

SHANE TELESCOPE

120 INCH PRIMARY ALUMINIZING PROCEDURE

FIRST DAY

1. Change from Cassegrain to Prime Focus.
2. Install (3) support arms to lock telescope in position. (fig.1-3)
3. Move Coude' third mirror onto West Mezzanine, leaving space for the Cass. tub. (fig.4-7)
4. Rereeve Bridge Crane hook to #2 position. (fig.8-10) Disconnect 5 ton hook, but don't hook up 15 ton hook until position #2 is completed. (fig.11-15)
5. Install mirror handling platform extensions; north-1, south-2. (fig.16-18)
6. Remove counter weight assemblies with Crown lift & store on East observing floor curb. (fig.19-22)

SECOND DAY

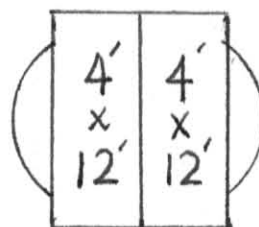
1. Remove Cable Trough, Cass. tub and necessary electronics. Store cable trough on West mezzanine near C.A.T.. Store T.V. & X-Y stages in NW mezzanine storeroom. (fig.23-30)
2. Store Cass. tub on West mezzanine next to third mirror. Use outhaul. (fig.31-32)
3. Remove flooring on mirror handling platform. (fig.33)
4. Position platform under cell; jack East side of platform up & slide 3/8 inch shims under wheels. (fig.33-35)
5. Record dial indicator readings and remove. (fig.36)
6. Remove micrometers and hold down springs (caution! don't change settings). Lift on counter weights to install allen wrench. (fig.37-38)
7. Install (2) taper guide pins between cell and handling platform. (E-W)
8. Install 2-1½"x24" N-S guide pins in telescope lower ring.
9. Remove (16) bolts and nuts (nut size- 2 3/16" & 2¼"). (fig.39-40)
10. Lower cell 6"; remove bottom thermistor. (fig.41)
11. Lower to down limit; remove top thermistor. (fig.42)
12. Remove 3/8" shims from under wheels and move platform to North limit.
13. Connect 2" wire cable stinger to crane hook. (refer to fig.46)
14. Remove floor covers over optic shop; use lifting chain extensions next to platform. (fig.43-45)
15. Pick up (2) cable slings (stored in West mezzanine) using 2-1" shackles. No outhaul needed. (fig.46)
16. Position hook over mirror and connect slings to holes closest to edge of cell. (fig.47-48)



17. Attach a rope to both sides of mirror cell for guiding; gently lift and position over grinding machine. (fig.48-49)
18. Disconnect slings, raise and position over mirror handling platform.
19. Install support arms for mirror spreader bar on South end of mirror handling platform while work on mirror continues. (fig.50)

THIRD DAY

1. Screw (3) jacks up against mirror (120° a part) with ½" key stock. (fig.51)
2. Rotate grinding machine table to get to them. (fig.52)
2. Test mirror surface with reflectometer. (fig.53)
3. Prepare mirror for stripping;
 - A) Remove aluminum foil, cardboard, and masking tape. (fig.54-55)
 - B) Apply (1) wrap of single face 2" masking tape in place of cardboard.
 - C) " (1) " " double " 2" " " over above. (fig.57)
 - D) " (1) " " 48" wide vinyl sheeting draped over edge of cell. (fig.56)
 - E) " (2) " " single face 2" masking tape. (fig.57)
4. Install PVC drain plug in center of mirror from bottom and inflate inner tube and connect (3) hangers. (fig.58-59)
5. Tilt table 5° and hose mirror surface with tap water.
6. Tie balls of cotton on end of PVC tubing (2' long). (fig.60)
7. Optician and (1) technician proceed with stripping (Green Death or Sodium Hydroxide). (fig.61)
8. Rinse and strip with "Tray Cleaner".
9. Rinse and wipe dry with cotton towels (optics lab). (fig.62)
10. Remove draping and all tape.
11. Carefully cover with strips of cellophane and tape to side of glass. Lift mirror and cell from optics shop and transfer to mirror handling platform. (fig.63-64)
12. Don't relax lifting slings until all (8) bolts and nuts (7/8" NF x 2½") are in position; use pin bar for alignment. (fig.65)
13. Relax lifting slings; tighten all bolts and nuts.
14. Close floor over optics shop.
15. With use of bridge crane install (2) edge arcs on mirror cell (NE-NW) and bolt down. (fig.66)
16. Cover mirror with (4) pieces of plywood.



FOURTH DAY

1. Remove the (2) defining units after steps A & B; (NOTE settings) (fig.67)
 - A) Screw (3) socket head graduated screws counter clockwise (35) turns to release the crowns. (CAUTION! on E-W screws)
 - B) Remove (6) flat head screws and install 2- $\frac{1}{2}$ " jack screws to push out assembly.
2. Locate 3- $\frac{1}{4}$ " slotted cheese head screws; screw in by hand until you feel resistance. This keeps crowns from floating. (fig.68-A)
3. Remove (2) aluminum clips from under 2- $\frac{1}{2}$ " socket head spring loaded guide pins. If the heads don't bottom out, take hold of (2) of (3) rectangular shaped counter weights and push up on one while rattling the other back and forth until bolts drop in place. (fig.70-E)
4. Install split wood keepers (nails down) around 1" shaft supporting large 70 pound counter weight and push up into hole in plate. (fig.73-A)
5. Remove (3) round counter weights from each support with 7/8" open end wrench at the cast iron lever arm bracket. (Don't move weight on shaft) They're all matched marked. (fig.68-C)
6. Loosen (2) of (4) radial set screws on large circular flange (those not painted red). Use "L" shaped $\frac{1}{4}$ " allen wrench. Don't touch radial centering screws in triangular grey casting! (fig.69-F)
7. Remove all socket head cap screws holding large round flange except the second one (3) clockwise of the triangular point of the center plate. (fig.69-B)
8. Remove (3) socket head cap screws, one from each point of the triangle shaped plate supporting the counter weight. (fig.69-E)
9. Install (3) hex shaped and relieved extension screws and triangular push plate for jack. Use (3) holes in triangle casting. (fig.70-B)
10. Install (3) long $\frac{1}{2}$ " extensions in first hole clockwise of triangular plate. Note: Center support has no triangle plate. (fig.72-D)
11. Install jack and align screw push plate by adjusting (3) nuts supporting jack; screw pilot and bearing to engagement with push plate. (fig.72-B,C)
12. Remove (3) remaining cap screws from counter weight assembly flange. (fig.71-A)
13. Wiggle jack gently while removing counter weight assembly until flange and radial set screws are no longer engaged.
14. Lower flange down 3" above mirror cell and install (3) clamps with slotted studs hanging down through (3) easily accessible holes and add bent bracket and nut. (fig.71-B)
15. Continue to lower flange till flush with mirror cell; using screwdriver rotate slotted studs (3) to engage clamps with outer diameter of hole and tighten with 15/16" open end wrench. (fig.71-B)

16. Remove all jack equipment and proceed to next support assembly.

FIFTH DAY

1. Remove cellophane cover from mirror.
2. Redrape with 48" vinyl sheeting and one wrap of single face masking tape.
3. Optician and one technician make final cleaning of mirror and cover with cellophane.
4. Slip sling around mirror through edge arcs and support with aluminum brackets attached to edge arcs. (6 technicians) (fig.76-77)
5. Use long 2" stinger to install lifting bar. (fig.74-75)
6. Install top U-shaped safety bracket on spreader bar (tapped holes next to alum. surface) and (2) safety brackets on sling. (fig.78,89)
7. Take up sling screw jacks until mirror starts to move. (fig.75)
8. Open floor over aluminizing tank.
9. After opening floor install ouhaul with snatch block and double line.
10. Attach a rope line to either side of sling. (fig.89)
11. Open aluminizing tank and remove all small mirror brackets from inside tank.
12. Install Tuggit hoist from bottom of platform to frame for safety. (fig.75)
13. Remove North Platform Extension.
14. As platform is tilted keep bridge crane hook snug on lifting bar and back off Tuggit hoist. (fig.79)
15. After mirror is in vertical position, lift mirror $\frac{1}{4}$ " off edge arcs so that lifting bar clears support arms. (fig.80)
16. Roll platform away from mirror. (fig.81)
17. Disconnect power cable to mirror handling platform and store on floor.
18. Rotate dome and position mirror over tank. (fig.82)
19. Position (2) technicians on tank to guide mirror sling into position. (fig.83)
20. Lower mirror enough to clear support arms and slide sling West into position; place weight on tank supports. (fig.83)
21. Don't slack lifting screws until top center support has been bolted to tank. (fig.84)
22. Slack lifting screws and disconnect from sling; stow bar clear of floor opening.
23. Remove (2) safety brackets and connect (2) bottom safety straps between sling and tank. (fig.88)
24. Remove all cellophane and allow optician to make final inspection of mirror. (fig.85)
25. Close tank and start roughing pump (approx. 10 hrs. roughing time.).
26. Rope off observing floor opening for safety.
27. Thoroughly inspect all crowns for damage. (fig.86)

ALLOW ONE DAY TO ALUMINIZE

SIXTH DAY

1. Open tank and cover surface of mirror with cellophane. (fig.85,87)
2. Lower spreader bar and jacks over mirror and connect to sling (tapped holes of top bracket next to aluminum).
3. Disconnect (2) safety brackets at bottom of sling. (fig.88)
4. Take up jacks equally about one turn (don't rotate mirror); lift mirror about 3" and outhaul to disengagement of tank supports. (fig.89)
5. Lift straight up while guiding with (2) attached ropes at bottom of sling and (2) technicians on tank. (fig.89)
6. Rotate dome and center mirror in North; connect platform power.
7. Drive platform North and carefully guide mirror past edge arcs. (fig.90)
8. Make sure mirror cell is parallel to back side of mirror; override limits if necessary. (fig.91)
9. Check rotation and center line of mirror with cell. Make adjustments with jacks after lifting bar is resting on supports.
10. Slack crane hook just a bit and start tilting platform down. Take up slack with Tuggit hoist.
11. Remove lifting bar after mirror is in horizontal position. (fig.91)
12. Level platform with machinist level on cell flange.
13. Don't move platform until (3) mirror supports have been installed (center, east & west). (fig.75)
14. Remove mirror sling and cover mirror with plywood. (fig.76)
15. Install North platform extension.
16. Close Aluminizing tank and floor over tank while mirror supports are being installed.
17. Roll platform under telescope tube for storage over night.
- 18.

SEVENTH DAY

1. Install mirror supports and remove edge arcs. (fig.33,66)
 - A) Carefully jack supports until crowns are engaged. Rattle large round weights.
 - B) Screw in radial set screws (2 unpainted set screws).
 - C) Lightly tighten (3) cap screws and remove jacks. (fig.69-B)
 - D) Release (3) $\frac{1}{4}$ " slotted cheese head screws (crown supports). (fig.68-A)
 - E) Finish installing cap screws on large flange. (fig.69-B)

- F) Install (2) aluminum clips on guide pins (install pull wire in hole in screw head). (fig.70-E)
- G) Remove split wood blocks. (fig.60-A)
- 2. Install both defining units. (fig.67-A)
 - A) Turn graduated screws clockwise (35) turns to previous setting.
 - B) Lower (3) mirror jacks with $\frac{1}{2}$ " key stock and crescent wrench.
- 3. Install $1\frac{1}{2}$ "x24" guide pins on N-S telescope tube for cell alignment.
- 4. Drive mirror handling platform under telescope; jack East side of platform and install $\frac{3}{8}$ " spacers. (fig.34-35)
- 5. Carefully remove cellophane from mirror surface.
- 6. Insulate mirror
 - A) 1 wrap of single face 2" masking tape.
 - B) 1 " " double " " " " .
 - C) 1 " " 3" corrugated cardboard.
 - D) 1 " " single face 2" masking tape.
 - E) 1 " " double " " " " .
 - F) 1 " " 3" corrugated cardboard.
 - G) 1 " " single face 2" masking tape.
 - H) 1 " " double " " " " .
 - I) 1 " " 18" wide foil.
- 7. Raise mirror and cell high enough to install top thermistor; Check for shorts. (fig.42)
- 8. Continue to raise mirror and install bottom thermistor. (fig.41)
- 9. Install (6) washer-spacers at W-S-E bolt pattern on cell.
- 10. Install cap screws in down position. (nuts down)
- 11. Align N-S guide pins and raise against tube.
- 12. Install (4) bolts at N-S-E-W position and torque with (2) man power. (fig.39)
- 13. Remove the N-S guide pins and store.
- 14. Remove (8) tie down bolts between platform and cell.
- 15. Lower platform and remove $\frac{3}{8}$ " spacers under East wheels.
- 16. Stow platform and replace wood flooring.

EIGHTH DAY

- 1. Install (3) micrometers and check readings; install springs between counter weights and brackets. (fig.38)
- 2. Install (3) dial gauges. (fig.36)

3. Check to make certain round counter weights are level; adjust by turning turn-buckles; counter clockwise raises weights.
4. Reset dial guages by rotating turn-buckles above micrometers. Don't change 0-settings on dial guages.
5. Check that all counter weights are free and floating.
6. Stow platform; remove spreader bar support arms. (fig.75)
7. Remove (2) South platform extensions. (fig.17-18)
8. Install (4) counter weights on telescope with Crown lift. (fig.19-21)
9. Position tub on platform and center under telescope. (fig.30-31)
10. Lift carefully aligning taper guide pins by moving the tub laterally with hydraulic jacks.
11. Install tub. (fig.28-29, 22-27)
 - A) Screw and torque (12) insulated hex head cap screws (special wrench with (1) man power).
 - B) Position and bolt on cable trough.
 - C) Install X-Y stage.
 - D) Install camera stage.
 - E) Install electronics.
12. Remove North platform extension (1).
13. Remove (3) support bars from fork and store in North Mezzanine. (fig.1-3)
14. Test telescope controls for proper operation.
15. Collimate primary mirror. (fig.37-38)
 - A) Prime Focus and Direct Camera.
 - B) Collimate by adjusting micrometers.