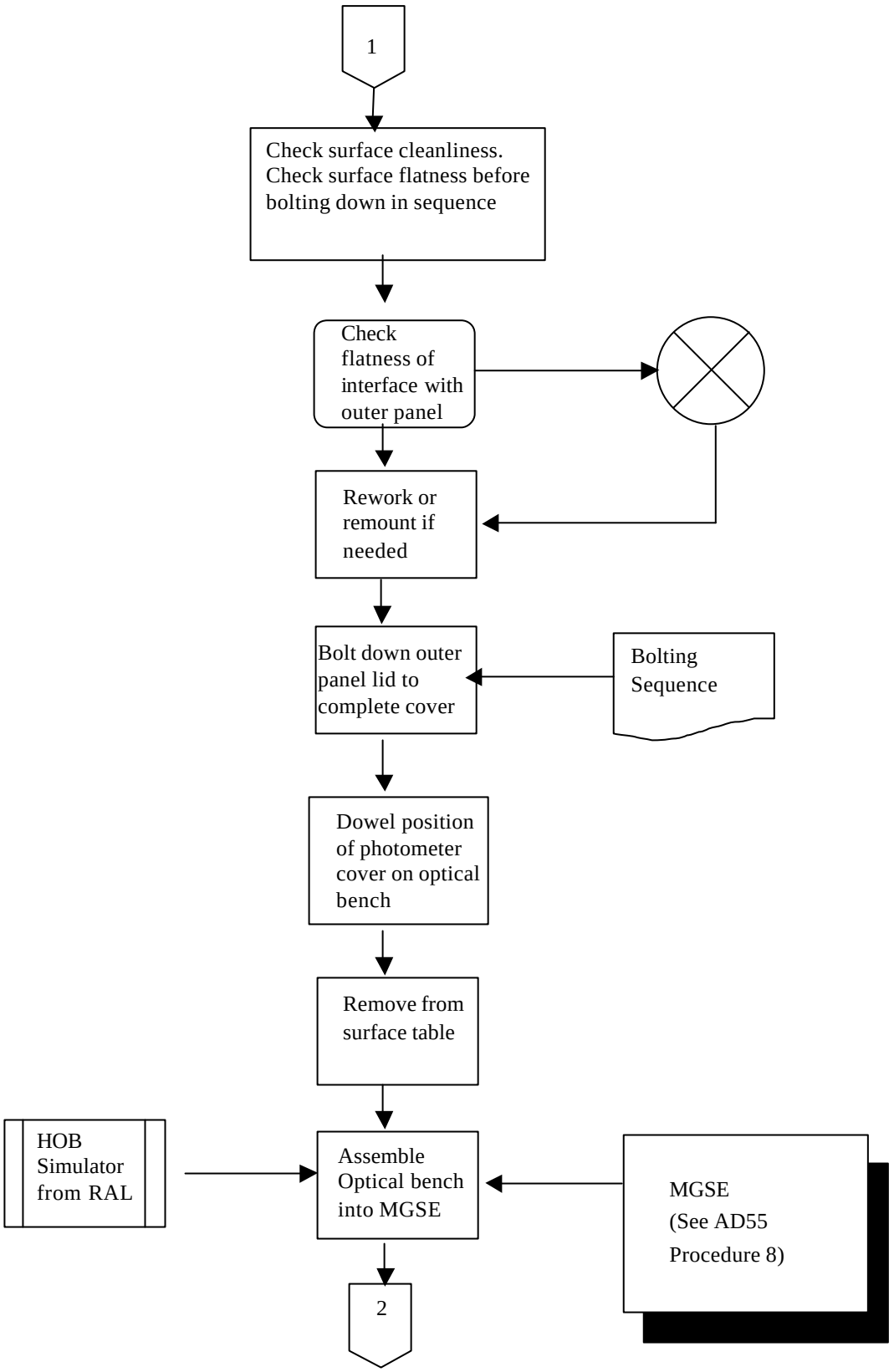
External
Equipment/GSE



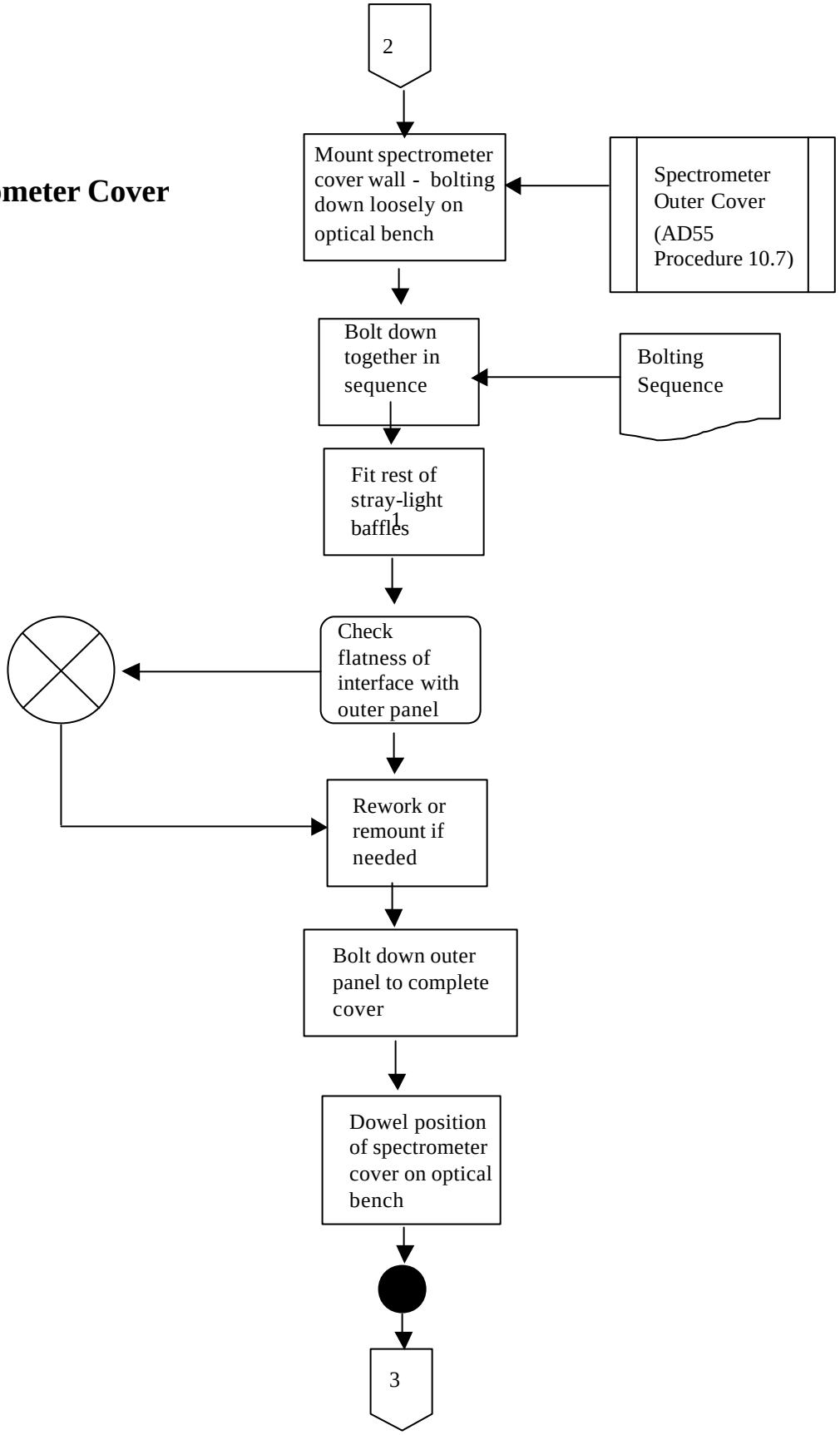
Major
Review

3.2 Structure MAIV Flow Chart

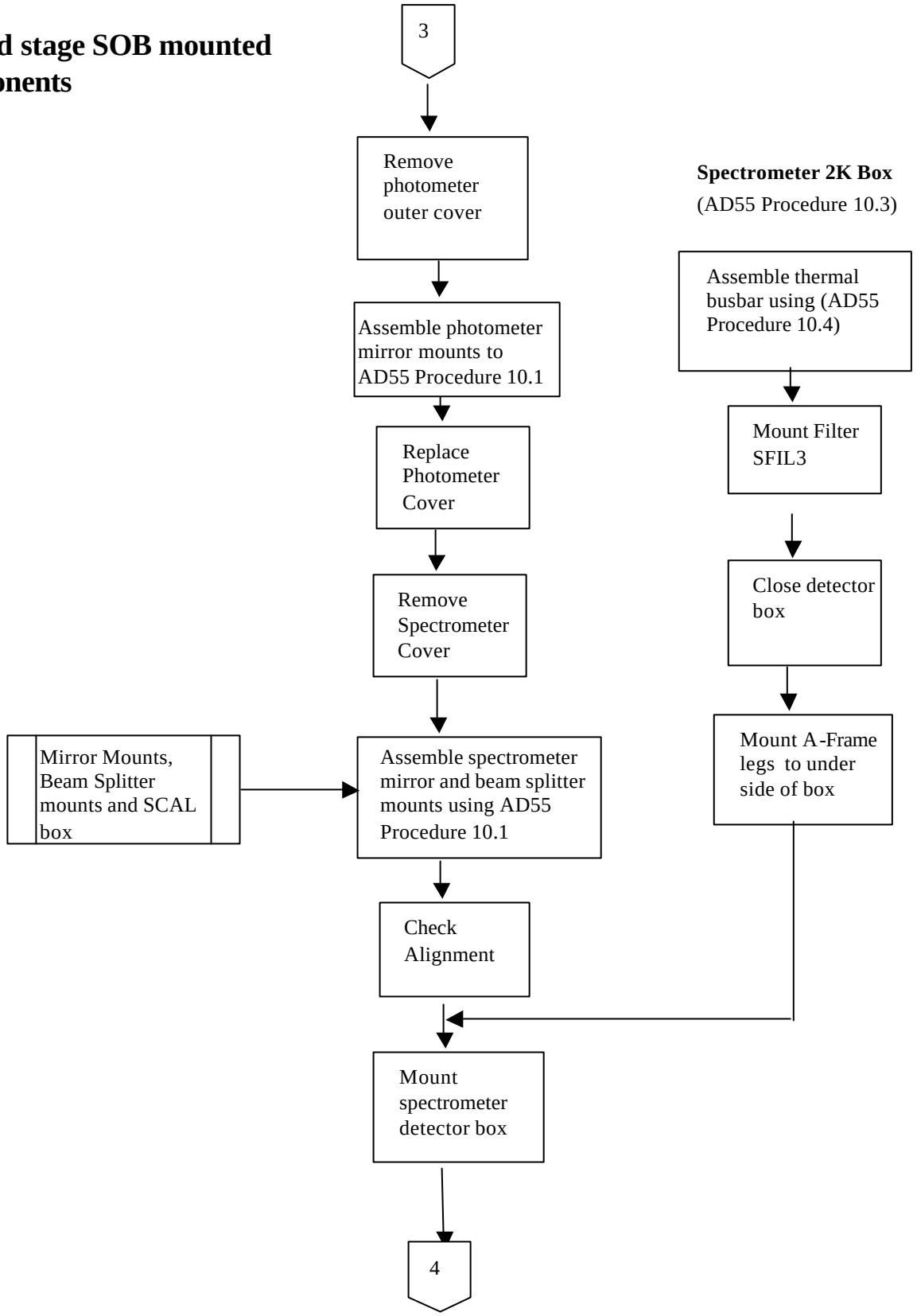


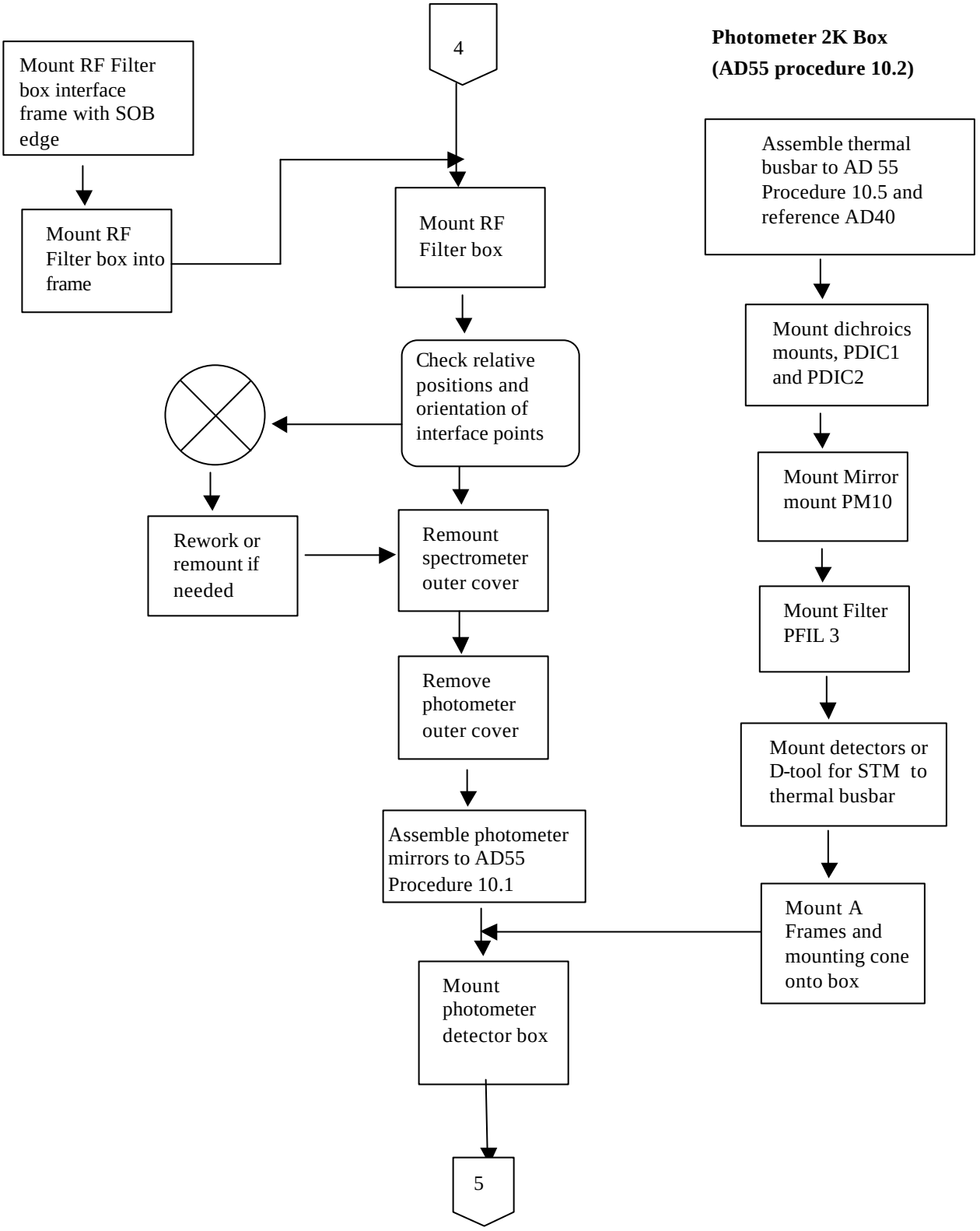

1
Check surface cleanliness. Check surface flatness before bolting down in sequence
Check flatness of interface with outer panel
Rework or remount if needed
Bolt down outer panel lid to complete cover
Bolting Sequence
Dowel position of photometer cover on optical bench
Remove from surface table
HOB Simulator from RAL
Assemble Optical bench into MGSE
MGSE (See AD55 Procedure 8)
2

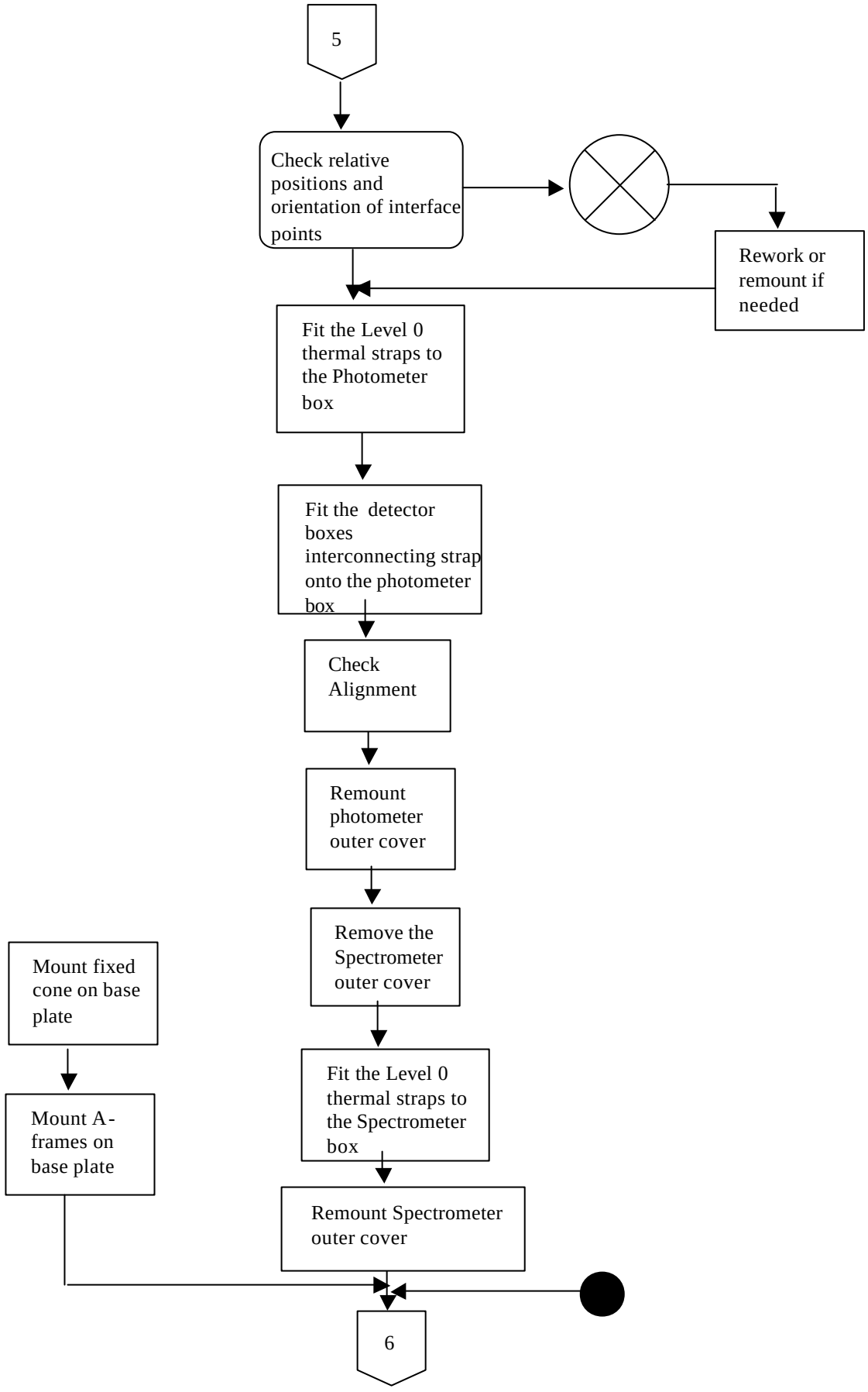
Spectrometer Cover

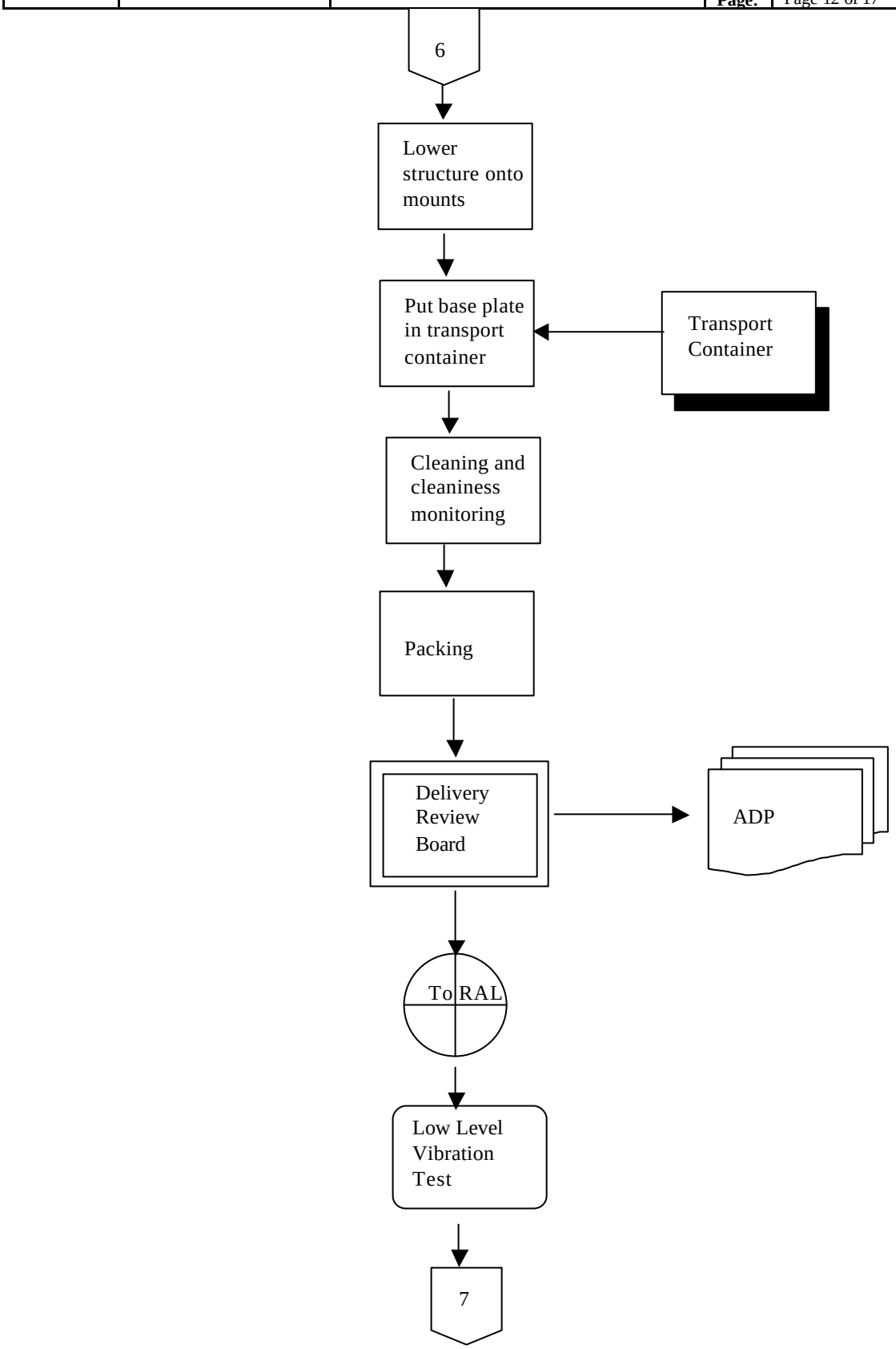


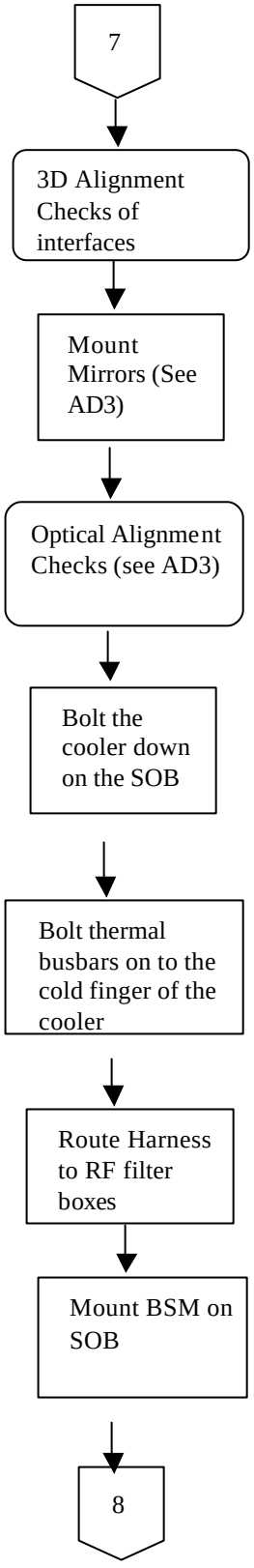
Second stage SOB mounted components

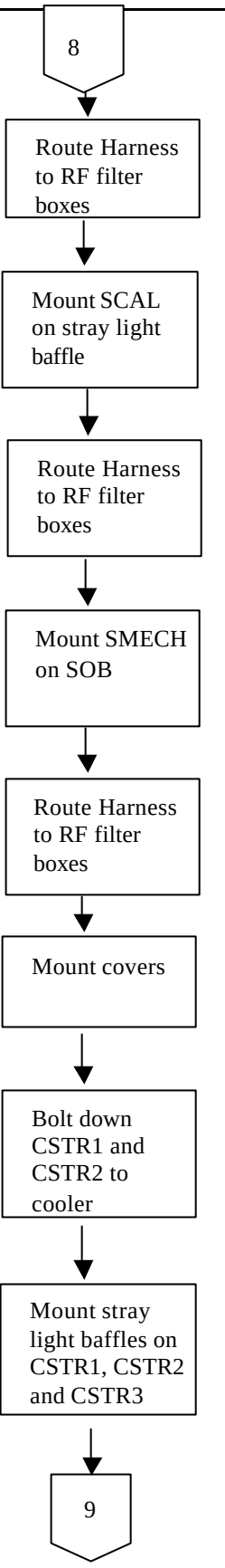



4
Mount RF Filter box interface frame with SOB edge
Mount RF Filter box into frame
Mount RF Filter box
Check relative positions and orientation of interface points
Rework or remount if needed
Remount spectrometer outer cover
Remove photometer outer cover
Assemble photometer mirrors to AD55 Procedure 10.1
Mount photometer detector box
5
Photometer 2K Box
(AD55 procedure 10.2)
Assemble thermal busbar to AD 55 Procedure 10.5 and reference AD40
Mount dichroics mounts, PDIC1 and PDIC2
Mount Mirror mount PM10
Mount Filter PFIL 3
Mount detectors or D-tool for STM to thermal busbar
Mount A Frames and mounting cone onto box

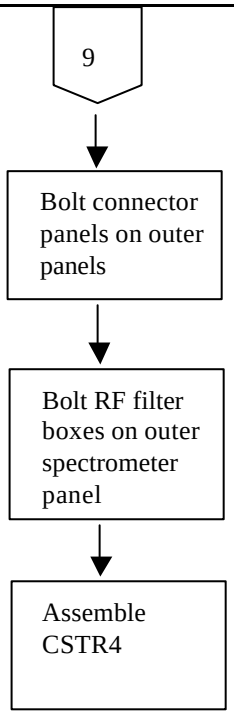

5
Check relative positions and orientation of interface points
Rework or remount if needed
Fit the Level 0 thermal straps to the Photometer box
Fit the detector boxes interconnecting strap onto the photometer box
Check Alignment
Remount photometer outer cover
Remove the Spectrometer outer cover
Fit the Level 0 thermal straps to the Spectrometer box
Remount Spectrometer outer cover
Mount fixed cone on base plate
Mount A-frames on base plate
6


6
Lower structure onto mounts
Put base plate in transport container
Transport Container
Cleaning and cleaniness monitoring
Packing
Delivery Review Board
ADP
To RAL
Low Level Vibration Test
7


7
3D Alignment Checks of interfaces
Mount Mirrors (See AD3)
Optical Alignment Checks (see AD3)
Bolt the cooler down on the SOB
Bolt thermal busbars on to the cold finger of the cooler
Route Harness to RF filter boxes
Mount BSM on SOB
8


8
Route Harness to RF filter boxes
Mount SCAL on stray light baffle
Route Harness to RF filter boxes
Mount SMECH on SOB
Route Harness to RF filter boxes
Mount covers
Bolt down CSTR1 and CSTR2 to cooler
Mount stray light baffles on CSTR1, CSTR2 and CSTR3
9

Final mounting of outer covers



4. Integration Notes

The SPIRE instrument consists of a monocoque shell holding a bending stiff optical bench. This optical bench supports a photometer and a spectrometer. All parts of these two measurement devices are mounted on the optical bench. The instrument is mounted on the FIRST optical bench via three interfaces. Two A-frames and a conical fixed point. These interfaces ensure a controlled contraction of the instrument when it is cooled down. The optical bench panel is on one side mounted on the fixed point, the side closest to the optical axis of the telescope. The two A-frames are mounted on the two corners the furthest away from the fixed point. The bending flexible direction of the A-frames is pointing towards the fixed point. Thus making the whole suspension kinematic.

The integration of the Spire structure is a very delicate operation. During the whole process great care has to be taken not to compromise the (future) alignment of the optical components. For this, during the manufacturing of the different parts and especially the optical bench, stress relaxation is required. In between various stages of machining the parts need to be heat treated. This to release as far as possible residual stress left behind after cutting the metal. The machining stages of the parts can be split between the first rough cutting and the final fine cutting. Before the final cutting, where the part is machined within its final tolerances, it is essential to have it heat treated.

The inaccuracy of machining of the various parts will lead to a build up of alignment errors of the structural interfaces upon which the various optical components will be mounted. The build up of this misalignment runs through the whole structure. It starts with the mounting of the instrument, continues through the covers and the optical bench. It is therefore of paramount importance that during integration the build-up of misalignment is minimised and moreover, to ensure that the construction and integration is done such that what ever the misalignment is, it will not change significantly after dismounting and re-mounting the covers.

The total allowable misalignment (error budget) of the optical components is given in AD24. The development plan, giving a listing of the various models required, is AD28. A more detailed description of the structure can be found in AD27.