

ADVANCED FLUOROSCOPIC SYSTEM MAINTENANCE (PHASE III)

Course Length: 2 weeks
CEUs Awarded: 8

Introduction

Advanced Fluoroscopic System Maintenance is a formal hands-on course that provides a comprehensive approach to servicing fluoroscopic and vascular imaging systems. Emphasis is placed on system performance and image evaluation. Each sub-component of the imaging system is thoroughly analyzed, and methods of optimizing system performance are applied.

Participants perform complete system alignment and calibration while evaluating each sub-component for its specific modulation transfer function. Participants also have the opportunity to troubleshoot all phases of the imaging system chain.

Prerequisites

To attend this course, the service professional must have good fundamental knowledge of radiological physics and procedures as taught by our Principles of Servicing Diagnostic X-Ray Systems (Phase I) course, or two years equivalent experience.

Objectives

At the conclusion of this course, participants will be able to:

- Perform complete calibration on fluoroscopic imaging systems
- Evaluate overall performance of imaging system components
- Troubleshoot imaging problems on all components of the imaging chain
- Use proper test equipment to evaluate system performance
- Perform complete CDRH testing of the imaging system

Course Outline

DAY 1

- I. Introduction
 - A. Introduction to fluoroscopic imaging
 - B. Contrast, resolution, and sharpness
 - C. Subject matter contrast and resolution
- II. The X-ray beam
 - A. X-ray tube operation
 - B. Quantity and quality
 - C. Filtration
 - D. Grids and scatter
 - E. X-ray tube resolution
- III. Radiation entrance and exit doses
 - A. Max. "R"
 - B. Half value layer
 - C. Absorption characteristics
 - D. Stabilized level

Lab Activities

- I. Max. "R" calibration
- II. Half value layer measurements
- III. Central ray alignment
- IV. Shutter alignment
- V. Focal spot measurements
- VI. Input radiation levels (I.I.)

DAY 2

- I. Image intensifiers
 - A. Image tube construction and operation
 - B. Conversion factor
 - C. Quantum detection efficiency
 - D. Resolution, contrast, and sharpness
 - E. Multiple mode image tubes
 - F. Contrast ratio
- II. Optical system
 - A. Collimating lenses and infinity focus
 - B. Focal length versus image size
 - C. Beam splitters

Lab Activities

- I. Low contrast resolution evaluation
- II. High contrast resolution evaluation
- III. Electronic I.I. focus with pie mesh
- IV. Quantum sink evaluation (input radiation)

DAY 3

- I. Brightness stabilization
 - A. kV, mA, and secondary switching
 - B. Light distributors and brightness pickup
 - C. Center scanning and shutter tracking
 - D. Photo tube alignment
 - E. Stabilizer circuits

Lab Activities

- I. Light distributor alignment
- II. Photo tube alignment
- III. Stabilized level adjustments
- IV. Center scan evaluation

DAY 4

- I. Video stabilization
 - A. Composite video
 - B. Video sampling
- II. Photospot
 - A. Circuit operation
 - B. Density runs
 - C. Focus runs

Lab Activities

- I. Beam splitter alignment
- II. Camera loading
- III. Photospot density runs
- IV. Input radiation adjustments

ADVANCED FLUOROSCOPIC SYSTEM MAINTENANCE (PHASE III) *CONTINUED*

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DAY 5

- I. Cine radiology
 - A. Circuit operation
 - B. Focus and density runs

Lab Activities

- I. Overall system calibration
- II. Overall system troubleshooting

DAY 6

- I. Introduction to television
 - A. Principles of television
 - B. Raster formation
 - C. Composite video
- II. Television system block diagram
 - A. Television camera block diagram
 - B. Monitor block diagram
- III. Camera tube construction and operation
 - A. Vidicon, lead oxide, saticon, newvicon
 - B. Camera tube supplies

Lab Activities

- I. System troubleshooting
 - A. Isolating camera from monitor
 - B. Evaluating the composite video signal
- II. Camera tube alignment
 - A. Beam current/alignment, target voltage
 - B. Mechanical, electrostatic and electromagnetic focus

DAY 7

- I. System timing circuit operation
 - A. Master oscillator and counter operation
 - B. Vertical and horizontal timing
 - C. Line rate conversions
- II. Vert and horiz blanking and sync generation
 - A. Mixed sync
 - B. Standard and circular blanking
 - C. Front and back porch delays
- III. Vertical and horizontal camera sweep generation
 - A. Vertical sweep circuit operation
 - B. Horizontal sweep circuit operation
 - C. Sweep loss protection circuits

Lab Activities

- I. Master oscillator and counter adjustments
 - A. Line rate conversion
 - B. Free run/line lock calibration
 - C. Troubleshooting master timing circuits
- II. Sync and blanking
 - A. Circular blanking calibration
 - B. Vertical and horizontal sync adjustments
- III. Sweep size and positioning
 - A. Aspect ratio
 - B. Overscanning
 - C. Sweep size and positioning

DAY 8

- I. Video chain
 - A. Camera signal and preamp
 - B. Input video processing
 - C. Output video processing
- II. Preamplifier
 - A. Circuit operation
 - B. Signal to noise ratio

III. Input video

- A. Aperture and streaking correction
- B. Standard and circular video clamping
- C. Bandwidth selection
- D. Normal and automatic gain control

IV. Output video

- A. Standard and automatic pedestal insertion
- B. Gamma correction circuit operation
- C. Sync and blanking signal insertion

Lab Activities

- I. Video chain alignment
- II. Video chain troubleshooting

DAY 9

- I. Monitor operation
 - A. Video circuits
 - B. Sync amp and separator
 - C. Vertical and horizontal sweep circuits
- II. Monitor alignment

Lab Activities

- I. Complete camera and monitor calibration
- II. Complete camera and monitor troubleshooting

DAY 10

- I. System review
- II. Final exam
- III. Course evaluation