

# GE LightSpeed CT Systems Maintenance (Phase 3)



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### Introduction

G.E. LightSpeed Computed Tomography Systems Maintenance is a skills development course designed as a continuation of the Principles of Servicing Computed Tomography Systems (CT Phase 1) and Multi-Vendor Computed Tomography Systems Maintenance (CT Phase 2) courses. Through attending this course, the service professional will become self-confident in working on the gantries, patient transports, detector assemblies, 4/8/16/32 slice DAS systems, image processing systems, X-ray control systems, rotor controls, and operator control systems of the LightSpeed CT family. Hands-on lab time is emphasized, and makes up approximately 80% of the overall course content.

### Prerequisites

To attend this course, the service professional must have an extensive knowledge of CT physics, physical principles and service procedures gained through attendance at the RSTI Principles of Servicing Computed Tomography Systems (Phase 1) and RSTI Multi-Vendor Computed Tomography Systems Maintenance (CT Phase 2) courses or equivalent training and experience.

### Objectives

Following attendance of this course, participants will be able to:

- Perform scheduled maintenance on GE LightSpeed CT systems
- Change the X-ray tube, realign and recalibrate the X-ray generator

- Calibrate, replace and align the collimator
- Calibrate, service, align, and use diagnostic tools to evaluate performance of the DAS and detector assembly
- Calibrate, replace and align the hardware associated with the gantry and patient transport
- Diagnose and correct problems in the scanning sequence
- Troubleshoot gantry, patient transport and X-ray system problems
- Diagnose and correct problems in the digital acquisition system and detector array
- Diagnose and correct problems in the image generation system
- Troubleshoot the operator workstation problems

### Course Outline

***Lab functions will be repeated on each system available.***

#### Day 1

- System operation and power distribution
  - Systems operational parameters
  - Major system component identification
  - System controls
    - Safety
    - Interlocks
  - Patient registration/scheduling
  - Exam/technique settings
- System architectures
  - System block diagrams
  - System revision changes

- Power distribution
  - Power distribution diagrams
    - Main AC power
    - Sub-system AC power
    - DC power supplies

#### Day 2

##### Lab Activities

- Scheduling an exam
  - Patient registration
  - Selecting technique parameters
    - Scout view
    - Axial views
    - Helical views
- Power distribution cont'd
  - Verify AC power supplies
    - Main power distribution
    - Gantry AC power
    - Table AC power
    - Console Power
  - Verify DC power supplies
    - Control system DC power supplies
    - Gantry DC power supplies
      - Stationary
      - Rotating
    - Table DC power supplies
    - X-ray system DC power supplies
      - X-ray generator
      - X-ray tube rotor control
      - Collimator
    - Detector/DAS area DC power supplies

#### Day 3

- Motor verification and replacement
  - Gantry rotation
    - Axial speed control
    - Axial motor driver
    - Harmonization/encoding

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- Patient transport/table movement and indexing
  - Tabletop horizontal control
    - ☐ Speed control
    - ☐ Motor drivers
    - ☐ Harmonization/Encoding
  - Table vertical travel
    - ☐ Speed control
    - ☐ Motor drive
    - ☐ Position indication
- Laser position indicators
  - Operation
  - Alignment

### Lab Activities

- Gantry rotation
  - Axial driver verification
    - Axial motor driver waveforms
    - Rotational speed tests
  - Drive assembly mechanical adjustments
  - Encoder verification
- Patient transport
  - Vertical motor driver waveforms
  - Vertical position indication
  - Horizontal motor driver waveforms
  - Encoder verification
- Laser adjustments

### Day 4

- X-ray generation
  - High voltage control
  - Filament controls
    - Filament drive
  - Rotor controller
  - Collimator controls
  - Filter control
- X-ray tube change
  - Tube selection

- De-install/install issues
- Required calibrations and alignment

### Lab Activities

- X-ray tube change
  - De-install procedures
  - Installation procedures
- High voltage control waveforms
  - Intermediate voltage verification
  - kV demanded
  - kV actual
  - VCO frequency
  - IGBT/SCR gate drive
- kV calibration
- Filament drive waveforms
  - Filament drive demanded
  - Filament drive actual
  - mA demanded
  - mA actual
- mA calibration

### Day 5

#### Lab Activities

- Rotor control waveforms
- Collimator control waveforms
- Collimator alignment
- Filter position control verification
- Beam on window adjustment
- Plane of rotation adjustment
- ISO center adjustment

### Day 6

- Detector and DAS
  - Detector architectures
    - Maintenance issues
    - Detector replacement
  - DAS architectures
    - Pre-amp/channel boards

- DAS control
- Data convolution
- Data transmission
  - Fiber optics
- Slip ring data transfers
  - Brushes
  - RF transmitters

### Day 7

#### Lab Activities

- Pre-amp/channel board verification
  - Detector output mapping
  - Pre-amp measurements
- Detector/DAS replacement
  - Removal procedures
  - Installation and alignment
  - Calibration
- Data transfer verification
  - DAS data output
  - Data transfer verification
  - Data to image processing verification

### Day 8

- Image processing and handling
  - Front end processing
  - Temporary preprocessed data storage
  - Image reconstruction
  - Processed image handling
    - Image generation for display
    - Image storage
      - ☐ System disk
      - ☐ MOD
      - ☐ CD/DVD ROM
      - ☐ Print services
      - ☐ DICOM

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### Lab Activities

- Image reconstruction system testing
  - Image processor
  - Image generator
- Image reconstruction testing
  - Real time reconstruction
  - Retro-reconstruction
- Manage image files
  - Image disks
    - Replacement
    - Managing storage space
  - MOD
  - DICOM setup
  - Printer setup
- Image noise
- System troubleshooting
  - Electronic
  - Software assisted

### Day 10

- Course review
- Final exam
- Course evaluation

### Day 9

- System control and image quality
  - System host computer
    - Field replaceable units
    - System hard drives
  - System to gantry control
    - Stationary controls
    - Rotating controls
  - System to x-ray system control
    - X-ray generation
    - Collimation/filter
  - System to image processing/handling
  - Image quality control tests

### Lab Activities

- System control communications verification
- System state back-up and restore
- QC phantom image evaluation
  - Resolution
  - Contrast
  - CT number tracking