Radiographic processing

Processing equipment
Typical manual processing unit
Automatic processing

-Introduced by Pako in 1942. Film hangers dunked from tank to tank
-First roller transport system introduced by Eastman Kodak in 1956. 10 ft long, weight 750 kg
Modern Film Processing Equipment

Automatic film processor

- First 90 second processor produced by Kodak in 1965.
- 45 second processor produced by Konoca in 1987
Major components
Film Transport System

- Film is placed on the input tray and gently advanced until taken by the **entry rollers**
- It is then transported via a system of rollers and guide plates in and out of Developer, Fixer, Wash and Drying sections
- Finally the dried film is delivered to the output tray
The rollers are arranged in racks
The individual rollers may be in ‘face to face’ or ‘staggered (Zig-Zag)’ configuration.
A system of guide plates are used where the film needs to change the direction, e.g. $180^0$ (in turn over and cross over assemblies)
The rollers are driven through a system of gear wheels or cogs by either a main drive shaft or chain, powered by a motor.

For safety, the processor lid operates a switch to stop the roller drive when the lid is open.

The rollers may be made from PVC or rubber.

The speed of the rollers determine the processor cycle time and the processor capacity.
Processing cycle time

- The expression of the time that it takes a film to travel from its dry unprocessed condition on the input tray to the dry processed state in the output tray.

- Rapid cycle: 90 sec, 115 sec

- In 90 sec cycle: Dev – 26 s, Fix - 15 s, Wash - 15 s, Drier – 24 s, travel time - 10 s
Processor capacity/production capacity

- A measure of a processor’s ability to process a given number of films in a given time and is expressed in number of ways.
  
  i. Number of single-size films capable of being processed in 1 hr.
  
  ii. Number of films of mixed sizes capable of being processed in 1 hr.
  
  iii. The speed of film through the processor (cm/s or m/h)
The film feed section

When no films are being processed the processor is in stand-by condition.

When a film is fed, the following events will be initiated.

- Drive motor energized to turn the rollers
- Safelight above the feed tray is extinguished
- Developer and fixer replenisher pumped into tanks
- Drier heater energized
- Wash water flow rate boosted
- Film signal delay timer activated
How are these activities triggered?

i. Entry roller detection system
ii. Infrared detectors
Entry roller detection system

Film

Micro switch
Infrared detectors

Infra-red detectors

Infra-red emitters below feed tray level

Feed tray

X-ray film
Developer section

Main activities

- Recirculation
- Temperature control
- Replenishment
- Drainage
Developer section

Overflow

From replenisher tank

To drain

Water

Heat exchange system

Developer

Heater

RPF

RPP

P

F
Developer tank with roller rack removed
Fixer Recirculation & Replenishment

Fixer tank

RP

Overflow

Rollers
Wash section

- **Spray wash** – consists of a series of water pipes containing perforations through which the water is forcibly sprayed onto each surface of the film. Water flow rate is about 10 l/min.

- **Tank immersion**; water is warmed by the developer heat exchanger. Water flow rate is between 4 and 7l/min.
Drying section

- **Hot air** drying – dust free hot air is blown onto the surface of the film – temperature is about 55 degrees C.

- **Infrared** (radiant heat) drying – contains a range of electrically heated elements to radiate heat onto both film surfaces.

- The used hot air should be ducted out of the room to prevent rise in humidity
Cross section – dryer rack

- Film transport rollers
- Film
- Hot air tube
Mixing of chemicals

- Manual mixing – according to the manufacturer’s recommendations
- Auto-mixers
Automixers

To Developer Tank

Water in

Display

To Fixer Tank

Dev

Fix
Dev/Fix. Replenisher pack

Developer replenisher

Fixer
Automixer - operation

Fixer

Water spray

Water

Full

Warning Alarm

Empty

Sensors
Standard of Development & processing

Standard of development & processing is ensured by maintaining the following:

- Constant temperature of chemicals
- Constant concentration of chemicals by regular replenishment
- Constant agitation of chemicals
- Constant processing time
Care & Maintenance of Processors

- Operating procedures
  i. Start-up procedure
  ii. Shutting down procedure

- Maintenance procedures
  i. Daily maintenance
  ii. Weekly maintenance
  iii. Monthly maintenance
Daylight processors

Functions

- Load cassettes with unexposed films
- Mark each film with patient name, Number etc.
- Unload cassettes
- Process films

Types

- Composite type
- Modular type
Composite type Daylight processor (Dupont) -
Kodak daylight processor

- Needs special type of cassettes, which can be opened by the mechanical system of the machine.
- Has a barcode attached to indicate the size of the film to be used.
Alternative processing methods

- **Rapid processing** – 45 - 30 second processors
- **Extended processing** – 3 minute processing for mammography
- **Dry processing** - using heat
  - Photothermography – print with laser & process with heat
  - Thermography – print & process with heat
Photothermography

- Uses a laser beam to form the latent image and heat to process the image
Summary

- Efficient Performance and Maintenance of Processing equipment is necessary to maintain standards of film quality
- It is necessary to have a thorough knowledge of the equipment
- A quality control programme is essential to monitor the performance of film processing equipment
End

Thank you