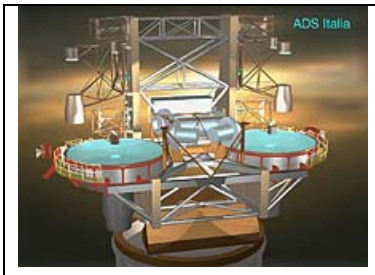


MINUTES OF MEETING

Subject: LBT672 Wind Protection Discussion 3

Date : 15-Mar-2007

By : Joar Brynnel

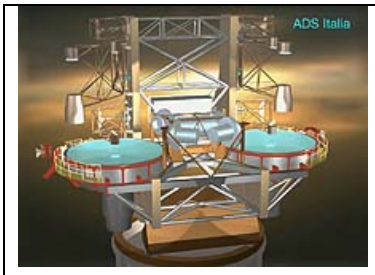
Participants	Org.	Participants	Org.	Additional distribution
Roberto Biasi	MG	Joar Brynnel	LBT	
Piero Salinari	OAA	Armando Riccardi	OAA	
Daniele Gallieni	ADS	Guido Brusa	LBT	
James Howard	LBT			

Type of action : **A** = Action **D** = Decision **R** = Recommendation **S** = Statement **Q** = Question

Type	Responsible	Text	Comments
	Brynnel	Review of action items AI#2: LBT submitted a drawing showing the as-installed clearance between LBC and LBT672 hub. AI #2 closed. AI#9: LBT submitted document 361s070. AI #9 closed. AI #11: Brusa submitted draft document describing operational status vs dome status and power supply status. AI #11 closed. AI #12: Biasi stated a nominal power requirement of 375W per side during TSS operation assuming 0.22N TSS force. 110W dissipation in coils. AI#12 closed.	
S	Gallieni	Shell protrudes 200 mm below hub leaving 300 mm clearance to LBC Blue hub.	
S	Salinari	OAA continues to work on FEA for shell stress. A maximal glass stress of 5MPa is assumed. It should be a goal to withstand 100 kmh wind speed. The retention ring appears to be good protection against wind induced negative pressure (separation from reference body) on shell.	
S	Salinari	We need access to historical wind data from SMT. OAA will post-process this data when it is available. Piero has contacted Strittmatter and Green to get access to data from SMT.	
D	All	OAA will define and buy two 3D wind sensors. LBTO will install sensors, and investigate a stand-alone data acquisition system.	

S	Biasi	TSS current drive testing is now complete. Current drive on backplane is being implemented, expected to be finished shortly. TSS power supply in redundant configuration will be located in swing arm rack.	
S	Brynnel	We need to define applied TSS force. To determine the force we need to: - Close AI#3 - Measured wind data on LBT	
S	Brusa	The AO unit must be tested at Microgate at the maximum applied TSS force	
S	Salinari	The final TSS value will be determined at the time of installation at the telescope. Microgate is requested to test TSS with TS3 installed at the maximum force, then reduce TSS to a low value.	
S	Brusa	The maximum TSS as determined by electronic HW is 0.5N. Salinari commented that 0.5N is equal to 9 times gravity on shell	
D	All	The electronic hardware will be tested at 0.5N without shell installed. The defined maximum operational TSS will be tested in Bolzano on TS1 and TS3.	
AI	All	Submit comments to Guido on “Adaptive Secondary Operation Diagram” document (AI11). Guido will update document.	
D	Brynnel	This was the last dedicated meeting for Shell Wind Protection. The remaining Action Items will be followed up on during the monthly AO progress meetings.	

End of minutes



MINUTES OF MEETING

Subject: LBT672 Wind Protection Discussion 3

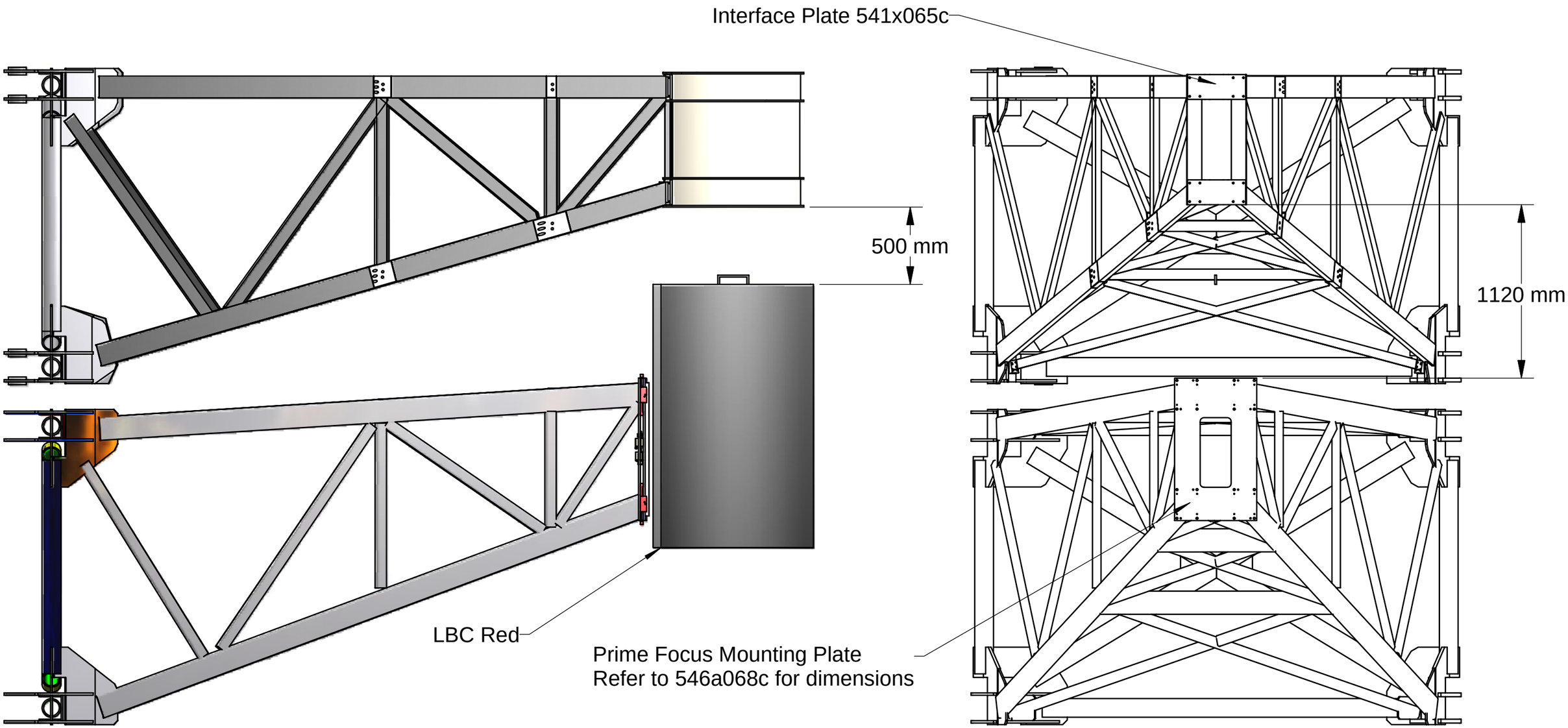
Date : 15-Mar-2007

By : Joar Brynnel

List of Action Items

AI#	Resp.	Text	Status	Deadline
AI #1	Brynnel	Distribute relevant document for LBT specified wind speed	Closed	Jan 31 2007
AI #2	Brynnel	Investigate clearance between LBT672 and LBC	Closed	~~Jan 31 2007~~ Mar 15 2007
AI #3	Group	Calculation of stress induced by dust and debris trapped between shell and reference body	Open	?
AI #4	Group	Risk analysis for telescope system failures	Open	?
AI #5	Gallieni	Preliminary design of retention ring	Closed	Jan 31 2007
AI #6	Brynnel	Study feasibility of UPS for LBT672 electronics	Closed	Jan 31 2007
AI #7	Brynnel	Analysis of single point failures that would prohibit closing observing doors	Open	June 2007
AI #8	Biasi	Make statement on impact on operational and handling procedures for TSS vs. inverted TSS	Closed	Jan 31 2007
AI #9	LBTO	Investigate emergeny closure procedure	Closed	Mar 15 2007
AI #10	Riccardi	Provide real time wind pressure data to TCS	Open	~~Apr 1 2007~~ 1 Jul 2007
AI #11	Brusa	Define scheme for TSS vs. Closed loop operation vs. Dome status and Power supply status	Open	Mar 15 2007
AI #12	Biasi	Define requirements for UPS supply to both AO units	Closed	Mar 15 2007
AI #13	Salinari	Issue official Change Request to LBTPO for implementation of AO-UPS (see also AI #12)	Open	~~Mar 15 2007~~ 1 Jul 2007
AI #14	Gallieni	Design, construct and implement retention ring	Open	~~Mar 15 2007~~ 7 Jun 2007

REVISION HISTORY				
REV	DESCRIPTION	DATE	AUTH	APPROVED
A	Released	3/13/2007	Value	J. Howard



DO NOT SCALE DRAWING

INTERPRET DIMENSIONS AND TOLERANCES IN ACCORDANCE WITH ASME Y14.5M-94

TOLERANCES
UNLESS OTHERWISE SPECIFIED

LINEAR	ANGULAR
X = ±	±
X.X = ±	
X.XX = ±	

DIAMETRICAL: SEE SPEC S-002
DIMENSIONS ARE IN MM / DIMENSIONS IN [ ] ARE IN INCHES

THIRD ANGLE PROJECTION

MATERIAL:

FINISH:

THIS DRAWING CREATED IN:

ACAD	MECH	IDEAS	INV
☐	☐	☐	■

NEXT ASSY	USED ON
ASSEMBLY APPLICATION	

		DATE:
DESIGNED BY:	J. Howard	3/13/2007
DRAWN BY:	J. Howard	3/13/2007
CHECKED BY		
CHECKED BY:		
ACCEPT BY:		
RELEASE BY:		

SCALE: N.T.S.

UNITS: mm

LARGE BINOCULAR TELESCOPE

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Sheet 1 of 1

PLOT SIZE: B

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REVISION: A

File Location: E:\Documents and Settings\jhoward\My Documents\Vault Working Folder\Projects\541 F 15 Swing Arms\Clearance with Prime Focus.iam

Adaptive Secondary Operation Diagram

The operation is summarized using a state table with next state transition (see Table 1).

Telescope Power	Dome	AS Unit	AS Shell State	Requested Action
OK	OPEN	OFF	TSS	Close Dome
		OK	CL	None
		Fault	TSS	Close Dome
	CLOSED	OFF	REF-P	None
		OK	CL	None
		Fault	REF-P	Shutdown AS Unit
Fault	OPEN	OFF	TSS	Telescope Power On
		OK[1]	CL	Telescope Power On
		Fault[2]	TSS	Telescope Power On
	CLOSED	OFF	REF-P	None
		OK[1]	CL	Shutdown AS Unit
		Fault[2]	REF-P	Shutdown AS Unit

Table 1 Table of states for telescope and adaptive secondary unit and next step action. Only the main states are included.

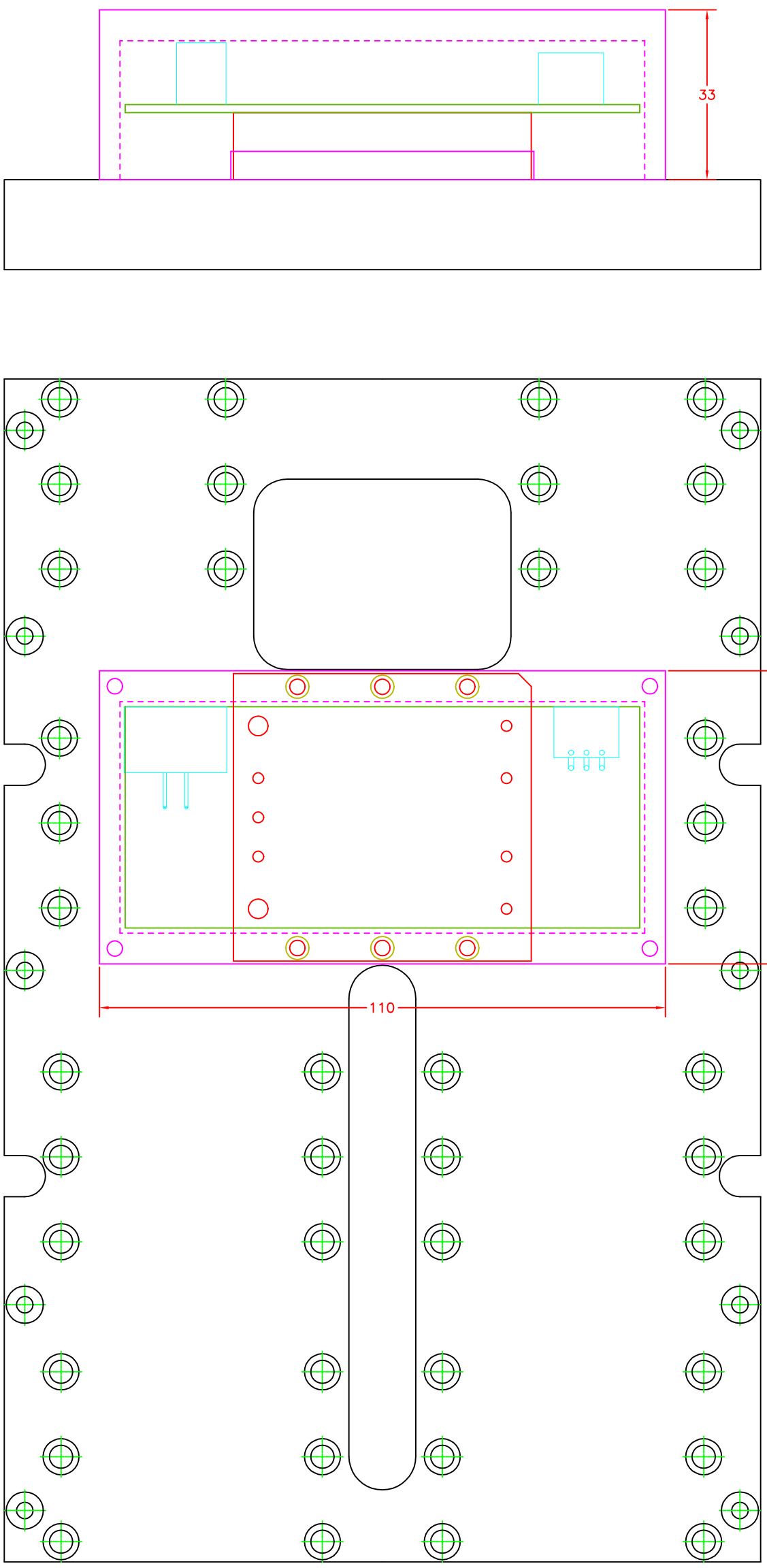
Columns description:

Telescope Power: The main power to the telescope
Dome: Telescope dome
AS Unit: This is the adaptive secondary unit as a whole. The Fault condition has several sub-cases not discussed at the moment.
AS Shell State: These are the 'preferred' states of the shell for the particular condition.
Requested Action: This column describes the next step to be taken at the telescope level.

Symbols description:

REF-P: shell pushed against the reference body by bias magnets only.
TSS: shell pushed against the reference body by bias magnets plus force provided by the actuators fed by the TSS circuitry.
CL: 'normal operation' condition, when the shell is operating under closed loop position control.

[1] This obviously assumes that we have an UPS system for the AS Unit main power supply.
[2] This obviously assumes that we have an UPS system for the AS Unit TSS power supply.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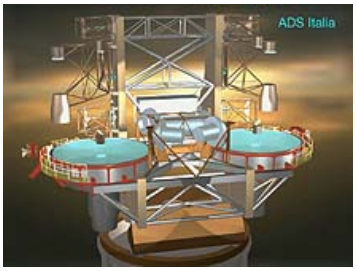

LBT PROJECT
2x8,4m TELESCOPE

Doc.No. : 361s070
Issue : a
Date : 13-Mar-07

LBT PROJECT

2 X 8,4m OPTICAL TELESCOPE

Shutter and Vent Doors

Closure in a Power Outage

	Signature	Date
Prepared	James Howard, John Little	13-Mar-07
Reviewed		
Approved	Joar Brynnel	14-Mar-07

1. Revision History

Issue	Date	Changes	Responsible
a	13-Mar-07	First issue	James Howard

2. Table Of Contents

3. List Of Abbreviations

MGIO Mount Graham International Observatory

4. About this document

4.1. Purpose

The ability to close the shutter doors in any situation is a critical element of the LBT's operations. Manual closure is possible, and a procedure is detailed here, but it is recommended that a 480 Volt 3 phase backup generator be purchased, and reserved for powering the shutter and vent doors in the event of a power failure.

4.2. Reference Documents

361m001c Plans and Elevations
361m007c Shutter Latches

5. System Description

The enclosure has two each of shutter doors, side vent doors, and rear vent doors. Each vent door is driven by one 480 Volt 3 phase motor, and each shutter door is driven by two of these motors. This makes a total of eight motors. In addition, the shutter doors are latched open during observing to keep the wind from closing them. The pins from four latch stations on each door are inserted into their sockets, but the balls are not extended. The pins are heavy and difficult to move without electrical power.

There are two alternatives to closing the doors when the power fails. First is to use a backup generator, and second is to do it manually

6. Backup Power

MGIO has a backup generator on site in case of a main power outage. Unfortunately, the switch on this generator has failed in the past (August of 2006), leaving the LBT totally without power for a period of days.

Because of this, a backup generator with a minimum capability of powering all the motors sequentially should be purchased. This generator could reside on level 4, and should be sized to at least power the pair of drive motors on the shutter doors. Each of those motors is 480 Volts, 9.5 Amps. All of the motors needed to close the doors use 480 Volt 3 Phase power.

6.1. Time Required

Switching the latch station and door drive power to a backup generator at the LBT should take 1 hour. Then, the doors can be closed and latched normally.

7. Manual Closing

7.1. Pin Retraction

There are four latch pins per shutter door that have to be retracted. They are SL1009, SL1010, SL1011, SL1013, SL1014, SL1015, SL0712, and SL0716. Their locations are shown in 361m001c. SL0712 and 0716 require a lift for access.

Figure 1: Location of SL0716

The balls should not be extended. In the event they are, the pin first needs to be extended a little to take the load off. The back cover is removed from the ball motor, and the ball

motor manually turned clockwise. Access ito the ball motor is very difficult, and may require partial disassembly of the latch station. The pin drive motors will have to be driven manually. Refer to Figure 2. First, the motor brakes need to be disengaged by flipping a lever on the fan housing. Then, the fan housing should be removed and and the motor shaft turned. The pin needs to be pulled back approximately 8.5 inches, so with the 207:1 combined gear ratio of the two gearboxes, and the 4 threads per inch (TBC) of the leadscrew, it works out that about 7000 turns of the motor are required to retract the pin.

Alternately, the heavy motor and reducer gearbox could be removed, and the pinion that drives the worm gear that drives the leadscrew could be turned. This would mean a 20:1 gear ratio, and 680 turns to remove the pin. This would have to be done for a total of 8 latch pins.

Figure 2: Shutter Latch Station

7.2. Door Closure

After all eight pins are retracted, the doors need to be closed, starting with the shutter doors. On the shutter doors, there is a motor at the bottom front, and a second at the top rear. These have motor brakes which must be disengaged. A come-along can then be attached between the door and the building to pull the door closed.

Once the doors are closed, the pins need to be extended. There are eight pins to extend per door in the closed position.

7.3. Time Required

It is difficult to estimate how long it would take to manually close the doors. A lot depends on the mechanical aptitude of the personnel on site. Two mechanical technicians should take about an hour per latch station to retract the pin, and then another two hours to close all the doors. More people could cut this time in half, but at best it will take several hours. Pinning the doors closed will add another day. This will all have to take place by the light of flashlights, which adds time.

8. Conclusion

Manually closing the doors is a long, slow and difficult process. We should ensure that we never have to do so. This means guaranteeing the reliability of the electrical system, with multiple backup sources, redundant systems, and high quality parts. We also need to have a large supply of flashlights and batteries.

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