

GE HD CT Systems Maintenance: Revolution & Discovery



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Introduction

GE HD CT Systems Maintenance is a skills development course designed as a continuation of the GE Non-HD CT Systems Maintenance course. Through meeting the prerequisites and attending this course, the service professional will become self-confident in servicing the Discovery CT750HD, Discovery CT, Revolution HD and Revolution Discovery w/GSI and HD configuration CT systems. This course will examine the various gantry systems, table systems, HD detector configurations (HD-HDAS/HD-CDAS), HD detectors (HD-HDAS/MERC40), console configurations, Performix HD/HD Plus X-ray Tubes and JEDI SC100 Generator, rotor control, and power distribution systems of the GE HD CT family of systems. Individual systems will be discussed in a modular format where a system is viewed as a collection of the various subsystems covered in class. 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 I), RSTI Multi-Vendor Computed Tomography Systems Maintenance (CT Phase II)

and GE Non-HD CT Systems Maintenance courses or equivalent training and experience.

Objectives

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

- Perform scheduled maintenance on GE HD CT systems
- Change the X-ray tube, realign and recalibrate the system
- Calibrate, test, repair/replace and align the collimator
- Calibrate, repair, align, and use diagnostic tools to test/evaluate performance of the DAS and detector assemblies
- Calibrate, test, replace and align the hardware associated with the gantry and patient transport systems
- Diagnose and correct faults occurring during the scanning sequence
- Troubleshoot gantry, patient transport and X-ray system problems
- Diagnose and correct problems in the digital acquisition system (DAS) and detector array
- Diagnose and correct problems in the data transport and image processing systems
- Troubleshoot and resolve console problems, reload software, backup/restore system settings

Course Outline

Lab functions will be repeated on each system available.

Day 1

- System Documentation
- System operation and power distribution
 - o Systems operational parameters
 - o Major system/component identification
 - o System controls
 - Safety
 - Interlocks
 - o Patient registration/scheduling
 - o Exam/technique settings
- System architectures
 - o System block diagrams
 - o System revisional changes
- Power distribution
 - o Power distribution diagrams
 - Main AC power
 - Sub-system AC power
 - DC power supplies

Lab Activities Day 1

- Scheduling an exam
 - o Patient registration
 - o Selecting technique parameters
 - Scout view
 - Axial views
 - Helical views
- Component ID
- Power distribution
 - o Verify AC power supplies
 - Main power distribution
 - Gantry AC power
 - Table AC power
 - Console Power

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- o 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 2

- Gantry systems
 - o Gantry/Table control
 - o Gantry rotation
 - Axial speed control
 - Axial motor driver
 - Harmonization/encoding
 - o Tilt control
 - Alignment for HD to avoid staircase artifact
 - o Operator interface
- Patient transport (table) systems
 - o Safety
 - o Patient transport/table movement and indexing
 - Tabletop horizontal control
 - Speed control
 - Motor drivers
 - Harmonization/Encoding
 - Table vertical travel
 - Speed control
 - Motor drive
 - Position indication
 - Tabletop horizontal control
 - Sub top movement

- Speed control
- Motor drivers
- Position/Encoding
 - Laser position indicators
- X-ray generation
 - o JEDI SC100
 - o High voltage control
 - Dual energy for Gemstone Spectral Imaging
 - o Filament controls
 - Filament drive
 - JEDI SC filament functions
 - FS Length control
 - FS Width/Position control
 - FS Transfer Function
 - o Rotor controller
 - o Collimator controls
 - o Filter control
- X-ray tube
 - o Tube selection
 - Liquid/Ball Bearing
 - Active getter
 - o Spit recovery
 - Heat soak
 - Pressure Recovery Kit
 - o De-install/install issues
 - o Required calibrations and alignment

Lab Activities Day 2

- Gantry rotation
 - o Axial driver verification
 - Axial motor driver tests
 - Rotational speed tests
 - o Drive assembly mechanical adjustments
 - o Encoder flag verification/replacement
- Patient transport

- o Vertical motor driver tests
- o Vertical position indication
- o Horizontal motor driver tests
- o Encoder verifications
- Laser adjustments
- X-ray tube change
 - o De-install procedures
 - o Installation procedures
 - De-airing tube
 - De-airing cooling unit
 - Pressure recovery procedure (De-gassing tube)
 - Tube installation alignments
 - Beam on window adjustment
 - Plane of rotation adjustment
 - ISO center adjustment
 - System calibrations following tube replacement
 - Detail calibrations
- High voltage/mA control
 - o Intermediate voltage verification
 - o kV Verification
 - kV single/dual energy
 - o Filament drive (mA) Verification
 - Filament drive
 - mA actual

Day 3

- Detector and DAS Control
 - o Gemstone Detector Technology
 - o HD-HDAS
 - Halo/Saturn Detector
 - o HD-CDAS
 - MERC40 Detector
 - o DAS/Detector architectures
 - HD-HDAS

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- Detector-A/D converter boards (FRDM)
- DAS Interface Board (DIFB)
- DAS Control Board
- HD-CDAS (Chiclet)
- Detector- A/D-VCS Module (MERC40)
- CDAS Control Board
- DAS board/module replacement procedures
- o Data transmission
 - Fiber optics
 - Slip ring data transfers
 - Brushes
 - RF transmitters/receivers

Lab Activities Day 3

- Rotor control
- Collimator controls
 - o Collimator tests
 - Function
 - Positioning
 - o Filter position control verification
- Detector verification
 - o Software assisted evaluations
 - o Fault identification
 - o Replacement part selection
- Detector/DAS board replacements
 - o Removal procedures
 - o Installation and alignment
 - o Calibration
- Data transfer verification
 - o DAS data output
 - o Data transfer verification
 - o Data to image processing verification

Day 4

- Console configurations

- Image processing and data handling
 - o Front end processing
 - o Scan Data Drive maintenance and testing
 - o Image reconstruction
 - o Processed image handling
 - Image generation for display
 - Image storage
 - System drive
 - USB
 - DVD
 - DICOM

Lab Activities Day4

- Image reconstruction testing
 - o Real time reconstruction
 - o Retro-reconstruction
- System software
 - o Load from cold
 - o Drive/RAID management
 - o DICOM setup

Day 5 (FULL DAY)

- System control and image quality
 - o System host computer
 - Field replaceable units
 - System hard drives
- System control/communication
 - o TCP/IP communication
 - o CAN bus
 - Testing/ Verification
 - o System to gantry control
 - Stationary controls
 - Rotating controls
 - o System to x-ray system control
 - X-ray generation
 - Collimation/filter

- o System to image processing/handling
- o Image quality control tests

Lab Activities Day 5

- System control communications verification
- System state back-up and restore
- QC phantom image evaluation
 - o Resolution
 - o Contrast
 - o CT number tracking
 - o Image noise
- System troubleshooting
 - o Electronic/Mechanical
 - o Software assisted

Course review

- Review
- Final exam
- Course evaluation