

PRINCIPLES OF SERVICING DIAGNOSTIC X-RAY SYSTEMS (PHASE I)

Hands-On Training Course

Course Length: 2 Weeks
CEUs Awarded: 8 CEUs

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 photo timed 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

DAY 2 *cont'd*

- 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. Learn 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. Bremsstrahlung 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

PRINCIPLES OF SERVICING DIAGNOSTIC X-RAY SYSTEMS (PHASE I) CONTINUED

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Lab Activities

- I. Identify applications and types of X-ray tubes
- 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 (*cont'd*)
 - 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*)
 - 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. Make routine adjustments of the television

DAY 10

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