Mammography unit

Health problem addressed
Mammographic radiographic units use x-rays to produce images of the breast—a mammogram—that provide information about breast morphology, normal anatomy, and gross pathology. Mammography is used primarily to detect and diagnose breast cancer and to evaluate palpable masses and nonpalpable breast lesions.

Product description
A complete mammographic radiographic system includes an x-ray generator, an x-ray tube and gantry, and a recording medium. The x-ray generator modifies incoming voltage to provide the x-ray tube with the power necessary to produce an x-ray beam. They also include a “paddle” for compression and placement of the breasts during imaging. Screen-film systems consist of a high-resolution phosphorescent screen with phosphor crystals that emit light when exposed to x-rays. Digital mammographic computed radiography (CR) uses a “digital” cassette to replace the traditional film cassette and digital cassette reader, producing a digital image from the cassette instead of developing film through a film processor.

Principles of operation
Low energy X-rays are produced by the x-ray tube (an evacuated tube with an anode and a cathode) when a stream of electrons, accelerated to high velocities by a high-voltage supply from the generator, collides with the tube’s target anode. The cathode contains a wire filament that, when heated, provides the electron source. The target anode is struck by the impinging electrons. X-rays exit the tube through a port window of beryllium. Additional filters are placed in the path of the x-ray beam to modify the x-ray spectrum. The x-rays that pass through the filter are shaped by either a collimator or cone apertures and then directed through the breast.

Operating steps
The mammography technician positions the patient, aligns the X-ray tube for projection, compresses the patient’s breast with the compression paddles, and then steps away to avoid X-ray exposure before initiating the exposure to the patient. Developed images are typically sent to a view box or work station for viewing.

Reported problems
Historically, the most common problems associated with mammography have not involved the units themselves but rather are related to radiation exposure risks to patients. Inadequate compression of the breast can cause poor image quality on mammograms. Sagging of the breast during mediolateral oblique and 90° lateral views, underexposure of the thick posterior part of the breast and overexposure of the thin anterior part, blurring of calcifications, and uneven exposure of fibroglandular tissue can result if compression is not properly applied during imaging.

Use and maintenance
User(s): Radiology/mammography technician, radiologist
Maintenance: Biomedical or clinical engineer/technician, radiology staff, manufacturer/servicer
Training: Initial training by manufacturer, operator’s manuals, user’s guide

Environment of use
Settings of use: Radiology departments, mammography clinics, stand-alone imaging centers, mobile (i.e., trailer- or truck-based) units
Requirements: Stable power source; appropriate shielding; imaging workstations or X-ray viewboxes

Product specifications
Approx. dimensions (mm): 1000 x 750 x 1000
Approx. weight (kg): 300
Consumables: NA
Price range (USD): 30,000-240,000
Typical product life time (years): 8-10
Shelf life (consumables): NA

Types and variations
Digital, film