

# Advanced Radiographic System Maintenance (Phase II)



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## Introduction

Advanced Radiographic System Maintenance is a hands-on course designed for those charged with the duties of repairing radiological equipment but having limited knowledge of the radiographic systems. Through attendance in this course, the service professional will become self-confident in working on various types of radiographic systems. Upon completion of the course, the service professional will be able to identify and repair malfunctions of a radiographic system as well as perform preventive maintenance and compliance tests on the system.

## Prerequisites

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

## Objectives

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

- Determine if the X-ray generator system meets the manufacturer's specifications
- Use proper test procedures to ensure optimum performance
- Isolate malfunctions to circuit level

- Perform complete preventive maintenance and system performance checks
- Perform complete CDRH compliance tests on the system

## Course Outline

### Day 1

- Introduction
  - X-ray control block diagram
  - Three phase generator circuit block diagram
  - Single phase generator
  - Terminology and symbology
- Lab Activities
  - Knobology
  - Circuit identification and location
  - Test equipment operation and identification

### Day 2

- Single- and three-phase H.V. secondary
  - X-ray tube parameters
  - Rectifier circuitry
    - Full wave
    - Half wave
  - Constant potential
  - Feedback circuitry
  - Pulsed secondary
  - Regulation circuitry
  - H.V. divider circuitry
  - Safety circuitry
- kV and mA overload protection devices
- Lab Activities
  - H.V. calibration
  - Stick rectifier location and verification
  - Waveform analysis

- kV, mA overload verification and calibration
- Midpoint overcurrent inspection and calibration
- H.V. secondary troubleshooting

### Day 3

- kV control
  - H.V. primary single phase
    - kV metering
    - Terminology and calibration
  - H.V. primary three phase:2 SCRs
    - Auto transformer versus variac control
    - Motor driven circuitry and feedback
    - Static and regulation compensation
  - Forced commutation
  - H.V. primary three phase:6 SCRs
    - Bit selectors
    - R.F. changeover
    - Safety circuitry
  - High frequency kV production
- Lab Activities
  - kV primary identification and calibration
  - Waveform analysis
  - Motor driven circuitry maintenance and calibration
  - Static and regulation calibration
  - kV primary troubleshooting

### Day 4

- mA filament control
  - Basic filament control
    - Focal spot selection
    - Modes of operation
    - Preheat circuitry
    - Space charge compensation
  - Saturable reactor
    - Filament feedback

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- Real mA feedback
- Safety circuitry
- Chopper stabilization
  - Max. filament limitations
  - Filament overcurrent protection
- High frequency mA control
  
- Lab Activities
  - X-ray tube filament inspection
  - Waveform analysis
  - Type identification
  - Preheat calibration
  - Max. filament limitation calibration
  - Space charge calibration
  - Filament control troubleshooting

## Day 5

- Time control
  - Core memory
  - Exposure start and stop
  - Digital timers
  - mAs integration
  - A.E.C.
  - A.B.C.
- Lab Activities
  - Timer identification and location
  - Waveform analysis
  - Timer calibration
  - A.E.C. calibration
  - Timer troubleshooting

## Day 6

- Control logic
  - Tube protectors
    - Allowable kW
    - Programmed kW
    - Auto rotor

- Rotor starters
- Relay control logic modes of operation
- Digital control logic
- Microprocessor control logic
- Lab Activities
  - Identification and verification
  - Interfacing and signal tracing
  - Control logic troubleshooting

## Day 7

- Ancillary equipment
  - Tube stands
  - Collimators
    - Identification and modes of operation
    - CDRH performance testing
    - Bucky sensing
    - Central ray
    - Beam alignment
    - Servo drive system
- Lab Activities
  - Identification and verification
  - Servo drive locations and calibration
  - Mechanical and electrical alignment
    - Light field versus radiation field
    - Central ray
    - S.I.D. shutter tracking calibration

## Day 8

- Ancillary equipment
  - Bucky table
  - R.F. tables

- Two- way & four-way table top
- Table tilt and safety
- Undertable tube alignment and shutter tracking
- Spot filmers
  - Mechanical
  - Electrical
- Lab Activities
  - Tube alignment
  - Table calibration and verification
    - Mechanical
    - Electrical
  - Spot filmer alignment and verification
    - Mechanical
    - Electrical

## Day 9

- System troubleshooting
  - System diagrams
    - Digital system
    - Microprocessor system
  - System documentation
- Lab Activities
  - System troubleshooting
  - System verification
  - System documentation

## Day 10

- System review
- Final exam
- Course evaluation