



LBT PROJECT
2x8.4m TELESCOPE

Doc.No. : 670s009
Issue : a
Date : 13 March 2007

LBT PROJECT
2 X 8.4m OPTICAL TELESCOPE

Instrument Rotator and Cable Chain

Installation and Handling Plan

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1 Revision History

Issue	Date	Changes	Responsible
a	13 March 07	First issue	T.Hair, R.Meeks

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3 About this document

3.1 Purpose

This document is to provide an overview of the steps and requirements for installing the Instrument Rotators and Cable Chains for the LBT. The purpose is to describe enough detail to support planning for handling and installation, not to provide a detailed installation procedure.

3.2 Reference Documents

None.

4 Safety Precautions

4.1 Installation Personnel

All personnel involved in the installation of any Rotator parts is required to follow these guidelines:

- Hardhats with chin straps required.
- Harnesses are required.
- All tools are tethered.
- Any tools or equipment should be ready and on hand prior to installation.

4.2 M1 Mirror Protection

Prior to any instrument rotator installation work is started, the mirror must be sufficiently protected and personnel prepared:

- Mirror cover must sufficiently support all personnel working on Rotator Gallery, and sufficiently protect mirror from impact of any tools, hardware, etc. It is important that a safe work platform be available in the area over the primary mirror adjacent to each bent Gregorian rotator. Because most of the instrument rotator components must be installed and adjusted over the mirror, there must be room for at least two people to work safely.
- In addition to the work platform the mirror must be covered prior to any installation work.

4.3 Rotator Parts and Materials

All necessary components of the instrument rotators should be adequately prepared prior to installation:

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- Major subassemblies should already be assembled prior to installation and all hardware needed for installation should be ready.
- Any lubricants (if needed) should be already applied where necessary prior to installation or should be available for use during installation. This includes filling the bearings with grease before installation and having enough grease on hand to grease the gears immediately after installation..
- All hardware and tools should be ordered and at the installation site prior to installation.

5 Electronics

- Install the Reef interface module in the Auxiliary Control Room.
- Attach existing fibers between left upper treehouse and aux control room.
- Install conduit/raceways from existing cable trays to junction boxes on the rotators
- Pull field wiring and terminate
- Install electronics modules (rotator interface module, drive power module, line reactors, and DC supplies) in upper right treehouse
- Connect fiber between left treehouse and right treehouse

6 Bent Gregorian Rotator

The bent Gregorian parts should be properly prepared prior to installation. All documentation indicating assembly and installation procedures should be followed appropriately. Installation should follow in the same order as items are listed below.

All parts should already be assembled according to design drawings prior to installation and adequate hardware should be available and ready for installation.

6.1 Bearing Installation

- The bearings should be removed, cleaned, and have their seals replaced before installation begins..
- Each of the bolts attaching the bearings to the rotator gallery should be tightened to the correct torque.
- A light film of grease should be applied to all exposed bearing surfaces.

6.2 Ring Gear Installation

- The rotator gear should be moved into place and supported with the crane where it just engages the bearing. Load-appropriate lifting eyes should be used. Lifting eye connection points are available on the gear. The gear will probably not hang straight but will be light enough to allow it to be tilted straight enough to allow installation.
- The rotator gear should be mounted flush onto bearing. The gear should not be “cocked” or tilted during installation and should not be forced on. A film of lubricant will be helpful.

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- All bolts should be tightened to the specified torque following a criss-cross pattern around the bearing.

6.3 Motor Mount Installation

- The wedge sections of the motor mount should be preassembled to the support beam prior to installation and all hardware required for attaching the support beam to the rotator gallery should be ready for installation.
- The support beam should be lifted with the crane and positioned near the top beam of the rotator gallery near its final position. Load appropriate lifting eyes should be used. Lifting eye connection points are available on the motor mount
- With the load supported by the crane, the support beam should be aligned and clamped into position on the rotator gallery using two or more bar clamps.
- Each hole in the back of the motor mount support beam should be transfer punched onto the gallery top beam. (Note: a template could also be produced to allow these holes to be drilled in advance.)
- Remove the top beam and drill the twelve 14 mm holes in the top beam with the mag drill.
- Reposition the support beam and install 12 M12 bolts from the instrument side of the gallery. Reach into the support beam from above and assemble a washer, lockwasher, and nut on each bolt.
- Snug the bolts with a ratchet and socket through the holes in the mirror side of the support beam.
- Position the support beam to its final position and tighten each nut to the specified torque.

6.4 Motor Assemblies

- Each motor assembly should already be assembled according to design documents prior to installation and the hardware required for installation should be ready.
- Use the crane to lift a motor assembly into position. Two lifting points are provided on the motor bracket.
- Position the motor assembly so that the flat face on the bracket is aligned with the flat face on the wedge block of the motor mount.
- Insert the bolts and snug them.
- Adjust the motor mount at the joint between the wedge block and the motor bracket and to mesh the gears properly. The ring and pinion gears should mesh appropriately so that gear teeth “flow” together and do not slide or hinder gear motion. Plastigage should be used for mesh measurement.
- Once the gears are running properly, pin the joint between the wedge block and the motor mount support beam.

6.5 Brake Plumbing and Adjustment

- The brakes should have already been installed as part of the motor assemblies but may have been manually disengaged or disconnected to facilitate gear meshing

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above. To begin this step, return the brake to its operating condition within the motor assembly.

- Attach the air line to the rotating union on the motor assembly. Ensure the other end of the air line is attached to the valve in the electronics enclosure in the treehouse.

6.6 Encoder Tape

- The encoder tape should be handled carefully to avoid any damage.
- The tape should be appropriately tensioned according to specification when installed. This is done by hanging weights from the tape and slowly rolling the tape onto the rotator gear.
- Once the tape is installed under the correct tension the ends must be secured and the gap closed. This is accomplished by attaching the free end of the tape to a block installed in the tensioning groove and tightening two screws until the gap is just closed. The block is then secured to the gear.

6.7 Tape Encoder Read Heads

- The read heads should be mounted after gears have been properly meshed and after the tape has been installed.
- Before installing the read heads, clean the tape to remove any debris that may become trapped in the small space between read head and tape and cause damage.
- The read heads should be mounted and gapped with feeler gauges according to specification.

6.8 Cable Chain

- Install and adjust the cable chain motor assembly
- Install the inner tray onto the rotator bearing
- Install the outer tray on the rotator gallery frame
- Install the energy chain
- Install cables and hoses
- Install covers

6.9 Relative Position Sensor, Limit Switches, and Hard Stop

- Install the relative position sensor and limit switches
- Adjust limit switches
- Install hard stop dampers and adjust

6.10 Ventilation Shroud and Ducting

- Shroud should enclose all motors, brakes, wiring, cabling, piping, hosing, etc.
- Air ventilation ducts should be installed after shroud is installed.
- Ducting should not interfere with the motion of any motors, electronics, etc.

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7 Direct Gregorian

Direct Gregorian parts should be properly prepared prior to installation. All documentation indicating assembly and installation procedures should be followed appropriately. Installation should follow in the same order as items are listed below.

All parts should be already assembled as according to design prior to installation, and have adequate hardware ready for installation.

7.1 *Instrument Support Structure Shipping*

- Due to the large size of the Instrument Support Structure, a procedure for transporting a wide load is necessary

7.2 *Bearing Installation*

- The bearings should be removed, cleaned, and have their seals replaced before installation begins.
- Each of the bolts attaching the bearings to the mirror cell should be tightened to the correct torque.
- A light film of grease should be applied to all exposed bearing surfaces.

7.3 *Ring Gear Installation*

- The rotator gear should be moved into place and supported with the crane where it just engages the mounting feature on the mirror cell. Load-appropriate lifting eyes should be used. Lifting eye connection points are available on the gear. The gear will probably not hang straight but will be light enough to allow it to be tilted straight to allow installation.
- All bolts should be tightened to the specified torque following a criss-cross pattern around the bearing.

7.4 *Installation of Instrument Support Structure*

- Load appropriate lifting eyes should be used. Lifting eye connection points are available on the Instrument Support Structure.
- Due to the large size of the Instrument Support Structure and mounting position, it may be necessary to mount while at horizon pointing.
- Lifting points are provided
- Move the ISS into position with the crane
- Align the ISS so it just begins to engage the bearing
- Carefully pull the ISS into the bearing with three or more bolts to avoid wedging it.
- Once it is fully seated, tighten all the bolts to the specified torque following a criss-cross pattern

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7.5 Motor Assemblies

- Each motor assembly should already be assembled according to design documents prior to installation and the hardware required for installation should be ready.
- Use the crane to lift a motor assembly into position. Two lifting points are provided on the motor bracket.
- Position the motor assembly so that the flange is aligned with the ear on the ISS.
- Insert the bolts and snug them.
- Verify the mesh of the gears with Plastigage. Adjust if necessary using the features provided.

7.6 Brake Plumbing and Adjustment

- The brakes should have already been installed as part of the motor assemblies but may have been manually disengaged or disconnected to facilitate gear meshing above. To begin this step, return the brake to its operating condition within the motor assembly.
- Attach the air line to the rotating union on the motor assembly. Ensure the other end of the air line is attached to the valve in the electronics enclosure in the treehouse.

7.7 Encoder Tape

- The encoder tape should be handled carefully to avoid any damage.
- The tape should be appropriately tensioned according to specification when installed. This is done by hanging weights from the tape and slowly rolling the tape onto the rotator gear.
- Once the tape is installed under the correct tension the ends must be secured and the gap closed. This is accomplished by attaching the free end of the tape to a block installed in the tensioning groove and tightening two screws until the gap is just closed. The block is then secured to the gear.

7.8 Tape Encoder Read Heads

- The read heads should be mounted after gears have been properly meshed and after the tape has been installed.
- Before installing the read heads, clean the tape to remove any debris that may become trapped in the small space between read head and tape and cause damage.
- The read heads should be mounted and gapped with feeler gauges according to specification.

7.9 Cable Chain

- Install and adjust the cable chain motor assembly

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- Install the inner tray onto the cable chain bearing
- Install the outer tray on the back of the mirror cell
- Install the energy chain
- Install cables and hoses
- Install covers

7.10 Relative Position Sensor, Limit Switches, and Hard Stop

- Install the relative position sensor and limit switches
- Adjust limit switches
- Install hard stop dampers and adjust

7.11 Ventilation Shroud and Ducting

- Shroud should enclose all motors, brakes, wiring, cabling, piping, hosing, etc.
- Air ventilation ducts should be installed after shroud is installed.
- Ducting should not interfere with the motion of any motors, electronics, etc.

Doc_info_start

Title: *Instrument Rotator and Cable Chain Installation and Handling Plan*

Document Type: Report

Source: Steward Observatory

Issued by: Thomas Hair

Date_of_Issue: *13 Mar 2007*

Revised by:

Date_of_Revision:

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Checked by:

Date_of_Check:

Accepted by:

Date_of_Acceptance:

Released by:

Date_of_Release:

File Type: MS Word

Local Name: *Instrument Rotator and Cable Chain Installation and Handling Plan*

Category: 600

Sub-Category: 670

Assembly: 670

Sub-Assembly:

Part Name:

CAN Designation: 670s009

Revision: a

Doc_info_end