Hands-On Training Course

Principles of Servicing Diagnostic X-Ray Systems (Phase I)

Course Length: 2 Weeks
CEUs Awarded: 8

Introduction

Principles of Servicing Diagnostic X-Ray Systems is a skills development program that teaches the new service professional the cognitive skills necessary to understand the X-ray system and its applications in the medical community. The program is divided into six major learning units:

- Introduction to radiography
- Radiation safety
- The production of X-rays
- Formation of the X-ray image
- Film and film processing
- Introduction to imaging

The course contains lecture, demonstration, and hands-on training, which teach participants proper operation, calibration, and preventive maintenance of the X-ray system. Upon completion of the course, the student will be able to perform first level service on the radiographic/fluoroscopic system.

Prerequisites

To attend this course, the service professional must have a two year associate degree in electronics or equivalent service experience.

Objectives

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

- Have a thorough understanding of X-rays and X-ray production
- Follow safety procedures for patients, physicians and individuals
- Describe the criteria for high quality radiographs
- Understand overtable radiographic, fluoroscopic, and special procedures system operation
- Describe the parameters of film and processing

Course Outline

DAY 1

I. Introduction to radiography
  A. X-rays: an overview
    1. What they are
    2. How they are produced
    3. What they do
  B. The radiographic system, an overview
  C. The radiograph, an overview
  D. Factors that measure radiographic quality
    1. Density
    2. Contrast
    3. Sharpness
  E. Factors that affect radiographic quality
  F. Operation of the overtable system
  G. Operation of the undertable system

Lab Activities

I. Operate overtable and undertable equipment
II. Take conventional and phototimed radiographs
III. Perform experiments using factors that affect image quality
IV. Process film and analyze results

DAY 2

I. Introduction to radiography (cont'd)
  A. Basic single purpose radiographic system
    1. Cine radiography
    2. Photo spot cameras
    3. High speed film changers
    4. Cassetteless radiography
    5. Tomography
    6. Mobile units
    7. C.T.
  B. Radiographic studies
    1. Common non-contrast media
    2. Common contrast media
    3. Special radiographic studies
  C. Introduction to troubleshooting the X-ray system
    1. Processor checkout
    2. Isolation of major areas
II. Radiation safety, principles and practices
  A. Radiation and its biological effects
    1. Atom
    2. X-ray beam
    3. Compton effect
  B. Radiation safety, working with radiation
    1. Rules governing working with radiation
    2. Time, distance, and shielding
    3. Radiation protective devices

Lab Activities

I. Operate cine and photo spot cameras
II. Operate tomo and mobile units
III. Troubleshoot R/F system to sub-assembly level
IV. Safety rules in working with radiation

DAY 3

I. The production of X-rays
  A. How X-rays are produced
    1. Where X-rays are produced
    2. How X-rays are controlled
    3. Bremmsstrahlung radiation theory
  B. The X-ray tube
    1. X-ray tube construction
    2. Functions of basic elements
    3. Electrical and mechanical requirements
    4. Proper usage
    5. Problems and cures
    6. Installation and evaluation

Lab Activities

I. Identify applications and types of X-ray tubes

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RSTI
Radiological Service Training Institute

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II. X-ray tube evaluation
  A. Proper stator resistance
  B. Filament continuity
  C. Direction of anode rotation
  D. Standby/max. filament using dummy load
  E. Anode speed using a reed tachometer
III. Evaluate focal spot size using a lead star
IV. Predict and observe instantaneous and accumulated anode heat
V. Identify common X-ray tube problems
VI. X-ray tube alignment

DAY 4

I. The production of X-rays (continued)
  A. H.V. cables and terminations
    1. Composition and conductors
    2. Federal terminations
  B. H.V. transformers (single phase)
    1. Ratio
    2. Stick rectifiers
    3. R/F changeover
    4. Full wave/half wave rectification
    5. Circuit failure and cause
  C. Generation of three phase
    1. Wye and delta
    2. Six and twelve-pulse generation
    3. Line-to-neutral versus line-to-line voltage
    4. Relationship of input to output voltages

Lab Activities

I. Grease and terminate X-ray cable
II. Measure primary and secondary kV
III. Follow safety rules for discharging cables, sticks, and transformer connections

DAY 5

I. The production of X-rays (cont'd)
  A. The X-ray generator
    1. kV circuitry
    2. Time/logic circuits
    3. mA control
    4. Troubleshooting

Lab Activities

I. Overall troubleshooting to sub-assembly level

DAY 6

I. Formation of the X-ray image
  A. Control of the X-ray image
    1. Techniques
    2. Technique charts
    3. Inverse square law
  B. Control & production of secondary and scatter radiation
    1. Photoelectric effect
    2. Compton effect
    3. Collimators
    4. Grids
  C. Intensifying screens
    1. Types
    2. Effect on quantity and quality
    3. Resolving capabilities
    4. Care and handling
  D. Measuring quantity and quality of the X-ray beam
    1. Ionization chambers
    2. Half-value layers

Lab Activities

I. Use technique charts to properly expose film
II. Evaluate the effect of scatter with and without grids
III. Perform "R" measurements
IV. Perform half value layer tests

DAY 7

I. X-ray film
  A. X-ray film and effects on radiographic quality
    1. Construction of X-ray film
    2. Formation of a latent image
    3. Sensitometric properties
    4. H & D Curve
    5. Speed, contrast, latitude, and base fog

Lab Activities

I. Evaluate speed, contrast, average gradient, latitude of different films
II. Plot H & D curves
III. Utilize sensitometer and densitometer
IV. Evaluate the effect of high speed screens on different films

DAY 8

I. Film processing
  A. Processing cycle
    1. Time versus temperature
    2. Chemical replenishment

Lab Activities

I. Adjust temperature and replenishment rates of processor
II. Perform routine maintenance on processor

DAY 9

I. Introduction to imaging
  A. The eye and what it sees
    1. Visual acuity
    2. Intensity discrimination
    3. Rod and cone vision
  B. Image intensifiers
    1. Construction
    2. Operation
  C. Optics
  D. Television

Lab Activities

I. Identify the major components of an imaging system
II. Operation of imaging system
III. Routine adjustments of the television

DAY 10

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

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