Hands-On Training Course

Advanced Radiographic System Maintenance (Phase II)

Course Length: 2 weeks
CEUs Awarded: 8

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 by 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

I. Introduction
  A. X-ray control block diagram
  B. Three phase generator circuit block diagram
  C. Single phase generator
  D. Terminology and symbology

Lab Activities

I. Knobology
II. Circuit identification and location
III. Test equipment operation and identification

DAY 2

I. Single- and three-phase H.V. secondary
  A. X-ray tube parameters
  B. Rectifier circuitry
    1. Full wave
    2. Half wave
  C. Constant potential
  D. Feedback circuitry
  E. Pulsed secondary
  F. Regulation circuitry
  G. H.V. divider circuitry
  H. Safety circuitry
  I. kV and mA overload protection devices

Lab Activities

I. H.V. calibration
II. Stick rectifier location and verification
III. Waveform analysis
IV. kV, mA overload verification and calibration
V. Midpoint overcurrent inspection and calibration
VI. H.V. secondary troubleshooting

DAY 3

I. kV control
  A. H.V. primary single phase
    1. kV metering
    2. Terminology and calibration
  B. H.V. primary three phase: 2 SCRs
    1. Auto transformer versus variac control
    2. Motor driven circuitry and feedback
    3. Static and regulation compensation
  C. Forced commutation
  D. H.V. primary three phase: 6 SCRs
    1. Bit selectors
    2. R.F. changeover
    3. Safety circuitry
  E. High Frequency kV Production

Lab Activities

I. kV primary identification and calibration
II. Waveform analysis
III. Motor driven circuitry maintenance and calibration
IV. Static and regulation calibration
V. kV primary troubleshooting

DAY 4

I. mA filament control
  A. Basic filament control
    1. Focal spot selection
    2. Modes of operation
    3. Preheat circuitry
    4. Space charge compensation
  B. Saturable reactor
    1. Filament feedback
    2. Real mA feedback
    3. Safety circuitry
  C. Chopper stabilization
    1. Max. filament limitations
    2. Filament overcurrent protection
  D. High frequency mA control

Advanced Radiographic System Maintenance (Phase II) *continued*

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Lab Activities

I. X-ray tube filament inspection
II. Waveform analysis
III. Type identification
IV. Preheat calibration
V. Max. filament limitation calibration
VI. Space charge calibration
VIII. Filament control troubleshooting

DAY 5

I. Time control
  A. Core memory
  B. Exposure start and stop
  C. Digital timers
  D. mAs Integration
  E. A.E.C.
  F. A.B.C.

Lab Activities

I. Timer identification and location
II. Waveform analysis
III. Timer calibration
IV. A.E.C. calibration
V. Timer troubleshooting

DAY 6

I. Control logic
  A. Tube protectors
    1. Allowable kW
    2. Programmed kW
    3. Auto rotor
  B. Rotor starters
  C. Relay control logic modes of operation
  D. Digital control logic
  E. Microprocessor control logic

Lab Activities

I. Identification and verification
II. Interfacing and signal tracing
III. Control logic troubleshooting

DAY 7

I. Ancillary equipment
  A. Tube stands
  B. Collimators
    1. Identification and modes of operation
    2. CDRH performance testing
    3. Bucky sensing
    4. Central ray
    5. Beam alignment
    6. Servo drive system

Lab Activities

I. Identification and verification
II. Servo drive locations and calibration
III. Mechanical and electrical alignment
  A. Light field versus radiation field
  B. Central ray
  C. S.I.D. shutter tracking calibration

DAY 8

I. Ancillary equipment
  A. Bucky table
  B. R.F. tables
    1. Two- and four-way table top
    2. Table tilt and safety
  C. Undertable tube alignment and shutter tracking
  D. Spot filmers
    1. Mechanical
    2. Electrical

Lab Activities

I. Tube alignment
II. Table calibration and verification
  A. Mechanical
  B. Electrical
III. Spot filmer alignment and verification
  A. Mechanical
  B. Electrical

DAY 9

I. System troubleshooting
  A. System diagrams
    1. Digital system
    2. Microprocessor system
  B. System documentation

Lab Activities

I. System troubleshooting
II. System verification
III. System documentation

DAY 10

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