

Q.A. Lab Experiment # 1

Visual Inspection of X-ray Room and Units

CR and DR Units

Purpose

To check the main components of the equipment to ensure that there are no hazardous, inoperative, out-of-alignment, or improperly operating items in the system.

Learning Objectives

After completing this lab, you should be able to:

1. Use the laboratory equipment properly.
2. Set up the control console and ceiling tube mount correctly.
3. Function effectively in group work.
4. Perform the experiment independently.

Materials Needed

- X-ray room and radiographic unit

Pre-Lab Discussion

When the x-ray equipment has been installed successfully and has passed all acceptance tests, it needs to be monitored periodically to ensure that it continues to perform according to the manufacturer's specifications. This periodic testing is the quality control testing of the equipment. The main goal of this quality control program is to ensure consistent, high-quality diagnostic images; minimize radiation exposure to both patient and department staff; and help in cost effectiveness by reducing downtime and waste. The three parts of a quality control program for radiographic equipment are visual inspection, environmental inspection, and performance testing. These tests should be performed upon acceptance of new equipment (or after a major repair of existing equipment) and then at least annually. Any items that are found to not meet manufacturer's specifications will need to be corrected or repaired. Most states and accrediting agencies require that all records of corrections or repairs be maintained for inspection. In

addition, records of QC testing should also be maintained in either written form or in a computerized database.

Environmental Inspection Environmental inspection should be performed at least annually (it may need to be performed more frequently with older equipment), and it involves general observation of mechanical and electrical integrity and stability. Often, it can be performed along with the visual inspection.

- **Mechanical Integrity**—Key items to look for are the presence of loose or absent screws, bolts, or other structural elements that may have been improperly installed or have worked loose because of use. The functioning of meters, dials, and other indicators should be checked.
- **Mechanical Stability**—Of key importance from the equipment side are the stability and stiffness of the x-ray tube support and image receptor (i.e., table bucky or wall-mounted cassette holder). The mechanical condition of the x-ray tube counterweights and tracks (especially in overhead tube stands) must also be included in the environmental inspection. Lubricate the moving parts. The availability and adequacy of patient support devices such as the table or immobilizing devices should also be checked. In addition it is important to check the reproducibility of positioning of the source and image receptor that may be indicated or controlled by physical marks or detents. A check of the accuracy of angulation scale should be made. As part of the check of structural stability an inspection of the electrical and/or mechanical locks on the machine should be carried out.
- **Electrical Integrity**—One item included in this portion of the environmental inspection is evaluation of the condition of the x-ray tube high-tension cables, which is accomplished by checking the covering on the outside of the cables (or any other wires that are visible on the outside of the unit). Any discoloration of the outside insulation, especially where the wire or cable bends, could be an indicator of internal heat and a potential short circuit. Check to ensure that the retaining rings at the termination points are tight and that there are no breaks in the insulation. It is important to observe the “lay” of the cables. If they do not hang properly, they can interfere with positioning of the tube and may fail prematurely. Consult a biomedical engineer, medical physicist, or vendor service technician if discoloration is present.
- **Electrical Safety**—Electrical safety is critical for both the patient and the equipment operator. The system should be checked by a safety engineer. This involves a physical inspection of the electrical wiring. Key areas where problems often occur include the power cord to light indicators in the beam limitation system, the wires to the exposure hand switch, and other similar power hook ups. Verify that all elements are well grounded (to each other and to the ground). All radiographic equipment should be grounded and all obvious electrical connections should be intact. Should the possibility of a short circuit exist, never touch an electrical device with one hand while the other hand is touching any type of conductor; doing so directs the flow of electricity through the heart.

If someone is experiencing an electric shock, do not grasp the person directly. Instead, either open the main switch (turn off the power) or use some type of insulator (dry wooden board) to separate the person from the source of the electricity. A good rule of thumb to remember when dealing with electric current is that the combination of high voltage and low amperage tends to throw a person, whereas a combination of low voltage and high amperage tends to hold a person

and is potentially more dangerous. For older equipment or equipment that has a history of problems with electrical safety, a biomedical engineer, medical physicist, or vendor service technician should be consulted for environmental inspections (you may also wish to have them accompany you during these inspections). Many states require that an electrical inspection record be posted on the equipment.

Instructions:

1. Perform visual inspection of X-ray room according to the steps in the form below.
2. Perform visual inspection of X-ray unit according to the steps in the form below.
3. Record results of your inspection in the form below.

Corrective Action:

Any items that are found to not meet manufacturer’s specifications will need to be corrected or repaired.

Visual Inspection of X-ray Room and Unit

Room Number _____

Date _____

Inspected by _____

Recommended Test Frequency _____

Item	Procedure	P/F/NA	
X-ray tube perpendicularity to table	Stand at the end of the table and observe whether the tube and collimator appear to be perpendicular to the table		
X-ray tube perpendicularity to upright bucky	Observe whether the tube and collimator appear to be perpendicular to the upright bucky		
SID indicator table bucky	Check SID accuracy with a tape		
SID indicator vertical bucky	Check SID accuracy with a tape		
Tube movement locks	Check the function of all locks		
Collimator field light	Check if the collimator field light is functioning		
High voltage (tension) cables	Check the covering on the outside of the cables, discoloration of the outside insulation, and unsupported areas		
Tube information label on housing	Ensure the information label can be found on the tube housing		
Focal spot mark on housing	Ensure focal spot is marked on the tube housing		

Anode and cathode indicator	Ensure anode and cathode are identified on the tube housing		
Filtration information	Ensure filtration information is on the tube housing		
Overhead tube crane movement	Move the crane system and make sure it moves without obstruction		
Bucky tray lock (table)	Ensure the lock is functioning		
Bucky tray lock (upright)	Ensure the lock is functioning		
Image receptor (cassette) lock (table)	Ensure the lock is functioning		
Image receptor (cassette) lock (upright)	Ensure the lock is functioning		
Hand switch placement	Check if it's placed in the fixed position behind the protective barrier		
Panel lights, switches, and meters	Ensure lights, switches and meters are functioning		
Door switch	Ensure door switch is functioning		
AEC use indicator light	Ensure AEC use indicator light is functioning		
Panel warning sign	Check functioning of the warning sign		
Technique charts	Ensure the technique charts (CR and DR system) are present		
Protective apparel	Check the availability of the protective apparel		
Visible indicator of exposure prep phase	Check functioning of the exposure prep phase indicator		
Visible indicator of exposure	Check functioning of the exposure indicator		
Audible signal of irradiation	Check functioning of the audible indicator		

P= Pass, F=Fail, N/A not available due to lack of testing equipment