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DOCUMENT IDENTIFICATION

MAINTENANCE INSTRUCTIONS

HELIOSTAT FIELD SUBSYSTEM

FOR

10 MEGAWATT SOLAR POWER SYSTEM/CENTRAL RECEIVER SYSTEM

APRIL 1981

REVISED AUGUST 1981

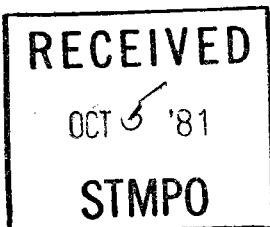
Prepared Under Contract No. DE-AC03-80SF-10539

By

Martin Marietta Corporation

For

The Department of Energy



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September 30, 1981

Refer to: SOL-81-718

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Solar Ten Megawatt Project Office  
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Attn: Mr. Richard N. Schweinberg, Director

Subj: Contract No. DE-AC03-80SF10539, Transmittal  
of Revised Maintenance Instructions

Ref: (a) Martin Marietta Corporation Letter SOL-81-385,  
Subj: Contract DE-AC03-80SF10539, Transmittal of  
Operation Instructions and Maintenance Instructions

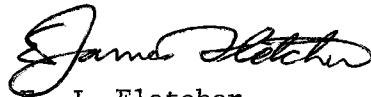
(b) Contract No. DE-AC03-80SF10539, Exhibit I, Task G.2

Encl: (1) MCR-81-1709A Maintenance Instructions

1. Enclosure (1) is transmitted herewith to update the transmittal of Reference (a) which was pursuant to Reference (b).
2. Questions regarding this transmittal may be addressed to the undersigned at (303) 977-0679, or the above address, Mail Stop C4000.

Very truly yours,

MARTIN MARIETTA CORPORATION



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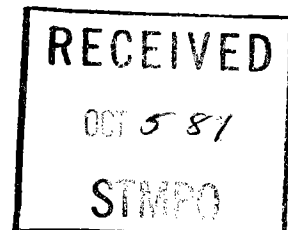
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Enclosure



## FOREWORD

This document is submitted in response to the requirement of The Department of Energy, Contract Number DE-AC03-80SF-10539, 10 Megawatt Solar Power Systems/Central Receiver System (Task G). Changes from the basic issue are denoted by a vertical line in the right hand column.

MCR-81-1709A  
MAINTENANCE INSTRUCTIONS  
HELIOSTAT FIELD SUBSYSTEM  
FOR

10 MEGAWATT SOLAR POWER SYSTEM/CENTRAL RECEIVER SYSTEM

VALIDATION APPROVAL

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## SECTION I - GENERAL

### 1.0 INTRODUCTION

#### 1.1 Purpose

This manual provides the information necessary to maintain the Heliostat Field Subsystem in an Operational Status.

#### 1.2 Scope

This manual describes the maintenance procedures required to properly maintain the Heliostat Field Subsystem. All required authorized maintenance procedures are described, including normal maintenance, preventative maintenance, and removal and replacement of components. Procedures for those items that are recommended to be returned to the supplier for repair are included. Retest and/or calibration procedures that must be performed after removal and replacement of components or after maintenance on the system are included.

### 2.0 APPLICABLE DOCUMENTS

2.1 The documents are listed in the individual sections of this manual.

#### 2.1.2 Modular Computers, Incorporated Documents

2.1.2.1 See Appendix A for Modular Computers, Incorporated computer control system documents.

2.1.2.2 The Maintenance and Service instruction portions of the documents are listed in the individual document Table of Contents.

2.1.2.3 The user should have in effect a Maintenance and Service Contract with Modular Computers, Inc., and/or other competent computer service company.

2.1.3 Other Component Suppliers

2.1.3.1 The user should have in effect a contract with the different component suppliers to provide spare parts as needed. This will assure spares are available without the necessity of stocking seldom-used items.



## SECTION II GENERAL MAINTENANCE PROCEDURES

### 1.0 INTRODUCTION

#### 1.1 Purpose

This portion of the Maintenance Manual provides the information necessary to perform general maintenance tasks on the heliostat components.

#### 1.2 Scope

This portion describes the general maintenance procedures that are required to maintain the heliostat in good working order. Also identified are those components that must be returned to the supplier or to Martin Marietta Corporation for repair.

### 2.0 APPLICABLE DOCUMENTS

2.1 MMC Drawing, Heliostat Assembly, 40M5005132720.

### 3.0 SAFETY EQUIPMENT

3.1 Safety sunglasses, American Optical Calobar Super Armour Plate lenses of 2.5 minimum shade, or equivalent, as needed.

3.2 Hard hats.

### 4.0 NOTES, CAUTIONS, AND WARNINGS

#### 4.1 Notes

4.1.1 Notes are used to denote steps that, if not performed as written, may cause invalid results or incorrect readings.

4.1.2 Notes precede the steps that are to be highlighted.

#### 4.2 Cautions

4.2.1 Cautions are used to denote steps that, if not performed as written, may cause damage to equipment.

4.2.2 Cautions precede the steps that are to be highlighted.

#### 4.3 Warnings

4.3.1 Warnings are used to denote steps that, if not performed as written, may cause serious injury to personnel.

4.3.2 Warnings precede the steps that are to be highlighted.

5.0 DRIVE MECHANISM

5.1 Oil Sampling and Level checks.

5.1.1 Annually check the level of the oil in approximately 10% of the drive mechanisms, selected at random and from all quadrants of the field.

5.1.1.1 Remove the oil filler plug located as shown in Figure II-5-1.

5.1.1.2 Check that the oil level is just to the bottom of the opening. If the oil level is low, add sufficient Mobilux EP023 semi-fluid extreme pressure grease, or equivalent, to bring the oil to the proper level. Record Heliostat number and amount of oil added.

5.1.1.3 Replace the oil filler plug, and tighten securely. Wipe off any spilled oil.

5.1.1.4 If more than 50% of the drive mechanisms checked have low oil levels, increase the number checked to 20%.

5.1.2 Every five years take a sample of the oil from approximately 10% of the drive mechanisms, selected at random and from all quadrants of the field.

5.1.2.1 Perform a chemical analysis of the oil sample to determine if water or other contaminants are present or if chemical deterioration has started.

5.1.2.1.1 -- The oil sample should be taken from the oil fill hole.

5.1.2.2 If contaminants or signs of deterioration are found, drain and refill the oil as described in the following procedures.

5.1.2.2.1 -- Place a funnel or other suitable device under the drain plug to direct the oil into a suitable container.

NOTE: Drive contains approximately 27 pints of oil.

5.1.2.2.2 -- Place the container under funnel to catch the oil.

5.1.2.2.3 -- Remove the oil fill plug, located as shown in Figure II-5-1.

5.1.2.2.4 -- Remove the oil drain plug, located as shown in Figure II-5-1, and allow the oil to completely drain from the drive mechanism. (Requires approximately 15 minutes, depending on temperature)

5.1.2.2.5 -- Replace the oil drain plug, and tighten securely.

5.1.2.2.6 -- Fill the drive mechanism with Mobilux EP023 semi-fluid extreme pressure grease until the level is just below the bottom of the opening.

5.1.2.2.7 -- Replace the oil fill plug, and tighten securely.

## 6.0 COMPONENTS REQUIRING NO FIELD MAINTENANCE

6.1 The components listed below require no field maintenance:

- a. Encoders
- b. Drive Motors
- c. Limit Switches
- d. HFC/HC
- e. Reflective Assembly
- f. Mirror Assembly
- g. Structure.

## 7.0 SUPPLIER MAINTENANCE

7.1 The components listed below should be returned directly to the supplier if they fail or if it is determined that they require maintenance. See Table 1 for the address of the suppliers. The components shall be removed as described in Section III of this manual.

7.1.1 Encoders.

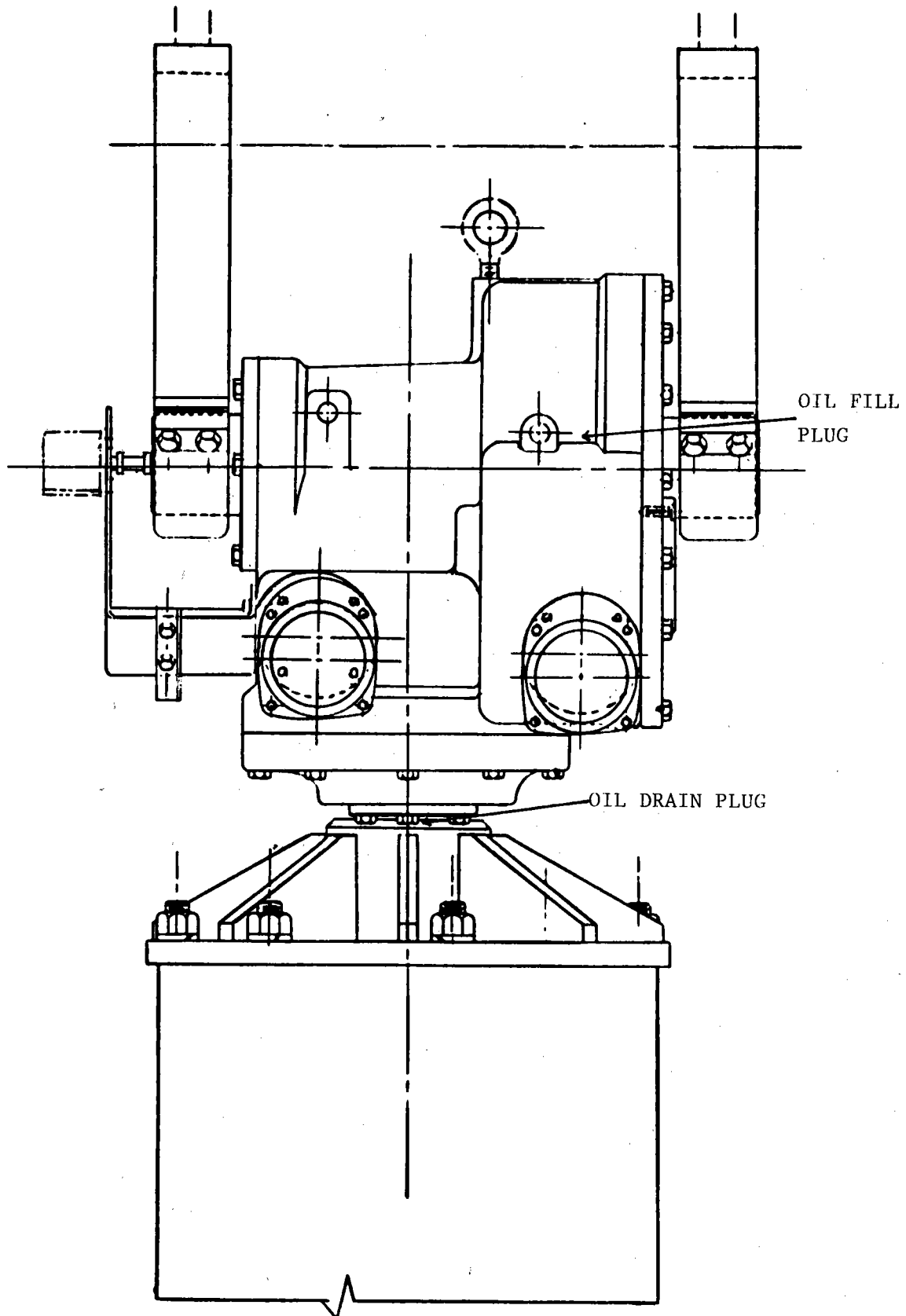


FIGURE II-5-1 DRIVE MECHANISM

7.1.2 Gear Motors, (depending on the failure).

7.1.3 Drive Mechanisms.

NOTE: No contracts currently exist with suppliers for replacement of these components, and it is recommended that said contracts be implemented by the user.

SECTION III

REMOVAL AND REPLACEMENT OF COMPONENTS

## SECTION III REMOVAL AND REPLACEMENT OF COMPONENTS

### 1.0 INTRODUCTION

#### 1.1 Purpose

This portion of the Maintenance Manual provides the information required to remove and replace those components which are authorized for field replacement.

#### 1.2 Scope

This portion of the manual describes the steps necessary to remove and replace each component authorized for field removal and replacement. Included are those procedures necessary to retest and/or recalibrate the component replaced.

### 2.0 APPLICABLE DOCUMENTS

2.1 The applicable documents are listed in the individual sections of this portion of the manual.

### 3.0 SAFETY PROCEDURES

3.2 Whenever possible field maintenance shall be performed during the hours of darkness.

3.3 Prior to any corrective maintenance to a heliostat, the circuit breaker located inside the heliostat power box, will be placed in the off position.

3.4 Adherence to the National Safety Standards and the applicable item technical instructions will reduce the potential for personnel injury or equipment damage during corrective maintenance on electrical components.

3.5 All weight limitations, operating instructions and restrictions for the crane shall be observed during all operations.

3.6 Hand signals to crane operators shall be those prescribed by the applicable American National Standards Institute standard for the type of crane in use.

3.7 All weight limitations, operating instructions and restrictions for the manlift shall be observed during all operations.

3.8 Gloves sized to provide adequate wrist and forearm protection will be worn by personnel during removal of broken mirror assemblies.

#### 4.0 MIRROR ASSEMBLY

##### 4.1 Safety Equipment

4.1.1 Safety sunglasses, American Optical Calobar Super Armour Plate Lenses of 2.5 minimum shade or equivalent, as needed.

4.1.2 Gloves sized to provide adequate wrist and forearm protection.

4.1.3 Hard hats.

##### 4.2 Equipment and Tools

WARNING: All load limitations, operating instructions and restrictions established for the mobile work platform shall be observed during operations.

4.2.1 Mobile work platform with 1,000 lb. capacity, Fabtek, model V24.

4.2.2 Motor Drive Tool, Tool No. 40E5005132784-019

4.2.3 Hand tool kits, as needed.

4.2.4 2 Padded sawhorses.

4.2.5 Reflective Assembly Drawing, 40M5005132730.

##### 4.3 Removal

WARNING: Gloves sized to provide adequate wrist and forearm protection will be worn by personnel during removal of broken Mirror Assemblies.

CAUTION: Mirrors shall be transported to and from the work site in a manner that shall ensure no damage occurs to the mirrors.

4.3.1 Mirror Assemblies Positions 11 and 12. Ref. Figure III-4-1.

CAUTION: Prior to movement, ensure all personnel and equipment are out of the arc to be swung by the heliostat.



- 4.3.1.1 Connect the Motor Drive Tool to the Elevation Gear Motor and position the heliostat to the vertical position.
- 4.3.1.2 While two men support the mirror, remove the three  $\frac{1}{2}$ -13 UNC hex nuts and the washers from the mirror mounting bolts.
- 4.3.1.3 Carefully lift the mirror clear of the mounting holes on the rack assembly. Place the mirror on a padded surface clear of the work area and install a mirror cover.

NOTE: Mirror module weighs 125 lbs.

- 4.3.2 Mirror Assemblies positions 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10.

- 4.3.2.1 Connect the Motor Drive Tool to the Elevation Gear Motor and position the heliostat so that the mirrors are horizontal and facedown.

CAUTION: When positioning Heliostat into the horizontal face-down position, the Heliostat will be very close to the mechanical stop. Exercise extreme caution not to drive Heliostat into hard stop.

- 4.3.2.2 Position the Fabtek so its longitudinal axis is parallel with the longitudinal axis of the mirror assembly to be removed, with the padded sawhorses directly under the mirror.

NOTE: The inboard nuts and washers for mirror assemblies in positions 5 and 6 may be reached by sitting on the Elevation Beam. Do not stand or sit on mirrors.

- 4.3.2.3 While two individuals support the mirror, one individual will reach over the end of the mirror assembly and remove the three  $\frac{1}{2}$ -13 UNC hex nuts and washers from the mirror mounting studs.
- 4.3.2.4 Carefully lower the mirror onto the padded sawhorses and lower the Fabtek to the lowest position.
- 4.3.2.5 While holding the mirror to prevent damage, move the Fabteks away from the work site.
- 4.3.2.6 Carefully lift the mirror over the side of the Fabtek and place

it on a padded surface.

4.3.2.7 Repeat steps 4.3.2.2 through 4.3.2.6 for each mirror to be removed.

#### 4.4 Replacement

4.4.1 Mirror Assemblies positions 11 and 12.

4.4.1.1 Install a mounting stud, one jam nut, one regular nut and one flat washer into each of the three mirror assembly doublers. Torque jam nut snug, plus 1/6 turn.

4.4.1.2 Carefully lift the mirrors and insert the three mounting studs into the mounting holes on the rack assembly.

4.4.1.3 Install three flat washers, three lock washers and three 1/2-13 UNC hex nuts on the mirror mounting studs. Tighten nuts as required by Drawing, 40M5005132730.

4.4.2 Mirror Assemblies positions 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10.

4.4.2.1 Connect the Motor Drive Tool to the Elevation Gear Motor and position the reflective assembly to the horizontal position with the mirrors facedown.

4.4.2.2 Place the padded sawhorses on the lift platform of the Fabtek, spaced properly to accept a mirror assembly.

4.4.2.3 Install a mounting stud, one jam nut, one regular nut and a flat washer into each of the three mirror assembly doublers. Torque jam nut snug plus 1/6 turn.

4.4.2.4 Carefully lift the mirror over the Fabtek guardrails and place it on the padded sawhorses.

4.4.2.5 Position the Fabtek so its longitudinal axis is parallel with the longitudinal axis of the empty space into which the mirror assembly is to be installed.

NOTE: The inboard nuts and washers for mirror assemblies in positions 5 and 6 may be installed by sitting on the Elevation Beam.

4.4.2.6 While two individuals lift the mirror assembly, one individual

will guide it so that the mounting studs are inserted into the mounting holes on the Bar Joists.

4.4.2.7 While the two individuals support the mirror, one individual will reach across from the ends and install one flat washer, one lock washer and one hex nut on each of the three mounting studs.

Tighten nuts as required by Drawing, 40M5005132730.

4.4.2.8 Repeat steps 4.4.2.3 through 4.4.2.8 for each mirror to be installed.

#### 4.5 Canting the Mirrors Replaced

4.5.1 Sun-cant the mirrors replaced using the BCS target.

4.5.1.1 Place mirror covers, 40M5005132772-009 on all mirrors except reference mirror #5.

NOTE: If #5 was replaced, use #6 as the ref. mirror.

4.5.1.2 Request computer operator to command heliostat to BCS target.

Image from ref. mirror should be at/near center of BCS target.

4.5.1.3 Remove mirror cover from replaced mirror.

4.5.1.4 Adjust two or more of the three mounting stud nuts (6) to align the image from the replaced mirror to fall directly on top of the ref. mirror image. Adjust single mounting stud nuts to move image horizontally. Move image to the left by loosening top nut and turning bottom nut CW. Rotating bottom nut CCW will move image to the right. Adjust other side (two studs) of mirror to move image vertically. Repeat adjustments until replacement image coincides with reference image.

4.5.1.5 Tighten top nuts as required by Drawing, 40M5005132730.

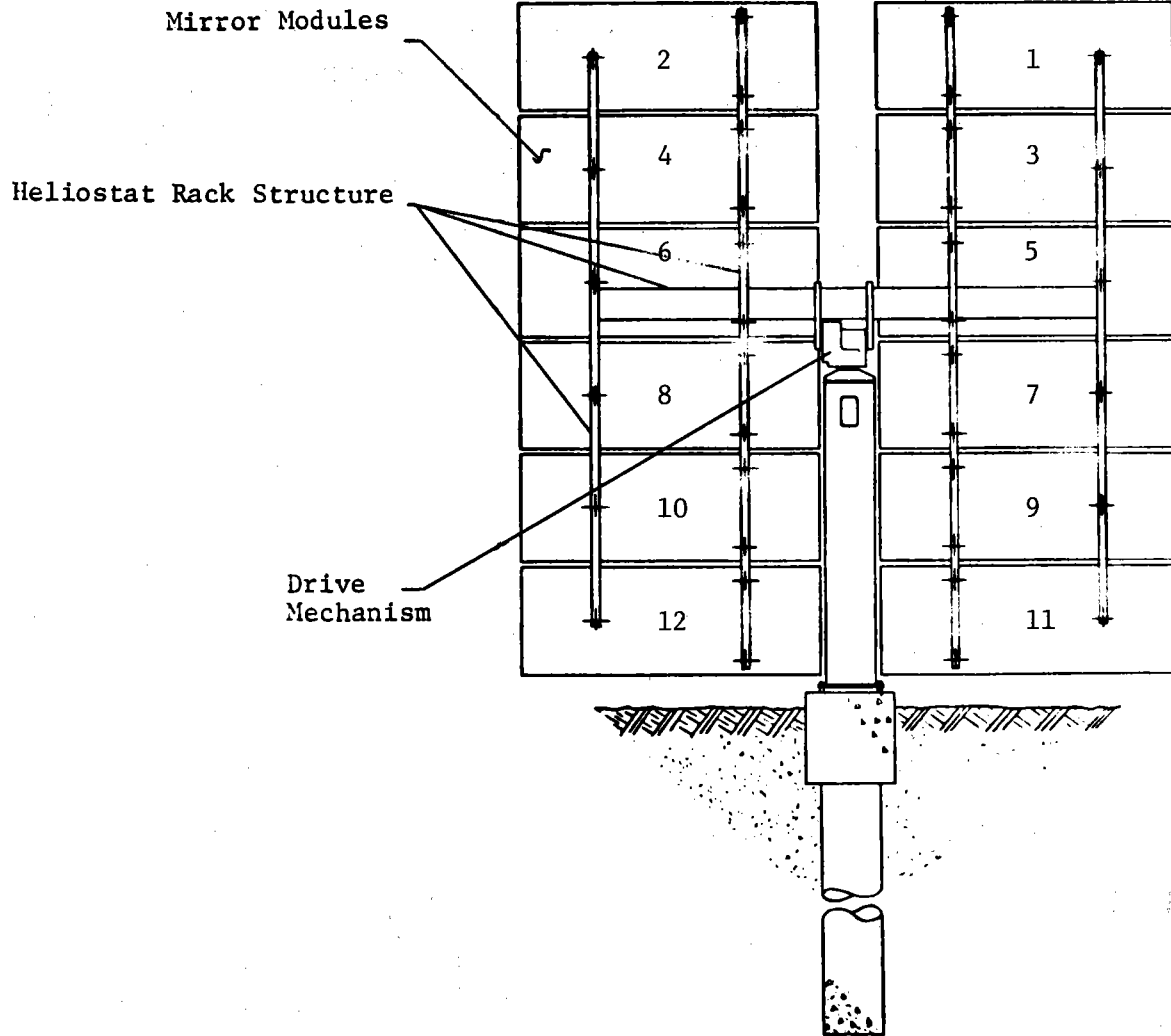


FIGURE III-4-1 Reflective Assembly (Rear View)

5.0 REFLECTIVE ASSEMBLY

5.1 Safety Equipment

5.1.1 Safety sunglasses, American Optical Calobar Super Armour Plate lenses of 2.5 minimum shade or equivalent, as needed.

5.1.2 Hard hats.

5.2 Safety Procedures

5.2.1 All lifting slings, nylon chokers, and associated rigging hardware shall be inspected for damage, proof load tags, correct load capacity for removal and replacement operations, and for general physical appearance. Any lifting devices that are suspect shall be routed to a specified safety organization for inspection and/or proof test.

5.2.2 All weight limitations, operating instructions, and restrictions established for the crane and the mobile work platform shall be observed during all operations.

5.3 Equipment and Tools

5.3.1 Reflective assembly transporter, 35' minimum length flatbed trailer.

5.3.2 3-Ton knuckle boom truck with 27' boom extension and fifth wheel tow capability.

5.3.3 Mobile work platform, 1,000 lb. capacity; Fabtek.

5.3.4 Torque wrench with 600 ft.lb. capacity.

5.3.5 Torque wrench with 200 ft.lb. capacity.

5.3.6 Motor drive tool, tool number 40E5005132784-019.

5.3.7 Zero set indicator, tool number 40E5005132782.

5.3.8 Lifting adapter, reflective assembly, tool number 40M5005132765.

5.3.9 Beam and control arm interface guide pins, 4 each, TA-1.

5.3.10 Shim, .015", 1 each.

5.3.11 Hand tool kits.

5.3.12 Tag lines, two each, minimum of 20 feet long.

5.3.13 Level Protractor.

5.4 Applicable Documents

5.4.1 Martin Marietta Heliostat Installation Instructions: 40M5001I.

5.4.2 Heliostat Assembly: 40M5005132720.

5.5 Removal

5.5.1 Position heliostat in the mirror faceup position.

5.5.2 The replacement reflective assembly shall be transported from the assembly area to the pedestal site by the transporter.

5.5.3 Position the boom truck in relation to the pedestal so that the reflective assembly may be lifted from the pedestal and moved over the transporter.

WARNING: All weight limitations, operating instructions, and restrictions for the crane and the mobile work platform shall be observed during all operations.

CAUTION: As soon as the boom truck is positioned correctly, all four outriggers shall be extended to the ground. Use dunnage as required to increase outrigger footprint to prevent sinking in soft ground.

5.5.4 Attach the Lifting Adapter to the knuckle boom truck.

5.5.5 Position the mobile work platform or Fabtek by the pedestal.

5.5.6 Remove the elevation encoder rain cover, disconnect the cable from the encoder, and remove the encoder and the upper bracket.

5.5.7 Position the boom over the reflective assembly on the pedestal, and lower the lifting adapter to the reflective assembly.

5.5.8 Attach the lifting adapter to the torque tube and to two places on the bar joists. Have the boom operator take up any slack in the lines.

- 5.5.9 Attach the tag lines, minimum of 20 feet long, to the bar joists near two diagonal corners of the reflective assembly.
- 5.5.10 Remove the eight  $\frac{1}{2}$ -13 UNC x 1-3/4 inch long hex bolts securing the reflective assembly to the control arms.
- WARNING: Suspended loads (reflective assembly) should not be allowed to pass over personnel.
- 5.5.11 Position individuals at the two corners of the reflective assembly where the tag lines are attached.
- 5.5.12 With the two individuals steadying the reflective assembly, carefully move it to clear the control arms and the pedestal assembly, and move it over to an empty position on the transporter.
- 5.5.13 With the two individuals steadying the reflective assembly, carefully lower it onto the transporter.
- 5.5.14 Secure reflective assembly to the transporter.
- 5.5.15 Lower the lifting adapter sufficiently, and remove it from the reflective assembly.
- 5.5.16 If the reflective assembly is not to be replaced, remove the lifting adapter from the boom, move boom truck and mobile platform to clear the area.

## 5.6 Replacement

- 5.6.1 Position work platform or Fabtek by the pedestal.
- 5.6.2 Position control arms to  $64^{\circ}$ . Use level protractor on interface surface of control arm.
- 5.6.3 Install four guide pins in the control arms.
- 5.6.4 Position the transporter and the knuckle boom truck in relation to the pedestal so that the reflective assembly may be lifted from the transporter with the knuckle boom and moved over the pedestal.
- WARNING: All weight limitations, operating instructions, and restrictions for the crane and the mobile work platform

shall be observed during all operations.

CAUTION: As soon as the knuckle boom truck is positioned correctly, all four crane outriggers shall be extended to the ground.

Use dunnage as required to increase outrigger footprint to prevent sinking in soft ground.

- 5.6.5 Attach the lifting adapter to the knuckle boom.
- 5.6.6 Position the knuckle boom over the reflective assembly on the transporter, and lower the lifting adapter to the assembly.
- 5.6.7 Attach the lifting adapter to the torque tube and to two places on the bar joists. Have the boom operator take up the load.
- 5.6.8 Attach two tag lines, minimum of 20 feet long, to the bar joists near two diagonal corners of the reflective assembly.

WARNING: Suspended load (reflective assembly) should not be allowed to pass over personnel.

- 5.6.9 While two individuals steady the reflective assembly with the tag lines, lift it clear of the transporter with the knuckle boom.
- 5.6.10 Position the reflective assembly over the pedestal, and lower it until the elevation beam interface lugs can be aligned with the control arm interfaces and tooling guide pins.
- 5.6.11 Install four  $\frac{1}{2}$ -13 UNC x 1-3/4 inch hex bolts, lock washers, and flat washers at the control arm and elevation beam interface.
- 5.6.12 Remove the tooling guide pins, and install the remaining four  $\frac{1}{2}$ -13 UNC x 1-3/4 hex bolts, lock washers, and flat washers.
- 5.6.13 Torque all eight  $\frac{1}{2}$ -13 UNC x 1-3/4 hex bolts to 70-75 foot pounds.
- 5.6.14 Retorque control arm cap bolts to 65-70 foot pounds at eight places.
- 5.6.15 Slack off the knuckle boom, and remove the lifting adapter from the reflective assembly.



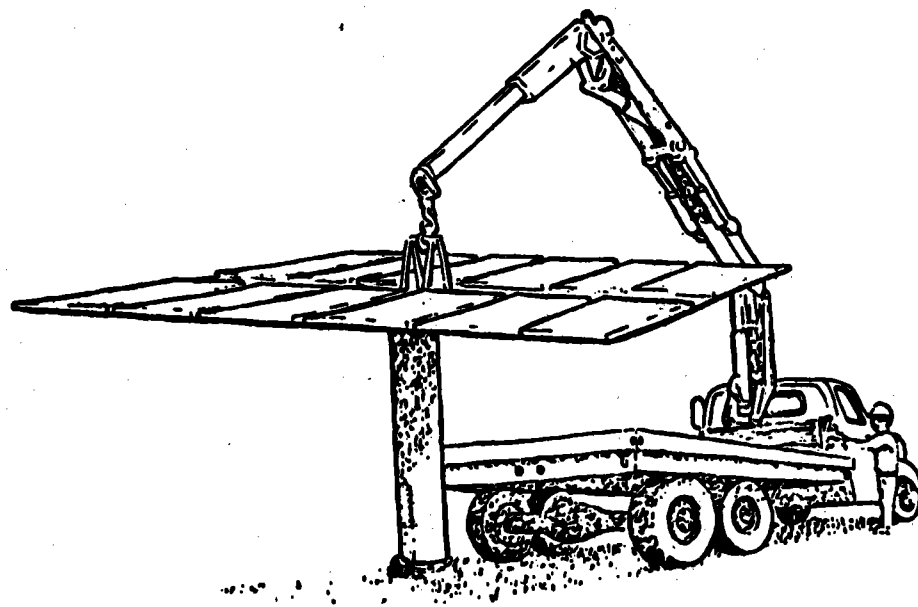


FIGURE III-5-1, Reflective Assembly Removal and Replacement

5.6.16 Move the knuckle boom truck clear of the area.

5.6.17 Reinstall the encoder and the bracket.

NOTE: Verify control arms are at 64°.

5.6.18 Connect the zero set indicator. Manually rotate the encoder two full turns in one direction, then set the encoder to 4218 + 5. Maintain .015 to .040 inch gap between the coupler and the limit switch bracket.

5.6.19 Reinstall the rain cover and reconnect the electrical harness.

NOTE: Check for interference between encoder cover and mirror modules.

CAUTION: Prior to movement, ensure that all personnel and equipment are clear of the arc to be swung by the heliostat.

5.6.20 Use the motor drive tool to position the heliostat to the stow position. Disconnect the motor drive tool. Reconnect the cable harness.

5.6.21 Move all equipment clear of the area.

## 6.0 DRIVE MECHANISM

### 6.1 Safety Equipment

6.1.1 Safety sunglasses, American Optical Calobar Super Armour Plate lenses of 2.5 minimum shade, or equivalent as needed.

6.1.2 Hard hats.

### 6.2 Safety Procedures

6.2.1 All lifting slings, nylon chokers and associated rigging hardware shall be inspected for damage, proof load tags, correct load capacity for the installation operation and for general physical appearance. Any lifting devices that are suspect shall be routed to a specified safety organization for inspection and/or proof test.

WARNING: All weight limitations, operating instructions and restrictions established for the crane and the mobile work platform shall be observed during all operations.

6.3 Equipment and Tools

- 6.3.1 Drive mechanism transporter, 3/4-ton pickup with shoring.
- 6.3.2 3-Ton knuckle boom truck.
- 6.3.3 Mobile work platform with 1,000 lb. capacity, Fabtek.
- 6.3.4 Nylon choker, 6 feet long, 6,000 lb. capacity.
- 6.3.5 Hand tool kits. Talyvel Adapter, 40M5005132766.
- 6.3.6 Torque wrench with 600 ft.lb. capacity. Talyvel II, Level and Sensor.

6.4 Removal

- 6.4.1 If the reflective assembly is installed, remove it as described in paragraph 5.5.

WARNING: All weight limitations, operating instructions, and restrictions established for the crane and the mobile work platform shall be observed during all operations.

- 6.4.2 Position the knuckle boom truck so that the drive mechanism assembly may be lifted from the pedestal and moved to the drive mechanism transporter.
- 6.4.3 Attach the handling sling to the knuckle boom, and position the boom above the drive mechanism assembly.
- 6.4.4 Position the mobile work platform next to the pedestal and at a height sufficient to unbolt the drive mechanism assembly, and guide it away from the pedestal.

WARNING: Verify circuit breaker in the HC box is in the off position.

- 6.4.5 Disconnect the cable harness from the drive mechanism assembly, and remove cable from the guide bar by removing the clamps.
- 6.4.6 Remove the plastic plug from the lifting eye bolt position, and install the lifting eye. Figure III-7-1.

6.4.7 Lower the knuckle boom, and attach the drive mechanism handling sling to the lifting eye.

6.4.8 Remove the eight 1-8 UNC nuts and plain washers from the pedestal studs.

WARNING: Suspended loads (drive assembly) should not be allowed to pass over personnel.

6.4.9 Carefully lift the drive mechanism assembly with the knuckle boom until it clears the pedestal studs, and move it over to an empty position on the drive mechanism transporter.

6.4.10 Lower the drive mechanism to the transporter.

6.4.11 Lower the boom sufficiently, and remove the handling sling. Move the knuckle boom truck out of the area.

## 6.5 Replacement

6.5.1 Position the knuckle boom truck so that the drive mechanism assembly may be lifted from the transporter and moved to the pedestal.

WARNING: All weight limitations, operating instructions, and restrictions established for the crane and the mobile work platform shall be observed during all operations.

6.5.2 Attach the handling sling to the knuckle boom, and position the boom above the drive mechanism assembly.

6.5.3 Position the mobile work platform next to the pedestal and at a height sufficient to guide the drive mechanism onto the pedestal.

6.5.4 Attach the handling sling to lifting eye of the drive mechanism. Release the drive mechanism's holding devices.

WARNING: Suspended loads should not be allowed to pass over personnel.

6.5.5 Lift the drive mechanism clear of the transporter.

6.5.6 Elevate the drive mechanism, and position it over the heliostat pedestal. Clock the drive mechanism so that the cast "E" on the interface adapter faces east.

WARNING: Do not allow hands and fingers between adapter plate and pedestal.

6.5.7 Lower the drive mechanism to within  $\frac{1}{4}$ -inch of the pedestal studs, line up the mechanism holes with the pedestal studs, and carefully lower the mechanism onto the pedestal studs.

6.5.8 Install 1.0 inch plain washers, lock washers, and 1-8 UNC nuts on the eight pedestal studs.

6.5.9 Remove the lifting sling from the drive mechanism, and move the knuckle boom truck clear of the area.

6.5.10 Tighten the eight nuts, and torque to 180-200 foot pounds.

#### 6.6 Adjusting Perpendicularity of the Azimuth Axis

6.6.1 Place the "Talyvel" level sensor with the adapter, part number 40M5005132766, on the leveling pad of the drive mechanism, and secure it with a tooling bolt.

6.6.2 Connect the level sensor to the Talyvel indicator and place the indicator near the base of the pedestal. Turn the level system to 8 minimum scale, and perform the zero check.

6.6.3 Back off the eight pedestal hold-down nuts two turns.

6.6.4 Uncage the level sensor by turning two adjustment knobs, on top of the sensor, CCW to their limit of travel--turn both knobs at the same time.

CAUTION: Whenever the level is moved for any reason, the two adjustment knobs must be in the "caged" position--both knobs turned to their limit of travel in a CW direction.

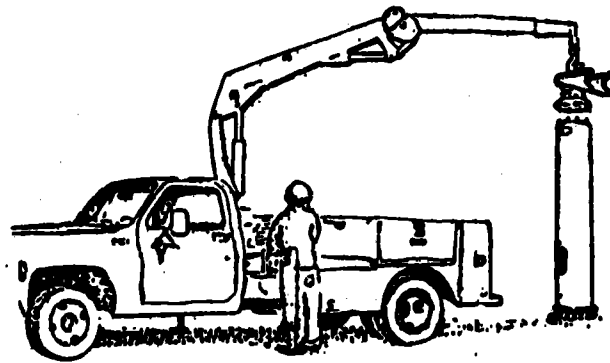


FIGURE III-6-1, Drive Mechanism Assembly Removal and Replacement

- 6.6.5 Connect the motor drive tool to the lower end of control cable.
- 6.6.6 Connect the motor drive tool power cord to the heliostat power box.
- 6.6.7 Place the circuit breaker in the heliostat power box to the "ON" position.
- 6.6.8 Verify the dowel pin hole between two gear motors on drive mech. (Figure III, page 30) is directly over the adapter plate stud at the cast "E". If necessary, adjust with the motor drive tool.  
CAUTION: Prior to movement, ensure that all personnel and equipment are clear of the arc to be swung by the heliostat.
- 6.6.9 Using the motor drive tool, position the drive mechanism so the level sensor (cable end) is pointing south. Remove  $\frac{1}{2}$  of the error indicated by the level indicator by adjusting the adjustment knobs on the level indicator. Remove the other  $\frac{1}{2}$  of the error by adjusting the north-south axis nuts at the base of the pedestal.
- 6.6.10 Using the motor drive tool, position the drive mechanism so that the level sensor is pointing west. Remove  $\frac{1}{2}$  of the error indicated by the level indicator by adjusting the adjustment knobs on the level indicator. Remove the other  $\frac{1}{2}$  of the error by adjusting the east-west axis nuts at the base of the pedestal.
- 6.6.11 Repeat steps 6.6.9 and 6.6.10 until the level indicator indicates  $0 \pm 30$  seconds in all positions.
- 6.6.12 During the torquing operation, check level in N-S, E-W, W-E, and S-N directions. Make the necessary adjustments to maintain a level indication.
- 6.6.13 Tighten the eight hold-down nuts of the pedestal, and torque to 300-400 ft.lb.

- 6.6.14 Using the motor drive tool, drive the drive mechanism through 180° in azimuth from STOW position while watching the level indicator. The indicator shall indicate 0 ± 30 seconds throughout travel. Reverse the direction, and drive the drive mechanism back to STOW and then an additional 180° while watching the level indicator. The indicator shall indicate 0 ± 30 seconds throughout travel.
- 6.6.15 Using the motor drive tool, position the drive mechanism in the STOW position.
- 6.6.16 Place the motor drive tool power switch to OFF. Disconnect the Drive tool from the cable harness. Disconnect the power cable from the heliostat power box.

6.6.17 Connect the cable harness.

## 7.0 GEAR MOTOR ASSEMBLY

### 7.1 Safety Equipment

7.1.1 Safety sunglasses, American Optical Calobar Super Armour Plate lenses of 2.5 minimum shade, or equivalent as needed.

7.1.2 Hard hats.

### 7.2 Safety Procedures

7.2.1 Assure that the circuit breaker in the heliostat power control box is in the OFF position.

7.2.2 All weight limitations, operation instructions, and restrictions established for the mobile work platform shall be observed during all operations.

### 7.3 Equipment and Tools

7.3.1 Mobile work platform with 1,000 pound capacity, Fabtek.

7.3.2 Motor drive tool, tool number 40E5005132784-019.

7.3.3 Hand tool kits.

### 7.4 Applicable Documents



## 7.5 Removal

**WARNING:** Position the circuit breaker on the heliostat power box to OFF.

7.5.1 Disconnect the gear motor cable from the cable harness.

7.5.2 Remove three of the four cap screws and washers holding the gear motor to the drive mechanism, leaving one of the top cap screws in place.

7.5.3 Support the gear motor, and remove the remaining cap screw and washer.

7.5.4 Carefully remove the gear motor ensuring that the key remains in the keyway of the motor shaft. After removal, secure the key in the keyway with tape or other suitable means.

7.5.5 If both gear motors are to be removed, repeat steps 7.5.1 through 7.5.4.

7.5.6 If the gear motor(s) are not to be replaced immediately, cover the hole(s) with a waterproof cover and hold in place with tape or other suitable means.

## 7.6 Replacement

**CAUTION:** The gear motor with part number 40E5005132712-019 is the elevation gear motor and is installed on the right-hand mounting bracket of the drive mechanism. Ref. Fig. III-7-1. The gear mechanism with part number 40E5005132712-020 is the azimuth gear motor and is installed on the left-hand mounting bracket of the drive mechanism.

7.6.1 Remove the gear motor from its package, and locate the key and gasket.

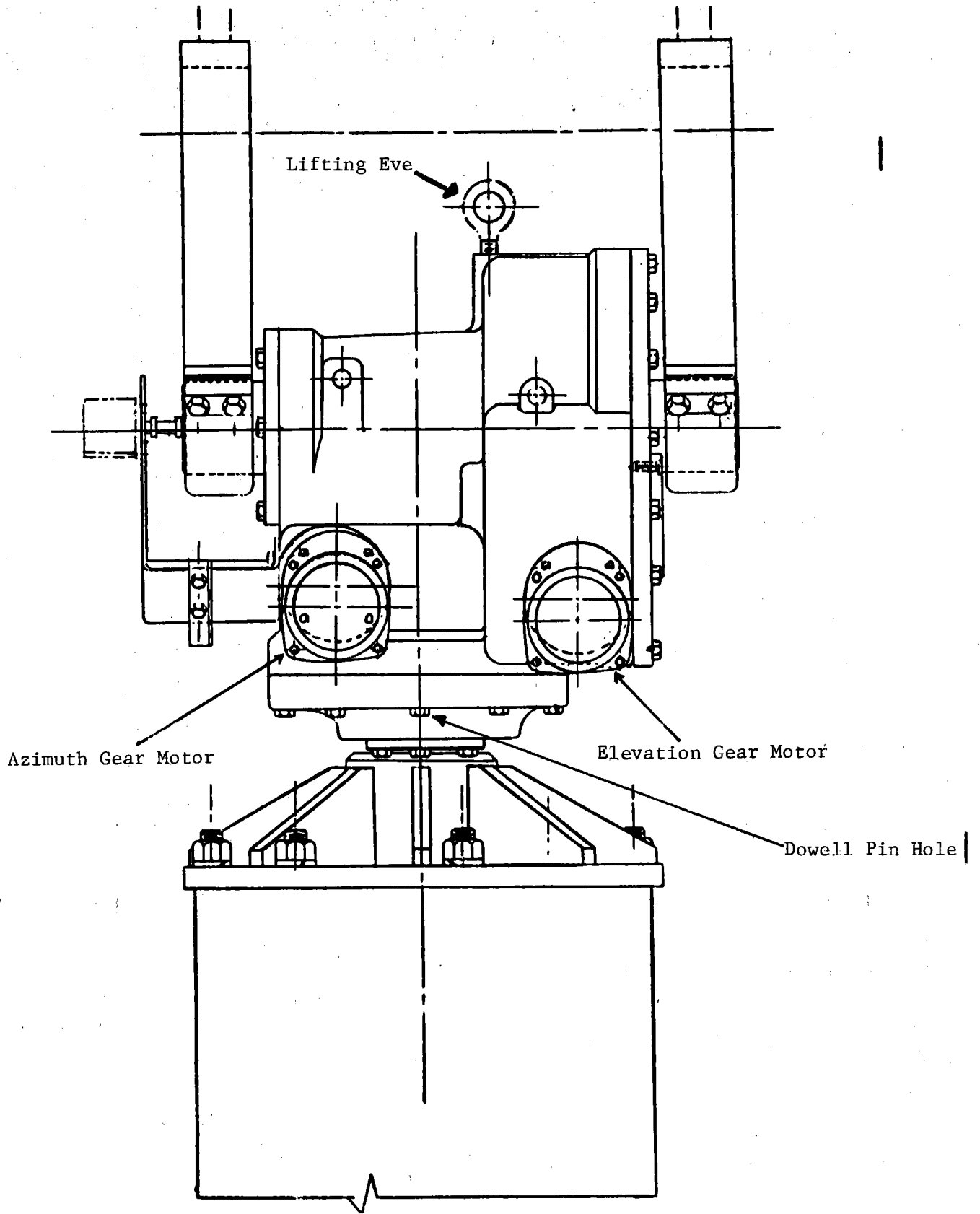


FIGURE III-7-1 Azimuth and Elevation Gear Motor Locations

7.6.2 Check the gear motor for obvious physical damage.

WARNING: Cautions and warnings printed on the container for the cleaning solvent and adhesive shall be observed.

7.6.3 Clean the motor drive shaft and key with an approved cleaning solvent and a rag. Wipe parts dry with a clean rag.

7.6.4 Apply one or two drops of adhesive to the bottom of the keyway and install the key in the keyway at a maximum of 1/8 inch from the end of the drive shaft. Hold the key in place for approximately 30 seconds to allow the adhesive to set.

7.6.5 Remove any excess adhesive which might be on the exterior of the drive shaft.

7.6.6 Place the gasket on the mating surface of the gear motor. Position the gear motor at the coupling position on the drive mechanism.

7.6.7 Align the key on the gear motor drive shaft with the keyway in the drive mechanism.

7.6.8 Slide the gear motor into position and rotate it to align the mounting holes in the gear motor housing with the holes in the drive mechanism mounting plate.

7.6.9 Install two 1/4-28 UNC x 1 1/4 inch cap screws and washers through the drive mechanism mounting flange, upper and lower locations on the left side of the motor, to secure the gear motor to the drive mechanism. Tighten the cap screws snug plus 1/3 turn.

7.6.10 Install two 1/4-28 UNC x 1 1/4 inch cap screws through the cable bracket, part no. 40M5005132727-016, and then through two 1/4 flat washers and the mounting flange on the right side of the gear motor to secure the gear motor to the drive mechanism. Tighten the cap screws snug plus 1/3 turn.

7.6.11 If the other gear motor is to be installed, repeat steps 7.6.1 through 7.6.10.

7.6.12 Reconnect the electrical cable.

8.0 ENCODER ASSEMBLIES

8.1 Safety Equipment

8.1.1 Safety sunglasses, American Optical Calobar Super Armour Plate lenses of 2.5 minimum shade, or equivalent as needed.

8.1.2 Hard hats.

8.2 Safety Procedures

8.2.1 Assure that all power is removed from the heliostat assembly prior to the start of this operation.

8.2.2 All weight limitations, operating instructions, and restrictions established for the mobile work platform shall be observed during all operations.

8.3 Equipment and Tools

8.3.1 Mobile work platform with 1,000 lb. capacity, Fabtek.

8.3.2 Motor drive tool, part number 40E5005132784-019.

8.3.3 Hand tool kits.

8.3.4 Zero Set Indicator Test Tool, 40E5005132782-040.

8.3.5 .375, .125, and .015" shims (TA-6).

8.4 Applicable Documents

8.5 Removal of Elevation Encoder (Ref. Fig. III-8-1)

WARNING: Place the circuit breaker in the heliostat power box to the OFF position.

8.5.1 Disconnect the cable from the encoder cable connector.

8.5.2 Loosen the two set screws on the encoder coupler.

8.5.3 Remove the four bolts and nuts and washers holding the encoder to the mounting bracket.

8.5.4 Carefully slide the encoder shaft from the coupler and place the defective encoder on a padded surface or in a padded container.

8.6 Replacement of Elevation Encoder

8.6.1 Elevation Encoder/Limit Switch Subassemblies

8.6.1.1 Slip one coupler (FC-16) on shaft of encoder--do not tighten set screws.

8.6.1.2 Install elevation encoder to the bracket assembly (40M5005132727-021), sliding encoder coupler (FC-16) on drive mechanism shaft.

8.6.1.3 Hold encoder in position and place four #10-24 x 5/8 filister head screws with four #10 flat washers through the encoder and into the bracket, then one #10-24 UNC hex nut on each screw. Tighten snug only. If necessary adjust position of bracket assembly, by loosening bracket mounting screws and aligning the encoder/bracket assembly for least amount of coupler deflection. Tighten all mounting bolts.

8.6.2 "Zero Set" the elevation encoder.

NOTE: Verify that the control arms of the drive mechanism are at stow (64 degrees). Check by placing a level protractor on the Control Arm/Elevator Beam Interface surface. Adjust if necessary using the motor drive tool to drive the elevation drive motor.

- 8.6.2.1 Insert the .375 (TA-19) shim between the encoder housing and the FC-16 coupling. Slide the coupling towards the encoder until the coupling is tight against the shim. Tighten the (2) set screws of the coupling--encoder shaft side--securing the coupler to the encoder shaft. Remove the shim.
- 8.6.2.2 Connect the zero set indicator tool's connector to the encoder. Turn the zero set indicator power switch to the ON position and the selector switch to "Encoder Position."
- 8.6.2.3 Slide the encoder coupler (FC-16) towards the limit switch bracket (M028); slip the tooling aid shim (TA-6) between the 1/2" flat washer and the limit switch bracket. Slide the encoder coupler towards the washer until the coupler is tight against the washer and limit switch bracket.
- 8.6.2.4 Manually rotate the encoder two revolutions to assure that the encoder has passed through mechanical "zero" position. Manually rotate the encoder shaft/coupler while watching the console zero set readout. Continue rotating until the zero set readout indicates  $0125 \pm 5$ .
- 8.6.2.5 Lock the set screws on the elevation drive side of the coupler. Try not to move the encoder position while tightening.
- 8.6.2.6 Check the zero set readout to determine that it still indicates the correct setting. Reset if necessary.
- 8.6.2.7 Turn zero set indicator off, and disconnect from encoder. Remove the tooling aid shim (TA-6).
- 8.7 Removal of Azimuth Encoder (Ref. Fig. III-8-1)

**WARNING:** Place the circuit breaker in the Heliostat Power Box  
in the OFF position.

- 8.7.1 Remove the three-inch plastic plug located above the small access panel on the pedestal. This allows observation of work being performed inside the pedestal.

8.7.2 Remove the small access panel on the pedestal.

NOTE: Verify that heliostat is in azimuth stow. i.e. Dowel pin lined up with "E" on adapter plate. Ref. Fig. III-7-1.

8.7.3 Disconnect the cable from the encoder cable connector and limit switches.

8.7.4 Loosen the two upper set screws on the encoder coupler.

8.7.5 Remove the two bolts, nuts and washers holding the encoder mounting bracket to the drive adapter.

8.7.6 Carefully remove the encoder shaft from the azimuth shaft and place the defective encoder subassembly on a padded surface or in a padded container.

#### 8.8 Replacement of Azimuth Encoder

NOTE: Omit steps that have been previously performed. Verify that heliostat is in azimuth stow. i.e. Dowel pin lined up with "E" on adapter plate. Ref. Fig. III-7-1.

##### 8.8.1 Azimuth Encoder/Limit Switch Subassemblies.

8.8.1.1 Install azimuth encoder (40E5001132713-019) on outside of bracket of 40M5005132727-M026 assembly. Use four filister head #10-24 x 5/8" screws, four #10-24 nuts. The filister head screws should go through the bracket, then through the encoder and nuts installed. Tighten four screws and nuts finger-tight.

8.8.1.2 Place one arm assembly (40M5005132727-020) on encoder shaft. Do not tighten set screw.

8.8.1.3 Place one arm (40M5005132727-023) on encoder shaft.

8.8.1.4 Place one coupling (FC-16) on end of encoder shaft; do not tighten set screws.

8.8.1.5 Place .025 shim between encoder and arm assembly. Move FC-16 coupling toward arms and tighten set screws on encoder shaft only.

NOTE: Use .140 shim when M026 assembly uses stainless steel springs.

8.8.1.6 Install azimuth switch assembly (40E5005132739-010) into azimuth limit switch clips on M026 assembly.

- 8.8.1.7 Glass limit switch must be mounted with green-lettered "UP" in the up position, and cabling must run back across bracket.
- 8.8.1.8 Install tinnerman wire clips by sliding onto bracket of M026 assembly. Slip wire into clips. Check by swinging long arm around to ensure that it clears wires.
- 8.8.2 Attach azimuth bracket/encoder assembly.
- 8.8.2.1 Place two 3/8"-16 x 1-1/2" capscrews through the pedestal adapter from the top with one 3/8" flat washer under each capscrew head.
- 8.8.2.2 Install bracket-encoder assembly against bottom of pedestal adapter and onto protruding capscrews; take care to slip FC-16 coupler onto shaft at bottom of azimuth drive shaft. Align encoder/bracket assembly to minimize coupling misalignment, moving encoder on bracket as required to effect alignment.
- 8.8.2.3 Place one flat washer and one 3/8"-16 hex nut on each capscrew and tighten snug plus 1/3 turn.
- 8.8.2.4 Secure encoder by tightening #10-24 screws to tight plus 1/3 turn.
- 8.8.2.5 Do not tighten set screws in FC-16 coupling to drive mechanism azimuth encoder shaft.
- 8.8.3 "Zero Set" the azimuth encoder.
- 8.8.3.1 NOTE: Verify heliostat is in azimuth stow position. Connect the zero set indicator tool to the encoder. Turn the zero set indicator power switch to the ON position and the selector switch to the "Encoder Position."
- 8.8.3.2 Manually rotate the encoder shaft two revolutions to assure that the encoder has passed through mechanical "zero" position. Manually rotate the encoder shaft/coupler while watching the console zero set readout. Continue rotating until the zero set readout indicates 0125 + 5 digits.



- 8.8.3.3 Lock the set screws (2) on the azimuth drive side of the coupler. Try not to move the encoder position while tightening.
- 8.8.3.4 Check the zero set readout to determine that it still indicates the correct setting. Reset if necessary.
- 8.8.3.5 Turn zero set indicator off, and disconnect from the encoder.
- 8.8.4 Set the orientation of the azimuth limit switch arm (40M5005132727-023) and arm assembly (40M5005132727-020).
  - 8.8.4.1 The arm should be oriented so the long end points toward "E" index marker.
  - 8.8.4.2 The arm assembly should have the set screw pointing approximately "E", and the pin end should be approximately equidistant between the limit switches.
  - 8.8.4.3 Place a .015 shim between the arm assembly and encoder housing, and tighten the set screw. Remove the shim.

NOTE: Use .125 shim when M026 assembly uses stainless steel springs.

## 9.0 LIMIT SWITCH ASSEMBLY

### 9.1 Safety Equipment

- 9.1.1 Sunglasses, American Optical Calobar Super Armour Plate lenses of 2.5 minimum shade, or equivalent as needed.
- 9.1.2 Hard hats.

### 9.2 Safety Procedures

- 9.2.1 Assure that all power is removed from the heliostat assembly prior to the start of this operation.
- 9.2.2 All weight limitations, operating instructions, and restrictions established for the mobile work platform shall be observed during all operations.

### 9.3 Equipment and Tools

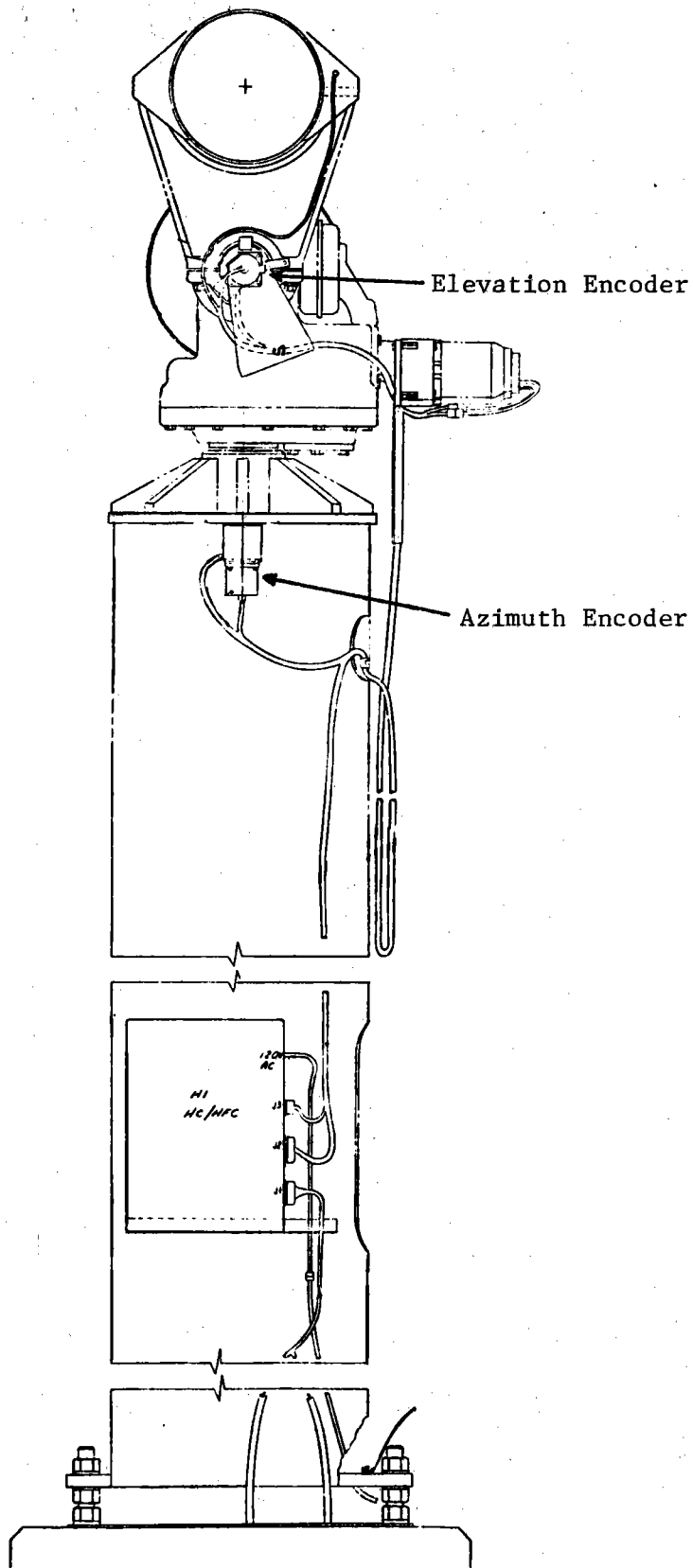


FIGURE III-8-1 Azimuth and Elevation Encoder Locations

9.3.1 Mobile work platform with 1,000 lb. capacity, Fabtek.

9.3.2 Hand tool kits.

9.3.3 Manual control box, tool number 40E5005132783.

9.4 Applicable Documents

9.4.1 Drive Mechanism Assembly, 40E5005132721.

9.5 Removal

9.5.1 Elevation Limit Switches.

WARNING: Place the circuit breaker in the heliostat power box to the "OFF" position.

9.5.1.1 Position the mobile work platform so the limit switches may be reached.

9.5.1.2 Disconnect the cable harness cable from the limit switch.

WARNING: Extreme care shall be taken when handling limit switches to assure the glass containers are not broken. The limit switches contain mercury, which is a heavy metal, and its ingestion may cause serious health problems.

9.5.1.3 Carefully slide the limit switch from its holder. Discard the defective limit switch in a suitable container.

9.5.1.4 If the other elevation limit switch is to be replaced, repeat steps 9.5.1.3 and 9.5.1.4.

9.5.2 Azimuth limit switches.

WARNING: Place the circuit breaker in the heliostat power box to the "OFF" position.

9.5.2.1 Position the mobile work platform so that the limit switches may be reached.

9.5.2.2 Disconnect the cable harness cable from the limit switch.

WARNING: Extreme care shall be taken when handling limit switches to assure that the glass containers are not broken. The limit switches contain mercury, which is a heavy metal, and its ingestion may cause serious health problems.

9.5.2.3 Carefully slide the limit switch from its holder. Discard the defective limit switch in a suitable container.

9.5.2.4 If the other limit switch is to be replaced, repeat steps 9.5.2.3 and 9.5.2.4.

## 9.6 Replacement

9.6.1 Elevation limit switches.

WARNING: Place the circuit breaker in the heliostat power box to the "OFF" position.

WARNING: All weight limitations, operating instructions, and restrictions established for the mobile work platform shall be observed during all operations.

9.6.1.1 Position the mobile work platform so the limit switches may be reached.

WARNING: Extreme care shall be taken when handling limit switches to assure that the glass containers are not broken. The limit switches contain mercury, which is a heavy metal, and its ingestion may cause serious health problems.

9.6.1.2 Carefully slide the replacement limit switch into the holder.

The manufacturer's green "UP" must be rotated to the "UP" position with the limit switch stamped in black ink "DW" on the top with the cable to the left, and the limit switch stamped in black ink "UP" on the bottom with the cabling to the right.

9.6.1.3 Connect the cable harness cable to the limit switch assembly.

9.6.2 Azimuth limit switches.

WARNING: Place the circuit breaker in the heliostat power box in the "OFF" position.

WARNING: All weight limitations, operating instructions, and restrictions established for the mobile work platform shall be observed during all operations.

9.6.2.1 Position the mobile work platform so that the limit switches may be reached.

WARNING: Extreme care shall be taken when handling limit switches to assure the glass containers are not broken. The limit switches contain mercury, which is a heavy metal, and its ingestion may cause serious health problems.

9.6.2.2 Carefully slide the replacement limit switch into the holder. The manufacturer's green "UP" must be rotated to the UP position. The limit switch stamped in black in "CCW" must be to the right when facing the east, "E", indicator.

9.6.2.3 Install two tinnerman wire clips by sliding them onto the encoder bracker, and then slip the wires into the clips. Check the wire clearance by swinging the top arm around to ensure it will clear the wires.

9.6.2.4 Connect the cable harness cable to the limit switch assembly.

9.7 Verification of Limit Switch Operation

CAUTION: Do not connect the Manual Control Box to the heliostat with power applied to the HC/HFC.

9.7.1 Verify that the circuit breaker in the heliostat power box is in the OFF position.

- 9.7.2 Connect the cable to the Manual Control Box.
- 9.7.3 Disconnect P1 and J1 from the HC/HFC.
- 9.7.4 Connect the Manual Control Box cables to P1 and J1 of the HC/HFC.
- 9.7.5 Place the circuit breaker in the Heliostat Power Box to the ON position.

CAUTION: Extreme care shall be taken when driving the heliostat as it nears the point where the Limit Switches will be activated. The heliostat shall be operated in the LOW SPEED mode as it nears the point at which the Limit Switch should activate.

- 9.7.6 Drive the heliostat in each direction until the Limit Switch(es) activate.
- 9.7.7 After all Limit Switches have been tested, return the heliostat to the STOW position.
- 9.7.8 Place the circuit breaker in the Heliostat Power Box to the OFF position.
- 9.7.9 Disconnect the Manual Control Box cables from the HC/HFC and the Manual Control Box.
- 9.7.10 Connect J1 and P1 of the Cable Harness to the HC/HFC.
- 9.7.11 Place the circuit breaker in the Heliostat Power Box to the ON position.

## 10.0 HELIOSTAT FIELD CONTROLLER (HFC)/HELIOSTAT CONTROLLER (HC)

### 10.1 Safety Equipment

- 10.1.1 Sunglasses, American Optical Calobar Super Armour Plate lenses of 2.5 minimum shade, or equivalent as needed.
- 10.1.2 Hard hats.

### 10.2 Safety Procedures

- 10.2.1 All power shall be removed from the heliostat prior to the start of this operation.

10.3 Equipment and Tools

10.3.1 Hand tool kits.

10.3.2 Stimulator, tool number 40E5005132775.

10.4 Applicable Documents

10.4.1 Heliostat Control - HC and Heliostat Field Control - HFC Drawing  
40E5005132740.

10.4.2 Stimulator Operator's Manual MCR-80-1376.

10.5 Removal

WARNING: Place the circuit breaker in the heliostat power box  
to the "OFF" position.

10.5.1 Remove the large access panel on the pedestal.

10.5.2 Disconnect the HFC/HC power cable.

10.5.3 Disconnect the cables J1, J2, and J3 from the cable connectors on  
the HFC/HC.

10.5.4 Carefully remove the HFC/HC from the pedestal, and place it on a  
padded surface.

10.6 Replacement

WARNING: Verify all power to the heliostat is OFF.

CAUTION: Verify whether the replacement is to be an HC or HFC.

10.6.1 Verify the single address switch is set properly for an HC, or  
that both address switches are set properly for an HFC/HC unit.

10.6.1.1 If address must be changed, remove the HFC PCB in accordance with  
step 11.4.3.2 of this manual.

10.6.1.2 Change the address in the DIP switches in accordance with step  
11.4.1.1 and step 11.4.2.1.

10.6.1.3 Perform stimulator check in accordance with step 11.4.3 of this  
manual.

- 10.6.2 Carefully place the HC or the HFC in the pedestal on the mounting bracket.
- 10.6.3 Connect the cables to J1, J2 and J3 connectors of the HC or HFC.
- 10.6.4 Connect the HC/HFC power cord to the heliostat power box.
- 10.6.5 Turn on power.
- 10.6.6 Perform a functional check to the HC/HFC in accordance with the Stimulator Checkout Procedure. Step 11.4.3 through 11.4.3.13 of this manual.
- 10.6.7 Replace the large access panel on the pedestal.
- 10.6.8 Return failed HC/HFC to the Electronic shop for repair.
- 10.7 HC/HFC Repair

NOTE: The Stimulator Checkout Procedure is the first step in troubleshooting the HC/HFC. Perform steps 11.4.3 through 11.4.3.13, of this manual. The stimulator will provide the area of the malfunction and standard troubleshooting techniques applied to isolate the component.

Refer to;

- a. Section 10.7.1 for Mechanical Relay Replacement
- b. " 10.8.0 " Power Supply Replacement
- c. " 10.9.0 " Transformer Replacement
- d. " 11.3.3 " HFC PCB Removal
- e. " 11.4.2 " HFC PCB Replacement
- f. " 11.3.4 " HC PCB Removal
- g. " 11.4.1 " HC PCB Replacement

- 10.7.1 Perform mechanical relay failure and replacement.
- 10.7.2 Since the mechanical relays are more susceptible to failure than the electronic components, an attempt to trace the failure to the mechanical relay, using the stimulator checkout and acceptable troubleshooting procedures, should be made.



- 10.7.3 Slide retaining clip off the relay and pull straight up. Discard defective relay or retain for shipment to vendor.
- 10.7.4 Align relay pins with the PCB receptacles and push down until fully seated. Slide retaining clip over the relay and center it on the top of the relay.
- 10.7.5 Perform stimulator check, in accordance with step 11.4.3 of this manual.
- 10.8 Model SLC 5-5 Power Supply Replacement
- 10.8.1 When ordering a replacement power supply, ceramic IC's should be specified. Use of the plastic IC often supplied with a new power supply may result in problems when cold weather is encountered.
- 10.8.2 Remove J3 connector by removing the four retaining screws. Push the connector through the box and lay it on the PCB.

- 10.8.3 Push the power cord plastic retaining plug from the inside of the box until it is free of the box.
- 10.8.4 Remove the four screws holding the complete electronics assembly in the HFC/HC.
- 10.8.5 Carefully raise the electronics assembly while feeding the power cord through the box. Raise sufficiently to unplug the J1A and J2A connectors from the HC PCB.
- 10.8.6 Carefully remove the electronics assembly from the HFC/HC and place on a padded surface. Feed the power cord through the box.
- 10.8.7 Turn the electronics assembly on the side to allow access to the two power supply mounting screws. Remove the mounting screws and move the power supply sufficiently to allow installation of the new power supplies.
- 10.8.8 Position the new power supply on the counting board and install the two mounting screws.
- 10.8.9 Position the old power supply by the new one. Disconnect the wires from the old power supply, one at a time and install on the proper connector on the new power supply.
- 10.8.10 Position the electronics assembly over the HFC/HC box and connect the ribbon cable connectors to J1A and J2A of the HC PCB.
- 10.8.11 Carefully insert the electronics assembly into the HFC/HC box while feeding the power cable through the box.
- 10.8.12 Align the mounting holes of the board with the mounting holes of the HFC/HC box and install the four mounting screws.
- 10.8.13 Allow sufficient slack in the power cable and push the plastic retainer into the HFC/HC.
- 10.8.14 Insert connector J3 through the HFC/HC box and align it so the keyway points left. Install the four retaining screws and tighten securely.
- 10.8.15 Perform stimulator check in accordance with step 11.4.3 of this manual.
- 10.9 Transformer 241-7-1383 Replacement
- 10.9.1 Remove the two retaining screws holding the transformer to the

board. Move the transformer sufficiently to allow installation of the new transformer.

10.9.2 Align the mounting holes of the new transformer with the mounting holes on the board. Install the two retaining screws.

10.9.3 Remove the wires from the old transformer, one at a time and install on the same posts on the new transformer.

10.9.4 Perform a stimulator check in accordance with step 11.4.3 of this manual.

#### 10.10 Transformer TA2898200 Replacement

10.10.1 Remove the electronics assembly from the HFC/HC box in accordance with steps 10.8.2 through 10.8.6.

10.10.2 Remove the transformer from the board by removing the retaining clips from the mounting posts. Move the transformer sufficiently to allow installation of the new transformer.

10.10.3 Align the mounting holes of the new transformer with the mounting holes of the board. Install the mounting posts through the transformer and through the board. Push the retaining clips over the posts and against the board so the transformer is held securely.

10.10.4 Position the old transformer by the new one. Disconnect the wires from the old transformer, one at a time and install on the new transformer on the proper connector.

10.10.5 Reinstall the electronics assembly in the HFC/HC in accordance with steps 10.8.10 through 10.8.14.

10.10.6 Perform stimulator check in accordance with step 11.4.3 of this manual.

#### 11.0 PRINTED CIRCUIT BOARD (PCB)

11.1 Equipment and Tools

11.1.1 Stimulator, tool no. 40E5005132775.

11.1.2 Hand tool kits.

11.2 Applicable Documents

11.2.1 Heliostat Control - HC, Heliostat Field Control - HFC Drawing, 40E5005132740.

11.2.2 Stimulator Operator's Manual, MCR-80-1376.

11.2.3 Martin Marietta Corporation Electrical Schematic, 40E5005132747 and -48.

11.3 Removal

WARNING: All electrical power to the HFC/HC shall be turned off prior to the start of this operation.

11.3.1 Open the cover of the HFC/HC.

11.3.2 HFC PCB Removal.

CAUTION: Extreme care shall be taken when removing the PCB's as damage will occur if the boards are bent or twisted.

11.3.3.1 Disconnect the connector from the HC to HFC cable.

11.3.3.2 Disconnect the wires from connectors E-1 through E-5 by carefully sliding the connectors up and off the posts.

11.3.3.3 Squeeze the tops of the PCB mounting posts and gently remove the PCB. There are four mounting posts for the HFC PCB.

11.3.3.4 Carefully remove the HFC PCB from the HFC box and place it on a protected surface or in a suitable container.

11.3.4 HC PCB removal.

CAUTION: Extreme care shall be taken when removing PCB's as damage will occur if the boards are bent or twisted.

- 11.3.4.1 If installed, the HFC PCB shall be removed as described in step 11.3.2 and placed on a protected surface to assure no damage occurs.
- 11.3.4.2 Disconnect the ribbon cable connectors from J1A and J2A.
- 11.3.4.3 Disconnect connector cable from J3A.
- 11.3.4.4 Disconnect the wires from connectors E-1 through E-18 by carefully sliding the connectors up and off the posts.
- 11.3.4.5 Squeeze the tops of the PCB mounting posts and gently remove the PCB.
- 11.3.4.6 Carefully remove the HC PCB from the HFC/HC box and place it on a protected surface or in a suitable container.

11.4 Replacement

NOTE: If both PCB's are to be replaced in an HFC, the HC PCB must be installed first.

11.4.1 HC PCB Replacement.

WARNING: All electrical power to the HC shall be turned OFF prior to the start of this operation.

**CAUTION:** Extreme care shall be taken when replacing the PCB's as damage will occur if the boards are bent or twisted.

11.4.1.1 Verify the proper address has been entered on the HC PCB. If the address has not been set or is incorrect, proceed as follows. The address in the new board must be the same as on the PCB being replaced.

**NOTE:** The dip switch has five switches marked 1-5 with OFF and ON positions. Switches 1, 2, 3, 4 and 5 have a value of 1, 2, 4, 8 and 16 respectively. The ON position value is 0 and the OFF position value is the value of the position.

**EXAMPLES:**

1. Switches 1, 3 and 5 are OFF. Switches 2 and 4 are ON. The dip switch would be set to 21.  $1 + 0 + 4 + 0 + 16 = 21$ .
2. All switches are OFF. The dip switch would be set to 31.  $1 + 2 + 4 + 8 + 16 = 31$ .
3. All switches are ON. The dip switch would be set to 0.  $0 + 0 + 0 + 0 + 0 = 0$ .

**CAUTION:** All switch settings must be made while the HFC or HC is on the table so the door where opened, is on the left of the HFC or HC. This orients the dip switch properly to allow the address to be set from left to right.

- 11.4.1.1.1 Remove the protective cover from the dip switch.
- 11.4.1.1.2 Set the proper address into the dip switch using an awl or other suitable device.
- 11.4.1.2 Carefully place the HC PCB on top of the mounting posts. Assure that all mounting posts have been started through the proper mounting hole in the HC PCB.
- 11.4.1.3 Gently push the PCB over each mounting post until it is fully seated.
- 11.4.1.4 Connect the ribbon cables to J1A and J2A.
- 11.4.1.5 Follow the schematic and connect the proper wires to connectors E-1 through E-18 by carefully sliding the connector over the post. Assure that all wires are fully seated on the posts.

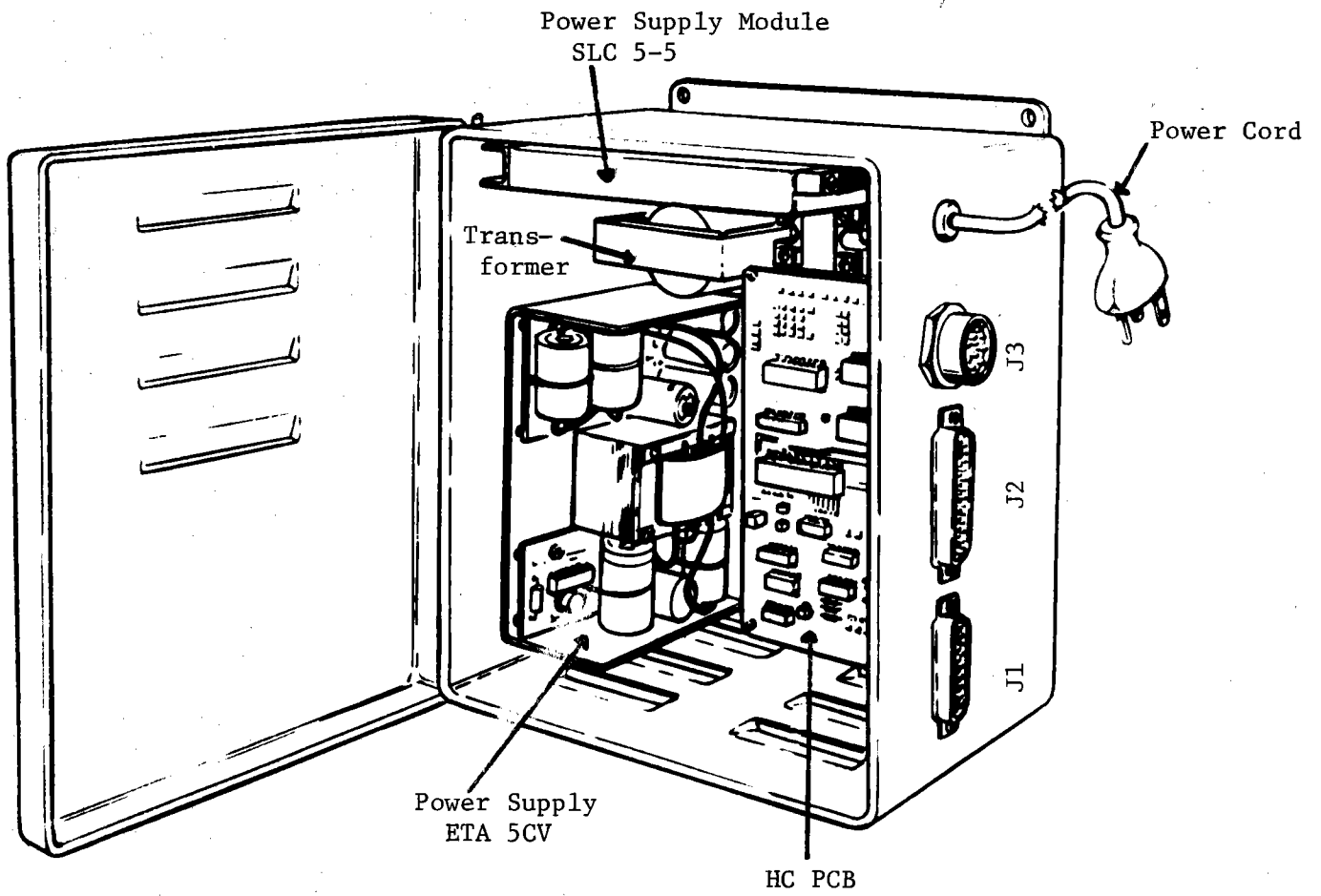


FIGURE III-11-1 HFC/HC Printed Circuit Boards in Place

11.4.1.6 If the HFC PCB is to be installed, proceed to step 11.4.2.

11.4.1.7 Perform a stimulator checkout of the HC in accordance with step 11.4.3.

11.4.2 HFC PCB replacement.

**WARNING:** All electrical power to the HFC shall be turned OFF prior to the start of this operation.

11.4.2.1 Verify the proper address has been entered on the HFC PCB dip switch. If the address has not been entered or is incorrect, proceed as follows. The address in the new board must be the same as on the PCB being replaced.

**NOTE:** The dip switch has five switches marked 5-1 with ON and OFF positions. Switches 5, 4, 3, 2 and 1 have a value of 1, 2, 4, 8 and 16 respectively. The ON position value is 0 and the OFF position value is the value of that position.

**EXAMPLE:**

1. Switches 5, 3, 4 & 1 are ON, switches 4 and 2 are OFF. The dip switch would be set  $21. 16 + 0 + 4 + 0 + 1 = 21.$
2. Switches 5 through 1 are ON. The dip switch would be set to  $31. 16 + 8 + 4 + 2 + 1 = 31.$
3. All switches are OFF. The dip switch would be set to  $0. 0 + 0 + 0 + 0 + 0 = 0.$

**CAUTION:** All switch settings must be made while the HFC or HC is on the table so the door, when opened is on the left of the HFC or HC. This orients the dip switch properly to allow the address to be set from left to right.

11.4.2.1.1 Remove the protective cover from the DIP switch.



- 11.4.2.1.2 Set the proper address into the dip switch using an awl or other suitable device.
- 11.4.2.2 Carefully place the HFC PCB on top of the mounting posts. Assure that all mounting posts have been started through the proper mounting hole in the HFC PCB.
- 11.4.2.3 Gently push the PCB over each mounting post until it is fully seated.
- 11.4.2.4 Connect the HC to HFC connector to the HFC PCB.
- 11.4.2.5 Follow the schematic and connect the proper wires to connectors E-1 through E-5 by carefully sliding the connector over the post. Assure that all wires are fully seated on the posts.

#### 11.4.3 Stimulator check.

CAUTION: The stimulator power must be turned ON before power is applied to the HFC/HC and must not be turned OFF until power to the HFC/HC has been removed.

- 11.4.3.1 On a 110 VAC electric outlet having an ON-OFF switch, place the switch to the OFF position. Connect the HFC/HC power cable to the outlet.
- 11.4.3.2 Connect the stimulator to 110 VAC electrical outlet.
- 11.4.3.3 Connect stimulator cables to J1 and J2 connectors on the HFC/HC. Close the HFC/HC cover and tighten the cover screws.
- 11.4.3.4 Turn the stimulator power switch to ON. The stimulator printer will print HELIOSTAT STIMULATOR .... and then READY.
- 11.4.3.5 Apply power to the HFC/HC by placing the electrical outlet ON-OFF switch to the ON position.
- 11.4.3.6 Type in HCA and depress return key. The HC responding number will be 1 more than the address entered into the dip switch.
- 11.4.3.7 After 5 minutes, the printer will print TEST COMPLETE.
- 11.4.3.8 If test aborts, remove power to the HFC/HC and reverify all connections inside the box. Repeat the test starting at step 11.4.3.4
- 11.4.3.9 If the box is an HFC, type in HFCA and depress return key. The HFC responding number will be 1 more than the address entered into the dip switch.

- 11.4.3.10 After 16 minutes, the printer will print TEST COMPLETE.
- 11.4.3.11 If the test aborts, remove power from the HFC/HC and reverify all connections inside the box. Repeat the test starting at step 11.4.3.9.
- 11.4.3.12 Remove power from the HFC/HC by turning the electrical outlet ON-OFF switch to the OFF position. Disconnect the HFC/HC power cable from the electrical outlet.
- 11.4.3.13 Turn the stimulator power switch to the OFF position. Disconnect the cable from the HFC/HC.

12.0 CABLE HARNESS (Ref. Fig. III-12-1)

12.1 Safety Equipment

12.1.1 Safety sunglasses, American Optical Calobar Super Armour Plate lenses with 2.5 minimum shade, or equivalent as needed.

12.1.2 Hard hats.

12.2 Safety Procedure

12.2.1 All power to the heliostat shall be turned off prior to the start of this operation.

12.2.2 All weight limitations, operating procedures and restrictions established for the mobile work platform shall be observed during all operations.

12.3 Equipment and Tools

12.3.1 Mobile work platform with 1,000 lb capacity, Fabtek.

12.3.2 Stimulator, tool no. 40E5005132775.

12.3.3 Hand tool kits.

12.4 Applicable Documents

12.4.1 Martin Marietta Corporation Electrical Installation, 40E5005132735.

12.4.2 Martin Marietta Corporation Electrical Schematic, 40E5005132739.

12.4.3 Stimulator Checkout Procedure.

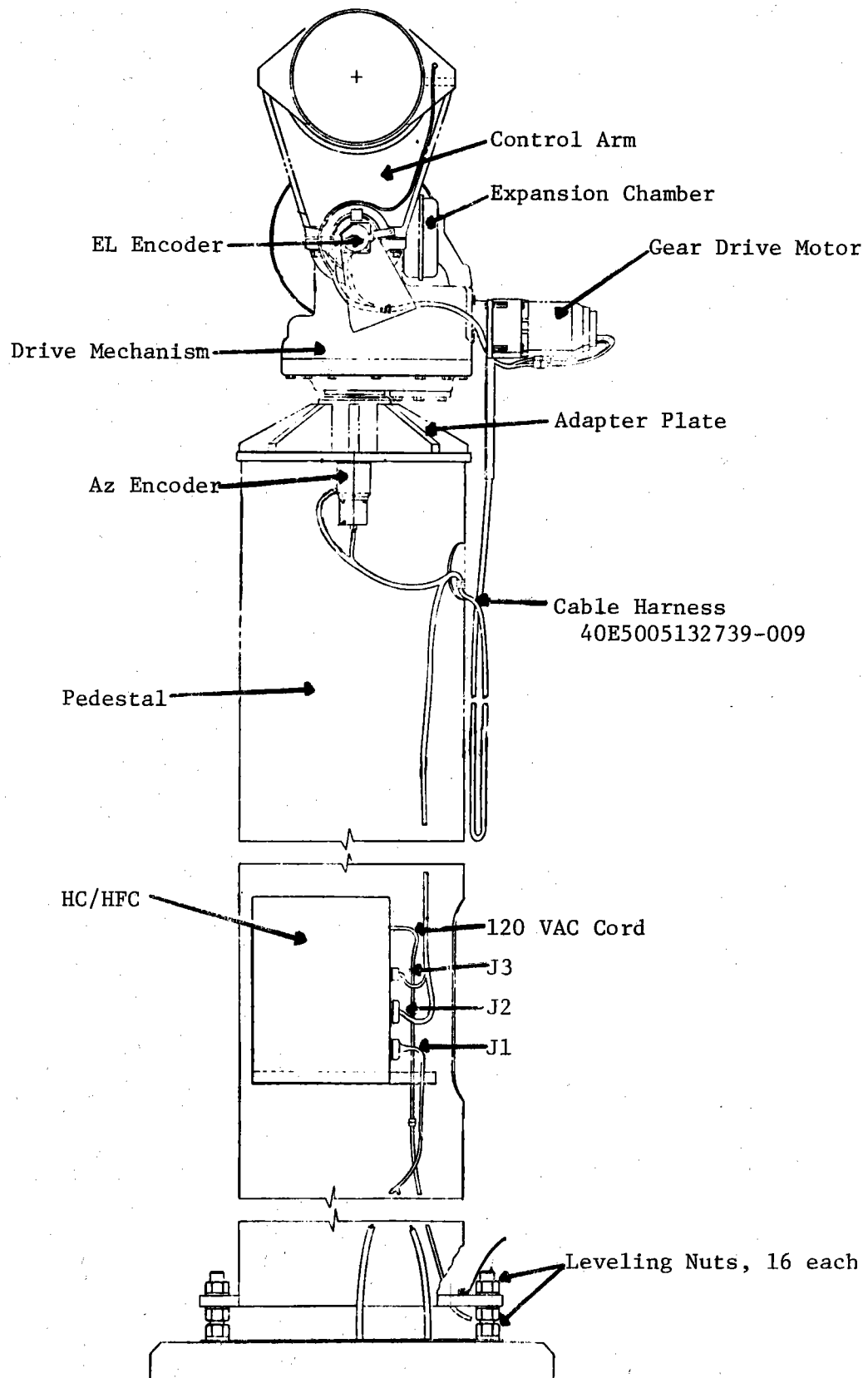


FIGURE III-12-1 Cable Harness in Place

12.5 Removal

WARNING: All electrical power to the heliostat shall be turned OFF prior to the start of this operation.

WARNING: All weight limitations, operating instructions and restrictions established for the mobile work platform shall be observed during all operations.

- 12.5.1 Position the mobile work platform so the cable harness may be reached.
- 12.5.2 Remove both access panels and the 3 inch plastic plug from the pedestal.
- 12.5.3 Disconnect P2 and P3 connectors from the HFC/HC.
- 12.5.4 Disconnect the cables from the azimuth encoder and the azimuth limit switch assembly.
- 12.5.5 Remove the cable harness from the pedestal and protect the connectors with Cannon plug dust covers or other suitable means. A plastic bag may be used if it is taped securely so moisture and other foreign matter cannot reach the connector.
- 12.5.6 Remove the  $\frac{1}{4}$ -20 UNC hex nut and flat washer from the grounding stud on the reflective assembly. Remove the ground wire and replace the  $\frac{1}{4}$ -20 UNC hex nut and washer.
- 12.5.7 Disconnect the cable harness pigtail from the elevation encoder. Protect the connector with a Cannon plug dust cover or other suitable means.
- 12.5.8 Remove the  $\frac{1}{4}$ -20 UNC hex nut and flat washer from the grounding stud on the drive mechanism. Remove the ground wire and replace the  $\frac{1}{4}$ -20 UNC hex nut and washer.
- 12.5.9 Disconnect the cable harness pigtails from the elevation and azimuth gear motors. Protect the connectors with Cannon plug dust covers or other suitable means.
- 12.5.10 Remove the cable clamps from the cable guide bar by removing the nuts, washers and bolts. Remove the cable from the clamps and reinstall the clamps on the cable guide bar.
- 12.5.11 Place the cable harness on a padded surface or in a suitable container.

## 12.6 Replacement

**WARNING:** All electrical power to the heliostat shall be turned OFF prior to the start of this operation.

**WARNING:** All weight limitations, operating instructions and restrictions established for the mobile work platform shall be observed during all operations.

- 12.6.1 Position the work platform so the cable harness may be connected to the connectors on the drive assembly.
- 12.6.2 Verify that the cable harness is serviceable. If not, perform a check of the cable as described starting with step 12.7.
- 12.6.3 Connect the cable harness pigtailed to elevation and azimuth gear motors.
- 12.6.4 Remove the  $\frac{1}{4}$ -20 UNC hex nut and flat washer from the drive mechanism grounding stud. Place the grounding wire over the grounding stud and install the flat washer and  $\frac{1}{4}$ -20 UNC hex nut. Tighten the nut securely.
- 12.6.5 Place the two cable clamps around the cable harness and install the clamps on the cable bracket with bolts, washers and nuts. Tighten nuts securely.
- 12.6.6 Connect the cable harness pigtail to the elevation encoder and the elevation limit switch assembly.
- 12.6.7 Remove the  $\frac{1}{4}$ -20 UNC hex nut and flat washer from the reflective assembly grounding stud. Place the grounding wire over the grounding stud and install the flat washer and  $\frac{1}{4}$ -20 UNC hex nut. Tighten the nut securely.
- 12.6.8 Measure and mark the cable harness at 64 inches from the bottom of the cable bracket attached to the drive mechanism.
- 12.6.9 Install the clamp in the access cover and secure the cable harness at the 64" mark.
- 12.6.10 Connect the cable harness pigtailed to the azimuth encoder and to the azimuth limit switch assembly.
- 12.6.11 Connect the cable harness pigtailed to J2 and J3 of HFC/HC.
- 12.6.12 Perform a stimulator check in accordance with step 11.4.3 of this manual.

12.7 Cable Harness Checkout

- 12.7.1 Using the schematic and a volt-ohm meter, perform a continuity check of the cable.

TABLE I -- MANUFACTURER/SUPPLIER ADDRESSES

ITEM	MANUFACTURER/SUPPLIER	ADDRESS	TELEPHONE
Encoder	BEI Electronics	Industrial Encoder Division 7230 Hollister Avenue Goleta, California 93017	(805) 968-0782
Gear Motors	Bodine Electric Co.	2500 W. Bradley Place Chicago, Illinois 60618	(312) 478-3515
HAC and Peripherals	Modular Computers, Inc.	501 N. Brookhurst Ave. Anaheim, California 92801	(714) 635-8461
Limit Switch Assy.	SERCORP	1104 Mercer Street Seattle, Washington 98109	(206) 225-0360
HFC and HC	Martin Marietta Corp. Denver Division	P. O. Box 179 Denver, Colorado 80201	(303) 977-3000
Cable Assemblies	SERCORP	1104 Mercer Street Seattle, Washington 98109	(206) 624-4109
Drive Mechanism	Hub City Division Safeguard	P. O. Box 1089 Aberdeen, South Dakota 57401	(605) 225-0360
Talyvel Level	Rank Precision Industries, Inc.	411 E. Jarvis Ave. Des Plaines, Illinois 60018	(312) 297-7720 Contact John Reinert

APPENDIX A - MANUFACTURER SUPPLIED SERVICE INSTRUCTIONS

1. MAX II/III/IV System Processors Non-Resident Job Control and Batch Facilities Reference Manual (210-600500-028)
2. MAX II/III/IV System Processors Source Editor Reference Manual (210-600500-018)
3. MAX IV System Processors Task/Overlay Catalogue Reference Manual (210-610500-021)
4. MAX II/III/IV System Processors Assembler Cross Reference Program Reference Manual (210-600500-024)
5. MAX IV System Processors Debug Reference Manual (210-610500-024)
6. MAX IV System Processors FORTRAN IV Reference Manual (210-610500-010)
7. MAX IV System Processors Link Editor Reference Manual (210-610500-010)
8. MAX II/III/IV System Processors Link Editor Reference Manual (210-600500-011)
9. MAX II/III/IV System Processors Link Loader Reference Manual (210-600500-010)
10. MAX II/III/IV System Processors Source Update Reference Manual (210-600500-006)
11. MAX II/III/IV Systems Processors Assemblers Reference Manual (210-600500-008)
12. MODCOMP Classic Central Processor Reference Manual (210-140000-000)



13. MAX IV Library Technical Manual (220-610400-000)
14. MAX IV General Operating System Reference Manual (210-610304-000)
15. MAX IV File Manager Users' Guide Reference Manual (210-610304-100)
16. MAX IV System Processors File Manager Volume Report Utility Reference Manual (210-610500-026)
17. MAX IV System Processors File Manager Volume Preparation Utility Reference Manual (210-610500-025)
18. MAX IV System Processors Utility Procedures Reference Manual (210-610500-007)
19. MAX IV System Processors General Information Reference Manual (210-610500-001)
20. MODCOMP Stand-Alone Support Software Reference Manual (210-602500-000)
21. MAX IV General Operating System Technical Manual (220-610304-000)
22. MAX IV Input/Output Reference Manual (210-610501-000)
23. MAX II/III/IV System Processors Binary-to-Hexadecimal Record Dump Reference Manual (210-600500-020)
24. MAX II/III/IV System Processors Direct Access Maintenance Processor Reference Manual (210-600500-015)
25. MAX II/III/IV System Processors Library Update Reference Manual (210-600500-014)
26. MODACS III Process Input/Output Subsystem Reference Manual (210-602903-000)

27. Modular Data Acquisition and Control Subsystem III (MODACS III) Technical Manual (225-200301-102)
28. Model 1908-X Integrated Communications Subsystem Technical Manual (225-200209-002)
29. MODCOMP Classic Central Processor Technical Manual (220-140000-002)
30. Peripheral Controller Interface Model 4903 Technical Manual (225-200020-002)
31. Console/Disc Controller Models 3765-XX and 3766-XX Technical Manual (225-200056-002)
32. Controller for Magnetic Tape Unit (NRZI, Dual-Word) Model 4145-1 Section 8C Technical Manual (225-200096-002)
33. Asynchronous Terminal Controller Model 4807-X Technical Manual (225-200137-002)
34. Classic Series Model 3693 Dual 32KW Solid-State Memory Technical Manual (225-200212-102)
35. Model 820 KSR Terminal Maintenance Manual (2206552-9701)
36. Operator's Manual and System Manual Model 820 KSR Terminal (2208225-9701)
37. Model 810 Printer Operating Instructions (994343-9701)
38. How to Use the 8001 CRT (no manual #)
39. Maintenance Manual - 8001 CRT (no manual #)
40. Instruction Manual Model 8120 Time Code Generator (Serial no. 1352)

41. Operating and Service Manual WWV Receiver Model WVTR Mark V  
(Manual dated 2-76)
42. Diagnostic Manual Modacs III Subsystem Model 18XX (225-  
200301-003)
43. Mod 10 Magnetic Tape Transport NRZI Operation and Maintenance  
Volumes 1 and 2 (200237-001/002)
44. Super Series (SF and ST) Magnetic Dist Drive Operation and  
Maintenance Volumes 1 and 2 (301462-001/002)
45. Modcomp Classic Central Processor Diagnostic Manual (220-140000-  
003)

STMPD-296

MARTIN MARIETTA AEROSPACE

DENVER AEROSPACE  
POST OFFICE BOX 179  
DENVER, COLORADO 80201  
TELEPHONE (303) 977-3000

May 3, 1982

Refer to: DAC-82-389

To: U. S. Department of Energy  
P. O. Box 808  
Livermore, California 94550

Attn: Roger S. Gaither, Esq.  
Assistant Chief for Prosecution  
Office of Patent Counsel, L-376

Subj: Contract DE-ACO3-80SF10539

1. Attached is the Patent Certification on the subject contract.
2. If you have any questions, please contact me at (303) 977-6109.

Very truly yours,

MARTIN MARIETTA CORPORATION

*Phillip L. DeArment*  
Phillip L. DeArment  
Assistant Patent Counsel

PLD:jes

PATENT CERTIFICATION

DOE CONTRACT NO. DE-ACO3-80SF10539

1. The following is a complete list of technical reports prepared during the course of the work under this contract and the DOE office to which the reports were sent:

See Attachment I

2. Technical data of this contract other than reports (i.e., notebooks, drawings, etc.) are completely listed, as follows:

See Attachment II

3. Each of the above-listed documents under paragraphs 1 and 2 has been examined for invention subject matter by me and/or technical personnel under my direction; to the best of my knowledge and belief, no inventions or discoveries were made or conceived in the course of or under this contract other than the following:

<u>CONTRACTOR NO.</u>	<u>TITLE</u>	<u>DATE REPORTED</u>	<u>DOE NO.</u>
Docket # 80YD41	FASTON TERMINAL INSTALLATION TOOLS	03/09/81	S-55,956, RL-8354
Docket # 81YD19	FASTON TERMINAL EXTRACTION TOOLS	05/03/82	S-59,046, RL-8843

4. There were no subcontracts or purchase orders involving research and development, except as follows:

NONE

5. The completion date of this contract is as follows: February 13, 1982

6. The following period is covered by this certification:

December 3, 1979	to	February 13, 1982
<u>Month Day Year</u>		<u>Month Day Year</u>

Martin Marietta Corporation  
Contractor Denver Aerospace  
P. O. Box 179  
Denver, Colorado 80201  
Address

Phillip L. DeArment  
Signature Phillip L. DeArment  
Assistant Patent Counsel

Title

Submit in duplicate to:

Roger S. Gaither  
Assistant Chief for Prosecution  
California Patent Group, L-376  
U. S. Department of Energy  
P. O. Box 808  
Livermore, California 94550

Form completed by: M. Frohardt  
Date: Feb 23, 1982  
M. Frohardt

Date of Certification

February 22, 1982  
Attachment I  
Patent Certification  
DOE Contract No. DE-AC03-80SF10539

1. The following is a complete list of technical reports prepared during the course of the work under this contract and the DOE office to which the reports were sent:

<u>Report Type</u>	<u>Office Mailed</u>
Monthly Submittals	Huntington Beach
Technical Status Report Issue 1 through Issue 25	Huntington Beach
Design and Manufacturing Drawings	Huntington Beach and Canoga Park
Technical Correspondence	Huntington Beach and Canoga Park
Contract Correspondence	Oakland, CA.
Deliverables	Huntington Beach and Canoga Park
Periodic Reports	Huntington Beach and Canoga Park

2. Technical data of this contract other than reports (i.e., notebooks, drawings, etc.) are completely listed, as follows:

All correspondence, reports, etc., mailed to Huntington Beach office.

Monthly submittals, Issue 1 through 25 as follows:

- a. Milestone Schedule and Status Report
- b. Cost Management Report
- c. Project Status Report
- d. Documentation Tab Run
- e. List of active changes/modifications
- f. List of drawing revisions/levels
- g. Indentured Parts List

Minority Business Reports

Updated OPDD Documentation

Controls Hardware Drawings

Software Design Specification

Safety Plan

Hazard Analysis

Preliminary Design Review Package

Preliminary Design Review Package Final

Manufacturing Plan

Quality Assurance Plan

Functional Test Plan

Functional Test Report

C/S Integrated Acceptance Test Plan

February 22, 1982  
Attachment II  
Patent Certification  
DOE Contract No. DE-AC03-80SF10539

Page Two

C/S Integrated Test Report

Supplemental Spares Plan

Two Copies of Drawings with Latest Revisions

Operational and Maintenance Manuals

Collector Subsystem Instrumentation

Maintenance Instructions

Control System Theory of Operations

Software/Firmware Design Specifications



S T M P O - 296

MARTIN MARIETTA AEROSPACE

DENVER DIVISION  
POST OFFICE BOX 179  
DENVER, COLORADO 80201  
TELEPHONE (303) 977-3000

10 November 1982

Ms. Mary Jane Holliday  
Contract Examiner  
Department of Energy  
California Patent Group  
San Francisco Operations Office  
Oakland, California 94612

Re: Final Patent Certification for DOE  
Contract DE-ACO3-80SF10539

Dear Ms. Holliday:


Pursuant to your letter of September 7, 1982, addressed to Mr. Cecil W. Duclon, I have made the corrections you requested thereon.

With respect to Invention Disclosures 81YD16, 81YD24 and 81YD25, please see our attached letters dated March 11, 1982 wherein you were notified that these inventions are not reportable. I am also attaching Mr. Carnahan's letter dated March 22, 1982.

If we can be of further assistance, please contact our office. Mr. DeArment may be reached at (303) 977-6109 and I may be reached at (303) 977-6501/6110.

Very truly yours,

MARTIN MARIETTA CORPORATION

  
(Miss) Josephine E. Salazar  
Assistant to Phillip L. DeArment  
Assistant Patent Counsel

cc: C. W. Duclon  
W. A. Brever  
J. T. Weber

STMPD-296



Department of Energy  
San Francisco Operations Office  
1333 Broadway  
Oakland, California 94612

Reply to:  
DOE Site Office  
P.O. Box 366  
Daggett, CA 92327  
ATTN: S. D. Elliott, Jr.

Melvin W. Frohardt  
Martin Marietta Aerospace  
P.O. Box 179  
Denver, CO 80201

JUN 25 1983

Subj.: Request for patent clearance and TIC Distribution of Documents from  
DOE Contracts ET21007 and SF10539 (Solar One Heliostats, Phases I & II)

Dear Mel:

We are about to come out, with the help of EPRI, with a bibliography of key Project documents. To cope with anticipated requests for copies, I would like to arrange for properly cleared documents to be filed with and distributed through the DOE Technical Information Center at Oak Ridge. A check with TIC shows that only MCR-80-1377 has been cleared by them to date. Can you provide me with signed-off Patent Clearance Requests for:

- o The five indicated documents from the Phase I study (ET21007);
- o The twelve indicated documents from Phase II (SF10539);
- o The as-built drawing set provided via Sandia at the end of Phase II;
- o Any other Project documents generated by MMC you think the utility/industry community should have ?

I'd also appreciate a check on the Phase I CDR handout; was it MCR-78-1325?

Your help is greatly appreciated; it will save me (and you) a lot of running about once the bibliography comes out. I will insure that you get a copy; it lists about 500 documents, not including drawings (these we will provide to TIC in aperture card form at a later date, with a full index). Please call me ((619) 254-2672/-2142) if you have any questions or concerns.

Sincerely yours,

S. D. Elliott, Jr.  
DOE Project Director



STMPD-296

Department of Energy  
San Francisco Operations Office  
1333 Broadway  
Oakland, California 94612

Reply to:  
DOE Site Office  
Post Office Box 366  
Daggett, CA 92327

Mr. Melvin T. Frohardt  
Martin Marietta Aerospace  
Post Office Box 179  
Denver, CO 80201

DEC 06 1983

Subj.: Closeout Actions on Martin Marietta Contracts with DOE San Francisco Operations Office

Dear Mel:

Nearly six months ago, I requested your assistance in finalizing patent clearance on a number of the documents from the Collector Phase I and Phase II contracts which we wish to enter into the DOE Technical Information Center system. Thus far, I have not had any response to this request. We are about to issue the bibliography developed by Burns & McDonnell under the EPRI-funded "Lessons Learned and Project Documentation" study (I assume you have received a copy of Vol. 1, "Lessons Learned" - if not, let me know and I will send you one), and we and TIC anticipate a substantial number of requests for key documents, including yours.

In addition, SAN Contracts Closeout (Sonia Jackson) advises me that several of the final documents needed to complete closeout (and release final payment of withheld funds), ~~is~~ as yet lacking, not only on the above two contracts, but also on the old Preliminary Design contract. I would greatly appreciate your assistance (or your guidance as to who can assist us) in getting this wrapped up and off both of our desks. To recapitulate (adding the items needed by SAN) for the three contracts:

DE-AC03-76ET20422 (Old Contract -1110), Central Receiver System Prel. Design:

- o A "Final Invoice", to be submitted to Sonia Jackson, with copy to me;
- o "Contractors Assignment of Refunds and Rebates", to Sonia;
- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance" (send to me, only), for:
  - MCR-77-161, "System Safety Design Criteria for Central Receiver...System",
  - MCR-77-162, "System Safety Program Requirements for Solar Thermal Systems".(These were done under an extension to the Preliminary Design contract, and are valuable background documents.)

DE-AC03-78ET21007 Collector System, Phase I:

- o "Final Invoice", to Sonia, copy to me;
- o "Assignment of Funds and Rebates", to Sonia;

- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance", to me, for:
  - MCR-78-1323, "10-MWe Solar Thermal Pilot Plant Conceptual Design Review";
  - MTR-78-1330, "10-MWe Solar Thermal Pilot Plant Preliminary Design Review";
  - MCR-79-1302, "10-MWe Solar Thermal Pilot Plant Final Design Review (2 Vols.)";
  - 40-0-500-4P, "10-MWe Solar Thermal Pilot Plant Phase II O&M Equipment";
  - 40-0-500-6P, "10-MWe Solar Thermal Pilot Plant Phase II Planning."

DE-AC03-80SF10539, Collector System Phase II

- o "Final Invoice", to Sonia, copy to me;
- o "Assignment of Funds and Rebates", to Sonia;
- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance", to me, for:
  - MCR-79-1352B\* "Quality Assurance Plan for 10-MWe Phase II Collector..";
  - MCR-80-1304, "10-MWe Solar Pilot Plant Collector Subsystem Safety Plan";
  - MCR-81-1331B, "Hazard Analysis for 10-MWe ...Pilot Plant";
  - 40-0-500-2P, "10-MWe ...Pilot Plant Phase II Mfg. Plan, Rev. 2";
  - MCR-80-1341A, "10-MWe Collector Sybsystem Software/Firmware Functional Req'ts.";
  - MCR-80-1362, "System Description Document, Collector Subsystem...";
  - MCR-80-1376\* "Heliostat Stimulator Operators' Manual";
  - MCR-81-1708, "Operation Instructions, Heliostat Field Subsystem...";
  - MCR-81-1709A, "Maintenance Instructions, Heliostat Field Subsystem...";
  - MTR-81-1769, "...Collector Subsystem Functional Test Report";
  - MCR-81-1770, "Supplemental Spares Plan, Heliostat Field...";
  - MCR-80-1377A, "Software/Firmware Design Specifications...";
  - MCR-82-1701, "Control System Theory of Operation";
  - Drawing Set, as Identified in "Drawing Tree 400500 5132701";
  - Source Listing of Code for Heliostat Controller ROM or EPROM\*
  - Source Listing of Code for Heliostat Field Controller ROM/EPROM\*

Our files do not have current copies of the following other items identified in the Drawing Tree (400500 5132701):

Documents: 40M500-2S, "Foundation Req'ts.", 40M500-1T, "Installation Instructions", 40M500-2M, "Canting Procedures", 40M500-5P, "Acceptance Plan", MCR-80-1361, "Collector System Functional Test Plan", and MCR-81-1715, "Collector System Integrated Acceptance Test Plan."

\* Current copies of these four items are lacking from the Project files; your assistance in obtaining at least one copy of each will be most appreciated.

Drawings: 40X500 5132788, "Adapter Plate/Control Arm Heat Tool", 40X500 5132771, "Field Canting Tool", and 40E500 5132776, "Drive Unit Checkout Console".

While these items are not carried in the current version of the Bibliography (none of the Plant as-built drawings have been entered as yet), many, if not all, of them may be expected to be of interest to the solar community. I would appreciate at least one copy of each, again with your release. To save you considerable effort in preparing the Patent Clearance Request forms (I am enclosing several copies of the form), you may combine many of the above by simply clearing the "Drawing Tree", with its contents.

If you need the other closeout forms cited above (your Contract Administration staff should have them in stock), please call Sonia Jackson at FTS 536-4179, or write her at:

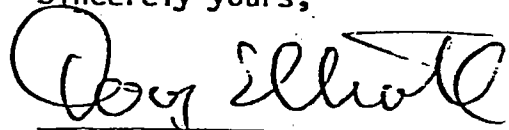
Ms. Sonia Jackson (CM)  
Department of Energy  
1333 Broadway  
Oakland, CA 94612

Finally, since we are required to forward two clean, reproducible copies of each document to DOE/TIC, as well as needing one clean copy for our on-site archives, any "extras" you can turn up around your offices would be greatly appreciated; certainly, rather than throw anything of possible interest out, send it to me.

Mel, I know (believe me!) that this is all a significant amount of work, and I wish I didn't have to ask you (or your staff) to go through it, but it will be to our mutual benefit in the end to get these three contracts all cleaned up, and a comprehensive package of Project documentation (currently, over 550 documents, plus drawings) into the archives. If there is anything further I can do to assist you in this effort, please call on me.

Encl.: DOE Proj. Ofc. ltr. 6/25/83  
Patent Clearance Req. Forms

Sincerely yours,



S. D. Elliott, Jr., Director,  
DOE Project Office, Barstow

cc: H. C. Wroton, MMC  
Sonia Jackson, DOE/SAN (CM)

PS: I keep running across references to a document I can't identify: MCR-78-1325; what was it?

STMPD-296

MARTIN MARIETTA AEROSPACE

DENVER DIVISION  
POST OFFICE BOX 179  
DENVER, COLORADO 80201  
TELEPHONE (303) 977-3000

January 30, 1984

Mr. Doug Elliott  
DOE Site Office  
Post Office Box 366  
Daggett, CA 92327

Subject: Closeout Actions on Martin Marietta Contracts with DOE San Francisco Operations Office

Reference: Letter of December 06, 1983, S.D. Elliott, Jr. to M. Frohardt, Closeout of Contracts

In regard to the referenced letter, following is the status and actions in process to close out these items:

1. Contract Closeout Status

In regard to the closeout of cost type contracts DE-AC03-76ET20422, Central Receiver Test Facility, and DE-AC03-78ET21007, Collector System Phase I, we include the "Contractors Assignment of Refunds and Rebates" and "Contractors Release" with our final invoice package. The final invoices for these two contracts will be submitted upon completion of final settlement negotiations for our 1979 overhead and G&A rates which is currently in progress. In reference to the closeout of contract DE-AC03-80SF10539, Collector System Phase II, please see Attachment 1, the letter to Ms. Joann Littlehales dated January 23, 1984, for the current status.

2. Patent Clearance

The following documents are in the process of being cleared by our Patent office. When this transmittal is available, I will send a copy to you.

- MCR-78-1323, "10-MWe Solar Thermal Pilot Plant Conceptual Design Review"
- MCR-78-1330, "10-MWe Solar Thermal Pilot Plant Preliminary Design Review"
- MCR-79-1302, "10-MWe Solar Thermal Pilot Plant Final Design Review (2 Vols)"
- 40-0-500-4P, "10-MWe Solar Thermal Pilot Plant Phase II O&M Equipment"
- 40-0-500-6P, "10-MWe Solar Thermal Pilot Plant Phase II Planning"

Mr. Doug. Elliott  
January 27, 1984  
Page 2

The remainder of the documents have been previously cleared by the following letters, copies of which are included in Attachment 2.

Letters from Phillip DeArment to Roger Gaither:

DAC-83-417, dated May 24, 1983  
80-Y-15555, dated July 28, 1980  
DAC-82-389, dated May 3, 1982  
Letter dated March 11, 1982  
Letter dated November 10, 1982

3. Documents

You requested copies of some documents and drawings in the referenced letter. Copies of the following drawings and documents are being submitted under Attachment 3.


MCR-78-1330, "Preliminary Design Review Package"  
MCR-79-1352B, "Quality Assurance Plan for 10-MWe Phase II  
Collector"  
MCR-80-1376, "HelioStat Stimulator Operators' Manual"  
40M500-2S, "Foundation Requirements"  
40M500-2M, "Canting Procedures"  
40M500-1T, "Installation Instructions"  
40M500-5P, "Acceptance Plan"  
MCR-81-1715, "Collector System Integrated Acceptance Test Plan"  
MCR-80-1361, "Collector System Functional Test Plan"  
40M500 5132788, "Adapter Plate/Control Arm Heat Tool"  
40M500 5132771, "Field Canting Tool"  
Source Listing of Code for HelioStat Controller ROM or EPROM\*  
Source Listing of Code for HelioStat Field Controller ROM/EPROM

No drawing exists for 40E500 5132776, "Drive Unit Checkout Console" as this checkout console consisted of a stimulator to operate a production Drive Mechanism Assembly. Also MCR-78-1330 is the correct document number for the Preliminary Design Review Package rather than MCR-78-1325. MCR-78-1325 is the document number assigned to all the Monthly Progress Reports written during the Phase I contract.

Doug, I hope this will help in getting the documentation finalized. I will follow-up with the additional information identified. If you have any questions please call on me.

Sincerely yours,

MARTIN MARIETTA CORPORATION

  
Melvin W. Frohardt  
Solar Programs

Enclosures

cc: H. Wroton  
Sonia Jackson

STO-PO-296

U.S. DEPARTMENT OF ENERGY

memorandum

DATE: MAY 14 1984

COPIES TO  
ATTN OF

S. D. Elliott, Jr., Director, DOE Solar One Project Office

SUBJECT:

Submission of Thirteen Reports Prepared for 10-MWe Pilot Plant ("Solar One") Project by Martin Marietta Corporation under Contract DE-AC03-80SF10539

TO

Roger S. Gaither, DOE/SAN Office of Patent Counsel  
William D. Matheny, DOE/TIC Document Control

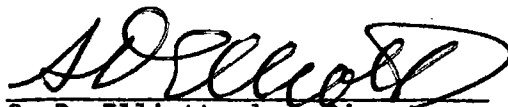
Enclosed are thirteen documents prepared by the Martin Marietta Corporation, Denver Aerospace Division, for the Solar Ten-Megawatt Project Office in conjunction with design and fabrication of the Pilot Plant Collector (Heliostat) System, under Contract DE-AC03-80SF10539:

<u>Primary Document No.</u>	<u>Secondary No.</u>	<u>Brief Title</u>
DOE/SF/10539-01	(STMP0-288)	"Quality Assurance Plan..."
DOE/SF/10539-02	(STMP0-289)	"...System Safety Plan"
DOE/SF/10539-03	(STMP0-290)	"Hazard Analysis..."
* DOE/SF/10539-04	(STMP0-291)	"Phase II Manufacturing Plan (Revision 2)"
DOE/SF/10539-05	(STMP0-292)	"Software/Firmware Functional Requirements..."
* DOE/SF/10539-06	(STMP0-293)	"System Description Document..."
DOE/SF/10539-07	(STMP0-294)	"Heliostat Stimulator Operator's Manual"
DOE/SF/10539-08	(STMP0-295)	"Operations Instructions, Heliostat Field..."
* DOE/SF/10539-09	(STMP0-296)	"Maintenance Instructions, Heliostat Field..."
DOE/SF/10539-10	(STMP0-297)	"...Functional Test Report"
DOE/SF/10539-11	(STMP0-298)	"Supplemental Spares Plan..."
* DOE/SF/10539-12	(STMP0-299)	"Software/Firmware Design Specification..."
DOE/SF/10539-13	(STMP0-300)	"Control System Theory of Operation"

One copy of each document, accompanied by a SAN Form 70 prepared by the Project Office (on the basis of Attachment 1, the Contractor's Patent Certification as submitted May 3, 1982), is provided for SAN/OPC review and clearance. The fabrication and maintenance materials indicated in the above list by an asterisk should be reviewed in the light of the two disclosures filed with Attch. 1, as well as the Martin Marietta Dockets 81YD16, -24, and -25, claimed as developed outside the scope of the contract in Attch. 2, MMC letter of November 10, 1982. Please return the "feedback" copies of the Form 70's to this office; the clearance copies of the documents themselves may be returned to Mr. Mike Lopez, SAN/FGS.

Two copies of each document, accompanied by a completed DOE Form RA-426, are submitted for archiving and announcement by the DOE Technical Information Center and for forwarding to the National Technical Information Service.

- Attchs.: 1. Martin Marietta Ltr. 5/3/82
- 2. Martin Marietta ltr. 11/10/82

  
S. D. Elliott, Jr., Director,  
DOE Solar One Project Office

Encls.: 13 Documents w/transmittal forms

- cc: Mike Lopez, DOE/SAN (FGS)
- Don Holz, DOE/SAN (ISEA)
- Mary Soderstrum, Burns & McDonnell





DEPARTMENT OF ENERGY  
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE  
FOR RELEASE OF UNCLASSIFIED DOCUMENT

TO: Roger S. Gaither, Asst. Chief for Prosecution  
Office of Patent Counsel/Livermore Office  
P.O. Box 808, L-376  
Livermore, California 94550

FROM: DOE Solar One Project Office  
Post Office Box 366  
Daggett, CA 92327

Prime Contract No.	DE-AC03-80SF10539
Subcontract No.	(N/A)
Report No.	DOE/SF/10539-09 (STMP0-296)
Date of Report	August 1981 (Revised)
Name & Phone No. of DOE Technical Representative	S. D. Elliott, Jr. (619) 254-2672

- Document Title: "Maintenance Instructions, Heliostat Field Subsystem for 10 Megawatt Solar Power System/Central Receiver System"
- Type of Document:  Technical Report,  Conference Paper,  Journal Article,  Abstract or Summary,  Copy of Oral Presentation,  Other (please specify): \_\_\_\_\_
- In order to meet a publication schedule or submission deadline, patent clearance by \_\_\_\_\_ (routine) would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:
- Attention should be directed to pages \_\_\_\_\_ of this document.
  - This document describes matter relating to an invention:
    - Contractor Invention Docket No. 80YD41, 81YD19
    - A disclosure of the invention was submitted to DOE on 3/9/81, 5/3/82 (date)
    - A disclosure of the invention will be submitted shortly \_\_\_\_\_ (approximate date)
    - A waiver of DOE's patent rights to the contractor:
  has been granted,  has been applied for; or  will be applied for \_\_\_\_\_ (date)   
by me
5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks: See Martin Marietta ltr. 5/3/82 for Patent Certification and disclosure data

Reviewing/Submitting Official: Name (Print/Type) S. D. Elliott, Jr., Director  
Title DOE Solar One Project Office  
Signature *S. D. Elliott* Date 11 May, 1984

TO: INITIATOR OF REQUEST

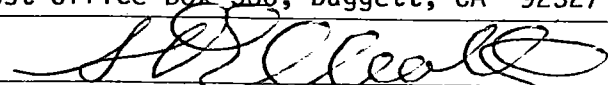
FROM: ASSISTANT CHIEF FOR PROSECUTION  
Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.
- Please defer release until advised by this office.

Signed \_\_\_\_\_ Date Mailed \_\_\_\_\_

DOE AND MAJOR CONTRACTOR RECOMMENDATIONS FOR ANNOUNCEMENT AND DISTRIBUTION OF DOCUMENTS

See Instructions on Reverse Side

1. DOE Report No. DOE/SF/10539-09 (STMP0-296)	2. Contract No. DE-AC03-80SF10539	3. Subject Category No. UC-62
4. Title INTENANCE INSTRUCTIONS, HELIOSTAT FIELD SUBSYSTEM FOR 10 MEGAWATT SOLAR POWER		
5. Type of Document ("x" one) <input checked="" type="checkbox"/> a. Scientific and technical report <u>SYSTEM/CENTRAL RECEIVER SYSTEM"</u> <input type="checkbox"/> b. Conference paper: Title of conference _____ _____ Date of conference _____		
Exact location of conference _____ Sponsoring organization _____ <input type="checkbox"/> c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.)		
6. Copies Transmitted ("x" one or more) <input type="checkbox"/> a. Copies being transmitted for standard distribution by DOE-TIC. <input type="checkbox"/> b. Copies being transmitted for special distribution per attached complete address list. <input checked="" type="checkbox"/> c. Two completely legible, reproducible copies being transmitted to DOE-TIC. (Classified documents, see instructions) <input type="checkbox"/> d. Twenty-seven copies being transmitted to DOE-TIC for TIC processing and NTIS sales.		
7. Recommended Distribution ("x" one) <input type="checkbox"/> a. Normal handling (after patent clearance): no restraints on distribution except as may be required by the security classification. Make available only <input type="checkbox"/> b. To U.S. Government agencies and their contractors. <input type="checkbox"/> c. within DOE and to DOE contractors. <input type="checkbox"/> d. within DOE. <input type="checkbox"/> e. to those listed in item 13 below. <input checked="" type="checkbox"/> f. Other (Specify) Archive/issue on request		
8. Recommended Announcement ("x" one) <input checked="" type="checkbox"/> a. Normal procedure may be followed. <input type="checkbox"/> b. Recommend the following announcement limitations:		
9. Reason for Restrictions Recommended in 7 or 8 above. <input type="checkbox"/> a. Preliminary information. <input type="checkbox"/> b. Prepared primarily for internal use. <input type="checkbox"/> c. Other (Explain)		
10. Patent, Copyright and Proprietary Information Does this information product disclose any new equipment, process or material? <input type="checkbox"/> No <input type="checkbox"/> Yes If so, identify page nos. _____ Has an invention disclosure been submitted to DOE covering any aspect of this information product? <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (see 13, below) If so, identify the DOE (or other) disclosure number and to whom the disclosure was submitted. Are there any patent-related objections to the release of this information product? <input type="checkbox"/> No <input type="checkbox"/> Yes If so, state these objections. Does this information product contain copyrighted material? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If so, identify the page number _____ and attach the license or other authority for the government to reproduce. Does this information product contain proprietary information? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If so, identify the page numbers _____ ("x" one <input type="checkbox"/> a. DOE patent clearance has been granted by responsible DOE patent group. <input checked="" type="checkbox"/> b. Document has been sent to responsible DOE patent group for clearance.		
11. National Security Information (For classified document only; "x" one) Document <input type="checkbox"/> a. does <input type="checkbox"/> b. does not contain national security information		
12. Copy Reproduction and Distribution Total number of copies reproduced <u>25</u> Number of copies distributed outside originating organization <u>10</u>		
13. Additional Information or Remarks (Continue on separate sheet, if necessary) Disclosures S-55,956,RL-8354 and S-59,046,RL-8843 submitted to SAN/OPC (MMC ltr. 5/3/82). SAN/OPC will review this document for patent issues.		
14. Submitted by (Name and Position) (Please print or type) <u>S. D. Elliott, Jr., Director, DOE Solar One Project Office</u> Organization _____ <u>Post Office Box 366, Daggett, CA 92327 (619) 254-2672</u> Signature <u></u> Date <u>MAY 11 1984</u>		



DEPARTMENT OF ENERGY  
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE  
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No. <b>DE-AC03-80SF10539</b>
Subcontract No. <b>(N/A)</b>
Report No. <b>DOE/SF/10539-09 (STMPO-296)</b>
Date of Report <b>August 1981 (Revised)</b>
Name & Phone No. of DOE Technical Representative <b>S. D. Elliott, Jr. (610) 254-2672</b>

TO: Roger S. Gaither, Asst. Chief for Prosecution  
Office of Patent Counsel/Livermore Office  
P.O. Box 808, L-376  
Livermore, California 94550

FROM: DOE Solar One Project Office  
Post Office Box 366  
Daggett, CA 92327

- Document Title: "Maintenance Instructions, Heliostat Field Subsystem for 10 Megawatt Solar Power System/Central Receiver System"
- Type of Document:  Technical Report,  Conference Paper,  Journal Article,  Abstract or Summary,  Copy of Oral Presentation,  Other (please specify): \_\_\_\_\_
- In order to meet a publication schedule or submission deadline, patent clearance by (routine) would be desired.

**SENDER IS TO CHECK BOX #4 OR #5 BELOW.**

4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:
- Attention should be directed to pages \_\_\_\_\_ of this document.
  - This document describes matter relating to an invention:
    - Contractor Invention Docket No. 80YD41, 81YD19
    - A disclosure of the invention was submitted to DOE on 3/9/81, 5/3/82 (date)
    - A disclosure of the invention will be submitted shortly \_\_\_\_\_ (approximate date)
    - A waiver of DOE's patent rights to the contractor:
 

has been granted,  has been applied for; or  will be applied for \_\_\_\_\_ (date)

5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks: See Martin Marietta ltr. 5/3/82 for Patent Certification and disclosure data

Reviewing/Submitting Official: Name (Print/Type) S. D. Elliott, Jr., Director  
 Title DOE Solar One Project Office  
 Signature *S. D. Elliott* Date 11 May, 1984

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION  
Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.  
 Please defer release until advised by this office.

*M. Lopez, SAN*

Signed *L. E. Carruth*

*llc*  
*5/8/84*

Date Mailed 5/21/84