

# Principles of Servicing Computed Tomography Systems (Phase 1)



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## Introduction

Principles of Servicing Computed Tomography Systems is designed for the new service professional. It teaches all the cognitive skills necessary to understand the CT system and its application to the medical industry.

The program is divided into seven major areas:

- Basic CT principles
- Safety procedures
- System operation
- Verification of system specifications
- Backing up software
- Troubleshooting to major subsystems
- Preventive maintenance

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

## Prerequisites

It is recommended completion of Phase 1 or a service background and two year Associate's Degree in electronics or equivalent service experience.

## Objectives

At the conclusion of this course, participants will:

- Have a thorough understanding of CT principles and image production
- Follow safety procedures for patients, physicians, and individuals

- Be able to load and backup system and diagnostic software
- Be able to completely operate the CT system including local operation
- Troubleshoot to the major subsystem level
- Perform preventive maintenance

## Course Outline

### Day 1

- Introduction
  - Overview of CT
    - What is it
    - Advantages/disadvantages
    - Different generations of scanners
    - Detector differences
- CT principles
  - Matrix sizes
  - CT numbers
  - Window width and level
  - Slice thickness
  - Collimators
  - Algorithm
- Lab Activities
  - Proper power up and power down procedures
  - Location of E-stop/emergency off switches
  - Booting computer into scan software
  - Measurement of power requirements
  - X-ray tube warm up procedure

### Day 2

- CT principles cont'd
  - CT X-ray principles

- Sampling rates and number of detectors
- Back projection
- Attenuation coefficients
- Tomographic blurring
- Scan parameters
- Noise/algorithms
- Image manipulation techniques
  - Standard deviation
  - Isodensity
  - Region of interest
  - Multiviewing of images
- Simplified block diagram
- Lab Activities
  - Introduction to scanning software operation
  - Pilot/scout scans
  - Scanner parameter manipulation
  - Patient transport operation

### Day 3

- Computer fundamentals review
  - CPU/memory/input, output
  - DMA transfers
  - Special CT applications
- CT imaging principles
  - Filtered back projection
  - Air calibration-why needed
    - Pilot/scout scans
    - Normal scan
  - Spectrum correction
- Lab Activities
  - Scanner parameter manipulation
  - Technique selection/application

### Day 4

- System hardware overview- block diagram

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- Power distribution block diagram
- X-ray system block diagram
- Gantry block diagram
- Patient transport block diagram
- Data acquisition block diagram
- Computer block diagram
- Lab Activities
  - Major component locations
  - Major signal flow
    - kV/mA
    - Detector data
    - Motor feedbacks

## Day 5

- Types and uses of phantoms
  - Spatial resolution
  - Contrast resolution
  - Linearity
  - CT numbers of water equal to zero
  - Slice thickness
- Manufacturers' specification
- Lab Activities
  - Verification of manufacturers' specification
    - Linearity
    - CT number
    - Spatial/contrast resolution

## Day 6

- Backing up software
  - Scan software
  - Diagnostic software
  - Images
  - Raw data
- Loading software onto a CT system
  - How to do a "cold" boot
  - Minimum diagnostics hardware
- Lab Activities

- Make back-up tapes
- Load software

## Day 7

- Operate subsystem locally
  - X-ray subsystem
  - Gantry subsystem
  - Computer subsystem
  - Data acquisition subsystem
- Introduction to system troubleshooting
- Lab Activities
  - Operation of all subsystems locally
  - Location of problems to major subsystems

## Day 8

- System troubleshooting
  - Recognizing and localizing problems
  - Most common problems to watch for
- Introduction to P.M.
  - What constitutes a P.M.
  - How often should they be performed
- Lab Activities
  - System troubleshooting

## Day 9

- Preventive maintenance
  - Items to do weekly
  - Items to do monthly
  - Items to do quarterly
  - Equipment needed to do a P.M.
- Lab Activities
  - Perform PM procedures

## Day 10

- System review
- Final exam
- Course evaluation