University Health™	**Policy #: 13.7a**
SUBJECT: Daily Equipment Quality Control for CT Equipment	**Effective: 10/1/2013** **Reviewed: 10/1/2016**
APPROVED BY: Radiology Technical Director	**Page 1 of 6**

Purpose:

The QC program assesses relative changes in system performance as determined by the technologist, service engineer, qualified medical physicist, or supervising physician. The equipment QC program is designed to ensure CT equipment is operating within the specifications and guidelines set by the manufacturer, Department Environmental Quality and the American College of Radiology (ACR).

Scope: All CT staff technologist

Policy:

The CT Technologist will perform and log quality control procedures based on the following criteria:

1. Once every 24 hours (scanner used 24/7) or before the first patient is scanned
2. After major repairs. Major repairs include replacement or repair of components such as an x-ray tube or detector assembly.
3. Any out of range quality control values or other problems will be immediately brought to the attention of the supervisor or manager.

Procedure:

The QC program consists of the following procedures.

PROCEDURE	MINIMUM FREQUENCY	APPROXIMATE TIME IN MINUTES
Water CT Number and Standard Deviation	Daily	5
Artifact Evaluation	Daily	5 (or less)
Visual Checklist	Monthly	5
Display Monitor Quality Control	Monthly	5

Water CT Numbers and Standard Deviation (Noise) – is performed to ensure the relative calibration of all CT numbers to water remains within acceptable limits and quantum noise and electronic system noise do not increase. Too much image noise degrades low-contrast detectability.	
Frequency:	Daily
Required Equipment:	Use the water phantom provided by the scanner manufacturer.
Record:	Data are recorded on the data form for daily CT Equipment Quality Control.
Test Procedure:	1. Warm up the scanner's x-ray tube according to manufacturer recommendations. Select daily prep on the GE operators console or check-up from the setup tab on the Siemens. 2. Perform calibration scans (often called air-calibration scans) according to scanner manufacturer recommendations. Perform fast cals on the GE and calibration on the Siemens.
	3. Place the QC phantom on the holder device provided. Center the phantom at the isocenter of the scanner using the laser alignment lights of the scanner and the alignment marks on the phantom surface. 4. For GE equipment, set up a scan of the QC phantom using the scanner's ACR daily QC scan parameter settings. Complete recon 1 and 2. Plastic, Air and Water mean and standard deviation values should be monitored for both axial and helical scan modes. 5. For Siemens equipment, follow the manufacturer's guidelines. See the attached letter from Thomas Larry of KLS Physics Group.
Data Interpretation and Corrective Action:	GE Equipment 1. Select the first image of the axial group of images obtained, to analyze. Place a region-of-interest (ROI) in the plastic, the water and in air on the image. If the size of this ROI is not specified by the scanner manufacturer, use an area around 400 mm 2 . Record the values reported for the plastic, air and water mean and standard deviation on the data form. 2. Repeat the above measurements for the first image of the helical group.

	Record the values reported for the plastic, air and water mean and standard deviation on the data form. 3. For Siemens equipment, follow manufacturer's suggestions. See the attached letter from Thomas Larry of KLS Physics Group. 4. The mean values ranges for plastic, air and water should correspond with the specific unit. CT Unit Plastic Air Water the data form. 3. For Siemens equipment, follow manufacturer's suggestions. See the attached letter from Thomas Larry of KLS Physics Group. 4. The mean values ranges for plastic, air and water should correspond with the specific unit. CT Unit Plastic Air Water Standard Deviation LS 16 (2nd fl) 16 to 126 -970 to 10005 -5 to 5 2.7 to 4.7 VCT 113 to 123 -1001 to -991 -5 to 5 2.7 to 4.7 LS 16 (FW) 121 to 131 -995 to -985 -5 to 5 2.6 to 4.6 Siemens AS -------5 to 5 11 to 16 5. If either the mean CT number or the noise (standard deviation) is not within the criteria limit for 3 days in a row or 3 times within a 7-day period, corrective action should be taken by reporting the problem to service representatives and the manager.
Artifact Evaluation – is performed to identify and correct artifacts in images of a uniform test phantom before they become severe enough to be detected in patient images.	
Frequency:	Daily
Required Equipment:	Use the water phantom provided by the scanner manufacturer Data are recorded on the Data Form for Daily CT Equipment Quality Control.
Record:	
Test Procedure:	1. Use the thin reconstructed images acquired during the daily QC 2. Visually assess the images acquired using a window width/level setting of 100/0. Look for rings, streaks, lines, or anything that should not be present in the image. This process can be accomplished by quickly cycling through all artifact images in a stack. Record findings on the data form. Indicate if there are artifacts on the image by writing "yes" or "no" in the appropriate place on the data form.
Data Interpretation and Corrective Action:	1. Ring artifacts typically indicate detector or data channel imbalance. Repeat the air-calibration procedure and then repeat artifact images. If the ring artifacts are not corrected after performing repeat air-calibration procedures, immediately call service to correct issue. Until service is completed, the QC team should decide if the scanner can be used for patient exams (perhaps on a limited basis and depending on the type and severity of the artifact). 2. If the difference between the artifact mean CT number (within the ring or circle) and the unaffected background mean is greater than 3 HU, service should be called to address the artifact. 3. All images with an artifact should be saved to a library of artifact images of the water phantom. These images should be reviewed periodically to ensure that: a. Subtle artifacts that can be removed by repair are properly addressed and b. Subtle artifacts that are present when the scanner is functioning properly

	▯ are ignored to avoid unnecessary downtime and expense.

Visual Checklist – is performed to ensure the CT system's patient bed transport, alignment and system indicator lights, intercom, the emergency cart, room safety lights, signage, and monitors are present, working properly, and are mechanically and electrically stable.	
Frequency:	Monthly
Required Equipment:	
Record:	
Test Procedure:	This visual checklist must be completed on the first working day of the month. The checklist includes the following: 1. Table height indicator 2. Table position indicator 3. Angulation indicator 4. Laser localization light a. inside light b. outside light 5. Table motion smooth 6. X-ray on indicator 7. Exposure switch 8. Display window width/level 9. Panel switches/lights/meters 10. Warning labels present 11. Intercom system functioning 12. Postings present a. X-ray on light b. Do not enter x-ray in progress 13. Pregnancy notification 14. Service records present
Data Interpretation and Corrective Action:	Each of the items listed in the visual checklist should pass or receive a check mark. Items that do not pass the visual checklist should be replaced or corrected immediately. Items missing from the room should be replaced immediately. Malfunctioning equipment should be reported to the CT service engineer for repair or replacement as soon as possible

Gray Level Performance of CT Scanner Acquisition Display Monitors – is performed to ensure that images on the monitors of the CT scanner display the entire range of gray shades produced by the CT scanner.	
Frequency:	Monthly or whenever a significant change is made to the imager's display monitors.
Required Equipment:	SMPTE Test Pattern or Equivalent

Record:	
Test Procedure:	1. Display the test pattern on the imaging console. Set the display window width/level to the manufacturer-specified values for the SMPTE pattern. Do not set the window width/level by eye; doing so invalidates this procedure. 2. Examine the pattern to confirm that the gray level display on the imaging console is subjectively correct. The visual impression should indicate an even progression of gray levels around the ring of gray level patches. Verify the following: a. The 5% patch can be distinguished in the 0/5% patch; b. The 95% patch can be distinguished in the 95/100% patch; and c. All the gray level steps around the ring of gray levels are distinct from adjacent steps. If these conditions are not met, do not adjust the display window width/level in an effort to correct the problem. Corrective action for the monitor is needed.
Data Interpretation and Corrective Action:	The monitor should be positioned so that there is no glare from room lighting. Most often, the problem is caused by incorrect adjustment of the monitor's brightness and contrast. Excessive ambient lighting can cause the problem. Occasionally, components of the display may need recalibration, repair, or replacement. Perform the manufacturer's recommended procedure for monitor contrast and brightness adjustment. If there is any doubt about the correct procedure, or if the brightness and contrast controls are not accessible, have the qualified medical physicist or service engineer make the adjustments. Note: As part of the periodic maintenance program of the CT scanner, the display monitors of the CT scanner should be checked and recalibrated at least annually.

Daily QA Procedure

1. The daily QA must be ordered in RIS, use following as a guide.
2. Scheduling
3. Enter Edit
4. Locate Patient (see list below)

The following demographics have been set up in RIS for each CT unit:

CT Unit Name MRN

CT 2nd floor CT, PHANTOMCTSP SHV13000000

CT64 CT, PHANTOMCT64 SHV90000000

CTER CT, PHANTOMCTER SHV11000000
CTFW CT, PHANTOMCTFW SHV12000000
ARTIFACT CT, PHANTOMARTIFACT SHV14000000
Accession # -New
Exam – CWQC
Pat Status -I
Location – SHV RAD CAT
Modifier -COMP
History – Daily QA
Provider -Gonzales-Toledo
Requester – Gonzales-Toledo
Save data

1. Go to technologist work list and assign order to appropriate scanner.
2. Select ACR QC protocol and scan phantom.
3. Perform QA as required
   - a. Send required images to PACS and mark them Reference only
   - b. Save screen axial image with measurements
   - c. Save screen helical image with measurements
4. Track images to complete
5. All data will be recorded in a CT QC logbook.

University Health Shreveport's Radiology Department is committed to ensuring that every technologist will execute this quality control program on a daily basis. To that end, enforcement of this policy will be accomplished through education and progressive disciplinary action steps:
Step 1 – Verbal counseling and education as determined by the section manager.
Step 2 – Written reprimand
Step 3 – Written reprimand with referral to Human Resources for disciplinary action.
Violations of guidelines will be tracked within a 12 month period from the first infraction