

## Overview of Radiographic Equipment

Radiographic equipment is used to produce and control X-rays for diagnostic imaging.

### Main Components:

- Control panel
- X-ray tube
- Collimator
- Image receptor (IR)
- Table / upright Bucky
- Generator

### Control Panel

#### Purpose:

Allows the technologist to set exposure factors

#### Controls Include:

- kVp (kilovoltage peak) → controls beam energy/penetration
- mA (milliamperage) → controls number of electrons
- Time → length of exposure
- mAs → total radiation ( $\text{mA} \times \text{time}$ )
- AEC (Automatic Exposure Control) → stops exposure automatically

### X-Ray Tube Assembly

The heart of the imaging system—where X-rays are produced

#### Components:

##### Cathode (Negative Side)

- Filament (tungsten) → releases electrons
- Focusing cup → directs electrons toward anode

##### Anode (Positive Side)

- Target (tungsten) → converts electron energy into X-rays
- Types:
  - Stationary anode
  - Rotating anode (reduces heat)

### Important Concept:

- Thermionic emission → electrons released when filament is heated

### X-Ray Tube Housing

#### Function:

- Protects tube
- Absorbs radiation
- Dissipates heat

#### Contains:

- Insulating oil
- Lead-lined casing

## **Collimator**

### **Purpose:**

- Narrows (limits) the X-ray beam

### **Benefits:**

- Reduces patient dose
- Improves image quality
- Decreases scatter radiation

## **Filtration**

### **Function:**

- Removes low-energy (useless) X-rays

### **Types:**

- Inherent filtration → built into tube
- Added filtration → aluminum filters

## **Image Receptor (IR)**

### **Purpose:**

Captures the image

### **Types:**

- Digital detectors
- CR plates (computed radiography)

## **Bucky System**

### **Types:**

- Table Bucky
- Upright Bucky (wall stand)

### **Contains:**

- Grid
- Image receptor

## **Grids**

### **Function:**

- Absorb scatter radiation before it reaches IR

### **Result:**

- Improves contrast
- Requires increased exposure

## **Generator**

### **Function:**

- Supplies electrical power to X-ray tube

### **Types:**

- Single-phase
- Three-phase
- High-frequency (most efficient)

## **Exposure Switch**

### **Two-step switch:**

1. Prep → heats filament
2. Expose → produces X-rays

### **Safety Features**

- Dead-man switch (must be held)
- Warning lights
- Lead shielding
- Tube housing protection

## **Key Terms to Know**

- kVp – controls beam energy
- mA – controls electron flow
- mAs – total radiation output
- Cathode – negative electrode
- Anode – positive electrode
- Filament – tungsten wire producing electrons
- Thermionic emission – release of electrons by heat
- Collimation – restriction of beam size
- Filtration – removal of low-energy photons
- Grid – device that absorbs scatter
- Bucky – grid + IR holder system
- AEC – automatic exposure control
- Scatter radiation – deflected X-rays
- Image receptor (IR) – captures image
- Generator – provides electrical energy

1. The \_\_\_\_\_ panel is used to adjust exposure factors.
2. kVp controls beam \_\_\_\_\_.
3. mA controls the number of \_\_\_\_\_ produced.
4. mAs is equal to \_\_\_\_\_  $\times$  time.
5. The \_\_\_\_\_ is the negative side of the X-ray tube.
6. The \_\_\_\_\_ is the positive side of the X-ray tube.
7. The filament is located in the \_\_\_\_\_.
8. \_\_\_\_\_ emission is the release of electrons due to heat.
9. The anode target is usually made of \_\_\_\_\_.
10. The \_\_\_\_\_ reduces the size of the X-ray beam.
11. \_\_\_\_\_ removes low-energy X-rays.
12. The \_\_\_\_\_ captures the radiographic image.
13. A \_\_\_\_\_ is used to reduce scatter radiation.
14. The \_\_\_\_\_ system holds the grid and IR.
15. The generator provides \_\_\_\_\_ to the X-ray tube.
16. The exposure switch has a \_\_\_\_\_ step and an expose step.
17. Scatter radiation decreases image \_\_\_\_\_.
18. Increasing grid use improves \_\_\_\_\_.
19. \_\_\_\_\_ control automatically terminates exposure.
20. The tube housing contains \_\_\_\_\_ to help with cooling.

1. The protected area for the technologist during exposure is the:
  - A. Tube housing
  - B. Control booth
  - C. Collimator
  - D. Bucky
  
2. The mechanism that locks the X-ray tube into position is called a:
  - A. Transformer
  - B. Detent
  - C. Filament
  - D. Grid
  
3. The center of the X-ray beam is known as the:
  - A. Primary beam
  - B. Central ray
  - C. Exit beam
  - D. Scatter line
  
4. Radiation that exits the patient and reaches the image receptor is:
  - A. Scatter radiation
  - B. Primary radiation
  - C. Remnant radiation
  - D. Secondary radiation
  
5. The absorption or reduction of X-rays by matter is called:
  - A. Ionization
  - B. Attenuation
  - C. Collimation
  - D. Filtration
  
6. The device used to control the size of the X-ray beam is the:
  - A. Grid
  - B. Bucky
  - C. Collimator
  - D. Tube port
  
7. Scatter radiation primarily comes from the:
  - A. X-ray tube
  - B. Control panel
  - C. Patient
  - D. Collimator

8. The device that reduces scatter reaching the image receptor is a:
  - A. Cassette
  - B. Grid
  - C. Filter
  - D. Anode
  
9. A type of imaging system that uses a reader device is:
  - A. Film-screen
  - B. Fluoroscopy
  - C. Computed radiography
  - D. MRI
  
10. Radiation is present in the X-ray room:
  - A. At all times
  - B. Only during exposure
  - C. After exposure
  - D. Only near the tube
  
11. The main purpose of a pre-exposure safety check is to:
  - A. Improve image quality
  - B. Protect coworkers from exposure
  - C. Speed up workflow
  - D. Reduce patient wait time
  
12. The most common accident in a radiology department is:
  - A. Burns
  - B. Pinching injuries
  - C. Falling
  - D. Electrical shock
  
13. The invisible image on the image receptor is called the:
  - A. Visible image
  - B. Latent image
  - C. Digital image
  - D. Processed image
  
14. The light field should match the:
  - A. Grid pattern
  - B. Radiation field
  - C. Patient size
  - D. Detector type

15. X-rays travel at the speed of:

- A. Sound
- B. Electricity
- C. Light
- D. Heat

1. The \_\_\_\_\_ is the protected area where the operator stands.
2. The \_\_\_\_\_ locks the X-ray tube into position.
3. The center of the beam is the \_\_\_\_\_.
4. \_\_\_\_\_ radiation exits the patient and forms the image.
5. The reduction of beam intensity is called \_\_\_\_\_.
6. The \_\_\_\_\_ controls beam size.
7. Scatter radiation is mainly produced by the \_\_\_\_\_.
8. A \_\_\_\_\_ absorbs scatter before it reaches the IR.
9. The invisible image is called the \_\_\_\_\_ image.
10. Radiation is present only during an \_\_\_\_\_.