

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES

TITLE **BIANNUAL LABORATORY MAINTENANCE PROCEDURES FOR 35 MM
AUTOMATIC CAMERA SYSTEMS**

TYPE **TECHNICAL INSTRUCTION**

NUMBER **4120-3500**

DATE **DECEMBER 1993**

AUTHORIZATIONS

| TITLE | NAME | SIGNATURE |
|-----------------|-------------------|-----------|
| ORIGINATOR | Karen K. Rosener | |
| PROJECT MANAGER | James H. Wagner | |
| PROGRAM MANAGER | David L. Dietrich | |
| QA MANAGER | Gloria S. Mercer | |
| OTHER | | |

REVISION HISTORY

| REVISION NO. | CHANGE DESCRIPTION | DATE | AUTHORIZATIONS |
|--------------|--|------------|----------------|
| 0.1 | Add discussion regarding assessment log. | April 1996 | |
| | | | |
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1.0 PURPOSE AND APPLICABILITY

The purpose of biannual laboratory maintenance is to assure quality data capture and minimize data loss by performing maintenance procedures that will verify proper system operation and/or quickly identify the probable source of an automatic camera system malfunction. This technical instruction (TI) describes biannual laboratory maintenance procedures for 35 mm camera systems.

Maintaining the visibility monitoring camera system includes preventive maintenance by a factory-authorized repair facility to ensure the system will continue to function properly. This TI is referenced in SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* and serves as a guideline to facilitate the following scheduled maintenance tasks:

- Notification by the data coordinator that the biannual laboratory maintenance is due
- Installation of replacement camera system component(s)
- Mailing the original camera system to Air Resource Specialists, Inc. (ARS) for maintenance procedures

Site operators should be fully trained and supplied with a Site Operator's Manual for Automatic Visibility Monitoring Camera Systems, which contains detailed routine site operator maintenance and troubleshooting procedures for the specific camera monitoring system(s) located at the site. Additional manufacturer's instruction booklets and a supply of automatic camera system Visibility Monitoring Status/Assessment Sheets are also provided.

Close personal communications should be maintained between ARS and site operators throughout all monitoring and scheduled maintenance efforts. Operators are encouraged to call or notify ARS if they have any questions or problems. Many problems can be fully resolved over the phone.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Coordinate with the site operator, his/her supervisor, the field specialist, and the data coordinator concerning the schedule and requirements for biannual maintenance.

2.2 DATA COORDINATOR

The data coordinator shall:

- Coordinate the replacement of camera systems.
- Coordinate all aspects of biannual camera maintenance.
- Enter all correspondence with site operators and the results of all performed procedures into the site-specific Quality Assurance Database.

- Document all capital instrumentation changes and maintain inventory records in the ARS Purchase Order/Inventory Database.

2.3 SITE OPERATOR

The site operator shall:

- Perform all on-site procedures described in this TI.
- Thoroughly document all procedures on the Visibility Monitoring Status/Assessment Sheet and mail the white copy of the completed sheet to the data coordinator.
- Report any noted inconsistencies immediately to the data coordinator.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 SITE VISIT EQUIPMENT

Equipment and materials generally required to remove the original camera system and install a replacement system include:

- Medium and small flat-blade screwdriver
- Small Phillips-head screwdriver
- Medium adjustable wrench
- Keys for enclosure and padlocks
- Voltmeter
- Backup camera and timer batteries
- Watch
- Site Operator's Manual for Automatic Visibility Monitoring Camera Systems containing:
 - SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)*
 - Technical instructions for routine site operator maintenance procedures
 - Technical instructions for troubleshooting and emergency maintenance procedures
 - Automatic 35 mm Camera System User's Manual
 - Manufacturer's instruction booklets
 - Visibility Monitoring Status/Assessment Sheets
 - Film canister labels

- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of biannual maintenance be thoroughly documented. Specific model and serial numbers of the exchanged camera body, lens, databack, and timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

- 4.1 General Information
- 4.2 Biannual Laboratory Maintenance Procedures
- 4.3 Final System Verification Check
- 4.4 Capital Equipment Exchange Procedures

Maintaining a visibility monitoring camera system includes biannual laboratory maintenance to ensure the system continues to function properly. The biannual laboratory maintenance process should progress as outlined below to ensure ongoing, consistent data collection.

- The data coordinator contacts the site operator to inform him/her of the scheduled maintenance date.
- The data coordinator ships the replacement camera system along with a Photographic Monitoring Network Quality Assessment Log. When received, the site operator exchanges the systems and ships the system in need of servicing to ARS, and documents the exchange on the log. The documentation should include:
 - Date of installation
 - Steps taken to test system components
 - Current operational status
- All biannual laboratory maintenance communications documentation will be retained in the site-specific Quality Assurance Database for future reference.

A variety of automatic camera monitoring configurations exist. Specific equipment servicing and maintenance requirements for each site will vary with the system configuration.

4.1 GENERAL INFORMATION

Internal quality assurance of automatic camera equipment is based primarily on visual review of processed visibility monitoring film. Film handling and review procedures are fully discussed in SOP 4305, *Collection of Scene Monitoring Photographs and Film (IMPROVE Protocol)*. Alignment, exposure, and data collection efficiency can all be assessed from processed film.

Operational camera systems are biannually cycled out of the monitoring network. Enclosures remain in place and the cameras and timers are cycled for laboratory maintenance. The laboratory maintenance ensures that the camera systems are in good working order, minimizing down time and data loss.

Throughout the monitoring effort, ARS and site operators should maintain close personal communications. Site operators should call ARS immediately if any inconsistencies are noted or if any questions arise. Many problems can be resolved through telephone consultation.

ARS may be reached at the following telephone numbers:

Telephone: 970/484-7941
Fax: 970/484-3423

If the person you need to speak with is not in, ask to be directed to another or leave a message including your name, location, and a brief description of the problem(s) or need(s).

4.2 BIENNIAL LABORATORY MAINTENANCE PROCEDURES

4.2.1 Equipment Exchange

The data coordinator will notify the site operator regarding the equipment exchange date. At that time, the specifics regarding replacement camera system installation and returning camera system shipping will be discussed.

The current camera system at the site (including the camera, timer, and all cables) should be removed at the next site visit following receipt of a replacement system. Perform the following steps when reinstalling:

- Load a new roll of film in the replacement camera and verify that all settings are correct. A more detailed description of preparing a camera system is presented in the technical instructions for routine site operator maintenance procedures (appropriate for each camera model).
- After taking the documentation photograph, attach the camera-timer cable and mount on the tripod head.
- Attach the timer/battery cable. Program the timer to the correct settings.
- Verify that the system is working (see Section 4.3).

- Pack the camera system requiring servicing according to the data coordinator's specifications.
- Ship the system to ARS.

4.2.2 Factory-Authorized Laboratory Maintenance

Automatic camera system maintenance is normally provided by local factory-authorized repair facilities capable of performing the following:

- Completely disassembling and thoroughly cleaning the camera, including pivot points and shutter bearings
- Troubleshooting and repairing any noted problems so that the system fully meets or exceeds the manufacturer's specifications
- Relubricating to factory specifications and reassembling
- Testing shutter speed and curtain travel time at room temperature and 25°F
- Checking the meter readout and auto exposure
- Checking the diaphragm operation and film transport
- Testing electrical current consumption

A work order accompanies each camera system to the factory-authorized repair facility. An example of a work order is presented as Figure 4-1. After repair, Camera Meter Test Logs are returned to ARS along with the camera system; an example Camera Meter Test Log is presented as Figure 4-2.

4.2.3 In-House Laboratory Maintenance

The following tests are performed on timers and cables at ARS:

- Timer exteriors are visually inspected and cleaned.
- Timers are disassembled and the interiors visually inspected and cleaned.
- All solder points are checked.
- Replacement batteries are installed.
- A continuity test is performed on all cables with a voltmeter.
- A final system verification check is performed (see Section 4.3).



FRONT RANGE CAMERA REPAIR
WORK ORDER

DATE _____

PROJECT _____
ISSUED BY _____
INVOICE ARS _____

P.O.# _____
INV. # _____
AMOUNT \$ _____

INSTRUCTIONS _____

DATE NEEDED BY _____

WORK DONE _____

EXPOSURE TESTS SUMMARY: AMBIENT _____
COLD _____ HOT _____
CURRENT DRAW RESULTS: IDLE _____
SHUTTER _____ METER _____
DATE COMPLETED _____ BY _____

FOLLOW UP TESTS _____

EQUIPMENT DISPOSITION _____

Figure 4-1. Example Factory-Authorized Work Order.

FRONT RANGE CAMERA REPAIR
CAMERA METER TEST

DATE: _____
TEMP: _____

BODY
 Canon EOS 630 Contax 137MA
 Contax 167MT Olympus OM2N
 Olympus OM2S

LENS
 Canon Yashica Olympus
 50mm 135mm
Other: _____

Serial #: _____ Serial #: _____

METERING COMMENTS: _____

| SHUTTER SPEEDS | | | | | | | | |
|----------------|--------|-------|-------|-------|------|------|------|-----|
| Indicated | 1/1000 | 1/500 | 1/250 | 1/125 | 1/60 | 1/30 | 1/15 | 1/8 |
| Opening | | | | | | | | |
| Closing | | | | | | | | |
| Overall | | | | | | | | |

| METER READOUT ASA 25 | | | | | | |
|----------------------|----|----|----|----|---|---|
| EV | 15 | 14 | 12 | 11 | 9 | 6 |
| Error | | | | | | |
| Shutter Speed | | | | | | |
| Aperture | | | | | | |

| | EV15 | EV12 | EV9 | EV6 |
|----------|---------------|---------------|---------------|---------------|
| Aperture | error/sh. sp. | error/sh. sp. | error/sh. sp. | error/sh. sp. |
| 22.0 | / | / | / | / |
| 16.0 | / | / | / | / |
| 11.0 | / | / | / | / |
| 8.0 | / | / | / | / |
| 5.6 | / | / | / | / |
| 4.0 | / | / | / | / |
| 2.8 | / | / | / | / |

CURRENT DRAW
IDLE
COLD _____
HOT _____
SHUTTER
COLD _____
HOT _____
METER
COLD _____
HOT _____

Figure 4-2. Example Camera Meter Test Log.

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings is made following any system maintenance. The entire camera system is assembled, tested, and stored at ARS until needed. Refer to the technical instructions for routine site operator maintenance procedures for 35 mm automatic camera system (appropriate camera model), for complete system verification procedures.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

It is imperative that any capital instrumentation changes made as a result of laboratory maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the enclosure, camera body, lens, databack, and automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.

| QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES | |
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| TITLE | BIANNUAL LABORATORY MAINTENANCE PROCEDURES FOR 8 MM AUTOMATIC TIME-LAPSE CAMERA SYSTEMS |
| TYPE | TECHNICAL INSTRUCTION |
| NUMBER | 4120-3510 |
| DATE | JANUARY 1994 |

| AUTHORIZATIONS | | |
|-----------------|-------------------|-----------|
| TITLE | NAME | SIGNATURE |
| ORIGINATOR | Karen K. Rosener | |
| PROJECT MANAGER | James H. Wagner | |
| PROGRAM MANAGER | David L. Dietrich | |
| QA MANAGER | Gloria S. Mercer | |
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| REVISION HISTORY | | | |
|------------------|--|------------|----------------|
| REVISION NO. | CHANGE DESCRIPTION | DATE | AUTHORIZATIONS |
| 0.1 | Add discussion regarding assessment log. | April 1996 | |
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| 4-1 Example Factory-Authorized Work Order | 6 |

1.0 PURPOSE AND APPLICABILITY

The purpose of biannual laboratory maintenance is to assure quality data capture and minimize data loss by performing maintenance procedures that will verify proper system operation and/or quickly identify the probable source of an automatic time-lapse camera system malfunction. This technical instruction (TI) describes biannual laboratory maintenance procedures for 8 mm time-lapse camera systems.

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 - Technical instructions for routine site operator maintenance procedures
 - Technical instructions for troubleshooting and emergency maintenance procedures
 - Automatic 8 mm Time-Lapse Camera System User's Manual
 - Manufacturer's instruction booklets
 - Visibility Monitoring Status/Assessment Sheets
 - Film cartridge labels

- Pen or pencil
- Grease pencil
- Supplemental visibility monitoring film

3.2 INVENTORY

It is imperative that any capital instrumentation changes made as a result of biannual maintenance be thoroughly documented. Specific model and serial numbers of the exchanged camera body and timer should be documented for future reference by the data coordinator in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database. Any on-site changes made should be documented by the site operator on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log (described in Section 4.0). Capital equipment exchange procedures are discussed in Section 4.4.

4.0 METHODS

This section includes four (4) major subsections:

- 4.1 General Information
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- 4.3 Final System Verification Check
- 4.4 Capital Equipment Exchange Procedures

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 - Steps taken to test system components
 - Current operational status
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4.2.1 Equipment Exchange

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The current camera system at the site (including the camera, timer, and all cables) should be removed at the next site visit following receipt of a replacement system. Perform the following steps when reinstalling:

- Load a new roll of film in the replacement camera and verify that all settings are correct. A more detailed description of preparing a camera system is presented in the technical instructions for routine site operator maintenance procedures (appropriate for each camera model).
- Mount the camera on the tripod head and attach the camera cable to the timer.
- Attach the timer/battery cable. Program the timer to the correct settings.
- Verify that the system is working (see Section 4.3).
- Pack the camera system requiring servicing according to the data coordinator's specifications.
- Ship the system to ARS.

4.2.2 Factory-Authorized Laboratory Maintenance

Automatic time-lapse camera system maintenance is normally provided by local factory-authorized repair facilities capable of performing the following:

- Completely disassembling and thoroughly cleaning the camera, including pivot points and shutter bearings
- Troubleshooting and repairing any noted problems so that the system fully meets or exceeds the manufacturer's specifications
- Relubricating to factory specifications and reassembling
- Testing shutter speed and overall exposure quality
- Checking the film transport operation
- Testing electrical current consumption

A work order accompanies each camera system to the factory-authorized repair facility. An example of a work order is presented as Figure 4-1.

4.2.3 In-House Laboratory Maintenance

The following tests are performed on timers and cables at ARS:

- Timer exteriors are visually inspected and cleaned.
- Timers are disassembled and the interiors visually inspected and cleaned.
- All solder points are checked.
- Replacement batteries are installed.
- A continuity test is performed on all cables with a voltmeter.
- A final system verification check is performed (see Section 4.3).

4.3 FINAL SYSTEM VERIFICATION CHECK

A thorough review of all system components and camera settings is made following any system maintenance. The entire camera system is assembled, tested, and stored at ARS until needed. Refer to the technical instructions for routine site operator maintenance procedures for 8 mm automatic camera system (appropriate camera model), for complete system verification procedures.



FRONT RANGE CAMERA REPAIR
WORK ORDER

DATE _____

PROJECT _____
ISSUED BY _____
INVOICE ARS _____

P.O.# _____
INV. # _____
AMOUNT \$ _____

INSTRUCTIONS _____

DATE NEEDED BY _____

WORK DONE _____

EXPOSURE TESTS SUMMARY: AMBIENT _____
COLD _____ HOT _____
CURRENT DRAW RESULTS: IDLE _____
SHUTTER _____ METER _____
DATE COMPLETED _____ BY _____

FOLLOW UP TESTS _____

EQUIPMENT _____ DISPOSITION _____

Figure 4-1. Example Factory-Authorized Work Order.

4.4 CAPITAL EQUIPMENT EXCHANGE PROCEDURES

It is imperative that any capital instrumentation changes made as a result of laboratory maintenance be thoroughly documented. The data coordinator should document the specific model and serial numbers of the enclosure, camera body, and automatic timer in the site-specific Quality Assurance Database and ARS Purchase Order/Inventory Database for future reference. The site operator should document any on-site changes made on a Visibility Monitoring Status/Assessment Sheet or Photographic Monitoring Network Quality Assessment Log.